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Table of Radionuclides (Vol. 6 – $A = 22$ to 242)

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Preface

This monograph is one of several published in a series by the Bureau International des Poids et Mesures (BIPM) on behalf of the Consultative Committee for Ionizing Radiation (*Comité Consultatif des Rayonnements Ionisants*, CCRI¹). The aim of this series of publications is to review topics that are of importance for the measurement of ionizing radiation and especially of radioactivity, in particular those techniques normally used by participants in international comparisons. It is expected that these publications will prove to be useful reference volumes both for those who are already engaged in this field and for those who are approaching such measurements for the first time.

The purpose of this monograph, number 5 in the series, is to present the recommended values of nuclear and decay data for a wide range of radionuclides. Activity measurements for more than sixty-three of these radionuclides have already been the subject of comparisons under the auspices of Section II (dedicated to the *Measurement of radionuclides*) of the CCRI. The material for this monograph is now covered in six volumes. The first two volumes contain the primary recommended data relating to half-lives, decay modes, x-rays, gamma-rays, electron emissions; alpha- and beta-particle transitions and emissions, and their uncertainties for a set of sixty-eight radionuclides, Volume 1 for those radionuclides with mass number up to and including 150 and Volume 2 for those radionuclides with mass number over 150. Volume 3 contains the equivalent data for twenty-six additional radionuclides as listed and re-evaluations for ¹²⁵Sb and ¹⁵³Sm ; Volume 4 contains the data for a further thirty-one radionuclides with a re-evaluation for ²²⁶Ra and Volume 5 includes seventeen new radionuclide evaluations and eight re-evaluations of previous data as identified in the contents page. The present volume 6 contains twenty-one new radionuclide evaluations and four re-evaluations for Cu-64, Np-236, Np-237 and U-239. The data have been collated and evaluated by an international working group (Decay Data Evaluation Project, DDEP) led by the Laboratoire national de métrologie et d'essais – Laboratoire national Henri Becquerel (LNE-LNHB). The evaluators have agreed on the methodologies to be used and the CD-ROM included with this monograph contains the evaluators' comments for each radionuclide in addition to the data tables included in the monograph itself.

The work involved in evaluating nuclear data is on-going and the recommended values are kept up to date on the LNE-LNHB website at http://www.nucleide.org/DDEP_WG/DDEPdata.htm.

The BIPM and the DDEP are most grateful to the International Atomic Energy Agency (IAEA) for their assistance and financial support to some evaluators in the production of data for Volumes 1 to 3 through their Coordinated Research Project "Update of x-ray and gamma ray decay data standards for detector calibration and other applications" and for Volumes 4 to 6 through their Coordinated Research Project "Updated decay data library for actinides". The BIPM and the DDEP are indebted also to some other evaluators who participate in the United States Nuclear Data Program (USNDP) for their support to these publications.

The publication of further volumes of Monographie 5 is envisaged when necessary to add new radionuclide data or re-evaluations in this more permanent format that can be referenced easily.

Although other data sets may still be used when evaluating radionuclide activity, use of this common, recommended data set should help to reduce the uncertainties in activity evaluations and lead to more coherent results for comparisons.

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President of the CCRI

M. Kühne
Director of the BIPM

¹ previously known as the *Comité Consultatif pour les Etalons de Mesure des Rayonnements Ionisants* (CCEMRI)

Monographie BIPM-5 – Table of Radionuclides, Volume 6

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“TABLE DE RADIONUCLÉIDES”

Sommaire - Ce volume regroupe l'évaluation des radionucléides suivants :

^{41}Ar , ^{59}Ni , ^{64}Cu , ^{99}Tc , ^{109}Pd , ^{125}I , ^{132}Te , ^{182}Ta , ^{209}Pb , ^{209}Po , ^{211}Po , ^{215}Po , ^{215}At , ^{219}At , ^{219}Rn , ^{223}Fr , ^{223}Ra , ^{228}Ac , ^{231}Pa , ^{234}Pa , $^{234\text{m}}\text{Pa}$, ^{236}Np , ^{237}Np , ^{239}U , $^{242\text{m}}\text{Am}$

Les valeurs recommandées et les incertitudes associées comprennent : la période radioactive, les modes de décroissance, les émissions α , β , γ , X et électroniques ainsi que les caractéristiques des transitions correspondantes.

“TABLE OF RADIONUCLIDES”

Summary - This volume includes the evaluation of the following radionuclides:

^{41}Ar , ^{59}Ni , ^{64}Cu , ^{99}Tc , ^{109}Pd , ^{125}I , ^{132}Te , ^{182}Ta , ^{209}Pb , ^{209}Po , ^{211}Po , ^{215}Po , ^{215}At , ^{219}At , ^{219}Rn , ^{223}Fr , ^{223}Ra , ^{228}Ac , ^{231}Pa , ^{234}Pa , $^{234\text{m}}\text{Pa}$, ^{236}Np , ^{237}Np , ^{239}U , $^{242\text{m}}\text{Am}$

Primary recommended data comprise half-lives, decay modes, X-rays, gamma-rays, electron emissions, alpha- and beta-particle transitions and emissions, and their uncertainties.

“TABELLE DER RADIONUKLIDE”

Zusammenfassung – Dieser Band umfaßt die Evaluation der folgenden Radionuklide:

^{41}Ar , ^{59}Ni , ^{64}Cu , ^{99}Tc , ^{109}Pd , ^{125}I , ^{132}Te , ^{182}Ta , ^{209}Pb , ^{209}Po , ^{211}Po , ^{215}Po , ^{215}At , ^{219}At , ^{219}Rn , ^{223}Fr , ^{223}Ra , ^{228}Ac , ^{231}Pa , ^{234}Pa , $^{234\text{m}}\text{Pa}$, ^{236}Np , ^{237}Np , ^{239}U , $^{242\text{m}}\text{Am}$

In diesem Bericht sind evaluierte Werte der Halbwertszeiten, Übergangswahrscheinlichkeiten und Übergangsenergien von α , β^- , β^+ , EC- und Gammaübergängen, Konversionskoeffizienten von Gammaübergängen sowie der Emissionswahrscheinlichkeiten von Röntgen- und Gammaquanten, Auger- und Konversionselektronen und deren Unsicherheiten zusammengefaßt.

“ТАБЛИЦА РАДИОНУКЛИДОВ”

Резюме. Этот том включает оценки характеристик распада для следующих нуклидов:

^{41}Ar , ^{59}Ni , ^{64}Cu , ^{99}Tc , ^{109}Pd , ^{125}I , ^{132}Te , ^{182}Ta , ^{209}Pb , ^{209}Po , ^{211}Po , ^{215}Po , ^{215}At , ^{219}At , ^{219}Rn , ^{223}Fr , ^{223}Ra , ^{228}Ac , ^{231}Pa , ^{234}Pa , $^{234\text{m}}\text{Pa}$, ^{236}Np , ^{237}Np , ^{239}U , $^{242\text{m}}\text{Am}$

Основные рекомендуемые данные включают периоды полураспада, виды распада, X-излучение, гамма-излучение, электронное излучение, альфа- и бета-переходы и излучения, а также погрешности рассмотренных величин.

“TABLA DE RADIONUCLEIDOS”

Contenido – Este volumen agrupa la evaluación de los radionucleidos siguientes:

^{41}Ar , ^{59}Ni , ^{64}Cu , ^{99}Tc , ^{109}Pd , ^{125}I , ^{132}Te , ^{182}Ta , ^{209}Pb , ^{209}Po , ^{211}Po , ^{215}Po , ^{215}At , ^{219}At , ^{219}Rn , ^{223}Fr , ^{223}Ra ,
 ^{228}Ac , ^{231}Pa , ^{234}Pa , $^{234\text{m}}\text{Pa}$, ^{236}Np , ^{237}Np , ^{239}U , $^{242\text{m}}\text{Am}$

Los valores recomendados y las incertidumbres asociadas comprenden: el período de semidesintegración radiactiva, los modos de desintegración, las emisiones α , β , γ , X y electrónicas incluyendo las características de las transiciones correspondientes.

TABLE DE RADIONUCLÉIDES
TABLE OF RADIONUCLIDES
TABELLE DER RADIONUKLIDE
ТАБЛИЦА РАДИОНУКЛИДОВ
TABLA DE RADIONUCLEIDOS

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TABLE DE RADIONUCLÉIDES

INTRODUCTION

Le Laboratoire National Henri Becquerel (LNHB) a commencé l'étude des données nucléaires et atomiques qui caractérisent la décroissance des radionucléides en 1974. Ces évaluations ont fait l'objet de la publication des quatre volumes de la Table de Radionucléides [87Ta] et de cinq volumes de la *Monographie* BIPM-5 [99Be, 04Be, 06Be, 08Be, 10Be]. Ce nouveau volume s'inscrit dans la continuation du travail précédent.

D'autre part, pour des raisons évidentes, telles la facilité de mise à jour des données ou la commodité de consultation pour les utilisateurs, le LNHB a créé une base de données informatisée. Le logiciel NUCLEIDE est la forme informatisée de cette table, il permet un accès aisé aux différentes informations à l'aide de menus déroulants atteints par un simple « clic » sur un « bouton ».

Le propos de la Table est d'étudier un nombre limité de radionucléides utiles dans le domaine de la métrologie ou dans des domaines variés d'applications (médecine nucléaire, environnement, cycle du combustible, etc.) et d'en présenter une étude complète.

Les données recommandées comprennent : la période radioactive, les modes de décroissance, les émissions α , β , γ , X et électroniques ainsi que les caractéristiques des transitions associées.

Dans le but de mettre à jour et d'ajouter de nouvelles évaluations plus rapidement Le Laboratoire National Henri Becquerel (LNHB, France) et le Physikalisch - Technische Bundesanstalt (PTB, Germany) ont établi un accord de coopération. Ils ont ensuite été rejoints par Idaho National Engineering & Environmental Laboratory (INEEL, USA), Lawrence Berkeley National Laboratory (LBNL, USA) et Khlopin Radium Institute (KRI, Russia). Le premier travail de cette collaboration internationale a été d'établir une méthode et des règles communes d'évaluation. Les évaluations proposent des valeurs recommandées et leurs incertitudes. Ces valeurs ont été évaluées à partir des données expérimentales disponibles. A défaut, elles sont issues de calculs théoriques. Toutes les références utilisées pour l'évaluation d'un radionucléide sont listées à la fin de chaque chapitre.

Ce volume est le sixième de la *Monographie* 5 publiée sous l'égide du BIPM.

VALEURS RECOMMANDÉES ET INCERTITUDES

Les principales étapes pour l'évaluation des données et leurs incertitudes sont :

- une analyse critique de toutes les publications disponibles afin de retenir ou non une valeur et son incertitude, ramenée à l'incertitude-type composée ;
- la détermination d'une valeur recommandée qui est, selon les cas, une moyenne simple ou pondérée des valeurs issues des publications, ceci est décidé après examen du chi carré réduit. Dans le cas d'une moyenne pondérée, le poids relatif de chaque valeur est limité à 50 %. L'incertitude, notée u_c , est la plus grande des valeurs des incertitudes interne ou externe ; dans le cas de valeurs incompatibles elle peut être étendue pour recouvrir la valeur la plus précise.

Pour certaines applications il est nécessaire de définir une incertitude élargie, notée U , telle que :

$$U(y) = k \times u_c(y) \quad \text{où } k \text{ est le facteur d'élargissement.}$$

La valeur de k retenue pour cette publication est : $k = 1$.

Les valeurs d'incertitude indiquées portent sur les derniers chiffres significatifs, ainsi :

9,230 (11) signifie $9,230 \pm 0,011$ et

9,2 (11) $9,2 \pm 1,1$

Si une valeur est donnée sans incertitude, cela signifie qu'elle est considérée comme douteuse. Elle est indiquée à titre indicatif et souvent a été estimée en fonction du schéma de désintégration comme étant « de l'ordre de ».

Des précisions concernant les techniques d'évaluation peuvent être obtenues dans les références [85Zi], [96He], [99In] (voir rubrique Références) ou directement auprès des auteurs.

La description physique des données évaluées est disponible dans la référence [99In].

NUMÉROTAGE

Les niveaux d'un noyau sont numérotés, arbitrairement, de 0 pour le niveau fondamental à n pour le n ème niveau excité. Les diverses transitions sont ainsi repérées par leur niveau de départ et leur niveau d'arrivée.

Dans le cas de transition de faible probabilité qu'il n'est pas possible de situer sur le schéma de désintégration, les niveaux de départ et d'arrivée sont notés $(-1, n)$.

Dans le cas de l'émission gamma de 511 keV qui suit une désintégration bêta plus, la notation adoptée est : $(-1, -1)$.

UNITÉS

Les valeurs recommandées sont exprimées :

- pour les périodes :

	Symbole
. en secondes pour $T_{1/2} \leq 60$ secondes	s
. en minutes pour $T_{1/2} > 60$ secondes	min
. en heures pour $T_{1/2} > 60$ minutes	h
. en jours pour $T_{1/2} > 24$ heures	d
. en années pour $T_{1/2} > 365$ jours	a

1 année = 365,242 198 jours = 31 556 926 secondes ;

- pour les probabilités de transition et nombre de particules émises, les valeurs sont données pour 100 désintégrations ;

- les énergies sont exprimées en keV.

Remarque : Si une valeur plus précise de la période est nécessaire, par exemple en jours plutôt qu'en années, le lecteur se référera aux commentaires de l'évaluation inclus sur le CD-Rom ou sur les sites web du LNE-LNHB ou du BIPM. Ceci évitera l'introduction d'erreurs d'arrondi supplémentaires en cas de conversion d'unités.

AVERTISSEMENT

Ce document a été imprimé en 2011, pour toutes les nouvelles évaluations et mises à jour ultérieures, le lecteur se référera aux documents accessibles sur :

<http://www.nucleide.org/NucData.htm>

<http://www.bipm.org/fr/publications/monographie-ri-5.html>

TABLE OF RADIONUCLIDES

INTRODUCTION

The evaluation of decay data for the “Table de Radionucléides” by the Bureau National de Métrologie – Laboratoire National Henri Becquerel/Commissariat à l’Énergie Atomique (BNM – LNHB/CEA) began in 1974, continued to 1987 and four volumes were published [87Ta] and then, in 1999, the fifth volume was published containing the revised evaluations for 30 selected radionuclides [99Be]. This work has been pursued and five volumes of evaluations have already been published as *Monographie* BIPM-5 [04Be, 06Be, 08Be, 10Be].

Moreover, LNHB developed a database and related software (NUCLÉIDE) with the objectives of making it easier to update and add data and, obviously, to offer easy access to the nuclear and atomic decay data to the user by “click on the button” facilities.

The aim of this Table is to provide recommended data for nuclides of special interest for metrology or practical applications like nuclear medicine, monitoring and reactor shielding, etc.

Primary recommended data comprise half-lives, decay modes, X-rays, gamma-rays, electron emissions, alpha- and beta-particle transitions and emissions, and their uncertainties. All the references used for the evaluations are given.

In order to update the data of the nuclides already present and to add new evaluations, the Laboratoire National Henri Becquerel (LNHB, France) and the Physikalisch-Technische Bundesanstalt (PTB, Germany) established a cooperative agreement; they were then joined by the Idaho National Engineering & Environmental Laboratory (INEEL, USA), the Lawrence Berkeley National Laboratory (LBNL, USA) and the Khlopin Radium Institute (KRI, Russia). This international collaboration is based on an informal agreement; the initial work of this group was to discuss and to agree on a methodology to be used in these evaluations. The data and associated uncertainties were evaluated from all available experiments and taking into account theoretical considerations.

This volume is the sixth in the series of the *Monographie* 5 published under the auspices of the BIPM.

RECOMMENDED VALUES AND UNCERTAINTIES

The main steps for the evaluation of the data and their uncertainties are:

- a critical analysis of all available original publications in order to accept or not each value and its uncertainty reduced to the combined standard uncertainty;
- the determination of the best value which is either the weighted or the unweighted average of the retained values, this is decided after examination of the reduced χ^2 value. For a weighted average of discrepant data, each weight is limited to 50 %, and the uncertainty, designated u_c , is the larger of the internal or external uncertainty values, which may be expanded to cover the most precise input value.

For some applications it may be necessary to define an expanded uncertainty, designated U , as:

$$U(y) = k \times u_c(y) \quad \text{where } k \text{ is the coverage factor.}$$

In this publication, standard uncertainties are quoted (i.e. $k = 1$).

The value of the uncertainty, in parentheses, applies to the least significant digits, i.e.:

$$\begin{array}{l} 9.230 (11) \text{ means } 9.230 \pm 0.011 \quad \text{and} \\ 9.2 (11) \quad \quad \quad 9.2 \pm 1.1 \end{array}$$

A value given without an uncertainty is considered questionable. It is provided for information and often its order of magnitude is estimated from the decay scheme.

Information on evaluation methods may be obtained from references [85Zi, 96He, 99In] or directly from the authors.

Information on the meaning of physical data may be obtained from reference [99In].

NUMBERING

Nuclear levels are arbitrarily numbered from 0 (for the ground state level) to n (for the n th excited level). All transitions are designated by their initial and final levels.

For transitions with weak emission probabilities that are not shown by an arrow in the decay scheme, the initial and final levels are noted $(-1, n)$.

For a 511 keV gamma emission, which follows a beta plus disintegration, the adopted numbering is $(-1, -1)$.

UNITS

The recommended values are given:

- for half-lives:

	Symbol
. in seconds for $T_{1/2} \leq 60$ seconds	s
. in minutes for $T_{1/2} > 60$ seconds	min
. in hours for $T_{1/2} > 60$ minutes	h
. in days for $T_{1/2} > 24$ hours	d
. in years for $T_{1/2} > 365$ days	a

1 year = 1 a = 365.242 198 d = 31 556 926 s

- for transition probabilities and number of emitted particles, the values are given for 100 disintegrations of the parent nuclide.

- for energies, the values are expressed in keV.

Remark: When a more precise evaluation of a half life is required, for example in days instead of years, the reader is referred to the commented evaluation included on the CD ROM or on the websites of the LNE-LNHB or the BIPM. This will avoid the introduction of rounding errors.

NOTICE

This report was printed in 2011. New evaluations and updated issues will be available on:

<http://www.nucleide.org/NucData.htm>

<http://www.bipm.org/en/publications/monographie-ri-5.html>

TABELLE DER RADIONUKLIDE

EINLEITUNG

Die Evaluation der Zerfallsdaten für die „Table de Radionucléides“ durch das Laboratoire National Henri Becquerel (BNM-LNHB/CEA) begann im Jahre 1974, diese Arbeit wurde bis 1987 fortgesetzt, und es wurden vier Bände veröffentlicht [87Ta]. Seitdem sind des weiteren vier Bände der *Monographie* BIPM-5 [04Be, 06Be, 08Be, 10Be] erschienen. Der vorliegende neue Band stellt die Fortsetzung der vorhergehenden Arbeit dar.

Darüber hinaus wurde im LNHB eine computerbasierte Datenbank entwickelt. Die Software NUCLEIDE erleichtert die Aktualisierung und die Einbeziehung weiterer Daten und ermöglicht den Zugang zu den Kern- und Atomdaten für den Anwender „auf Tastendruck“.

Der Zweck dieser Tabelle ist es, empfohlene Daten einer begrenzten Anzahl von Radionukliden für metrologische und praktische Anwendungen wie etwa in der Nuklearmedizin, der Umweltüberwachung, dem Brennstoffkreislauf, der Reaktorabschirmung usw. zur Verfügung zu stellen.

Die empfohlenen Daten betreffen die Halbwertszeit, die Art des Zerfalls und die Charakteristika der α -, β -, γ -, Röntgen- und Elektronenemissionen und der entsprechenden Übergänge.

Um die bereits vorliegenden Daten zu aktualisieren und neue Evaluationen schneller einbeziehen zu können, vereinbarten das Laboratoire National Henri Becquerel (LNHB, Frankreich) und die Physikalisch-Technische Bundesanstalt (PTB, Deutschland) eine Übereinkunft zur Zusammenarbeit. Es schlossen sich das Idaho National Engineering and Environmental Laboratory (INEEL, USA), das Lawrence Berkeley National Laboratory (LBNL, USA) und das Khlopin Radium Institute (KRI, Rußland) an. Eine der ersten Arbeiten dieser Gruppe war es, die in diesen Evaluationen benutzte Methodologie zu diskutieren und festzulegen. Die Datenbank umfaßt empfohlene Daten und ihre Unsicherheiten, die aus den verfügbaren experimentellen Daten oder theoretischen Berechnungen gewonnen wurden. Alle für die Evaluation benutzten Referenzen werden angegeben.

Dieser Band ist die sechste Ausgabe der *Monographie* BIPM-5.

EMPFOHLENE WERTE UND UNSICHERHEITEN

Die Hauptschritte für die Evaluation der Daten und Unsicherheiten sind:

- Eine kritische Analyse aller verfügbaren Veröffentlichungen, um einen jeweils veröffentlichten Wert und seine Unsicherheit - auf die kombinierte Standardunsicherheit zurückgeführt - zu berücksichtigen oder auszuschließen.
- Die Bestimmung eines empfohlenen Wertes, der entweder das gewichtete oder das ungewichtete Mittel der veröffentlichten Werte ist. Die Entscheidung wird nach der Prüfung des reduzierten Chi-Quadrat-Werts getroffen. Im Falle des gewichteten Mittels wird das Gewicht jedes Einzelwerts auf 50 % begrenzt. Die Unsicherheit, als u_c bezeichnet, ist der größere Wert der inneren oder äußeren Unsicherheit. Für einen diskrepanten Datensatz kann sie so vergrößert werden, daß der genaueste Einzelwert in der Unsicherheit mit eingeschlossen ist.

Für einige Anwendungen ist es notwendig, eine vergrößerte Unsicherheit, als U bezeichnet, wie folgt zu definieren:

$$U(y) = k \times u_c(y) \quad \text{wo } k \text{ der Erweiterungsfaktor ist.}$$

Für die vorliegende Veröffentlichung ist die erweiterte Unsicherheit mit $k = 1$ berechnet.

Die Werte der Unsicherheit beziehen sich auf die letzten Stellen, d. h.:

9,230(11) bedeutet $9,230 \pm 0,011$ und

9,2(11) bedeutet $9,2 \pm 1,1$

Wenn ein Wert ohne Unsicherheit angegeben ist, bedeutet das, daß dieser Wert als fragwürdig zu betrachten ist. Er wird zur Information mitgeteilt und ist oft abgeschätzt aus dem Zerfallsschema im Sinne „in der Größenordnung von“.

Informationen über die Evaluationsprozedur können aus den Referenzen [85Zi, 96He, 99In] oder direkt von den Autoren bezogen werden.

Die Bedeutung der evaluierten Daten kann aus Ref. [99In] entnommen werden.

NUMERIERUNG

Die Kernniveaus werden willkürlich numeriert von 0 für den Grundzustand bis zu n für das n -te angeregte Niveau. Alle Übergänge werden durch ihr Ausgangs- und Endniveau gekennzeichnet. Für Übergänge mit geringen Wahrscheinlichkeiten, die nicht im Zerfallsschema gezeigt werden können, werden als Ausgangs- und Endniveau $(-1, n)$ angegeben.

Für die 511 keV-Gamma-Emission, die dem Beta Plus-Zerfall folgt, ist die angenommene Numerierung $(-1, -1)$.

EINHEITEN

Die empfohlenen Werte sind ausgedrückt:

- für Halbwertszeiten:

. in Sekunden für $T_{1/2} \leq 60$ Sekunden	s
. in Minuten für $T_{1/2} > 60$ Sekunden	min
. in Stunden für $T_{1/2} > 60$ Minuten	h
. in Tagen für $T_{1/2} > 24$ Stunden	d
. in Jahren für $T_{1/2} > 365$ Tage	a

$$1 \text{ a} = 365,242 \text{ 198 d} = 31 \text{ 556 926 s}$$

- für Übergangswahrscheinlichkeiten und die Anzahl der emittierten Teilchen werden Werte angegeben, die sich auf 100 Zerfälle beziehen.

- die Werte der Energien sind in keV ausgedrückt.

HINWEIS

Dieses Dokument wurde im Jahre 2011 erstellt. Alle späteren Fassungen oder neueren Evaluationen können vom Leser unter

<http://www.nucleide.org/NucData.htm>

<http://www.bipm.org/en/publications/monographie-ri-5.html>

abgerufen werden.

ТАБЛИЦА РАДИОНУКЛИДОВ

ВВЕДЕНИЕ

Оценка данных распада для Table de Radionucléides, BNM – LNHB/CEA, была начата в 1974 г. и продолжалась до 1987 г. К тому времени были опубликованы четыре тома [87Ta] и затем, в 1999 г., был опубликован пятый том, содержащий ревизованные оценки для 30 выбранных радионуклидов [99Be]. Эта работа была продолжена, и три тома были опубликованы как *Monographie VIPM-5* [04Be, 06Be, 08Be, 10Be].

В дополнение в LNHB была разработана компьютерная форма Table de Radionucléides (программа NUCLEIDE) с тем, чтобы обеспечить более простое обновление и дополнение данных и, очевидно, также с целью предложить пользователю более легкий доступ к ядерным и атомным данным распада путем "нажатия кнопки".

Цель настоящего издания - дать рекомендованные данные для нуклидов, представляющих специфический интерес для метрологии или практических приложений, таких как ядерная медицина, мониторинг, реакторная защита и др.

Первичные рекомендованные данные включают периоды полураспада, виды распада, характеристики X- и гамма-излучений, электронных излучений, альфа- и бета-переходов и излучений и погрешности величин этих характеристик. В книге дан полный список литературы, использованной для оценок.

Для того чтобы обновить данные по нуклидам, уже имеющимся в Table de Radionucléides, и добавить новые оценки, Национальная лаборатория им. Анри Беккереля (LNHB, Франция) и Физико-Технический Институт (PTB, Германия) заключили кооперативное соглашение. К ним затем присоединились Национальная лаборатория прикладных и экологических исследований Айдахо (INEEL, США), Лоуренсовская Национальная Лаборатория Беркли (LBNL, США) и Радиевый институт им. В.Г. Хлопина (KRI, Россия). Это международное сотрудничество основано на неформальном соглашении. Первоначальная работа состояла в обсуждении и принятии согласованной методологии, которая должна быть использована в этих оценках. Данные и связанные с ними погрешности были оценены с использованием всех имеющихся в распоряжении результатов экспериментов и с учетом теоретических рассуждений.

Настоящий том представляет собой шестой выпуск *Monographie VIPM-5*.

РЕКОМЕНДОВАННЫЕ ЗНАЧЕНИЯ И ПОГРЕШНОСТИ

Основные шаги для оценки данных и их погрешностей следующие:

- критический анализ всех имеющихся оригинальных публикаций, чтобы принять или отвергнуть данное значение и его погрешность, приведенную к комбинированному стандартному отклонению;
- определение лучшего значения, которое является взвешенным или невзвешенным средним сохраненных величин; выбор взвешенного или невзвешенного среднего определяется анализом величины χ^2 . В случае среднего взвешенного вес каждого оригинального результата ограничивается 50 %. В качестве итоговой погрешности (u_c) принимается большая из двух погрешностей среднего взвешенного: внутренней и внешней. Для расходящегося набора данных она может быть расширена, чтобы перекрыть самое точное входное значение.

Для некоторых применений может оказаться необходимым расширенная погрешность (U), выраженная как: $U(y) = k \times u_c(y)$, где k - коэффициент перекрытия. Для этой публикации принято $k = 1$.

Значение погрешности, в скобках, приводится в единицах последней значащей цифры, т.е.:
9,230 (11) означает $9,230 \pm 0,011$ и
9,2 (11) $9,2 \pm 1,1$

Если значение величины дается без погрешности, она считается сомнительной и приводится для информации. Такие величины часто оценивались из схемы распада под рубрикой "порядка".

Информацию о процедурах оценки можно получить из публикаций [85Zi, 96He, 99In] или непосредственно от авторов.

Информация о смысле физических величин может быть получена из [99In].

НУМЕРАЦИЯ

Ядерные уровни произвольно пронумерованы от 0 для основного состояния до n для n -ого возбужденного уровня. Все переходы обозначаются по их начальному и конечному уровням.

Для слабых переходов, не показанных стрелкой в схеме распада, начальный и конечный уровни обозначаются как $(-1, n)$.

Для гамма-излучения с энергией 511 кэВ, которое следует за бета-плюс распадом, принято обозначение $(-1, -1)$.

ЕДИНИЦЫ

Рекомендованные значения выражены:

- для периодов полураспада:
- . в секундах для $T_{1/2} \leq 60$ секунд s
- . в минутах для $T_{1/2} > 60$ секунд min
- . в часах для $T_{1/2} > 60$ минут h
- . в сутках для $T_{1/2} > 24$ часов d
- . в годах для $T_{1/2} > 365$ суток a

1 год = 365,242198 суток = 31 556 926 секунд

- для вероятностей переходов и числа испускаемых частиц значения даны на 100 распадов;
- для энергий значения выражены в килоэлектронвольтах (keV).

ПРИМЕЧАНИЕ

Этот выпуск подготовлен в 2011 г. Новые оценки и обновленные результаты можно найти на сайте:

<http://www.nucleide.org/NucData.htm>

<http://www.bipm.org/en/publications/monographie-ri-5.html>

TABLA DE RADIONUCLEIDOS

INTRODUCCION

El Laboratorio Nacional Henri Becquerel (LNHB) inició en 1974 el estudio de datos nucleares y atómicos que caracterizan la desintegración de radionucleidos. Esas evaluaciones han permitido la publicación de cuatro volúmenes de la Tabla de Radionucleidos [87Ta, 99Be]. Este nuevo volumen es el siguiente en la continuación del estudio precedente *Monographie* BIPM-5 [04Be, 06Be, 08Be, 10Be].

Para facilitar la corrección de nueva información y mejorar la comodidad de consulta a los lectores, el LNHB a creado una base de datos informatizada. El programa NUCLEIDE permite el acceso a la Tabla de Radionucleidos con la ayuda de menues en cascada disponibles con un simple « clic ».

El objetivo de la Tabla de Radionucleidos es el de proporcionar información sobre un número limitado de radionucleidos utilizados en el campo de la metrología o en otras disciplinas (medicina nuclear, medio ambiente, ciclo del combustible, etc.)

Los datos recomendados incluyen : el período de semidesintegración, los modos de desintegración, las emisiones α , β , γ , X y de electrones atómicos asociados a las mismas.

Con el propósito de actualizar y agregar nuevas evaluaciones rapidamente el *Laboratoire National Henri Becquerel* (LNHB, Francia) y el *Physikalisch-Technische Bundesanstalt* (PTB , Alemania) establecieron un acuerdo de colaboración. Posteriormente se unieron el *Idaho National Engineering & Environmental Laboratory* (INEEL, USA), *Lawrence Berkeley National Laboratory* LBNL, USA) y *Khlopin Radium Institute* (KRI, Rusia). El primer trabajo de esta colaboración internacional fue el de establecer el método y las reglas comunes de evaluación. Las evaluaciones proponen valores recomendados e incertidumbres asociadas. Éstos valores han sido evaluados a partir de datos experimentales. En su ausencia, los valores se obtienen por cálculos teóricos. Todas las referencias utilizadas para la evaluación de un radionucleido se citan al final de cada capítulo.

VALORES RECOMENDADOS E INCERTIDUMBRES

Las principales etapas para evaluar datos con sus incertidumbres son:

- Un análisis crítico de todas las publicaciones disponibles con el fin de obtener un valor con su incertidumbre, considerada como incertidumbre típica combinada.
- La determinación de un valor recomendado que es, según el caso, una media simple o ponderada de valores obtenidos de publicaciones. Ésto se decide tras el chi-cuadrado reducido. En el caso de una media ponderada para conjuntos de valores discrepantes, el peso estadístico relativo de cada valor es limitado al 50 %. La incertidumbre, u_c , es el mayor de los valores de las incertidumbres interna o externa. En el caso de conjuntos de valores discrepantes, este valor puede ser extendido con el fin de incluir el valor experimental más preciso.

Para ciertas aplicaciones, es necesario definir una incertidumbre expandida, llamada U :

$$U(y) = k \times u_c(y) \quad \text{donde } k \text{ es el factor de cobertura.}$$

El valor de k utilizado en esta publicación es: $k = 1$.

Los valores de incertidumbres indicados entre paréntesis corresponden a las últimas cifras significativas, por ejemplo:

$$\begin{array}{lll} 9,230 \text{ (11)} & \text{significa} & 9,230 \pm 0,011 \quad \text{y} \\ 9,2 \text{ (11)} & \text{significa} & 9,2 \pm 1,1 \end{array}$$

Valores dados sin incertidumbres se consideran dudosos (usualmente se presentan como valores aproximados, y a menudo estimados a partir de los esquemas de desintegración).

Para más información sobre las técnicas de evaluación consultar [85Zi], [96He], [99In] o directamente con el autor.

NUMERACION

Los niveles de un núcleo están arbitrariamente numerados desde “0” (para el nivel fundamental), hasta “*n*” para el enésimo nivel excitado. Las transiciones se representan por sus niveles inicial y final.

En el caso de una transición débil e imposible de situar en el esquema de desintegración, el nivel inicial y el final están designados con la siguiente notación: (-1, *n*).

En el caso de una emisión γ de 511 keV que sigue a una desintegración β^+ , la notación adoptada es: (-1, -1).

UNIDADES

Los valores recomendados se dan:

- para los períodos de semidesintegración:

	Símbolo
. en segundos para $T_{1/2} \leq 60$ segundos	s
. en minutos para $T_{1/2} > 60$ segundos	min
. en horas para $T_{1/2} > 60$ minutos	h
. en días para $T_{1/2} > 24$ horas	d
. en años para $T_{1/2} > 365$ días	a

1 año = 365,242 198 días = 31 556 926 segundos;

- para las probabilidades de transición y número de partículas emitidas, los valores se dan por 100 desintegraciones;
- para las energías, los valores se expresan en keV.

ADVERTENCIA

Este documento ha sido imprimido en el 2011. Para obtener todas las nuevas evaluaciones actualizadas ulteriormente, el lector deberá referirse a los documentos disponibles en:

<http://www.nucleide.org/NucData.htm>

<http://www.bipm.org/en/publications/monographie-ri-5.html>

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Toutes demandes de renseignements concernant les données recommandées et la façon dont elles ont été établies doivent être adressées directement aux auteurs des évaluations.

Information on the data and the evaluation methods is available from the authors listed below.

Informationen über die Daten und Evaluationsprozeduren können bei den im folgenden zusammengestellten Autoren angefordert werden:

Todos los pedidos de información relativos a datos recomendados y la manera de establecerlos deben dirigirse directamente a los autores de las evaluaciones.

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7	Be-7	1 / 1	123	I-123	1 / 219	213	Po-213	4 / 71	238	Np-238	4 / 195
11	C-11	1 / 7	124	Sb-124	5 / 21	214	Pb-214	4 / 75	238	Pu-238	2 / 235
13	N-13	1 / 11	125	Sb-125	1 / 235	214	Bi-214	4 / 83	238	Pu-238*	5 / 153
15	O-15	1 / 17	125	Sb-125*	3 / 81	214	Po-214	4 / 111	239	U-239	4 / 205
18	F-18	1 / 21	125	I-125	6 / 37	215	Po-215	6 / 79	239	U-239*	6 / 251
22	Na-22	5 / 1	129	I-129	1 / 243	215	At-215	6 / 85	239	Np-239	4 / 221
24	Na-24	1 / 27	131	I-131	1 / 249	216	Po-216	2 / 177	239	Pu-239	4 / 231
32	P-32	1 / 35	131	Xe-131m	1 / 257	217	At-217	5 / 47	240	Pu-240	2 / 247
33	P-33	1 / 41	132	Te-132	6 / 43	217	Rn-217	4 / 117	240	Pu-240*	5 / 165
40	K-40	5 / 7	133	I-133	4 / 1	218	Po-218	4 / 121	241	Pu-241	4 / 259
41	Ar-41	6 / 1	133	Xe-133	4 / 11	218	At-218	4 / 125	241	Am-241	2 / 257
44	Sc-44	1 / 45	133	Xe-133m	4 / 17	218	Rn-218	4 / 129	241	Am-241*	5 / 175
44	Ti-44	1 / 51	133	Ba-133	1 / 263	219	At-219	6 / 91	242	Pu-242	2 / 277
46	Sc-46	1 / 57	135	Xe-135m	4 / 23	219	Rn-219	6 / 95	242	Pu-242*	5 / 197
51	Cr-51	1 / 63	137	Cs-137	3 / 91	220	Rn-220	2 / 183	242	Am-242	5 / 203
54	Mn-54	1 / 71	139	Ce-139	4 / 31	221	Fr-221	4 / 135	242	Am-242m	6 / 267
55	Fe-55	3 / 5	140	Ba-140	1 / 271	222	Rn-222	4 / 143	242	Cm-242	3 / 185
56	Mn-56	1 / 77	140	La-140	1 / 277	223	Fr-223	6 / 105	243	Am-243	3 / 195
56	Co-56	3 / 11	152	Eu-152	2 / 1	223	Ra-223	6 / 125	243	Am-243*	5 / 209
57	Co-57	1 / 83	153	Sm-153	2 / 27	224	Ra-224	2 / 189	244	Am-244	5 / 217
57	Ni-57	1 / 91	153	Sm-153*	3 / 99	225	Ra-225	5 / 53	244	Am-244m	5 / 223
59	Fe-59	1 / 99	153	Gd-153	2 / 21	225	Ac-225	5 / 59	244	Cm-244	3 / 203
59	Ni-59	6 / 7	154	Eu-154	2 / 37	226	Ra-226	2 / 195	246	Cm-246	4 / 269
60	Co-60	3 / 23	155	Eu-155	2 / 59	226	Ra-226*	4 / 149	252	Cf-252	4 / 277
63	Ni-63	3 / 29	159	Gd-159	3 / 109	227	Ac-227	4 / 155			
64	Cu-64	1 / 105	166	Ho-166	2 / 67	227	Th-227	2 / 201			
64	Cu-64*	6 / 13	166	Ho-166m	2 / 75	228	Ra-228	5 / 81			
65	Zn-65	3 / 33	169	Yb-169	2 / 87	228	Ac-228	6 / 139			
66	Ga-66	1 / 113	170	Tm-170	2 / 99	228	Th-228	2 / 227			
67	Ga-67	1 / 133	177	Lu-177	2 / 107	231	Th-231	5 / 85			
75	Se-75	5 / 13	182	Ta-182	6 / 49	231	Pa-231	6 / 165			
79	Se-79	3 / 39	186	Re-186	2 / 113	232	Th-232	5 / 95			
85	Kr-85	1 / 141	198	Au-198	2 / 121	232	U-232	4 / 169			
85	Sr-85	1 / 147	201	Tl-201	2 / 129	233	Th-233	3 / 133			
88	Y-88	1 / 153	203	Hg-203	2 / 135	233	Th-233*	5 / 101			
89	Sr-89	1 / 161	203	Pb-203	3 / 115	233	Pa-233	3 / 123			
90	Sr-90	3 / 43	204	Tl-204	2 / 141	233	Pa-233*	5 / 117			
90	Y-90	3 / 47	206	Tl-206	4 / 39	234	Th-234	5 / 127			
90	Y-90m	3 / 53	207	Bi-207	5 / 33	234	Pa-234	6 / 177			
93	Nb-93m	1 / 167	208	Tl-208	2 / 147	234	Pa-234m	6 / 213			
99	Mo-99	1 / 173	209	Pb-209	6 / 61	234	U-234	3 / 147			
99	Tc-99m	1 / 183	209	Po-209	6 / 65	235	U-235	5 / 133			
99	Tc-99	6 / 21	210	Tl-210	4 / 45	236	U-236	4 / 177			
108	Ag-108	3 / 59	210	Pb-210	4 / 51	236	Np-236	3 / 155			
108	Ag-108m	3 / 67	210	Bi-210	4 / 59	236	Np-236*	6 / 231			
109	Pd-109	6 / 27	210	Po-210	4 / 65	236	Np-236m	3 / 163			
109	Cd-109	1 / 191	211	Bi-211	5 / 41	237	U-237	3 / 169			
110	Ag-110	1 / 199	211	Po-211	6 / 73	237	U-237*	5 / 145			
110	Ag-110m	1 / 207	212	Pb-212	2 / 167	237	Np-237	4 / 183			
111	In-111	3 / 75	212	Bi-212	2 / 155	237	Np-237*	6 / 239			

* : updated evaluations

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227	Ac-227	4 / 155	67	Ga-67	1 / 133	212	Po-212	2 / 173	201	Tl-201	2 / 129
228	Ac-228	6 / 139	153	Gd-153	2 / 21	213	Po-213	4 / 71	204	Tl-204	2 / 141
108	Ag-108	3 / 59	159	Gd-159	3 / 109	214	Po-214	4 / 111	206	Tl-206	4 / 39
108	Ag-108m	3 / 67	3	H-3	3 / 1	215	Po-215	6 / 79	208	Tl-208	2 / 147
110	Ag-110	1 / 199	203	Hg-203	2 / 135	216	Po-216	2 / 177	210	Tl-210	4 / 45
110	Ag-110m	1 / 207	166	Ho-166	2 / 67	218	Po-218	4 / 121	170	Tm-170	2 / 99
241	Am-241	2 / 257	166	Ho-166m	2 / 75	238	Pu-238	2 / 235	232	U-232	4 / 169
241	Am-241*	5 / 175	123	I-123	1 / 219	238	Pu-238*	5 / 153	234	U-234	3 / 147
242	Am-242	5 / 203	125	I-125	6 / 37	239	Pu-239	4 / 231	235	U-235	5 / 133
242	Am-242m	6 / 267	129	I-129	1 / 243	240	Pu-240	2 / 247	236	U-236	4 / 177
243	Am-243	3 / 195	131	I-131	1 / 249	240	Pu-240*	5 / 165	237	U-237	3 / 169
243	Am-243*	5 / 209	133	I-133	4 / 1	241	Pu-241	4 / 259	237	U-237*	5 / 145
244	Am-244	5 / 217	111	In-111	3 / 75	242	Pu-242	2 / 277	238	U-238	3 / 177
244	Am-244m	5 / 223	40	K-40	5 / 7	242	Pu-242*	5 / 197	239	U-239	4 / 205
41	Ar-41	6 / 1	85	Kr-85	1 / 141	223	Ra-223	6 / 125	239	U-239*	6 / 251
215	At-215	6 / 85	140	La-140	1 / 277	224	Ra-224	2 / 189	131	Xe-131m	1 / 257
217	At-217	5 / 47	177	Lu-177	2 / 107	225	Ra-225	5 / 53	133	Xe-133	4 / 11
218	At-218	4 / 125	54	Mn-54	1 / 71	226	Ra-226	2 / 195	133	Xe-133m	4 / 17
219	At-219	6 / 91	56	Mn-56	1 / 77	226	Ra-226*	4 / 149	135	Xe-135m	4 / 23
198	Au-198	2 / 121	99	Mo-99	1 / 173	228	Ra-228	5 / 81	88	Y-88	1 / 153
133	Ba-133	1 / 263	13	N-13	1 / 11	186	Re-186	2 / 113	90	Y-90	3 / 47
140	Ba-140	1 / 271	22	Na-22	5 / 1	217	Rn-217	4 / 117	90	Y-90m	3 / 53
7	Be-7	1 / 1	24	Na-24	1 / 27	218	Rn-218	4 / 129	169	Yb-169	2 / 87
207	Bi-207	5 / 33	93	Nb-93m	1 / 167	219	Rn-219	6 / 95	65	Zn-65	3 / 33
210	Bi-210	4 / 59	57	Ni-57	1 / 91	220	Rn-220	2 / 183			
211	Bi-211	5 / 41	59	Ni-59	6 / 7	222	Rn-222	4 / 143			
212	Bi-212	2 / 155	63	Ni-63	3 / 29	124	Sb-124	5 / 21			
214	Bi-214	4 / 83	236	Np-236	3 / 155	125	Sb-125	1 / 235			
11	C-11	1 / 7	236	Np-236*	6 / 231	125	Sb-125*	3 / 81			
109	Cd-109	1 / 191	236	Np-236m	3 / 163	44	Sc-44	1 / 45			
139	Ce-139	4 / 31	237	Np-237	4 / 183	46	Sc-46	1 / 57			
252	Cf-252	4 / 277	237	Np-237*	6 / 239	75	Se-75	5 / 13			
242	Cm-242	3 / 185	238	Np-238	4 / 195	79	Se-79	3 / 39			
244	Cm-244	3 / 203	239	Np-239	4 / 221	153	Sm-153	2 / 27			
246	Cm-246	4 / 269	15	O-15	1 / 17	153	Sm-153*	3 / 99			
56	Co-56	3 / 11	32	P-32	1 / 35	85	Sr-85	1 / 147			
57	Co-57	1 / 83	33	P-33	1 / 41	89	Sr-89	1 / 161			
60	Co-60	3 / 23	231	Pa-231	6 / 165	90	Sr-90	3 / 43			
51	Cr-51	1 / 63	233	Pa-233	3 / 123	182	Ta-182	6 / 49			
137	Cs-137	3 / 91	233	Pa-233*	5 / 117	99	Tc-99	6 / 21			
64	Cu-64	1 / 105	234	Pa-234	6 / 177	99	Tc-99m	1 / 183			
64	Cu-64*	6 / 13	234	Pa-234m	6 / 213	123	Te-123m	1 / 229			
152	Eu-152	2 / 1	203	Pb-203	3 / 115	132	Te-132	6 / 43			
154	Eu-154	2 / 37	209	Pb-209	6 / 61	227	Th-227	2 / 201			
155	Eu-155	2 / 59	210	Pb-210	4 / 51	228	Th-228	2 / 227			
18	F-18	1 / 21	212	Pb-212	2 / 167	231	Th-231	5 / 85			
55	Fe-55	3 / 5	214	Pb-214	4 / 75	232	Th-232	5 / 95			
59	Fe-59	1 / 99	109	Pd-109	6 / 27	233	Th-233	3 / 133			
221	Fr-221	4 / 135	209	Po-209	6 / 65	233	Th-233*	5 / 101			
223	Fr-223	6 / 105	210	Po-210	4 / 65	234	Th-234	5 / 127			

* : updated evaluations



1 Decay Scheme

Ar-41 disintegrates by beta minus decay to excited levels and the ground state level of K-41.

L'argon 41 se désintègre par émission bêta moins vers des niveaux excités et le niveau fondamental de potassium 41.

2 Nuclear Data

$T_{1/2}({}^{41}\text{Ar})$: 109,611 (38) min

$Q^{-}({}^{41}\text{Ar})$: 2491,6 (4) keV

2.1 β^{-} Transitions

	Energy keV	Probability × 100	Nature	lg <i>ft</i>
$\beta_{0,2}^{-}$	814,6 (4)	0,0515 (49)	1st Forbidden	7,68
$\beta_{0,1}^{-}$	1197,96 (40)	99,165 (20)	Allowed	5,05
$\beta_{0,0}^{-}$	2491,6 (4)	0,784 (19)	Unique 1st Forbidden	9,72

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K (10 ⁻⁵)	α_L (10 ⁻⁵)	α_M (10 ⁻⁶)	α_T (10 ⁻⁵)	α_{π} (10 ⁻⁶)
$\gamma_{1,0}(\text{K})$	1293,64 (4)	99,165 (20)	M2 + 1,37 % E3	6,36 (9)	0,534 (8)	0,580 (9)	7,44 (11)	4,92 (7)
$\gamma_{2,0}(\text{K})$	1677,0 (3)	0,0515 (49)						

3 Atomic Data

3.1 K

$$\begin{aligned}\omega_K &: 0,143 \quad (4) \\ n_{KL} &: 1,654 \quad (6)\end{aligned}$$

3.1.1 X Radiations

	Energy keV	Relative probability	
X_K	$K\alpha_2$	3,3111	50,55
	$K\alpha_1$	3,3138	100
	$K\beta_1$	3,5896	}
	$K\beta_5''$	3,6028	
			18,44

4 Electron Emissions

	Energy keV	Electrons per 100 disint.
$\beta_{0,2}^-$	max: 814,6 (4)	0,0515 (49)
$\beta_{0,2}^-$	avg: 293,9 (2)	
$\beta_{0,1}^-$	max: 1197,96 (40)	99,165 (20)
$\beta_{0,1}^-$	avg: 459,18 (18)	
$\beta_{0,0}^-$	max: 2491,6 (4)	0,784 (19)
$\beta_{0,0}^-$	avg: 1076,6 (2)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV	Photons per 100 disint.	
XK α_2	(K)	3,3111	0,000270 (9)	} K α
XK α_1	(K)	3,3138	0,000533 (17)	
XK β_1	(K)	3,5896	} 0,000098 (4)	K' β_1
XK β_5''	(K)	3,6028		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}(K)$	1293,64 (4)	99,157 (20)
$\gamma_{2,0}(K)$	1677,0 (3)	0,0515 (49)

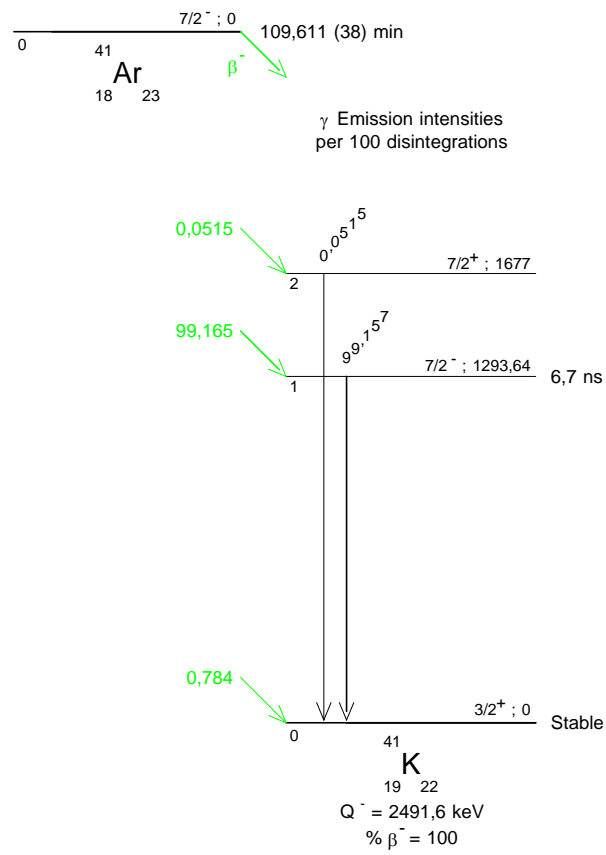
6 Main Production Modes

Cl – 41(β)Ar – 41
 Ar – 40(n, γ)Ar – 41
 Ar – 40(d,p γ)Ar – 41

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1 Decay Scheme

Ni-59 disintegrate by electron capture directly to the ground state level of Co-59.

Le nickel 59 se désintègre par capture électronique directement vers le niveau fondamental du cobalt 59.

2 Nuclear Data

$$T_{1/2}({}^{59}\text{Ni}) : 76 \quad (5) \quad 10^3 \text{ a}$$

$$Q^+({}^{59}\text{Ni}) : 1072,76 \quad (19) \quad \text{keV}$$

2.1 Electron Capture Transitions

	Energy keV	Probability × 100	Nature	lg <i>ft</i>	P _K	P _L	P _M
ε _{0,0}	1072,76 (19)	99,99996 (1)	2nd Forbidden	11,89	0,8870 (16)	0,0966 (13)	0,0156 (5)

2.2 β⁺ Transitions

	Energy keV	Probability × 100	Nature	lg <i>ft</i>
β _{0,0} ⁺	50,76 (19)	0,000037 (12)	2nd Forbidden	11,89

3 Atomic Data

3.1 Co

ω_K	:	0,388	(4)
$\bar{\omega}_L$:	0,0072	(5)
n_{KL}	:	1,418	(4)

3.1.1 X Radiations

	Energy keV	Relative probability	
X _K	K α_2	6,91538	51,16
	K α_1	6,9304	100
	K β_1	7,6495	}
	K β_5''	7,706	
X _L	L ℓ	0,6793	
	L α	0,7787 – 0,7795	
	L η	0,6949	
	L β	0,78642 – 0,9251	
	L γ	0,80198 – 0,80198	

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	5,806 – 6,099	100
KLX	6,667 – 6,927	27,4
KXY	7,508 – 7,703	1,88
Auger L	0,68 – 0,83	

4 Electron Emissions

		Energy keV	Electrons per 100 disint.
e _{AL}	(Co)	0,68 - 0,83	134,5 (8)
e _{AK}	(Co)		54,3 (4)
	KLL	5,806 - 6,099	}
	KLX	6,667 - 6,927	}
	KXY	7,508 - 7,703	}
$\beta_{0,0}^+$	max:	50,76 (19)	0,000037 (12)
$\beta_{0,0}^+$	avg:	24,81 (9)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV	Photons per 100 disint.
XL	(Co)	0,6793 — 0,9251	0,98 (7)
XK α_2	(Co)	6,91538	10,24 (12) } K α
XK α_1	(Co)	6,9304	20,02 (22) }
XK β_1	(Co)	7,6495	} 4,15 (6) K' β_1
XK β_5''	(Co)	7,706	}

5.2 Gamma Emissions

		Energy keV	Photons per 100 disint.
γ^\pm		511	0,000072 (24)

6 Main Production Modes

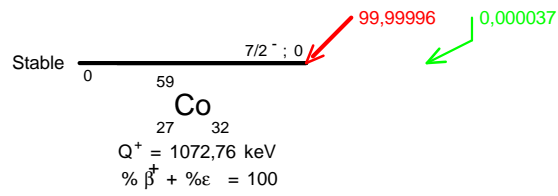
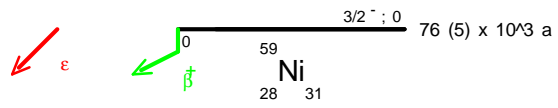
{ Ni – 58(n,γ)Ni – 59 σ : 4,13 (5) barns
 { Possible impurities : Co – 58

{ Ni – 60(n,2n)Ni – 59
 { Possible impurities : Co – 58

{ Co – 59(p,n)Ni – 59
 { Possible impurities : Co – 58

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1 Decay Scheme

Le cuivre 64 se désintègre par émission bêta moins (38%) vers le niveau fondamental de zinc 64 et par capture électronique vers le niveau excité et le fondamental de nickel 64.

Cu-64 disintegrates by beta minus emission to the Zn-64 ground state (38%) and by electron capture to the excited level and the ground state of Ni-64.

2 Nuclear Data

$T_{1/2}({}^{64}\text{Cu})$:	12,7003	(20)	h
$Q^{-}({}^{64}\text{Cu})$:	579,4	(7)	keV
$Q^{+}({}^{64}\text{Cu})$:	1675,03	(20)	keV

2.1 β^{+} Transitions

	Energy keV	Probability $\times 100$	Nature	lg ft
$\beta_{0,0}^{+}$	653,1 (2)	17,52 (15)	Allowed	4,97

2.2 Electron Capture Transitions

	Energy keV	Probability $\times 100$	Nature	lg ft	P_K	P_L	P_M
$\epsilon_{0,1}$	329,28 (20)	0,4744 (33)	Allowed	5,51	0,884 (3)	0,099 (2)	0,0162 (5)
$\epsilon_{0,0}$	1675,03 (20)	43,53 (20)	Allowed	4,97	0,888 (3)	0,095 (2)	0,0155 (5)

2.3 β^- Transitions

	Energy keV	Probability $\times 100$	Nature	lg ft
$\beta_{0,0}^-$	579,4 (7)	38,48 (26)	Allowed	5,29

2.4 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ $\times 100$	Multipolarity	α_K (10^{-4})	α_L (10^{-4})	α_T (10^{-4})	α_π (10^{-4})
$\gamma_{1,0}(\text{Ni})$	1345,75 (5)	0,4744 (33)	E2	1,112 (2)	0,109 (2)	1,24 (2)	0,394 (6)

3 Atomic Data

3.1 Ni

ω_K	:	0,421	(4)
$\bar{\omega}_L$:	0,0084	(4)
n_{KL}	:	1,388	(4)

3.1.1 X Radiations

	Energy keV	Relative probability
X_K	$K\alpha_2$	7,46093
	$K\alpha_1$	7,47819
	$K\beta_3$	8,2647
	$K\beta_5''$	8,3287
X_L	$L\ell$	0,7445
	$L\alpha$	0,8532 – 0,8539
	$L\eta$	0,7622
	$L\beta$	0,86123 – 1,0083
	$L\gamma$	0,87898 – 0,87898

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	6,262 – 6,567	100
KLX	7,196 – 7,475	27,6
KXY	8,109 – 8,326	1,9
Auger L	0,6 – 0,9	

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e _{AL}	(Ni)	0,6 - 0,9		57,9 (4)
e _{AK}	(Ni)			22,62 (21)
	KLL	6,262 - 6,567	}	
	KLX	7,196 - 7,475	}	
	KXY	8,109 - 8,326	}	
ec _{1,0} [±]	(Ni)	323,77	(6)	0,00001875 (37)
β _{0,0} ⁺	max:	653,1	(2)	17,52 (15)
β _{0,0} ⁺	avg:	278,21	(9)	
β _{0,0} ⁻	max:	579,4	(7)	38,48 (26)
β _{0,0} ⁻	avg:	190,7	(3)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV	Photons per 100 disint.	
XL	(Ni)	0,7445 — 1,0083	0,493 (10)	
XK α_2	(Ni)	7,46093	4,90 (6)	} K α
XK α_1	(Ni)	7,47819	9,56 (11)	
XK β_3	(Ni)	8,2647	}	} K' β_1
XK β_1	(Ni)		}	
XK β_5''	(Ni)	8,3287	}	

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
γ^\pm	511	35,04 (30)
$\gamma_{1,0}(\text{Ni})$	1345,77 (6)	0,4743 (33)

6 Main Production Modes

- { Cu – 63(n, γ)Cu – 64 σ : 4,50 (2) barns
- { Possible impurities : Cu – 67

- { Cu – 65(n,2n)Cu – 64
- { Possible impurities : Ni – 65

- { Zn – 64(n,p)Cu – 64
- { Possible impurities : Cu – 67, Zn – 63, Ni – 65

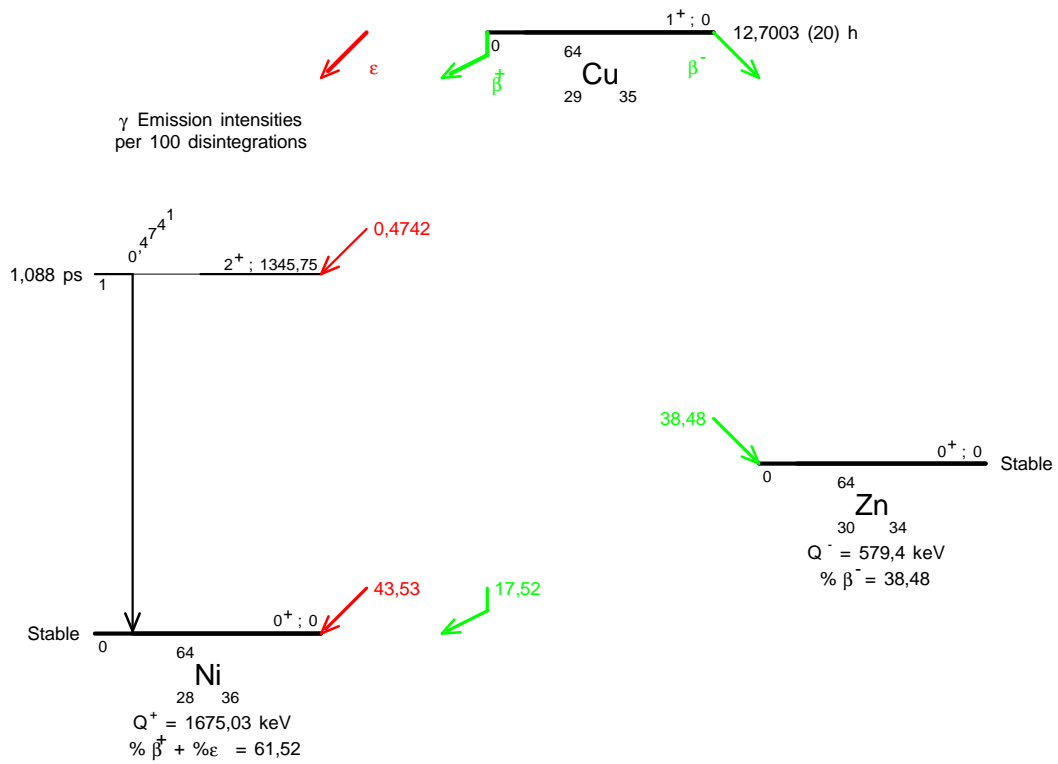
- { Zn – 64(d,2p)Cu – 64
- { Possible impurities : Cu – 67

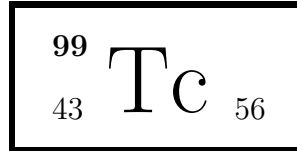
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1 Decay Scheme

Le technétium 99 se désintègre par émission bêta moins principalement vers le niveau fondamental de Ru-99. Une transition bêta de faible intensité vers le niveau excité de 89,52 keV a été mise en évidence.

Technetium 99 disintegrates by beta minus emission predominately to Ru-99 ground state, and very weakly to an 89,52 keV excited level.

2 Nuclear Data

$$T_{1/2}({}^{99}\text{Tc}) : 211,5 \quad (11) \quad 10^3 \text{ a}$$

$$Q^{-}({}^{99}\text{Tc}) : 293,8 \quad (14) \quad \text{keV}$$

2.1 β^{-} Transitions

	Energy keV	Probability $\times 100$	Nature	lg ft
$\beta_{0,1}^{-}$	204,3 (14)	0,00145 (30)	Unique 2nd Forbidden	15,8
$\beta_{0,0}^{-}$	293,8 (14)	99,99855 (30)	2nd Forbidden	12,3

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ $\times 100$	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{1,0}(\text{Ru})$	89,52 (51)	0,00145 (30)	M1+71,0(5)%E2	1,173 (19)	0,265 (5)	0,0497 (9)	1,495 (25)

2.3 Ru

ω_K	:	0,796	(4)
$\bar{\omega}_L$:	0,0453	(11)
$\bar{\omega}_M$:	0,0019	
n_{KL}	:	1,000	(4)

2.3.1 X Radiations

		Energy keV	Relative probability
X _K	K α_2	19,1506	52,7
	K α_1	19,2794	100
	K β_3	21,6349	}
	K β_1	21,6565	
	K β_5''	21,832	
	K β_2	22,074	}
	K β_4	22,104	
	X _L	L ℓ	2,2538
L α		2,5542 – 2,5591	
L η		2,3826	
L β		2,6831 – 2,9436	
L γ		2,8959 – 3,1825	

2.3.2 Auger Electrons

		Energy keV	Relative probability
Auger K			
KLL	15,565 – 16,329	100	
KLX	18,267 – 19,277	40,9	
KXY	20,947 – 22,113	4,18	
Auger L			
	1,75 – 3,12		

3 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Ru)	1,75 - 3,12		0,00080 (4)
e_{AK}	(Ru)			0,000139 (27)
	KLL	15,565 - 16,329	}	
	KLX	18,267 - 19,277	}	
	KXY	20,947 - 22,113	}	
$\beta_{0,1}^-$	max:	204,3	(14)	0,00145 (30)
$\beta_{0,1}^-$	avg:			
$\beta_{0,0}^-$	max:	293,8	(14)	99,99855 (30)
$\beta_{0,0}^-$	avg:	94,6	(17)	

4 Photon Emissions

4.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.
XL	(Ru)	2,2538 — 3,1825		0,000039 (4)
$XK\alpha_2$	(Ru)	19,1506		0,000155 (30) } $K\alpha$
$XK\alpha_1$	(Ru)	19,2794		0,00029 (6) }
$XK\beta_3$	(Ru)	21,6349	}	
$XK\beta_1$	(Ru)	21,6565	}	0,000079 (15) } $K\beta'_1$
$XK\beta''_5$	(Ru)	21,832	}	
$XK\beta_2$	(Ru)	22,074	}	
$XK\beta_4$	(Ru)	22,104	}	0,0000128 (25) } $K\beta'_2$

4.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}(\text{Ru})$	89,52 (15)	0,00058 (11)

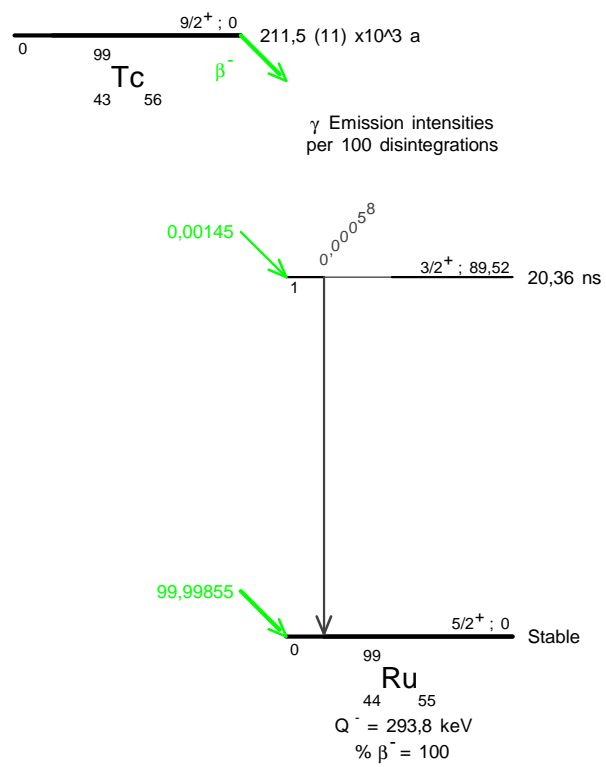
5 Main Production Modes

Mo – 98(n,γ)Mo – 99 σ : 0,130 (6) barns
 Mo – 99(β⁻)Tc – 99
 $T_{1/2} = 66h$
 Fission product.

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1 Decay Scheme

Pd-109 decays predominantly by beta- emission to the metastable state of Ag-109 which undergoes 100% IT decay (first excited state; half-life of 39.7(2) s). A full decay scheme has been proposed that encompasses Ag-109m decay to the ground state of Ag-109.

Le palladium 109 se désintègre par émissions bêta moins principalement vers le niveau excité de 39,7 s de période de l'argent 109.

2 Nuclear Data

$T_{1/2}({}^{109}\text{Pd})$:	13,58	(12)	h
$T_{1/2}({}^{109}\text{Ag}^{\text{m}})$:	39,7	(2)	s
$Q^{-}({}^{109}\text{Pd})$:	1116,1	(20)	keV

2.1 β^{-} Transitions

	Energy keV	Probability × 100	Nature	lg <i>ft</i>
$\beta_{0,23}^{-}$	17,6 (20)	0,00018 (3)	(allowed)	6,22
$\beta_{0,20}^{-}$	204,0 (22)	0,000074 (14)	1st forbidden non-unique	9,87
$\beta_{0,19}^{-}$	205,1 (20)	0,00166 (17)	allowed	8,53
$\beta_{0,16}^{-}$	246,6 (20)	0,0194 (9)	allowed	7,72
$\beta_{0,15}^{-}$	253,3 (20)	0,00167 (10)	1st forbidden non-unique	8,82
$\beta_{0,14}^{-}$	304,1 (21)	0,000108 (24)	(allowed)	10,3
$\beta_{0,11}^{-}$	380,8 (20)	0,0334 (15)	allowed	8,096
$\beta_{0,10}^{-}$	391,8 (20)	0,0204 (9)	(allowed)	8,351
$\beta_{0,9}^{-}$	409,1 (20)	0,00178 (12)	(allowed)	9,47
$\beta_{0,7}^{-}$	414,2 (20)	0,00460 (21)	1st forbidden non-unique	9,08
$\beta_{0,6}^{-}$	418,3 (20)	0,00016 (7)	(allowed)	10,55
$\beta_{0,4}^{-}$	700,9 (20)	0,0063 (2)	1st forbidden non-unique	9,73
$\beta_{0,3}^{-}$	804,7 (20)	0,0191 (22)	1st forbidden non-unique	9,46
$\beta_{0,1}^{-}$	1028,1 (20)	99,891 (3)	allowed	6,134

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ $\times 100$	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{2,1}$ (Ag)	44,7 (1)	0,0121 (15)	M1+E2	5,69 (9)	2,69 (5)	0,533 (10)	9,00 (15)
$\gamma_{1,0}$ (Ag)	88,03360 (103)	99,951 (4)	E3	11,41 (16)	12,06 (17)	2,47 (4)	26,33 (40)
$\gamma_{4,3}$ (Ag)	103,8 (2)	0,00097 (15)	M1+E2	0,329 (6)	0,0411 (7)	0,00783 (13)	0,379 (7)
$\gamma_{14,6}$ (Ag)	114,2 (9)	0,000063 (21)	(M1+E2)				
$\gamma_{16,11}$ (Ag)	134,2 (2)	0,00132 (12)	M1+E2	0,1658 (25)	0,0212 (4)	0,00404 (6)	0,192 (3)
$\gamma_{16,10}$ (Ag)	145,1 (2)	0,00096 (8)	(M1+E2)	0,1326 (20)	0,01670 (25)	0,00318 (5)	0,153 (2)
$\gamma_{7,4}$ (Ag)	286,7 (3)	0,000180 (16)	M1+E2	0,0216 (3)	0,00264 (4)	0,000501 (8)	0,0248 (4)
$\gamma_{10,4}$ (Ag)	309,1 (3)	0,00416 (23)	(E1)	0,00591 (9)	0,000697 (10)	0,0001317 (19)	0,00677 (10)
$\gamma_{3,0}$ (Ag)	311,4 (1)	0,0320 (21)	M1+E2	0,01749 (25)	0,00213 (3)	0,000405 (6)	0,0201 (3)
$\gamma_{4,1}$ (Ag)	327,2 (2)	0,000132 (15)	E1	0,00509 (8)	0,000599 (9)	0,0001133 (17)	0,00582 (9)
$\gamma_{7,3}$ (Ag)	390,5 (2)	0,00094 (7)	M1+E2	0,00980 (14)	0,001178 (17)	0,000224 (4)	0,01124 (16)
$\gamma_{9,3}$ (Ag)	395,6 (3)	0,000068 (13)	(E1)	0,00312 (5)	0,000366 (6)	0,0000692 (10)	0,00357 (5)
$\gamma_{23,6}$ (Ag)	400,7 (6)	0,000063 (23)	(M1+E2)				
$\gamma_{10,3}$ (Ag)	413,0 (2)	0,0068 (7)	(E1+(M2))	0,00366 (7)	0,000442 (8)	0,0000839 (16)	0,00420 (8)
$\gamma_{4,0}$ (Ag)	415,2 (2)	0,0110 (6)	E2	0,00944 (14)	0,001257 (18)	0,000240 (4)	0,01098 (16)
$\gamma_{11,3}$ (Ag)	423,9 (2)	0,00093 (7)	E1(+M2)	0,00436 (7)	0,000536 (9)	0,0001020 (16)	0,00502 (8)
$\gamma_{15,4}$ (Ag)	447,6 (4)	0,00087 (7)	M1+E2	0,00698 (10)	0,000833 (12)	0,0001580 (23)	0,00800 (12)
$\gamma_{16,4}$ (Ag)	454,3 (3)	0,00050 (4)	E1	0,00222 (4)	0,000259 (4)	0,0000490 (7)	0,00253 (4)
$\gamma_{20,4}$ (Ag)	496,9 (10)	0,000073 (14)	M1+E2	0,00541 (8)	0,000644 (10)	0,0001222 (18)	0,0062 (1)
$\gamma_{14,3}$ (Ag)	500,6 (6)	0,000045 (11)	(E1)	0,001756 (25)	0,000205 (3)	0,0000387 (6)	0,00201 (3)
$\gamma_{15,3}$ (Ag)	551,4 (3)	0,00065 (7)	M1+E2	0,00420 (6)	0,000500 (7)	0,0000948 (14)	0,00482 (7)
$\gamma_{16,3}$ (Ag)	558,1 (2)	0,00250 (17)	E1(+M2)	0,00207 (4)	0,000249 (4)	0,0000473 (8)	0,00238 (4)
$\gamma_{6,2}$ (Ag)	565,1 (5)	0,000108 (14)	(E2)	0,00386 (6)	0,000489 (7)	0,0000931 (14)	0,00446 (7)
$\gamma_{11,2}$ (Ag)	602,6 (2)	0,0086 (6)	E2	0,00324 (5)	0,000407 (6)	0,0000774 (11)	0,00374 (6)
$\gamma_{6,1}$ (Ag)	609,8 (4)	0,00018 (6)	(M1+E2)				
$\gamma_{10,1}$ (Ag)	636,3 (1)	0,0101 (6)	(E2)	0,00281 (4)	0,000350 (5)	0,0000665 (10)	0,00323 (5)
$\gamma_{11,1}$ (Ag)	647,3 (1)	0,0252 (14)	M1+E2				
$\gamma_{7,0}$ (Ag)	701,9 (2)	0,00348 (20)	M1+E2	0,00239 (4)	0,000280 (4)	0,0000531 (8)	0,00273 (4)
$\gamma_{9,0}$ (Ag)	707,0 (2)	0,00171 (12)	(E1)	0,000807 (12)	0,0000933 (13)	0,00001762 (25)	0,000921 (13)
$\gamma_{10,0}$ (Ag)	724,4 (1)	0,00025 (3)	(E1)	0,000766 (11)	0,0000885 (13)	0,00001672 (24)	0,000874 (13)
$\gamma_{16,2}$ (Ag)	736,7 (2)	0,00181 (13)	E2	0,00193 (3)	0,000236 (4)	0,0000448 (7)	0,00221 (4)
$\gamma_{19,2}$ (Ag)	778,3 (5)	0,00148 (17)	M1+E2				
$\gamma_{16,1}$ (Ag)	781,4 (1)	0,0123 (9)	M1+E2				
$\gamma_{23,3}$ (Ag)	787,1 (3)	0,0000216 (18)	(E1)	0,000644 (9)	0,0000743 (11)	0,00001403 (20)	0,000735 (11)
$\gamma_{19,1}$ (Ag)	823,0 (4)	0,000181 (18)	M1+E2				
$\gamma_{15,0}$ (Ag)	862,8 (2)	0,000148 (20)	E2	0,001313 (19)	0,0001583 (23)	0,0000300 (5)	0,00151 (2)
$\gamma_{16,0}$ (Ag)	869,5 (1)	0,000053 (16)	M2(+E3)	0,00372 (6)	0,000453 (7)	0,0000862 (13)	0,00427 (6)
$\gamma_{23,2}$ (Ag)	965,8 (3)	0,000068 (11)					
$\gamma_{23,1}$ (Ag)	1010,5 (2)	0,000030 (6)					

3 Atomic Data

3.1 Ag

ω_K	:	0,831	(4)
$\bar{\omega}_L$:	0,0583	(14)
n_{KL}	:	0,964	(4)

3.1.1 X Radiations

		Energy keV		Relative probability
X _K	K α_2	21,9906		53
	K α_1	22,16317		100
	K β_3	24,9118	}	
	K β_1	24,9427	}	
	K β_5''	25,146	}	27,7
	K β_2	25,4567	}	
	K β_4	25,512	}	4,8
	X _L			
	L ℓ	2,634		
	L α	2,978 – 2,984		
	L η	2,806		
	L β	3,151 – 3,348		
	L γ	3,52 – 3,75		

3.1.2 Auger Electrons

		Energy keV	Relative probability
Auger K			
	KLL	17,79 – 18,69	100
	KLX	20,945 – 22,160	42,5
	KXY	24,079 – 25,507	4,52
Auger L		1,9 – 3,8	1656

4 Electron Emissions

		Energy keV	Electrons per 100 disint.
e _{AL}	(Ag)	1,9 - 3,8	79,5 (5)
e _{AK}	(Ag)		7,06 (23)
	KLL	17,79 - 18,69	}
	KLX	20,945 - 22,160	}
	KXY	24,079 - 25,507	}
ec _{1,0 T}	(Ag)	62,52 - 88,03	96,29 (6)
ec _{1,0 K}	(Ag)	62,520 (1)	41,7 (4)
ec _{1,0 L}	(Ag)	84,2278 - 84,6825	44,1 (4)
$\beta_{0,23}^-$	max:	17,6 (20)	0,00018 (3)
$\beta_{0,23}^-$	avg:	4,5 (5)	
$\beta_{0,20}^-$	max:	204,0 (22)	0,000074 (14)
$\beta_{0,20}^-$	avg:	56,3 (7)	
$\beta_{0,19}^-$	max:	205,1 (20)	0,00166 (17)
$\beta_{0,19}^-$	avg:	56,7 (6)	
$\beta_{0,16}^-$	max:	246,6 (20)	0,0194 (9)
$\beta_{0,16}^-$	avg:	69,4 (6)	
$\beta_{0,15}^-$	max:	253,3 (20)	0,00167 (10)
$\beta_{0,15}^-$	avg:	71,5 (6)	
$\beta_{0,14}^-$	max:	304,1 (21)	0,000108 (24)
$\beta_{0,14}^-$	avg:	87,7 (7)	
$\beta_{0,11}^-$	max:	380,8 (20)	0,0334 (15)
$\beta_{0,11}^-$	avg:	113,1 (7)	
$\beta_{0,10}^-$	max:	391,8 (20)	0,0204 (9)
$\beta_{0,10}^-$	avg:	116,8 (7)	
$\beta_{0,9}^-$	max:	409,1 (20)	0,00178 (12)
$\beta_{0,9}^-$	avg:	122,8 (7)	
$\beta_{0,7}^-$	max:	414,2 (20)	0,00460 (21)
$\beta_{0,7}^-$	avg:	124,5 (7)	
$\beta_{0,6}^-$	max:	418,3 (20)	0,00016 (7)
$\beta_{0,6}^-$	avg:	125,9 (7)	
$\beta_{0,4}^-$	max:	700,9 (20)	0,0063 (2)
$\beta_{0,4}^-$	avg:	229,7 (8)	
$\beta_{0,3}^-$	max:	804,7 (20)	0,0191 (22)
$\beta_{0,3}^-$	avg:	270,3 (8)	
$\beta_{0,1}^-$	max:	1028,1 (20)	99,891 (3)
$\beta_{0,1}^-$	avg:	361,0 (8)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV	Photons per 100 disint.	
XL	(Ag)	2,634 — 3,75	4,92 (13)	
XK α_2	(Ag)	21,9906	9,92 (23)	} K α
XK α_1	(Ag)	22,16317	18,7 (5)	
XK β_3	(Ag)	24,9118	}	K' β_1
XK β_1	(Ag)	24,9427	}	
XK β_5''	(Ag)	25,146	}	
XK β_2	(Ag)	25,4567	}	K' β_2
XK β_4	(Ag)	25,512	} 0,90 (4)	

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{2,1}$ (Ag)	44,7 (1)	0,00121 (15)
$\gamma_{1,0}$ (Ag)	88,03360 (103)	3,66 (6)
$\gamma_{4,3}$ (Ag)	103,8 (2)	0,00070 (11)
$\gamma_{14,6}$ (Ag)	114,2 (9)	0,000063 (21)
$\gamma_{16,11}$ (Ag)	134,2 (2)	0,00111 (10)
$\gamma_{16,10}$ (Ag)	145,1 (2)	0,00083 (7)
$\gamma_{7,4}$ (Ag)	286,7 (3)	0,000176 (16)
$\gamma_{10,4}$ (Ag)	309,1 (3)	0,00413 (23)
$\gamma_{3,0}$ (Ag)	311,4 (1)	0,0314 (21)
$\gamma_{4,1}$ (Ag)	327,2 (2)	0,000131 (15)
$\gamma_{7,3}$ (Ag)	390,5 (2)	0,00093 (7)
$\gamma_{9,3}$ (Ag)	395,6 (3)	0,000068 (13)
$\gamma_{23,6}$ (Ag)	400,7 (6)	0,000063 (23)
$\gamma_{10,3}$ (Ag)	413,0 (2)	0,0068 (7)
$\gamma_{4,0}$ (Ag)	415,2 (2)	0,0109 (6)
$\gamma_{11,3}$ (Ag)	423,9 (2)	0,00093 (7)
$\gamma_{15,4}$ (Ag)	447,6 (4)	0,00086 (7)
$\gamma_{16,4}$ (Ag)	454,3 (3)	0,00050 (4)
$\gamma_{20,4}$ (Ag)	496,9 (10)	0,000073 (14)
$\gamma_{14,3}$ (Ag)	500,6 (6)	0,000045 (11)
$\gamma_{15,3}$ (Ag)	551,4 (3)	0,00065 (7)
$\gamma_{16,3}$ (Ag)	558,1 (2)	0,00249 (17)
$\gamma_{6,2}$ (Ag)	565,1 (5)	0,000108 (14)
$\gamma_{11,2}$ (Ag)	602,6 (2)	0,0086 (6)
$\gamma_{6,1}$ (Ag)	609,8 (4)	0,00018 (6)
$\gamma_{10,1}$ (Ag)	636,3 (1)	0,0101 (6)

	Energy keV	Photons per 100 disint.
$\gamma_{11,1}(\text{Ag})$	647,3 (1)	0,0252 (14)
$\gamma_{7,0}(\text{Ag})$	701,9 (2)	0,00347 (20)
$\gamma_{9,0}(\text{Ag})$	707,0 (2)	0,00171 (12)
$\gamma_{10,0}(\text{Ag})$	724,4 (1)	0,00025 (3)
$\gamma_{16,2}(\text{Ag})$	736,7 (2)	0,00181 (13)
$\gamma_{19,2}(\text{Ag})$	778,3 (5)	0,00148 (17)
$\gamma_{16,1}(\text{Ag})$	781,4 (1)	0,0123 (9)
$\gamma_{23,3}(\text{Ag})$	787,1 (3)	0,0000216 (18)
$\gamma_{19,1}(\text{Ag})$	823,0 (4)	0,000181 (18)
$\gamma_{15,0}(\text{Ag})$	862,8 (2)	0,000148 (20)
$\gamma_{16,0}(\text{Ag})$	869,5 (1)	0,000053 (16)
$\gamma_{23,2}(\text{Ag})$	965,8 (3)	0,000068 (11)
$\gamma_{23,1}(\text{Ag})$	1010,5 (2)	0,000030 (6)

6 Main Production Modes

Pd – 108(n, γ)Pd – 109

Pd – 108(d,p)Pd – 109

Pd – 110(n,2n)Pd – 109

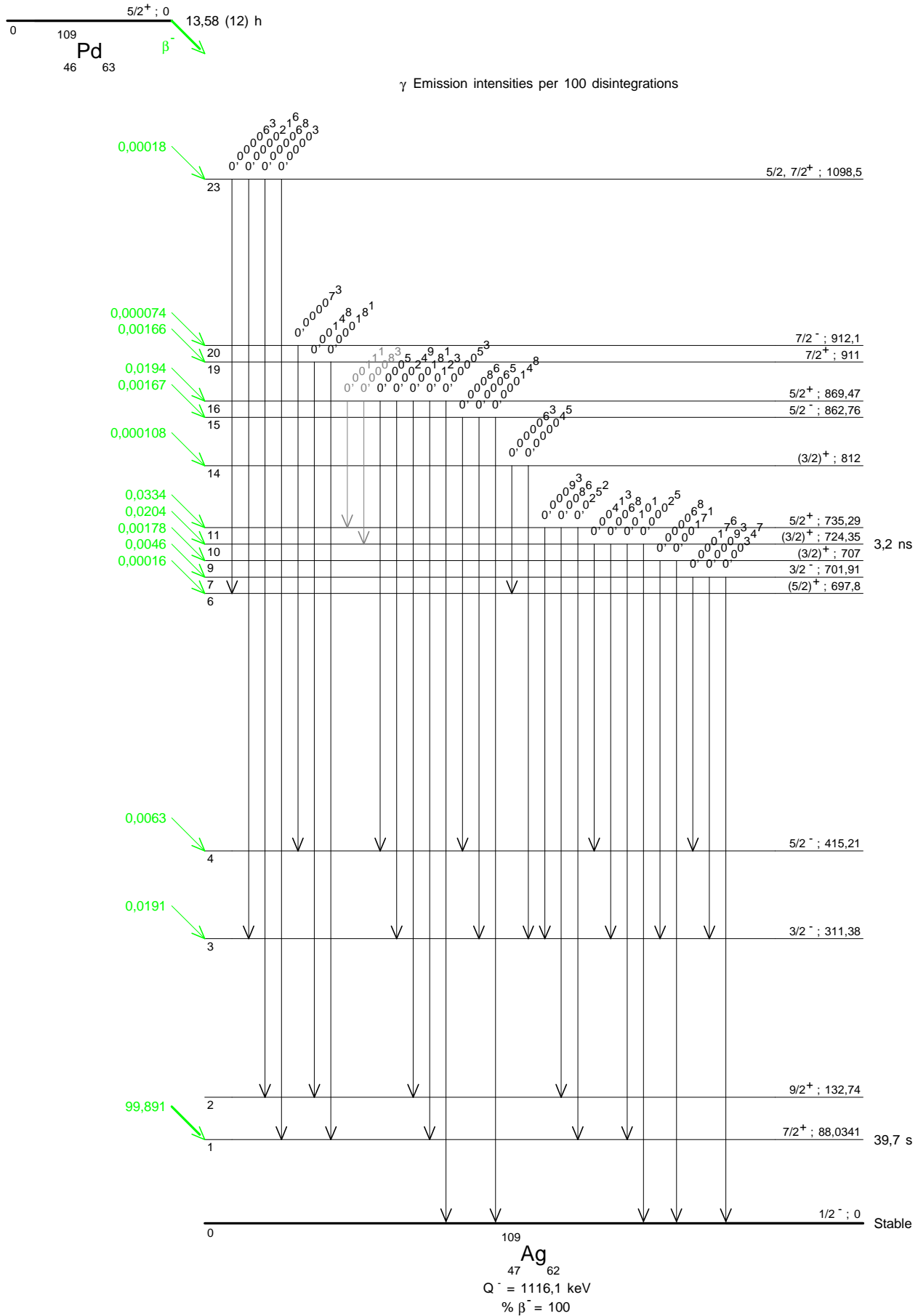
U – 238(n,f)Pd – 109

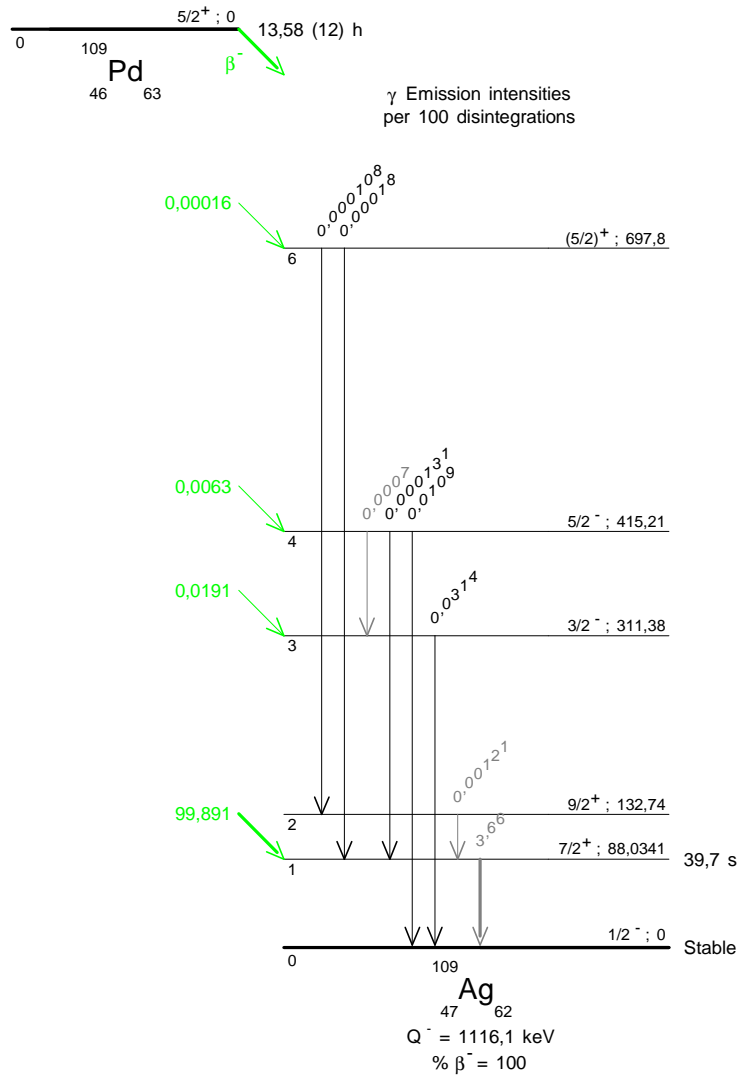
7 References

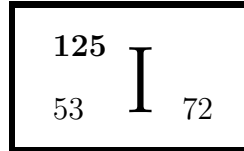
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1 Decay Scheme

I-125 disintegrates by 100% electron capture via the excited level of 35,5 keV of Te-125 into the ground state of Te-125. A direct transition to the ground state of Te-125 has not been observed.

L'iode 125 se désintègre à 100% par capture électronique vers le niveau fondamental de tellure 125 via le niveau excité de 35,5 keV.

Aucune transition directe vers le fondamental n'a été observée.

2 Nuclear Data

$$T_{1/2}({}^{125}\text{I}) : 59,388 \quad (28) \quad \text{d}$$

$$Q^+({}^{125}\text{I}) : 185,77 \quad (6) \quad \text{keV}$$

2.1 Electron Capture Transitions

	Energy keV	Probability × 100	Nature	lg <i>ft</i>	P_K	P_L	P_M
$\epsilon_{0,1}$	150,28 (6)	100	Allowed	5,4	0,8011 (17)	0,1561 (13)	0,0349 (7)

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{1,0}(\text{Te})$	35,4922 (5)	100	M1 + 0,72 % E2	11,70 (17)	1,91 (8)	0,386 (16)	14,08 (22)

3 Atomic Data

3.1 Te

ω_K	:	0,875	(4)
$\bar{\omega}_L$:	0,086	(4)
$\bar{\omega}_M$:	0,00298	(20)
n_{KL}	:	0,917	(4)
\bar{n}_{LM}	:	1,643	(50)

3.1.1 X Radiations

	Energy keV	Relative probability	
X _K	K α_2	27,202	53,7
	K α_1	27,4726	100
	K β_3	30,9446	}
	K β_1	30,996	}
	K β_5''	31,236	}
			28,62
	K β_2	31,7008	}
	K β_4	31,774	}
	KO _{2,3}	31,812	}
			6,21
X _L	L ℓ	3,3348	
	L α	3,7595 – 3,7697	
	L η	3,6052	
	L β	4,0299 – 4,3661	
	L γ	4,4448 – 4,8228	

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	21,804 – 22,989	100
KLX	25,814 – 27,470	45,3
KXY	29,80 – 31,81	5,13
Auger L	2,3 – 4,8	

4 Electron Emissions

		Energy keV	Electrons per 100 disint.
e _{AL}	(Te)	2,3 - 4,8	158,2 (8)
e _{AK}	(Te)		19,7 (7)
	KLL	21,804 - 22,989	}
	KLX	25,814 - 27,470	}
	KXY	29,80 - 31,81	}
ec _{1,0} K	(Te)	3,6784 (5)	77,6 (13)
ec _{1,0} L	(Te)	30,5530 - 31,1508	12,7 (5)
ec _{1,0} M	(Te)	34,4860 - 34,9201	2,56 (11)
ec _{1,0} N	(Te)	35,3239 - 35,4524	0,497 (20)

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV	Photons per 100 disint.
XL	(Te)	3,3348 — 4,8228	14,70 (28)
XK α_2	(Te)	27,202	39,3 (5) } K α
XK α_1	(Te)	27,4726	73,2 (8) }
XK β_3	(Te)	30,9446	}
XK β_1	(Te)	30,996	}
XK β_5''	(Te)	31,236	}
XK β_2	(Te)	31,7008	}
XK β_4	(Te)	31,774	}
XK $O_{2,3}$	(Te)	31,812	}
			4,54 (13) K' β_1
			K' β_2

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}(\text{Te})$	35,4922 (5)	6,63 (6)

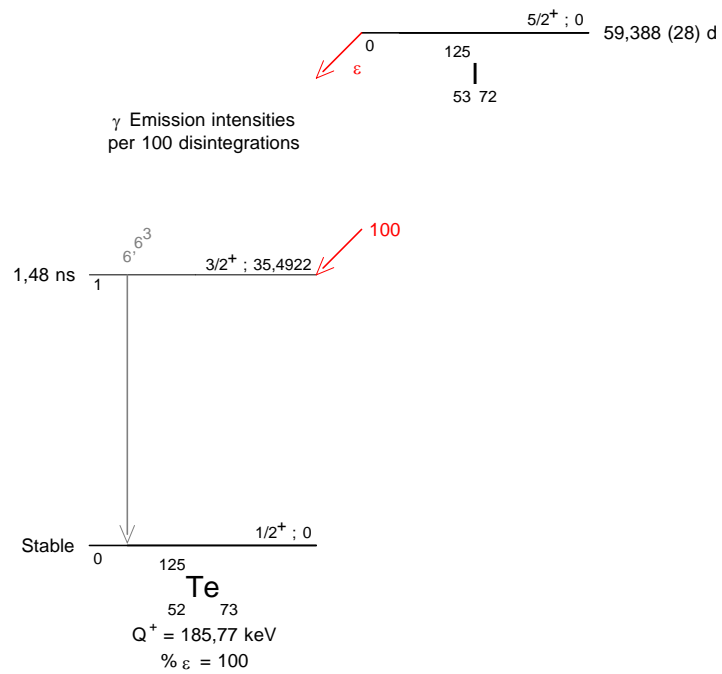
6 Main Production Modes

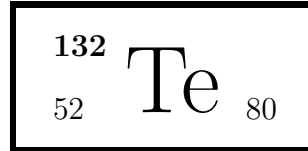
- $\text{Xe} - 124(n,\gamma)\text{Xe} - 125 \quad \sigma : 165 \text{ barns}$
 { $\text{Xe} - 125(\text{E.C.})\text{I} - 125$
 Possible impurities : $T_{1/2} = 16,9\text{h}$
- { $\text{Te} - 125(d,2n)\text{I} - 125$
 Possible impurities : $\text{I} - 126$

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1 Decay Scheme

Te-132 decays solely by one single beta- emission to the 277.86-keV nuclear level of I-132 which undergoes immediate decay to the ground state by means of a cascade of four gamma transitions.

Le tellure 132 se désintègre par une transition bêta moins vers le niveau excité de 277 keV de l'iode 132. Le niveau fondamental de l'iode 132 est atteint par des transitions gamma en cascade.

2 Nuclear Data

$T_{1/2}(^{132}\text{Te})$:	3,230	(13)	d
$T_{1/2}(^{132}\text{I})$:	2,295	(13)	h
$Q^-(^{132}\text{Te})$:	518	(4)	keV

2.1 β^- Transitions

	Energy keV	Probability $\times 100$	Nature	lg ft
$\beta_{0,5}^-$	240 (4)	100	allowed	4,85

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ $\times 100$	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{2,0}(\text{I})$	49,72 (1)	100	M1	4,83 (7)	0,638 (9)	0,1286 (18)	5,62 (8)
$\gamma_{4,2}(\text{I})$	111,81 (8)	3,2 (3)	M1 + 25 % E2	0,562 (17)	0,115 (9)	0,0238 (18)	0,71 (3)
$\gamma_{5,4}(\text{I})$	116,34 (13)	3,15 (12)	M1 + 22 % E2	0,489 (13)	0,093 (6)	0,0193 (13)	0,606 (20)
$\gamma_{5,2}(\text{I})$	228,327 (3)	96,8 (2)	E2	0,0802 (12)	0,01507 (21)	0,00311 (5)	0,0990 (14)

3 Atomic Data

3.1 I

ω_K	:	0,882	(4)
$\bar{\omega}_L$:	0,092	(4)
n_{KL}	:	0,909	(4)

3.1.1 X Radiations

	Energy keV	Relative probability
X_K		
$K\alpha_2$	28,3175	53,9
$K\alpha_1$	28,6123	100
$K\beta_3$	32,2397	}
$K\beta_1$	32,2951	}
$K\beta_5''$	32,544	}
		28,8
$K\beta_2$	33,042	}
$K\beta_4$	33,12	}
$KO_{2,3}$	33,166	}
X_L		
$L\ell$	3,485	
$L\alpha$	3,926 – 3,938	
$L\eta$	3,78	
$L\beta$	4,221 – 4,508	
$L\gamma$	4,802 – 5,065	

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	22,659 – 23,909	100
KLX	26,853 – 28,609	45,9
KXY	31,02 – 33,16	5,27
Auger L	2,37 – 3,88	1219

4 Electron Emissions

		Energy keV	Electrons per 100 disint.
e _{AL}	(I)	2,37 - 3,88	78,0 (13)
e _{AK}	(I)		9,7 (3)
	KLL	22,659 - 23,909	}
	KLX	26,853 - 28,609	}
	KXY	31,02 - 33,16	}
ec _{2,0} K	(I)	16,55 (1)	72,9 (18)
ec _{2,0} L	(I)	44,53 - 45,16	9,63 (23)
ec _{2,0} M	(I)	48,65 - 49,10	1,94 (5)
ec _{2,0} N	(I)	49,53 - 49,67	0,393 (10)
ec _{4,2} K	(I)	78,64 (8)	1,04 (11)
ec _{5,4} K	(I)	83,17 (13)	0,96 (4)
ec _{4,2} L	(I)	106,62 - 107,25	0,21 (3)
ec _{5,4} L	(I)	111,15 - 111,78	0,183 (13)
ec _{5,2} K	(I)	195,158 (3)	7,07 (11)
ec _{5,2} L	(I)	223,139 - 223,770	1,328 (19)
ec _{5,2} M	(I)	227,255 - 227,708	0,274 (4)
ec _{5,2} N	(I)	228,141 - 228,277	0,0539 (8)
$\beta_{0,5}^-$	max:	240 (4)	100
$\beta_{0,5}^-$	avg:	67,0 (13)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV	Photons per 100 disint.
XL	(I)	3,485 — 5,065	7,9 (4)
XK α_2	(I)	28,3175	20,6 (5) } K α
XK α_1	(I)	28,6123	38,2 (9) }
XK β_3	(I)	32,2397 }	
XK β_1	(I)	32,2951 }	11,0 (3) K' β_1
XK β_5''	(I)	32,544 }	

		Energy keV	Photons per 100 disint.		
XK β_2	(I)	33,042	}	2,49 (9)	K' β_2
XK β_4	(I)	33,12	}		
XKO $_{2,3}$	(I)	33,166	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{2,0}$ (I)	49,72 (1)	15,1 (3)
$\gamma_{4,2}$ (I)	111,81 (8)	1,85 (18)
$\gamma_{5,4}$ (I)	116,34 (13)	1,97 (7)
$\gamma_{5,2}$ (I)	228,327 (3)	88,12 (13)

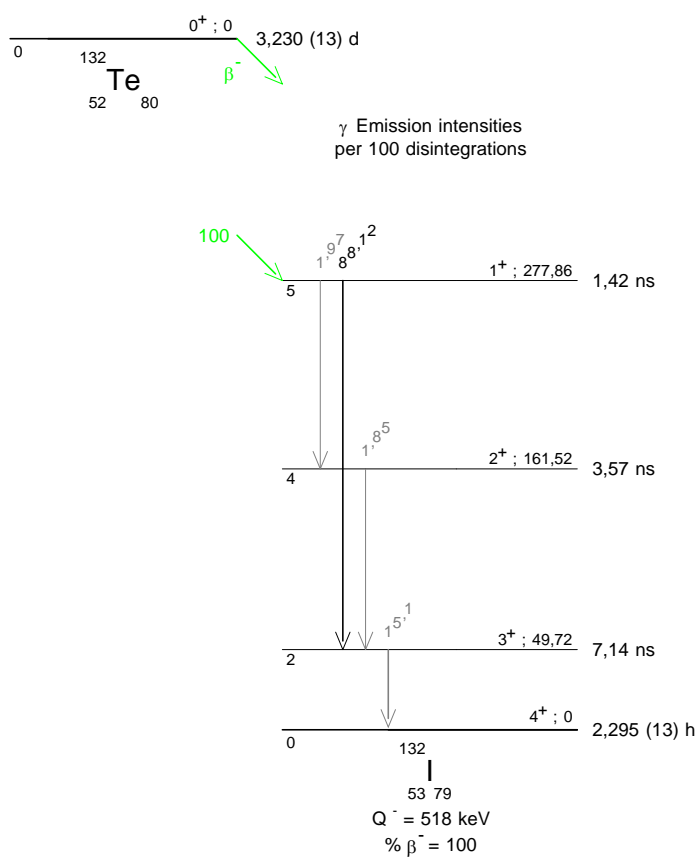
6 Main Production Modes

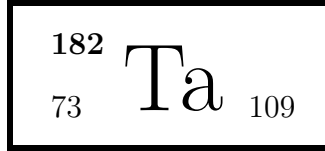
U – 238(n,f)
Cf – 252(sf)

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(Theoretical ICC)





1 Decay Scheme

Ta-182 disintegrates by beta minus emissions to excited levels of W-182.

Le tantale 182 se désintègre par émission beta moins vers les niveaux excités du tungstène 182.

2 Nuclear Data

$$T_{1/2}(^{182}\text{Ta}) : 114,61 \quad (13) \quad \text{d}$$

$$Q^-(^{182}\text{Ta}) : 1814,3 \quad (17) \quad \text{keV}$$

2.1 β^- Transitions

	Energy keV	Probability $\times 100$	Nature	lg ft
$\beta_{0,13}^-$	261,1 (17)	29,0 (7)	Allowed	7,5
$\beta_{0,12}^-$	304,0 (17)	0,1414 (39)	1st Forbidden	10
$\beta_{0,11}^-$	326,8 (17)	1,5 (7)	Allowed	9,1
$\beta_{0,10}^-$	371,5 (17)	0,563 (10)	1st Forbidden	9,7
$\beta_{0,9}^-$	440,5 (17)	19,9 (7)	Allowed	8,4
$\beta_{0,8}^-$	483,2 (17)	2,39 (15)	1st Forbidden	9,5
$\beta_{0,7}^-$	525,2 (17)	45,1 (23)	Allowed	8,3
$\beta_{0,6}^-$	556,9 (17)	0,22 (21)	1st Forbidden	10,7
$\beta_{0,5}^-$	592,9 (17)	1,6 (22)	1st Forbidden	9,9
$\beta_{0,2}^-$	1484,9 (17)	~ 0	1st Forbidden	13
$\beta_{0,1}^-$	1714,2 (17)	~ 0	1st Forbidden	12,2

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	P _{γ+ce} × 100	Multipolarity	α _K	α _L	α _M	α _T
γ _{7,6} (W)	31,7377 (15)	2,20 (16)	E1		1,259 (18)	0,293 (4)	1,628 (23)
γ _{9,8} (W)	42,7148 (14)	0,463 (12)	E1		0,557 (8)	0,1286 (18)	0,72 (1)
γ _{13,11} (W)	65,72215 (15)	11,6 (7)	M1+0,88%E2		2,25 (15)	0,52 (4)	2,92 (20)
γ _{7,5} (W)	67,74970 (10)	53,2 (22)	E1+0,03%M2		0,173 (21)	0,040 (6)	0,22 (3)
γ _{9,7} (W)	84,68024 (26)	22,7 (6)	M1+8,7%E2	5,88 (9)	1,36 (4)	0,321 (8)	7,66 (11)
γ _{1,0} (W)	100,10595 (7)	69,5 (12)	E2	0,878 (13)	2,28 (4)	0,576 (8)	3,89 (6)
γ _{13,10} (W)	110,388 (9)	0,1384 (43)	[E1]	0,238 (4)	0,0408 (6)	0,00931 (13)	0,290 (4)
γ _{11,9} (W)	113,67170 (22)	7,83 (13)	M1+10,3%E2	2,50 (5)	0,529 (16)	0,124 (4)	3,19 (5)
γ _{9,6} (W)	116,4179 (6)	0,557 (7)	E1	0,207 (3)	0,0353 (5)	0,00805 (12)	0,253 (4)
γ _{6,4} (W)	121,50 (14)	0,0060 (21)	[E2]	0,596 (9)	0,936 (15)	0,236 (4)	1,83 (3)
γ _{9,5} (W)	152,42991 (26)	7,89 (15)	E1	0,1038 (15)	0,01703 (24)	0,00387 (6)	0,1258 (18)
γ _{11,8} (W)	156,3864 (3)	2,976 (30)	E1	0,0972 (14)	0,01590 (23)	0,00362 (5)	0,1177 (17)
γ _{13,9} (W)	179,39381 (25)	5,05 (22)	M1+59,4%E2	0,44 (8)	0,148 (7)	0,0358 (21)	0,63 (7)
γ _{11,7} (W)	198,35187 (29)	1,925 (21)	E2	0,1725 (25)	0,1097 (16)	0,0273 (4)	0,317 (5)
γ _{13,8} (W)	222,1085 (3)	7,91 (8)	E1	0,0399 (6)	0,00630 (9)	0,001429 (20)	0,0480 (7)
γ _{2,1} (W)	229,3207 (6)	4,347 (45)	E2	0,1167 (17)	0,0605 (9)	0,01497 (21)	0,196 (3)
γ _{13,7} (W)	264,0740 (3)	4,054 (41)	E2	0,0799 (12)	0,0347 (5)	0,00852 (12)	0,1254 (18)
γ _{3,2} (W)	351,02 (6)	0,01219 (39)	E2	0,0380 (6)	0,01210 (17)	0,00293 (5)	0,0538 (8)
γ _{12,3} (W)	829,80 (9)	0,0142 (25)	[E2]	0,00536 (8)	0,000962 (14)	0,000222 (4)	0,00661 (10)
γ _{5,2} (W)	891,9733 (12)	0,0573 (25)	E2	0,00464 (7)	0,000810 (12)	0,000187 (3)	0,00569 (8)
γ _{6,2} (W)	927,9853 (13)	0,617 (7)	E2	0,00429 (6)	0,000738 (11)	0,0001698 (24)	0,00524 (8)
γ _{7,2} (W)	959,7230 (12)	0,352 (5)	M2+96,8%E3	0,00901 (15)	0,00196 (3)	0,000463 (7)	0,01157 (19)
γ _{8,2} (W)	1001,6885 (12)	2,08 (5)	M1+98,8%E2	0,00374 (6)	0,000627 (10)	0,0001438 (23)	0,00455 (8)
γ _{4,1} (W)	1035,80 (14)	0,0060 (21)	E2	0,00346 (5)	0,000575 (8)	0,0001317 (19)	0,00420 (6)
γ _{9,2} (W)	1044,4033 (12)	0,2394 (42)	E1+18,7%M2	0,00444 (12)	0,000703 (20)	0,000160 (5)	0,00535 (15)
γ _{10,2} (W)	1113,409 (9)	0,444 (8)	M1+96,1%E2	0,00311 (8)	0,000504 (12)	0,000115 (3)	0,00376 (10)
γ _{5,1} (W)	1121,290 (3)	35,30 (33)	M1+99,9%E2	0,00297 (5)	0,000483 (7)	0,0001104 (16)	0,00360 (5)
γ _{4,0} (W)	1135,91 (14)		E0				
γ _{6,1} (W)	1157,3061 (11)	0,84 (13)	M1+62,8%E2	0,0039 (11)	0,00060 (15)	0,00014 (4)	0,0046 (13)
γ _{11,2} (W)	1158,0750 (12)	0,296 (18)	E1	0,001159 (17)	0,0001632 (23)	0,0000366 (6)	0,001377 (20)
γ _{12,2} (W)	1180,82 (7)	0,0872 (29)	E2+88,7%M1	0,0030 (4)	0,00047 (5)	0,000108 (11)	0,0036 (4)
γ _{7,1} (W)	1189,040 (3)	16,66 (16)	60%E1+13%M2+27%E3	0,003732 (33)	0,000638 (6)	0,0001468 (14)	0,004567 (41)
γ _{5,0} (W)	1221,395 (3)	27,35 (27)	E2	0,00252 (4)	0,000402 (6)	0,0000915 (13)	0,00305 (5)
γ _{13,2} (W)	1223,7972 (12)	0,205 (21)	E1+12,6%M2	0,0024 (5)	0,00037 (8)	0,000083 (17)	0,0029 (6)
γ _{8,1} (W)	1231,004 (3)	11,66 (11)	M1+99,9%E2	0,00249 (4)	0,000395 (6)	0,0000901 (13)	0,00301 (5)
γ _{6,0} (W)	1257,407 (3)	1,515 (15)	E2	0,00239 (4)	0,000378 (6)	0,0000860 (12)	0,00289 (4)
γ _{9,1} (W)	1273,719 (3)	0,660 (7)	81%E1+11%M2+7%E3	0,002278 (21)	0,0003583 (31)	0,0000816 (8)	0,002781 (25)
γ _{7,0} (W)	1289,145 (3)	1,391 (17)	M2	0,01019 (15)	0,001630 (23)	0,000372 (6)	0,01231 (18)
γ _{10,1} (W)	1342,72 (5)	0,2569 (29)	E2+1,2%M3	0,0023 (5)	0,00036 (9)	0,000082 (21)	0,0028 (6)
γ _{9,0} (W)	1373,824 (3)	0,2237 (32)	E3	0,00400 (6)	0,000728 (11)	0,0001685 (24)	0,00496 (7)
γ _{11,1} (W)	1387,390 (3)	0,0729 (11)	M2+87,1%E3	0,00450 (15)	0,000791 (22)	0,000183 (5)	0,00554 (18)
γ _{12,1} (W)	1410,14 (7)	0,0400 (8)	E2	0,00193 (3)	0,000298 (5)	0,0000676 (10)	0,00235 (4)
γ _{13,1} (W)	1453,118 (1)	0,037 (7)	M2+81,5%E3	0,0043 (3)	0,00074 (5)	0,000169 (10)	0,0053 (4)

3 Atomic Data

3.1 W

ω_K	:	0,954	(4)
$\bar{\omega}_L$:	0,283	(11)
n_{KL}	:	0,825	(4)

3.1.1 X Radiations

	Energy keV	Relative probability
X_K		
$K\alpha_2$	57,9823	57,57
$K\alpha_1$	59,3189	100
$K\beta_3$	66,952	}
$K\beta_1$	67,2451	}
$K\beta_5''$	67,664	}
		33,15
$K\beta_2$	69,033	}
$K\beta_4$	69,295	}
$KO_{2,3}$	69,484	}
		9,08
X_L		
$L\ell$	7,3881	
$L\alpha$	8,3352 – 8,3976	
$L\eta$	8,725	
$L\beta$	9,526 – 9,9485	
$L\gamma$	10,9501 – 11,6761	

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	45,109 – 48,882	100
KLX	54,514 – 59,312	53,7
KXY	63,89 – 69,51	7,18
Auger L	4,5 – 12,1	

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e _{AL}	(W)	4,5	- 12,1	59,5 (7)
e _{AK}	(W)			1,68 (15)
	KLL	45,109	- 48,882	}
	KLX	54,514	- 59,312	}
	KXY	63,89	- 69,51	}
ec _{9,7} K	(W)	15,1553	(14)	15,41 (42)
ec _{7,6} L	(W)	19,6379	- 21,5309	1,06 (8)
ec _{7,6} M	(W)	28,9181	- 29,9285	0,246 (18)
ec _{1,0} K	(W)	30,58098	(7)	12,49 (23)
ec _{9,8} L	(W)	30,615	- 32,508	0,1498 (45)
ec _{11,9} K	(W)	44,1467	(14)	4,67 (11)
ec _{13,11} L	(W)	53,6224	- 55,5154	6,8 (5)
ec _{7,5} L	(W)	55,6499	- 57,5429	7,5 (10)
ec _{13,11} M	(W)	62,9026	- 63,9130	1,57 (13)
ec _{7,5} M	(W)	64,9301	- 65,9405	1,74 (27)
ec _{13,11} N	(W)	65,1270	- 65,6864	0,374 (29)
ec _{7,5} N	(W)	67,1550	- 67,7139	0,41 (6)
ec _{9,7} L	(W)	72,5805	- 74,4735	3,56 (13)
ec _{9,7} M	(W)	81,8607	- 82,8711	0,841 (28)
ec _{9,5} K	(W)	82,90491	(26)	0,728 (17)
ec _{9,7} N	(W)	84,0850	- 84,6445	0,201 (7)
ec _{11,8} K	(W)	86,8614	(3)	0,2587 (46)
ec _{1,0} L	(W)	88,0062	- 89,8992	32,4 (7)
ec _{1,0} M	(W)	97,2864	- 98,2968	8,19 (15)
ec _{1,0} N	(W)	99,5110	- 100,0702	1,931 (35)
ec _{11,9} L	(W)	101,5719	- 103,4649	0,989 (32)
ec _{13,9} K	(W)	109,86881	(25)	1,36 (25)
ec _{11,9} M	(W)	110,8521	- 111,8625	0,232 (8)
ec _{11,7} K	(W)	128,82687	(29)	0,2520 (45)
ec _{9,5} L	(W)	140,3301	- 142,2231	0,1194 (28)
ec _{13,8} K	(W)	152,5835	(3)	0,301 (5)
ec _{2,1} K	(W)	159,7957	(6)	0,424 (7)
ec _{13,9} L	(W)	167,294	- 169,187	0,459 (22)
ec _{13,9} M	(W)	176,5742	- 177,5846	0,111 (7)
ec _{11,7} L	(W)	186,2521	- 188,1451	0,1603 (29)
ec _{13,7} K	(W)	194,5490	(3)	0,288 (5)
ec _{2,1} L	(W)	217,2209	- 219,1139	0,2199 (39)
ec _{13,7} L	(W)	251,974	- 253,867	0,1250 (22)
ec _{5,1} K	(W)	1051,765	(3)	0,1045 (20)
$\beta_{0,13}^-$	max:	261,1	(17)	29,0 (7)
$\beta_{0,13}^-$	avg:	72,5	(5)	
$\beta_{0,12}^-$	max:	304,0	(17)	0,1414 (39)

		Energy keV	Electrons per 100 disint.
$\beta_{0,12}^-$	avg:	85,7 (5)	
$\beta_{0,11}^-$	max:	326,8 (17)	1,5 (7)
$\beta_{0,11}^-$	avg:	92,8 (5)	
$\beta_{0,10}^-$	max:	371,5 (17)	0,563 (10)
$\beta_{0,10}^-$	avg:	107,0 (6)	
$\beta_{0,9}^-$	max:	440,5 (17)	19,9 (7)
$\beta_{0,9}^-$	avg:	129,6 (6)	
$\beta_{0,8}^-$	max:	483,2 (17)	2,39 (15)
$\beta_{0,8}^-$	avg:	143,9 (6)	
$\beta_{0,7}^-$	max:	525,2 (17)	45,1 (23)
$\beta_{0,7}^-$	avg:	158,2 (6)	
$\beta_{0,6}^-$	max:	556,9 (17)	0,22 (21)
$\beta_{0,6}^-$	avg:	169,2 (6)	
$\beta_{0,5}^-$	max:	592,9 (17)	1,6 (22)
$\beta_{0,5}^-$	avg:	181,8 (6)	
$\beta_{0,2}^-$	max:	1484,9 (17)	~ 0
$\beta_{0,2}^-$	avg:	529,0 (7)	
$\beta_{0,1}^-$	max:	1714,2 (17)	~ 0
$\beta_{0,1}^-$	avg:	625,2 (70)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV	Photons per 100 disint.
XL	(W)	7,3881 — 11,6761	24,4 (5)
XK α_2	(W)	57,9823	10,06 (17)
XK α_1	(W)	59,3189	17,48 (29)
XK β_3	(W)	66,952	}
XK β_1	(W)	67,2451	}
XK β_5''	(W)	67,664	}
XK β_2	(W)	69,033	}
XK β_4	(W)	69,295	}
XK $O_{2,3}$	(W)	69,484	}
			5,79 (13) K' β_1
			1,59 (5) K' β_2

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{7,6}(\text{W})$	31,7377 (15)	0,84 (6)
$\gamma_{9,8}(\text{W})$	42,7148 (14)	0,269 (7)
$\gamma_{13,11}(\text{W})$	65,72215 (15)	2,97 (8)
$\gamma_{7,5}(\text{W})$	67,74970 (10)	43,6 (15)
$\gamma_{9,7}(\text{W})$	84,68024 (26)	2,62 (6)
$\gamma_{1,0}(\text{W})$	100,10595 (7)	14,22 (16)
$\gamma_{13,10}(\text{W})$	110,388 (9)	0,1073 (33)
$\gamma_{11,9}(\text{W})$	113,67170 (22)	1,869 (20)
$\gamma_{9,6}(\text{W})$	116,4179 (6)	0,445 (5)
$\gamma_{6,4}(\text{W})$	121,50 (14)	0,0021 (7)
$\gamma_{9,5}(\text{W})$	152,42991 (26)	7,01 (13)
$\gamma_{11,8}(\text{W})$	156,3864 (3)	2,662 (27)
$\gamma_{13,9}(\text{W})$	179,39381 (25)	3,099 (31)
$\gamma_{11,7}(\text{W})$	198,35187 (29)	1,461 (15)
$\gamma_{13,8}(\text{W})$	222,1085 (3)	7,54 (7)
$\gamma_{2,1}(\text{W})$	229,3207 (6)	3,634 (36)
$\gamma_{13,7}(\text{W})$	264,0740 (3)	3,602 (36)
$\gamma_{3,2}(\text{W})$	351,02 (6)	0,01157 (37)
$\gamma_{12,3}(\text{W})$	829,80 (9)	0,0141 (25)
$\gamma_{5,2}(\text{W})$	891,9710 (12)	0,0570 (25)
$\gamma_{6,2}(\text{W})$	927,9828 (13)	0,614 (7)
$\gamma_{7,2}(\text{W})$	959,7203 (12)	0,348 (5)
$\gamma_{8,2}(\text{W})$	1001,6856 (12)	2,07 (5)
$\gamma_{4,1}(\text{W})$	1035,80 (14)	0,0060 (21)
$\gamma_{9,2}(\text{W})$	1044,4001 (12)	0,2381 (42)
$\gamma_{10,2}(\text{W})$	1113,406 (9)	0,442 (8)
$\gamma_{5,1}(\text{W})$	1121,290 (3)	35,17 (33)
$\gamma_{6,1}(\text{W})$	1157,3022 (11)	0,83 (13)
$\gamma_{11,2}(\text{W})$	1158,0711 (12)	0,295 (18)
$\gamma_{12,2}(\text{W})$	1180,82 (7)	0,0869 (29)
$\gamma_{7,1}(\text{W})$	1189,040 (3)	16,58 (16)
$\gamma_{5,0}(\text{W})$	1221,395 (3)	27,27 (27)
$\gamma_{13,2}(\text{W})$	1223,7928 (12)	0,204 (21)
$\gamma_{8,1}(\text{W})$	1231,004 (3)	11,62 (11)
$\gamma_{6,0}(\text{W})$	1257,407 (3)	1,511 (15)
$\gamma_{9,1}(\text{W})$	1273,719 (3)	0,658 (7)
$\gamma_{7,0}(\text{W})$	1289,145 (3)	1,374 (17)
$\gamma_{10,1}(\text{W})$	1342,72 (5)	0,2562 (28)
$\gamma_{9,0}(\text{W})$	1373,824 (3)	0,2226 (32)
$\gamma_{11,1}(\text{W})$	1387,390 (3)	0,0725 (11)
$\gamma_{12,1}(\text{W})$	1410,14 (7)	0,0400 (8)
$\gamma_{13,1}(\text{W})$	1453,1118 (10)	0,037 (7)

6 Main Production Modes

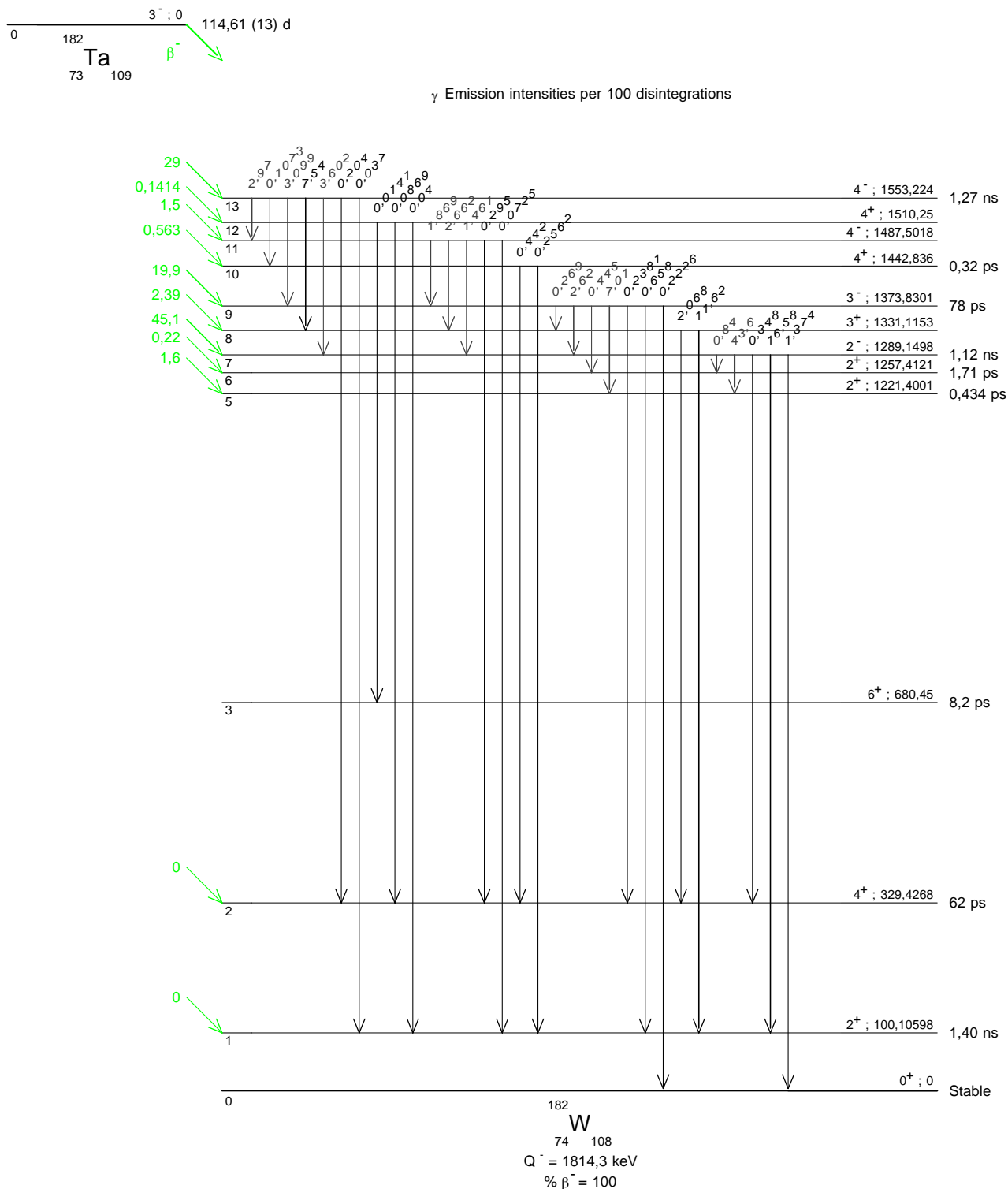
Ta – $^{182}(\beta^-)W$ – 182

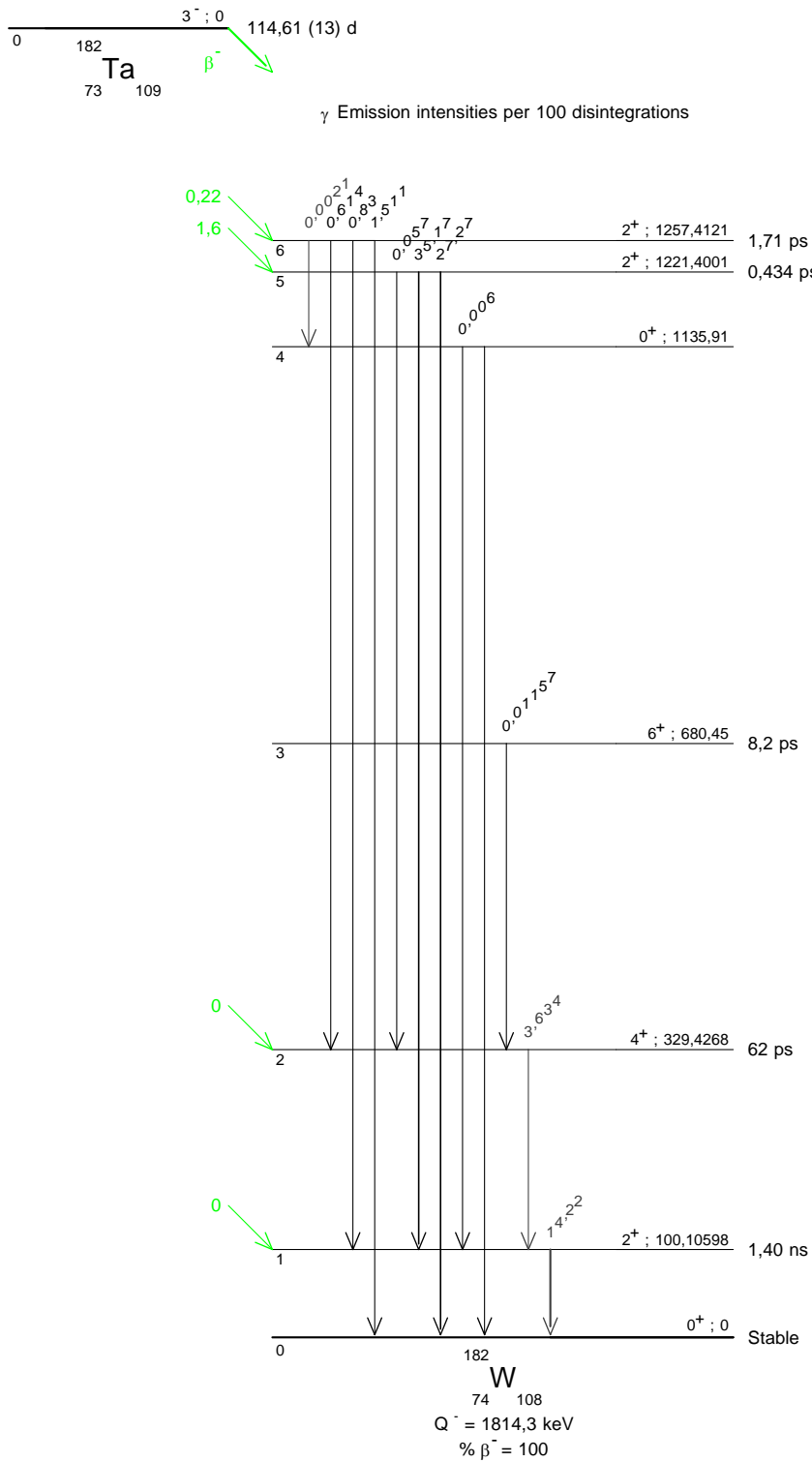
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(Spin, parity, energy levels, multipolarity)







1 Decay Scheme

Pb-209 disintegrates by 100% beta minus decay directly to the ground state of Bi-209.

Le plomb 209 se désintègre par émission bêta moins directement vers le niveau fondamental du bismuth 209.

2 Nuclear Data

$T_{1/2}^{(209\text{Pb})}$:	3,277	(15)	h
$T_{1/2}^{(209\text{Bi})}$:	19	(2)	10^{18} a
$Q^{-}(209\text{Pb})$:	644,0	(12)	keV

2.1 β^{-} Transitions

	Energy keV	Probability $\times 100$	Nature	lg ft
$\beta_{0,0}^{-}$	644,0 (12)	100	1st forbidden non-unique	5,54

3 Electron Emissions

	Energy keV	Electrons per 100 disint.
$\beta_{0,0}^{-}$	max: 644,0 (12)	100
$\beta_{0,0}^{-}$	avg: 197,35 (42)	

4 Main Production Modes

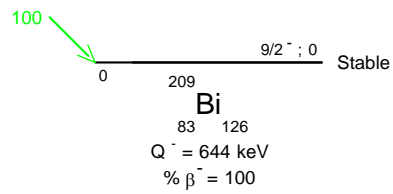
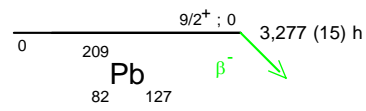
Tl – $209(\beta^-)\text{Pb} - 209$

Pb – $208(n,\gamma)\text{Pb} - 209$

Pb – $208(d,p)\text{Pb} - 209$

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(Q value)





1 Decay Scheme

Po-209 disintegrates by alpha emissions (99,546 (7) %) to excited levels and to the ground state level in Pb-205 and by electron capture (0,454 (7) %) to the excited level of 896,3 keV in Bi-209.

Le polonium 209 se désintègre par émission alpha (99,546 (7) %) vers des niveaux excités et le niveau fondamental du plomb 205 et par capture électronique (0,454 (7) %) vers le premier niveau excité du bismuth 209.

2 Nuclear Data

$T_{1/2}(^{209}\text{Po})$:	115	(13)	a
$T_{1/2}(^{209}\text{Bi})$:	1,9	(2)	10^{19} a
$T_{1/2}(^{205}\text{Pb})$:	17,3	(7)	10^6 a
$Q^\alpha(^{209}\text{Po})$:	4979,2	(14)	keV
$Q^+(^{209}\text{Po})$:	1892,5	(16)	keV

2.1 α Transitions

	Energy keV	Probability $\times 100$	F
$\alpha_{0,2}$	4716,4 (14)	0,548 (7)	4,5
$\alpha_{0,1}$	4976,9 (14)	79,2 (32)	1,3
$\alpha_{0,0}$	4979,2 (14)	19,8 (32)	6

2.2 Electron Capture Transitions

	Energy keV	Probability × 100	Nature	lg <i>ft</i>	<i>P_K</i>	<i>P_L</i>	<i>P_M</i>
ε _{0,1}	996,2 (16)	0,454 (7)	Unique 2nd Forbidden	14,36	0,70796 (22)	0,21518 (16)	0,07686 (7)

2.3 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	<i>P_{γ+ce}</i> × 100	Multipolarity	<i>α_K</i>	<i>α_L</i>	<i>α_M</i>	<i>α_T</i>
γ _{1,0} (Pb)	2,328 (7)	79,6 (32)					
γ _{2,1} (Pb)	260,50 (5)	0,411 (6)	M1+E2	0,503 (12)	0,0874 (14)	0,0205 (3)	0,617 (13)
γ _{2,0} (Pb)	262,80 (5)	0,1370 (33)	M1 + 0,25 % E2	0,500 (9)	0,0857 (13)	0,0201 (3)	0,612 (10)
γ _{1,0} (Bi)	896,28 (6)	0,454 (7)	M1 + 27,8 % E2	0,0170 (5)	0,00292 (7)	0,000687 (16)	0,0208 (6)

3 Atomic Data

3.1 Bi

<i>ω_K</i>	:	0,964 (4)
<i>ω_L</i>	:	0,391 (16)
<i>n_{KL}</i>	:	0,809 (5)

3.1.1 X Radiations

	Energy keV	Relative probability	
X _K	Kα ₂	74,8157	
	Kα ₁	77,1088	
	Kβ ₃	86,835	
	Kβ ₁	87,344	
	Kβ ₅ ''	87,862	
	Kβ ₂	89,732	
	Kβ ₄	90,074	
	KO _{2,3}	90,421	
			59,77
			100

	Energy keV	Relative probability
X_L		
L ℓ	9,4207	
L α	10,7308 – 10,8387	
L η	11,7127	
L β	12,4814 – 13,8066	
L γ	14,7735 – 15,7084	

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	57,491 – 63,419	100
KLX	70,025 – 77,105	56
KXY	82,53 – 90,52	7,84
Auger L	5,42 – 16,34	

3.2 Pb

$$\begin{aligned} \omega_K &: 0,963 \quad (4) \\ \bar{\omega}_L &: 0,379 \quad (15) \\ n_{KL} &: 0,811 \quad (5) \end{aligned}$$

3.2.1 X Radiations

	Energy keV	Relative probability
X_K		
K α_2	72,8049	59,5
K α_1	74,97	100
K β_3	84,451	}
K β_1	84,937	}
K β_5''	85,47	}
		34,2
K β_2	87,238	}
K β_4	87,58	}
KO $_{2,3}$	87,911	}
		10,3
X_L		
L ℓ	9,186	
L α	10,4495 – 10,5512	
L η	11,3495	
L β	12,1443 – 12,7953	
L γ	14,3078 – 15,2169	

3.2.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	56,028 – 61,669	100
KLX	68,181 – 74,969	55,8
KXY	80,3 – 88,0	7,78
Auger L	5,33 – 15,82	

4 α Emissions

	Energy keV	Probability $\times 100$
$\alpha_{0,2}$	4622 (5)	0,548 (7)
$\alpha_{0,1}$	4883 (2)	79,2 (32)
$\alpha_{0,0}$	4885 (2)	19,8 (32)

5 Electron Emissions

		Energy keV	Electrons per 100 disint.
e _{AL}	(Bi)	5,42 - 16,34	0,2240 (27)
e _{AK}	(Bi)		0,0118 (14)
	KLL	57,491 - 63,419	}
	KLX	70,025 - 77,105	}
	KXY	82,53 - 90,52	}
e _{AL}	(Pb)	5,33 - 15,82	0,1044 (14)
e _{AK}	(Pb)		0,0063 (7)
	KLL	56,028 - 61,669	}
	KLX	68,181 - 74,969	}
	KXY	80,3 - 88,0	}
ec _{2,1 K}	(Pb)	172,5 (1)	0,1278 (34)

6 Photon Emissions

6.1 X-Ray Emissions

		Energy keV	Photons per 100 disint.	
XL	(Bi)	9,4207 — 15,7084	0,1411 (24)	
XK α_2	(Bi)	74,8157	0,0927 (16)	} K α
XK α_1	(Bi)	77,1088	0,1551 (25)	}
XK β_3	(Bi)	86,835	}	
XK β_1	(Bi)	87,344	}	
XK β_5''	(Bi)	87,862	}	
XK β_2	(Bi)	89,732	}	
XK β_4	(Bi)	90,074	}	
XKO _{2,3}	(Bi)	90,421	}	
XL	(Pb)	9,186 — 15,2169	0,0631 (13)	
XK α_2	(Pb)	72,8049	0,0478 (11)	} K α
XK α_1	(Pb)	74,97	0,0804 (18)	}
XK β_3	(Pb)	84,451	}	
XK β_1	(Pb)	84,937	}	
XK β_5''	(Pb)	85,47	}	
XK β_2	(Pb)	87,238	}	
XK β_4	(Pb)	87,58	}	
XKO _{2,3}	(Pb)	87,911	}	

6.2 Gamma Emissions

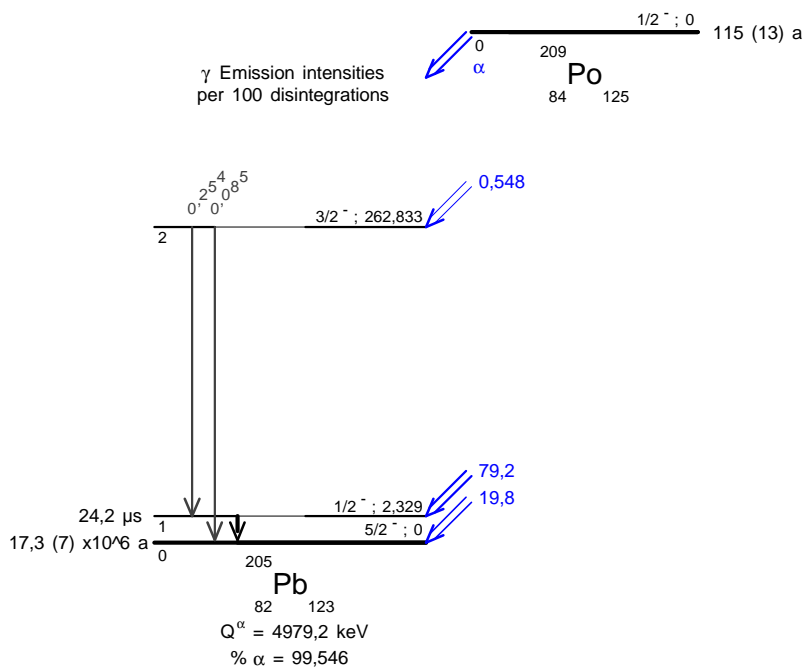
	Energy keV	Photons per 100 disint.
$\gamma_{2,1}(\text{Pb})$	260,50 (5)	0,254 (3)
$\gamma_{2,0}(\text{Pb})$	262,80 (5)	0,085 (2)
$\gamma_{1,0}(\text{Bi})$	896,28 (6)	0,445 (7)

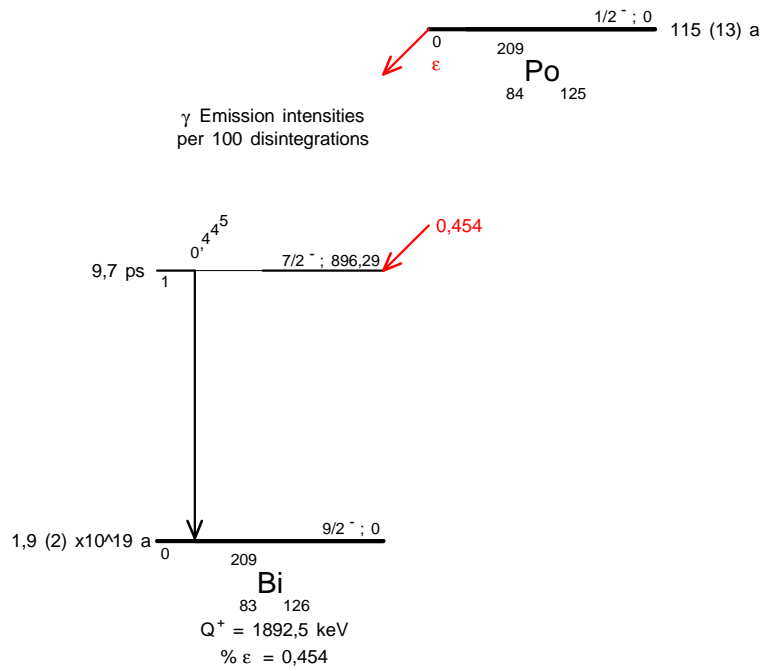
7 Main Production Modes

Bi – 209(d,2n)Po – 209
 { Bi – 209(p,n)Po – 209
 { Possible impurities : Po – 208

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(Theoretical ICCs.)







1 Decay Scheme

Po-211 decays 100 % by alpha-particle emissions, populating mainly the ground state of Pb-207.
Le polonium 211 se désintègre par émission alpha vers le niveau fondamental du plomb 207.

2 Nuclear Data

$$T_{1/2}(^{211}\text{Po}) : 0,516 \quad (3) \quad \text{s}$$

$$Q^\alpha(^{211}\text{Po}) : 7594,48 \quad (51) \quad \text{keV}$$

2.1 α Transitions

	Energy keV	Probability $\times 100$	F
$\alpha_{0,2}$	6695,3 (10)	0,523 (9)	17,9
$\alpha_{0,1}$	7024,4 (10)	0,541 (17)	272
$\alpha_{0,0}$	7594,2 (3)	98,936 (19)	112

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ $\times 100$	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{2,1}(\text{Pb})$	328,2 (2)	0,0043 (15)	M1	0,273 (4)	0,0465 (7)	0,01089 (16)	0,334 (5)
$\gamma_{1,0}(\text{Pb})$	569,65 (15)	0,546 (17)	E2	0,01583 (23)	0,00439 (7)	0,001081 (16)	0,0216 (3)
$\gamma_{2,0}(\text{Pb})$	897,8 (2)	0,519 (9)	M1+E2	0,0192 (3)	0,00318 (5)	0,000741 (11)	0,0233 (4)

3 Atomic Data

3.1 Pb

ω_K	:	0,963	(4)
$\bar{\omega}_L$:	0,379	(15)
n_{KL}	:	0,811	(5)

3.1.1 X Radiations

	Energy keV	Relative probability
X_K		
$K\alpha_2$	72,8049	59,44
$K\alpha_1$	74,97	100
$K\beta_3$	84,451	}
$K\beta_1$	84,937	}
$K\beta_5''$	85,47	}
		34,22
$K\beta_2$	87,238	}
$K\beta_4$	87,58	}
$KO_{2,3}$	87,911	}
		10,33
X_L		
$L\ell$	9,186	
$L\alpha$	10,4495 – 10,5512	
$L\eta$	11,3495	
$L\beta$	12,1443 – 13,3763	
$L\gamma$	14,3078 – 15,2169	

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	56,028 – 61,669	100
KLX	68,181 – 74,969	55,8
KXY	80,3 – 88,0	7,78
Auger L	5,33 – 15,82	

4 α Emissions

	Energy keV	Probability $\times 100$
$\alpha_{0,2}$	6568,4 (10)	0,523 (9)
$\alpha_{0,1}$	6891,2 (10)	0,541 (17)
$\alpha_{0,0}$	7450,2 (3)	98,936 (19)

5 Electron Emissions

		Energy keV	Electrons per 100 disint.
e_{AL}	(Pb)	5,33 - 15,82	0,01216 (17)
e_{AK}	(Pb)		0,00071 (8)
	KLL	56,028 - 61,669	}
	KLX	68,181 - 74,969	}
	KXY	80,3 - 88,0	}

6 Photon Emissions**6.1 X-Ray Emissions**

		Energy keV	Photons per 100 disint.	
XL	(Pb)	9,186 — 15,2169	0,00740 (16)	
XK α_2	(Pb)	72,8049	0,00535 (14)	} K α
XK α_1	(Pb)	74,97	0,00900 (24)	}
XK β_3	(Pb)	84,451	}	
XK β_1	(Pb)	84,937	}	K' β_1
XK β_5''	(Pb)	85,47	}	
XK β_2	(Pb)	87,238	}	
XK β_4	(Pb)	87,58	}	K' β_2
XKO $_{2,3}$	(Pb)	87,911	}	

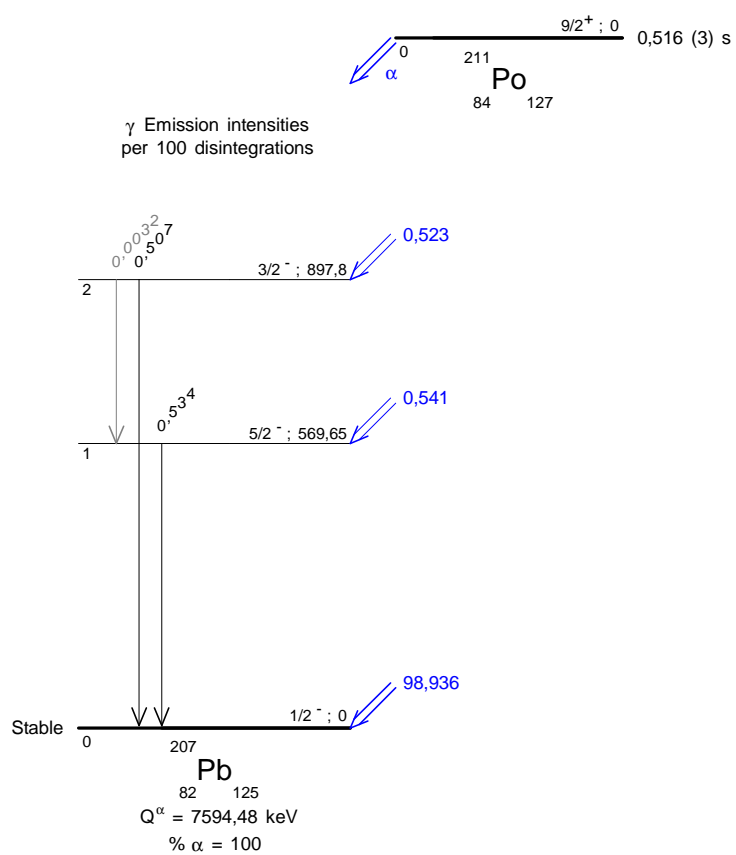
6.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{2,1}(\text{Pb})$	328,2 (2)	0,0032 (11)
$\gamma_{1,0}(\text{Pb})$	569,65 (15)	0,534 (17)
$\gamma_{2,0}(\text{Pb})$	897,8 (2)	0,507 (9)

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(Theoretical ICC)





1 Decay Scheme

Po-215 decays 100 % by alpha transitions to Pb-211 and $2.3(2) \times 10^{-4}$ by beta- emission to At215.
*Le polonium 215 se désintègre par émissions alpha principalement vers le niveau fondamental du plomb 211.
 Il existe un faible branchement bêta moins vers l'astate 215.*

2 Nuclear Data

$T_{1/2}(^{215}\text{Po})$:	1,781	(4)	10^{-3} s
$T_{1/2}(^{215}\text{At})$:	0,10	(2)	10^{-3} s
$T_{1/2}(^{211}\text{Pb})$:	36,1	(2)	min
$Q^{\alpha}(^{215}\text{Po})$:	7526,3	(8)	keV
$Q^{-}(^{215}\text{Po})$:	715	(7)	keV

2.1 α Transitions

	Energy keV	Probability $\times 100$	F
$\alpha_{0,7}$	6632 (3)	0,0003	365
$\alpha_{0,6}$	6711 (3)	0,0020 (6)	109
$\alpha_{0,5}$	6793 (3)	0,0008 (3)	550
$\alpha_{0,4}$	6883 (3)	0,0008 (3)	1170
$\alpha_{0,3}$	6928 (3)	0,0016 (5)	8500
$\alpha_{0,2}$	6942 (3)	0,0004 (2)	3800
$\alpha_{0,1}$	7087,4 (8)	0,06 (2)	82
$\alpha_{0,0}$	7526,3 (8)	99,934 (20)	1,34

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ $\times 100$	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{7,2}(\text{Pb})$	310 (4)						
$\gamma_{1,0}(\text{Pb})$	438,9 (2)	0,06 (2)	E2	0,0275 (4)	0,00984 (14)	0,00247 (4)	0,0405 (6)
$\gamma_{2,0}(\text{Pb})$	584 (3)						
$\gamma_{3,0}(\text{Pb})$	598 (3)						
$\gamma_{4,0}(\text{Pb})$	643 (3)		(M1+E2)	0,029 (17)	0,0054 (23)	0,0013 (6)	0,036 (20)
$\gamma_{5,0}(\text{Pb})$	733 (3)						
$\gamma_{6,0}(\text{Pb})$	815 (3)						
$\gamma_{7,0}(\text{Pb})$	894 (3)						

3 Atomic Data

3.1 Pb

ω_K	:	0,963	(4)
$\bar{\omega}_L$:	0,379	(15)
n_{KL}	:	0,811	(5)

3.1.1 X Radiations

	Energy keV	Relative probability	
X_K	$K\alpha_2$	72,8049	
	$K\alpha_1$	74,97	
	$K\beta_3$	84,451	}
	$K\beta_1$	84,937	}
	$K\beta_5''$	85,47	}
	$K\beta_2$	87,238	}
	$K\beta_4$	87,58	}
	$KO_{2,3}$	87,911	}
			34,18
X_L	$L\ell$	9,186	
	$L\alpha$	10,4495 – 10,5512	
	$L\eta$	11,3495	
	$L\beta$	12,1443 – 13,3763	
	$L\gamma$	14,3078 – 15,2169	
			10,32

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	56,028 – 61,669	100
KLX	68,181 – 74,969	55,8
KXY	80,3 – 88,0	7,78
Auger L	5,33 – 15,82	

4 α Emissions

	Energy keV	Probability $\times 100$
$\alpha_{0,7}$	6509 (3)	0,0003
$\alpha_{0,6}$	6586 (3)	0,0020 (6)
$\alpha_{0,5}$	6667 (3)	0,0008 (3)
$\alpha_{0,4}$	6755 (3)	0,0008 (3)
$\alpha_{0,3}$	6799 (3)	0,0016 (5)
$\alpha_{0,2}$	6813 (3)	0,0004 (2)
$\alpha_{0,1}$	6955,4 (8)	0,06 (2)
$\alpha_{0,0}$	7386,1 (8)	99,934 (20)

5 Electron Emissions

		Energy keV	Electrons per 100 disint.
e _{AL}	(Pb)	5,33 - 15,82	0,00115 (14)
e _{AK}	(Pb)		0,000059 (21)
	KLL	56,028 - 61,669	}
	KLX	68,181 - 74,969	}
	KXY	80,3 - 88,0	}
ec _{1,0} K	(Pb)	350,9 (2)	0,0016 (5)
ec _{1,0} L	(Pb)	423,0 - 425,9	0,00057 (19)
ec _{1,0} M	(Pb)	435,0 - 436,4	0,000143 (47)

6 Photon Emissions

6.1 X-Ray Emissions

		Energy keV	Photons per 100 disint.	
XL	(Pb)	9,186 — 15,2169	0,00071 (12)	
XK α_2	(Pb)	72,8049	0,00045 (15)	} K α
XK α_1	(Pb)	74,97	0,00075 (25)	
XK β_3	(Pb)	84,451	}	} K' β_1
XK β_1	(Pb)	84,937	}	
XK β_5''	(Pb)	85,47	}	
XK β_2	(Pb)	87,238	}	} K' β_2
XK β_4	(Pb)	87,58	}	
XKO $_{2,3}$	(Pb)	87,911	}	

6.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}(\text{Pb})$	438,9 (2)	0,058 (19)

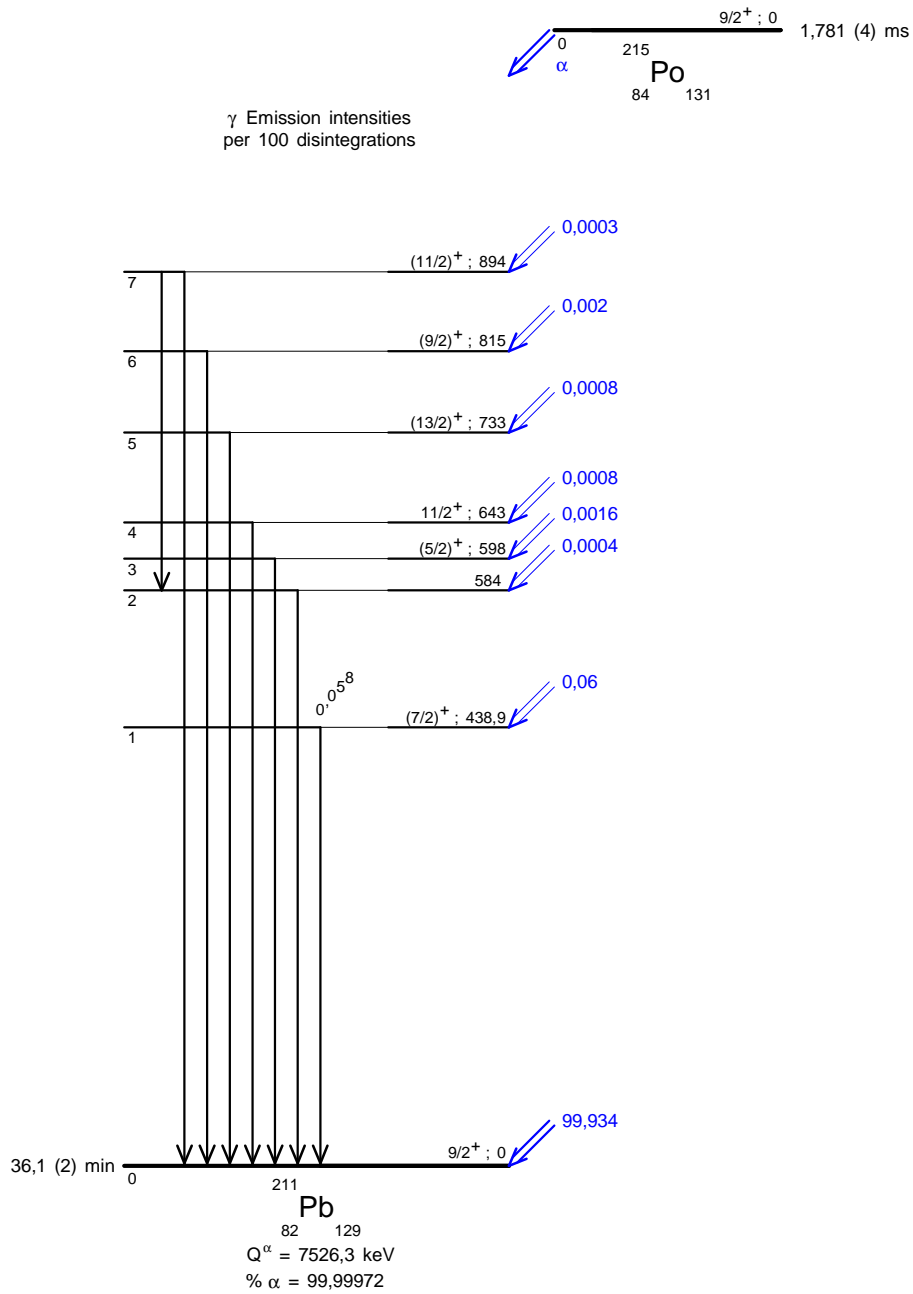
7 Main Production Modes

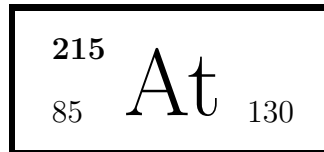
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(Band-Raman ICC for gamma-ray transitions)





1 Decay Scheme

At-215 decays 100% to levels of Bi-211 by emission of alpha-particles.

L'astate 215 se désintègre par émissions alpha essentiellement vers le niveau fondamental du bismuth 211.

2 Nuclear Data

$$T_{1/2}({}^{215}\text{At}) : 0,10 \quad (2) \quad 10^{-3} \text{ s}$$

$$T_{1/2}({}^{211}\text{Bi}) : 2,15 \quad (2) \quad \text{min}$$

$$Q^\alpha({}^{215}\text{At}) : 8178 \quad (4) \quad \text{keV}$$

2.1 α Transitions

	Energy keV	Probability × 100	F
$\alpha_{0,1}$	7773 (4)	0,05 (2)	390
$\alpha_{0,0}$	8178 (4)	99,95 (2)	2,8

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{1,0}(\text{Bi})$	404,854 (9)	0,05 (2)	M1+E2	0,095 (7)	0,0206 (8)	0,00498 (17)	0,122 (8)

3 Atomic Data

3.1 Bi

ω_K	:	0,964	(4)
$\bar{\omega}_L$:	0,391	(16)
n_{KL}	:	0,809	(5)

3.1.1 X Radiations

	Energy keV	Relative probability
X _K		
K α_2	74,8157	59,77
K α_1	77,1088	100
K β_3	86,835	}
K β_1	87,344	}
K β_5''	87,862	}
		34,25
K β_2	89,732	}
K β_4	90,074	}
K $O_{2,3}$	90,421	}
		10,49
X _L		
L ℓ	9,4207	
L α	10,7308 – 10,8387	
L η	11,7127	
L β	12,4814 – 13,8066	
L γ	14,7735 – 15,7084	

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	57,491 – 63,419	100
KLX	70,025 – 77,105	56
KXY	82,53 – 90,52	7,84
Auger L	5,42 – 16,34	

4 α Emissions

	Energy keV	alpha per 100 disint.
$\alpha_{0,1}$	7628 (4)	0,05 (2)
$\alpha_{0,0}$	8026 (4)	99,95 (2)

5 Electron Emissions

		Energy keV	Electrons per 100 disint.
e _{AL}	(Bi)	5,42 - 16,34	0,0027 (5)
e _{AK}	(Bi)		0,00015 (7)
	KLL	57,491 - 63,419	}
	KLX	70,025 - 77,105	}
	KXY	82,53 - 90,52	}
ec _{1,0 T}	(Bi)	314,328 - 404,830	0,0055 (22)
ec _{1,0 K}	(Bi)	314,328 (9)	0,0043 (17)
ec _{1,0 L}	(Bi)	388,466 - 391,435	0,00093 (37)
ec _{1,0 M}	(Bi)	400,855 - 402,274	0,00022 (9)
ec _{1,0 N}	(Bi)	403,916 - 404,697	0,000057 (23)

6 Photon Emissions**6.1 X-Ray Emissions**

		Energy keV	Photons per 100 disint.	
XL	(Bi)	9,4207 — 15,7084	0,0017 (4)	
XK α_2	(Bi)	74,8157	0,0012 (5)	} K α
XK α_1	(Bi)	77,1088	0,0020 (9)	}
XK β_3	(Bi)	86,835	}	
XK β_1	(Bi)	87,344	}	} K' β_1
XK β_5''	(Bi)	87,862	}	

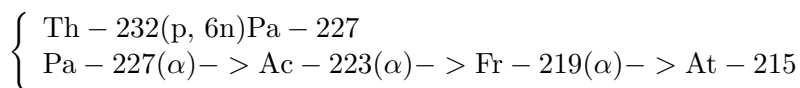
	Energy keV	Photons per 100 disint.
XK β_2 (Bi)	89,732	} 0,00021 (9) K' β_2
XK β_4 (Bi)	90,074	
XKO $_{2,3}$ (Bi)	90,421	

6.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$ (Bi)	404,853 (9)	0,045 (18)

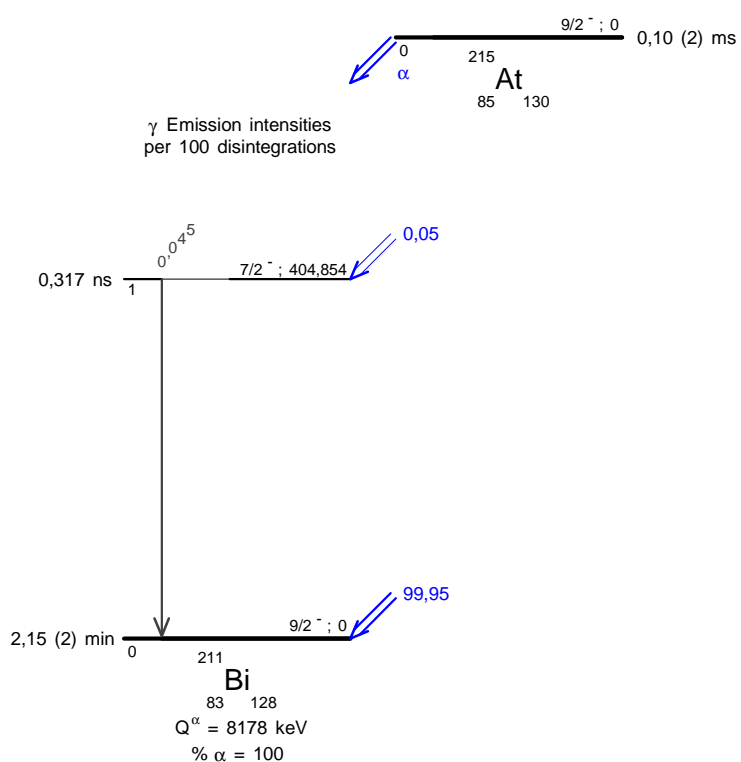
7 Main Production Modes

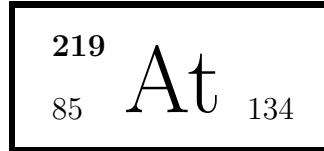
U – 235 decay chain



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1 Decay Scheme

At-219 undergoes approximately 3% beta-minus decay to the ground state of Rn-219, and approximately 97% alpha-particle decay to the ground state of Bi-215.

L'astate 219 se désintègre par émission bêta moins vers le niveau fondamental du radon 219 (~ 3 %), et par émission alpha vers le niveau fondamental du bismuth 215 (~ 97 %).

2 Nuclear Data

$T_{1/2}(^{219}\text{At})$:	56	(4)	s
$T_{1/2}(^{219}\text{Rn})$:	3,98	(3)	s
$T_{1/2}(^{215}\text{Bi})$:	7,6	(2)	min
$Q^-(^{219}\text{At})$:	1566	(3)	keV
$Q^\alpha(^{219}\text{At})$:	6324	(15)	keV

2.1 α Transitions

	Energy keV	Probability × 100	F
$\alpha_{0,0}$	6324 (15)	~ 97	~ 1,07

2.2 β^- Transitions

	Energy keV	Probability × 100	Nature	lg <i>ft</i>
$\beta_{0,0}^-$	1566 (3)	~ 3	1st forbidden	~ 6,2

3 α Emissions

	Energy keV	Probability $\times 100$
$\alpha_{0,0}$	6208 (15)	~ 97

4 Electron Emissions

	Energy keV	Electrons per 100 disint.
$\beta_{0,0}^-$	max: 1566 (3)	~ 3
$\beta_{0,0}^-$	avg: 547 (2)	

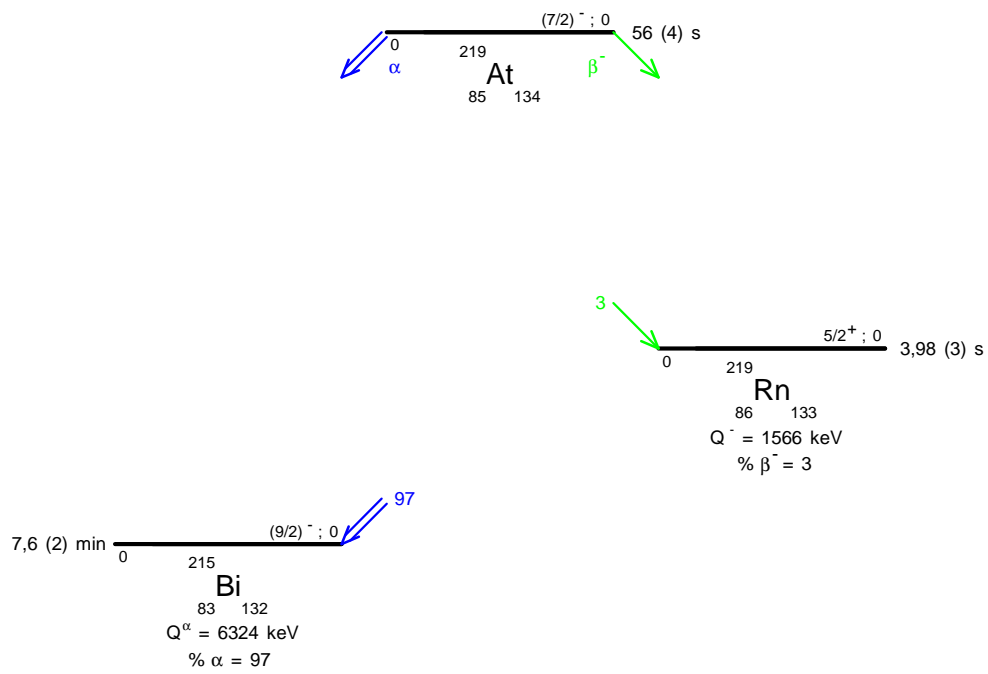
5 Main Production Modes

U – 235(4n + 3) decay chain

Th – 232(p,x)At – 219

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1 Decay Scheme

Rn-219 decays 100% by alpha-particle emission to various nuclear levels of Po-215.

Le radon 215 se désintègre par émissions alpha vers des niveaux excités du polonium 215.

2 Nuclear Data

$T_{1/2}(^{219}\text{Rn})$:	3,98	(3)	s
$T_{1/2}(^{215}\text{Po})$:	1,781	(4)	10^{-3} s
$Q^\alpha(^{219}\text{Rn})$:	6946,1	(3)	keV

2.1 α Transitions

	Energy keV	Probability $\times 100$	F
$\alpha_{0,14}$	5851,9 (10)	0,00009 (5)	245
$\alpha_{0,13}$	5872,4 (5)	0,00094 (19)	33
$\alpha_{0,12}$	6016,1 (10)	0,00009 (5)	1590
$\alpha_{0,11}$	6055,0 (4)	0,0021 (3)	103
$\alpha_{0,10}$	6068,9 (7)	0,0003 (1)	830
$\alpha_{0,9}$	6110,8 (4)	0,0032 (5)	120
$\alpha_{0,8}$	6213,4 (5)	0,00123 (12)	880
$\alpha_{0,7}$	6238,0 (6)	0,00064 (12)	2170
$\alpha_{0,6}$	6269,4 (3)	0,0184 (22)	103
$\alpha_{0,5}$	6337,8 (3)	0,0043 (10)	860
$\alpha_{0,4}$	6428,5 (3)	0,048 (3)	184
$\alpha_{0,3}$	6544,3 (3)	7,85 (24)	3,31
$\alpha_{0,2}$	6652,5 (3)	0,098 (5)	710
$\alpha_{0,1}$	6674,9 (3)	12,6 (3)	6,75
$\alpha_{0,0}$	6946,1 (3)	79,4 (10)	11,2

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ $\times 100$	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{3,1}(\text{Po})$	130,58 (1)	0,72 (6)	M1+26.5%E2	3,19 (16)	0,94 (4)	0,234 (10)	4,44 (13)
$\gamma_{4,2}(\text{Po})$	224,04 (7)	0,0019 (3)	(E2)	0,1296 (19)	0,1407 (20)	0,0370 (6)	0,319 (5)
$\gamma_{1,0}(\text{Po})$	271,228 (10)	13,30 (26)	M1+94%E2	0,111 (6)	0,0668 (11)	0,0173 (3)	0,201 (7)
$\gamma_{2,0}(\text{Po})$	293,56 (4)	0,101 (4)	M1+50%E2	0,25 (4)	0,062 (4)	0,0152 (7)	0,34 (5)
$\gamma_{12,5}(\text{Po})$	322 (1)	0,00009 (5)					
$\gamma_{8,3}(\text{Po})$	330,9 (4)	0,00100 (11)					
$\gamma_{11,4}(\text{Po})$	373,5 (3)	0,00025 (3)					
$\gamma_{6,2}(\text{Po})$	383,1 (1)	0,00044 (7)					
$\gamma_{3,0}(\text{Po})$	401,81 (1)	7,12 (23)	E2	0,0351 (5)	0,01528 (22)	0,00390 (6)	0,0555 (8)
$\gamma_{6,1}(\text{Po})$	405,4 (1)	0,00025 (4)					
$\gamma_{7,1}(\text{Po})$	436,9 (5)	0,00031 (6)					
$\gamma_{8,1}(\text{Po})$	461,5 (4)	0,00017 (3)					
$\gamma_{11,3}(\text{Po})$	489,3 (3)	0,00064 (9)					
$\gamma_{4,0}(\text{Po})$	517,60 (6)	0,046 (4)	M1+50%E2	0,058 (9)	0,0115 (11)	0,00277 (24)	0,073 (10)
$\gamma_{13,4}(\text{Po})$	556,1 (4)	0,00006 (4)	M1+50%E2	0,048 (7)	0,0095 (9)	0,00226 (21)	0,061 (8)
$\gamma_{9,1}(\text{Po})$	564,1 (2)	0,0015 (3)					
$\gamma_{14,4}(\text{Po})$	576,6 (10)	0,00009 (5)					
$\gamma_{5,0}(\text{Po})$	608,30 (7)	0,0044 (10)	(M1+E2)				
$\gamma_{11,1}(\text{Po})$	619,9 (3)	0,00033 (11)					
$\gamma_{(-1,1)}(\text{Po})$	665,5 (10)	0,00009 (5)					
$\gamma_{13,3}(\text{Po})$	671,9 (4)	0,00022 (11)	M1+E2				
$\gamma_{6,0}(\text{Po})$	676,66 (7)	0,018 (2)					
$\gamma_{7,0}(\text{Po})$	708,1 (5)	0,00033 (11)					
$\gamma_{8,0}(\text{Po})$	732,7 (4)	0,00007 (4)					
$\gamma_{13,1}(\text{Po})$	802,5 (4)	0,00033 (11)	M1+E2				
$\gamma_{9,0}(\text{Po})$	835,32 (22)	0,0017 (3)					
$\gamma_{10,0}(\text{Po})$	877,2 (6)	0,00033 (11)					
$\gamma_{11,0}(\text{Po})$	891,1 (3)	0,0009 (2)					
$\gamma_{13,0}(\text{Po})$	1073,7 (4)	0,00033 (11)	E2	0,00510 (8)	0,001002 (14)	0,000240 (4)	0,00641 (9)

3 Atomic Data

3.1 Po

ω_K	:	0,965	(4)
$\bar{\omega}_L$:	0,403	(16)
n_{KL}	:	0,807	(5)

3.1.1 X Radiations

	Energy keV	Relative probability
X_K		
$K\alpha_2$	76,864	60
$K\alpha_1$	79,293	100
$K\beta_3$	89,256	}
$K\beta_1$	89,807	}
$K\beta_5''$	90,363	}
		34
$K\beta_2$	92,263	}
$K\beta_4$	92,618	}
$KO_{2,3}$	92,983	}
		10,7
X_L		
$L\ell$	9,658	
$L\alpha$	11,016 – 11,13	
$L\eta$	12,085	
$L\beta$	12,823 – 13,778	
$L\gamma$	15,742 – 16,213	

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	58,978 – 65,205	100
KLX	71,902 – 79,289	56
KXY	84,8 – 93,1	7,8
Auger L	5,434 – 10,934	3660

4 α Emissions

	Energy keV	alpha per 100 disint.
$\alpha_{0,14}$	5745 (1)	0,00009 (5)
$\alpha_{0,13}$	5765,1 (5)	0,00094 (19)
$\alpha_{0,12}$	5906,2 (10)	0,00009 (5)
$\alpha_{0,11}$	5944,4 (4)	0,0021 (3)
$\alpha_{0,10}$	5958,1 (7)	0,0003 (1)
$\alpha_{0,9}$	5999,2 (4)	0,0032 (5)
$\alpha_{0,8}$	6099,9 (5)	0,00123 (12)
$\alpha_{0,7}$	6124,1 (6)	0,00064 (12)
$\alpha_{0,6}$	6154,9 (3)	0,0184 (22)
$\alpha_{0,5}$	6222,0 (3)	0,0043 (10)
$\alpha_{0,4}$	6311,1 (3)	0,048 (3)
$\alpha_{0,3}$	6424,8 (3)	7,85 (24)
$\alpha_{0,2}$	6531,0 (3)	0,098 (5)
$\alpha_{0,1}$	6553,0 (3)	12,6 (3)
$\alpha_{0,0}$	6819,2 (3)	79,4 (10)

5 Electron Emissions

		Energy keV	Electrons per 100 disint.
eAL	(Po)	5,434 - 10,934	1,50 (5)
eAK	(Po)		0,067 (9)
	KLL	58,978 - 65,205	}
	KLX	71,902 - 79,289	}
	KXY	84,8 - 93,1	}
ec _{1,0} T	(Po)	178,130 - 271,227	2,23 (4)
ec _{1,0} K	(Po)	178,13 (1)	1,23 (2)
ec _{1,0} L	(Po)	254,30 - 257,43	0,74 (2)
ec _{1,0} M	(Po)	267,08 - 268,55	0,19 (1)
ec _{3,0} K	(Po)	308,71 (1)	0,234 (8)
ec _{3,0} L	(Po)	384,88 - 388,00	0,102 (3)
ec _{3,0} M	(Po)	397,66 - 399,13	0,026 (1)

6 Photon Emissions

6.1 X-Ray Emissions

		Energy keV	Photons per 100 disint.	
XL	(Po)	9,658 — 16,213	1,01 (5)	
XK α_2	(Po)	76,864	0,540 (24)	} K α
XK α_1	(Po)	79,293	0,90 (4)	}
XK β_3	(Po)	89,256	}	
XK β_1	(Po)	89,807	}	K' β_1
XK β_5''	(Po)	90,363	}	
XK β_2	(Po)	92,263	}	
XK β_4	(Po)	92,618	}	K' β_2
XKO $_{2,3}$	(Po)	92,983	}	

6.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{3,1}(\text{Po})$	130,58 (1)	0,133 (11)
$\gamma_{4,2}(\text{Po})$	224,04 (7)	0,0014 (2)
$\gamma_{1,0}(\text{Po})$	271,228 (10)	11,07 (22)
$\gamma_{2,0}(\text{Po})$	293,56 (4)	0,075 (3)
$\gamma_{12,5}(\text{Po})$	322 (1)	0,00009 (5)
$\gamma_{8,3}(\text{Po})$	330,9 (4)	0,00100 (11)
$\gamma_{11,4}(\text{Po})$	373,5 (3)	0,00025 (3)
$\gamma_{6,2}(\text{Po})$	383,1 (1)	0,00044 (7)
$\gamma_{3,0}(\text{Po})$	401,81 (1)	6,75 (22)
$\gamma_{6,1}(\text{Po})$	405,4 (1)	0,00025 (4)
$\gamma_{7,1}(\text{Po})$	436,9 (5)	0,00031 (6)
$\gamma_{8,1}(\text{Po})$	461,5 (4)	0,00017 (3)
$\gamma_{11,3}(\text{Po})$	489,3 (3)	0,00064 (9)
$\gamma_{4,0}(\text{Po})$	517,60 (6)	0,043 (3)
$\gamma_{13,4}(\text{Po})$	556,1 (4)	0,00006 (4)
$\gamma_{9,1}(\text{Po})$	564,1 (2)	0,0015 (3)
$\gamma_{14,4}(\text{Po})$	576,6 (10)	0,00009 (5)
$\gamma_{5,0}(\text{Po})$	608,30 (7)	0,0044 (10)
$\gamma_{11,1}(\text{Po})$	619,9 (3)	0,00033 (11)
$\gamma_{(-1,1)}(\text{Po})$	665,5 (10)	0,00009 (5)
$\gamma_{13,3}(\text{Po})$	671,9 (4)	0,00022 (11)
$\gamma_{6,0}(\text{Po})$	676,66 (7)	0,018 (2)
$\gamma_{7,0}(\text{Po})$	708,1 (5)	0,00033 (11)

	Energy keV	Photons per 100 disint.
$\gamma_{8,0}(\text{Po})$	732,7 (4)	0,00007 (4)
$\gamma_{13,1}(\text{Po})$	802,5 (4)	0,00033 (11)
$\gamma_{9,0}(\text{Po})$	835,32 (22)	0,0017 (3)
$\gamma_{10,0}(\text{Po})$	877,2 (6)	0,00033 (11)
$\gamma_{11,0}(\text{Po})$	891,1 (3)	0,0009 (2)
$\gamma_{13,0}(\text{Po})$	1073,7 (4)	0,00033 (11)

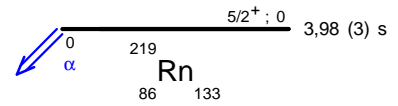
7 Main Production Modes

U – 235 (4n + 3) decay chain

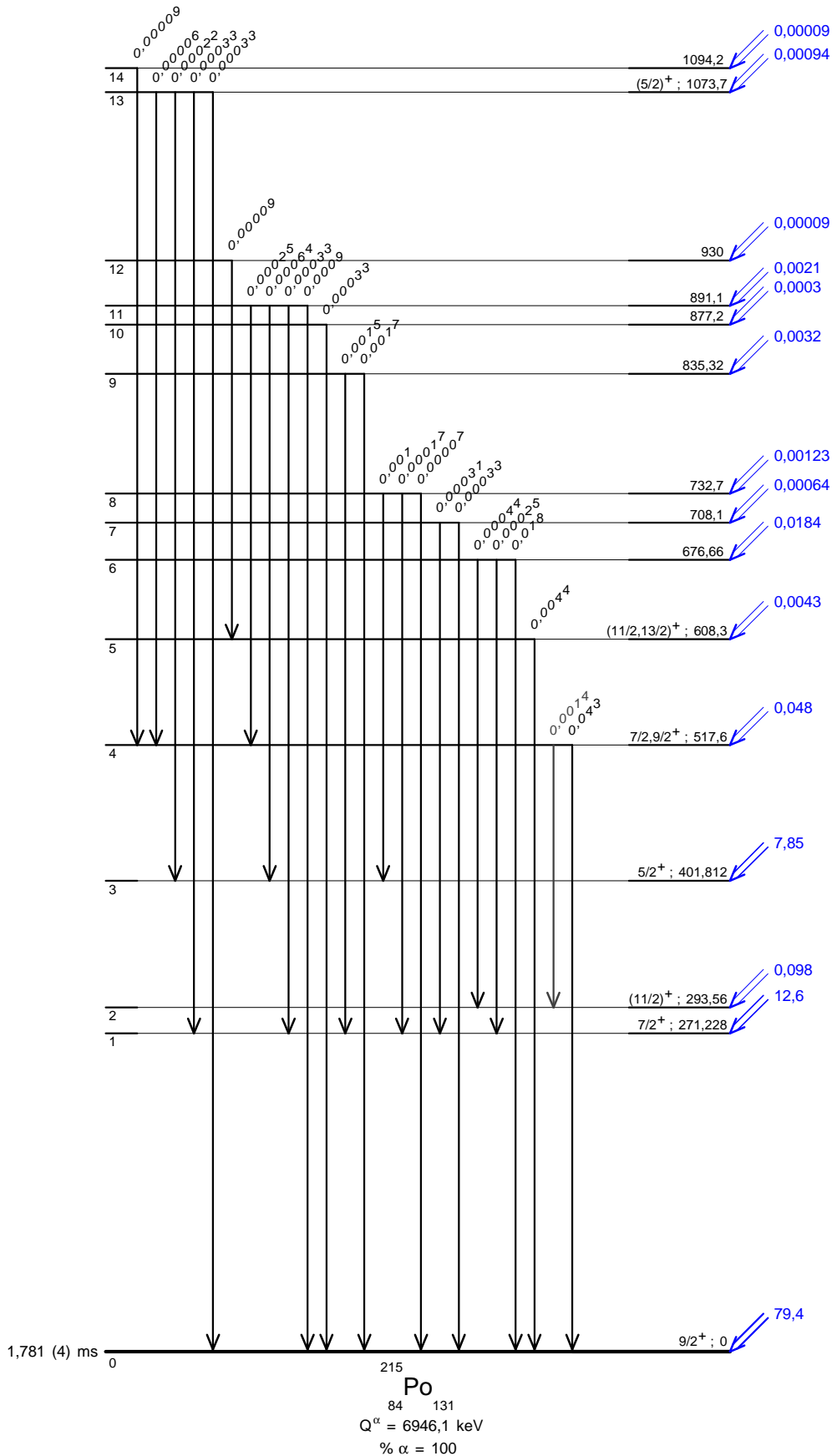
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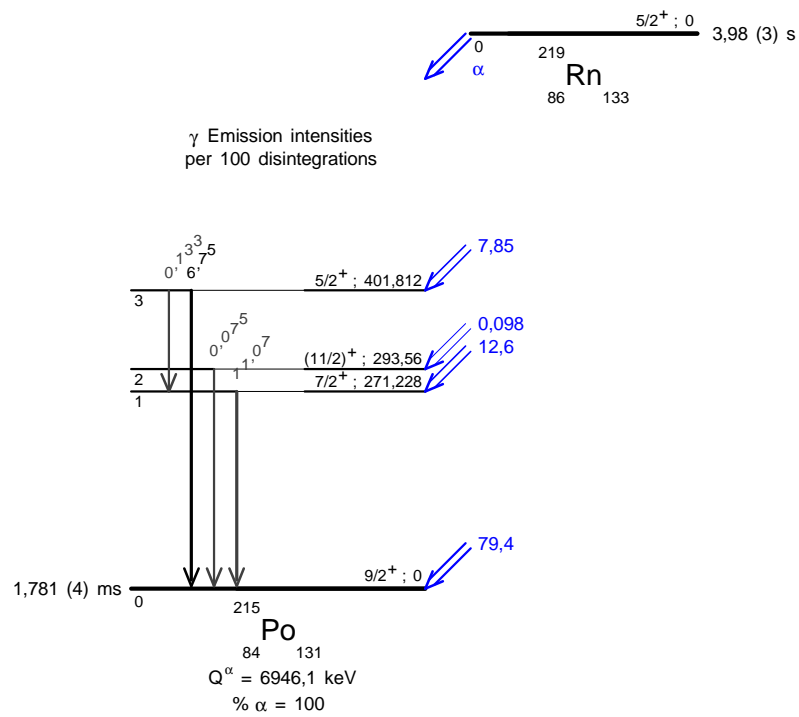
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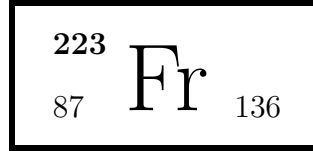
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γ Emission intensities per 100 disintegrations







1 Decay Scheme

Fr-223 disintegrates 0.020(4)% by alpha emission to excited levels in At-219 and 99.980 (4)% by beta minus emission to excited levels in Ra-223.

Le francium 223 se désintègre par émission alpha (0,020 %) vers des niveaux excités de l'astate 219 et par émission bêta moins (99,980 %) vers le radium 223.

2 Nuclear Data

$T_{1/2}(^{223}\text{Fr})$:	22,00	(7)	min
$T_{1/2}(^{223}\text{Ra})$:	11,43	(5)	d
$T_{1/2}(^{219}\text{At})$:	56	(3)	s
$Q^\alpha(^{223}\text{Fr})$:	5562	(3)	keV
$Q^-(^{223}\text{Fr})$:	1149,2	(9)	keV

2.1 α Transitions

	Energy keV	Probability $\times 100$	F
$\alpha_{0,4}$	5266 (5)	0,0009 (5)	
$\alpha_{0,3}$	5388 (4)	0,0060 (26)	
$\alpha_{0,2}$	5411 (4)	0,0053 (23)	
$\alpha_{0,1}$	5502 (3)	0,0044 (20)	
$\alpha_{0,0}$	5562 (3)	0,0033 (15)	

2.2 β^- Transitions

	Energy keV	Probability $\times 100$	Nature	lg ft
$\beta_{0,32}^-$	120,3 (10)	0,0012 (3)	Super Allowed Or Allowed	7,3
$\beta_{0,31}^-$	124,6 (10)	0,0004 (1)	1st Forbidden	7,82
$\beta_{0,30}^-$	129,9 (10)	0,00046 (12)	1st Forbidden	7,82
$\beta_{0,29}^-$	191,5 (9)	0,020 (4)	Unique th Forbidden	6,7
$\beta_{0,28}^-$	205,9 (9)	0,0082 (18)	Unique th Forbidden	7,19
$\beta_{0,27}^-$	208,4 (9)	0,0051 (12)		7,41
$\beta_{0,26}^-$	222,6 (9)	0,106 (22)	Unique th Forbidden	6,18
$\beta_{0,25}^-$	243,3 (10)	0,0011 (4)	1st Forbidden	8,29
$\beta_{0,24}^-$	281,9 (9)	0,025 (5)	Unique th Forbidden	7,14
$\beta_{0,23}^-$	302,8 (9)	0,088 (18)	1st Forbidden	6,69
$\beta_{0,22}^-$	306,9 (9)	0,035 (7)	Unique th Forbidden	7,11
$\beta_{0,21}^-$	323,3 (9)	0,54 (10)		5,99
$\beta_{0,20}^-$	326,0 (9)	0,014 (3)	Unique th Forbidden	7,59
$\beta_{0,19}^-$	343,8 (9)	0,0040 (8)	Unique th Forbidden	8,21
$\beta_{0,18}^-$	345,4 (9)	0,14 (3)	Unique th Forbidden	6,67
$\beta_{0,17}^-$	362,1 (9)	0,019 (4)	1st Forbidden	7,6
$\beta_{0,16}^-$	366,7 (10)	0,00111 (22)	Unique th Forbidden	8,85
$\beta_{0,15}^-$	555,3 (9)	0,013 (3)	1st Forbidden	8,38
$\beta_{0,14}^-$	773,1 (10)	0,0046 (12)		9,31
$\beta_{0,13}^-$	779,9 (9)	1,8 (4)		6,73
$\beta_{0,11}^-$	806,7 (9)	0,037 (8)	1st Forbidden	8,47
$\beta_{0,10}^-$	814,9 (9)	0,042 (9)	1st Forbidden	8,43
$\beta_{0,9}^-$	819,4 (9)	0,049 (10)	Super Allowed Or Allowed	8,37
$\beta_{0,8}^-$	863,1 (9)	0,032 (9)	1st Forbidden	8,64
$\beta_{0,7}^-$	869,0 (9)	0,004 (4)		9,5
$\beta_{0,6}^-$	914,5 (9)	9,1 (17)		6,27
$\beta_{0,5}^-$	1025,5 (9)	0,24 (6)		8,02
$\beta_{0,4}^-$	1069,6 (9)	15 (3)		6,29
$\beta_{0,3}^-$	1087,8 (9)	0,27 (19)		8,1
$\beta_{0,2}^-$	1099,1 (9)	67 (13)	Super Allowed Or Allowed	5,68
$\beta_{0,1}^-$	1119,3 (9)	6 (6)		6,8
$\beta_{0,0}^-$	1149,2 (9)	1	1st Forbidden	7,6

2.3 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ $\times 100$	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{2,1}$ (Ra)	20,27 (5)	12,3 (26)	[E1]		5,77 (16)	1,50 (3)	7,76 (22)
$\gamma_{3,2}$ (At)	24,14 (3)	0,012 (6)					
$\gamma_{1,0}$ (Ra)	29,78 (4)	26 (7)	M1+8,26%E2		280 (40)	72 (10)	370 (50)
$\gamma_{3,1}$ (Ra)	31,69 (5)	0,35	M1+7,27%E2		190 (60)	50 (15)	260 (80)
$\gamma_{9,8}$ (Ra)	43,5 (2)	0,0044	E1		0,767 (15)	0,189 (4)	1,015 (19)
$\gamma_{5,4}$ (Ra)	44,0 (1)	0,178	M1+21,3%E2		97 (9)	25,5 (24)	131 (12)
$\gamma_{4,1}$ (Ra)	49,80 (5)	4,3 (10)	E1		0,535 (8)	0,1309 (19)	0,708 (10)
$\gamma_{2,0}$ (Ra)	50,10 (2)	56 (12)	E1		0,526 (8)	0,1288 (18)	0,696 (10)
$\gamma_{1,0}$ (At)	58,9 (2)	0,0095 (36)	M1		8,27 (15)	1,96 (4)	10,87 (19)
$\gamma_{3,0}$ (Ra)	61,43 (5)	0,34 (7)	E2		71,0 (11)	19,3 (3)	96,5 (14)
$\gamma_{5,3}$ (Ra)	62,31 (6)	0,022 (10)	E1		0,294 (5)	0,0716 (11)	0,389 (6)
$\gamma_{5,2}$ (Ra)	73,5 (1)	0,054 (38)	E2		30,0 (5)	8,16 (13)	40,8 (6)
$\gamma_{4,0}$ (Ra)	79,65 (2)	10,8 (22)	E1		0,1530 (22)	0,0370 (6)	0,202 (3)
$\gamma_{13,7}$ (Ra)	89,08 (10)	0,054 (11)					
$\gamma_{5,1}$ (Ra)	93,88 (5)	0,067 (16)	E1		0,0989 (14)	0,0239 (4)	0,1305 (18)
$\gamma_{6,5}$ (Ra)	111,05 (3)	0,0049 (14)					
$\gamma_{13,6}$ (Ra)	134,60 (2)	0,62 (12)	[E1]	0,184 (3)	0,0383 (6)	0,00921 (13)	0,234 (3)
$\gamma_{4,2}$ (At)	145,3 (3)	0,00078 (47)	M1+(E2)	1,8 (16)	0,8 (2)	0,20 (6)	2,9 (13)
$\gamma_{2,0}$ (At)	150,9 (2)	0,0135 (12)	E2	0,287 (4)	0,836 (13)	0,224 (4)	1,417 (21)
$\gamma_{6,4}$ (Ra)	155,5 (5)	0,0027					
$\gamma_{6,3}$ (Ra)	173,35 (5)	0,36 (15)	M1, E2	1,4 (12)	0,53 (5)	0,136 (20)	2,1 (12)
$\gamma_{6,2}$ (Ra)	184,65 (5)	0,24 (6)	E1	0,0868 (13)	0,01701 (24)	0,00407 (6)	0,1092 (15)
$\gamma_{7,4}$ (Ra)	200,7 (2)	0,0027 (10)					
$\gamma_{6,1}$ (Ra)	204,85 (5)	2,8 (5)	M1+1,42%E2	1,62 (4)	0,304 (5)	0,0726 (11)	2,02 (5)
$\gamma_{9,5}$ (Ra)	205,6 (2)	0,0090 (17)	E2	0,1533 (22)	0,277 (4)	0,0747 (11)	0,530 (8)
$\gamma_{10,5}$ (Ra)	210,60 (5)	0,0105 (21)	E1	0,0637 (9)	0,01222 (18)	0,00292 (4)	0,0798 (11)
$\gamma_{7,3}$ (Ra)	218,80 (5)	0,0232 (46)	M1	1,368 (20)	0,252 (4)	0,0603 (9)	1,701 (24)
$\gamma_{6,0}$ (Ra)	234,70 (5)	6,5 (12)	M1(+0,5%E2)	1,120 (16)	0,207 (3)	0,0495 (7)	1,393 (16)
$\gamma_{8,2}$ (Ra)	236,05 (5)	0,029 (8)	E1	0,0489 (7)	0,00922 (13)	0,00220 (3)	0,0610 (9)
$\gamma_{13,5}$ (Ra)	245,60 (5)	0,019 (4)					
$\gamma_{7,1}$ (Ra)	250,25 (5)	0,035	M1	0,941 (14)	0,1733 (25)	0,0414 (6)	1,170 (16)
$\gamma_{9,4}$ (Ra)	250,25 (5)	0,0043	M1+81,5%E2	0,26 (6)	0,132 (4)	0,0344 (8)	0,44 (7)
$\gamma_{10,4}$ (Ra)	254,6 (2)	0,0060 (13)	E1	0,0411 (6)	0,00767 (11)	0,00183 (3)	0,0512 (7)
$\gamma_{8,1}$ (Ra)	256,18 (5)	0,025 (5)	E2	0,0983 (14)	0,1117 (16)	0,0299 (5)	0,250 (4)
$\gamma_{11,4}$ (Ra)	262,9 (2)	0,0037 (12)	E1	0,0382 (6)	0,00709 (10)	0,001692 (24)	0,0475 (7)
$\gamma_{10,3}$ (Ra)	272,8 (2)	0,0064 (23)	M1+E2	0,4 (4)	0,112 (25)	0,028 (5)	0,6 (4)
$\gamma_{7,0}$ (Ra)	280,7 (5)	0,0003					
$\gamma_{11,3}$ (Ra)	280,7 (5)	0,0003					
$\gamma_{8,0}$ (Ra)	286,0 (2)	0,0069 (24)	M1+E2	0,4 (3)	0,096 (24)	0,024 (5)	0,5 (4)
$\gamma_{13,4}$ (Ra)	289,67 (5)	0,21					
$\gamma_{14,4}$ (Ra)	296,5 (2)	0,0022 (7)	M1+1,66%E2	0,581 (9)	0,1074 (16)	0,0257 (4)	0,723 (9)
$\gamma_{9,1}$ (Ra)	299,95 (5)	0,0207 (41)	E1	0,0284 (4)	0,00518 (8)	0,001234 (18)	0,0352 (5)
$\gamma_{10,1}$ (Ra)	304,40 (5)	0,0142 (28)	M1+6,3%E2(+E0)	0,518 (12)	0,0978 (16)	0,0234 (4)	0,647 (14)
$\gamma_{15,8}$ (Ra)	307,93 (5)	0,012 (3)					
$\gamma_{13,3}$ (Ra)	307,93 (5)	0,0013 (13)					
$\gamma_{11,1}$ (Ra)	312,65 (5)	0,026 (6)	M1+2,5%E2	0,499 (9)	0,0924 (14)	0,0221 (4)	0,621 (10)
$\gamma_{14,3}$ (Ra)	314,6 (2)	0,0023 (7)	E1	0,0255 (4)	0,00463 (7)	0,001103 (16)	0,0316 (5)
$\gamma_{13,2}$ (Ra)	319,25 (5)	0,73 (14)	M1+3,14%E2	0,468 (8)	0,0869 (13)	0,0208 (3)	0,583 (10)
$\gamma_{9,0}$ (Ra)	329,80 (5)	0,025 (5)	(E1)	0,0230 (4)	0,00415 (6)	0,000988 (14)	0,0285 (4)
$\gamma_{10,0}$ (Ra)	334,30 (6)	0,0119 (24)	M1+27,12%E2	0,325 (11)	0,0674 (14)	0,0164 (3)	0,414 (13)
$\gamma_{13,1}$ (Ra)	339,50 (5)	0,062 (13)					
$\gamma_{11,0}$ (Ra)	342,50 (7)	0,0145 (30)	M1+62,5%E2	0,183 (4)	0,0501 (8)	0,012520 (19)	0,250 (5)
$\gamma_{12,0}$ (Ra)	350,5 (2)	0,0028 (15)	E1	0,0202 (3)	0,00361 (5)	0,000858 (12)	0,0249 (4)
$\gamma_{13,0}$ (Ra)	369,32 (5)	0,089 (18)					
$\gamma_{18,13}$ (Ra)	434,4 (1)	0,0022 (7)					
$\gamma_{16,11}$ (Ra)	439,6 (3)	0,00030 (8)					
$\gamma_{17,11}$ (Ra)	444,5 (3)	0,0011 (4)					

	Energy keV	$P_{\gamma+ce}$ $\times 100$	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{16,9}(\text{Ra})$	452,9 (2)	0,0008					
$\gamma_{17,10}(\text{Ra})$	452,9 (2)	0,0008					
$\gamma_{17,9}(\text{Ra})$	457,5 (2)	0,0008					
$\gamma_{18,10}(\text{Ra})$	469,3 (2)	0,001					
$\gamma_{15,5}(\text{Ra})$	469,3 (2)	0,001					
$\gamma_{19,9}(\text{Ra})$	475,4 (1)	0,0027					
$\gamma_{21,12}(\text{Ra})$	475,4 (1)	0,003					
$\gamma_{20,11}(\text{Ra})$	480,9 (3)	0,0013 (4)					
$\gamma_{20,9}(\text{Ra})$	493,4 (2)	0,0024 (7)					
$\gamma_{17,7}(\text{Ra})$	506,9 (2)	0,0022 (7)					
$\gamma_{23,9}(\text{Ra})$	516,7 (2)	0,0032 (8)					
$\gamma_{24,11}(\text{Ra})$	524,8 (2)	0,0043 (12)					
$\gamma_{24,10}(\text{Ra})$	533,1 (3)	0,0019 (7)					
$\gamma_{24,9}(\text{Ra})$	537,2 (2)	0,0019					
$\gamma_{20,8}(\text{Ra})$	537,2 (2)	0,0032					
$\gamma_{21,8}(\text{Ra})$	539,8 (2)	0,0059 (18)					
$\gamma_{21,7}(\text{Ra})$	545,4 (4)	0,00030 (8)					
$\gamma_{17,6}(\text{Ra})$	552,3 (2)	0,0027 (8)					
$\gamma_{22,8}(\text{Ra})$	556,3 (3)	0,0011 (4)					
$\gamma_{18,6}(\text{Ra})$	569,03 (8)	0,049 (11)					
$\gamma_{25,9}(\text{Ra})$	576,1 (4)	0,0011 (4)					
$\gamma_{24,8}(\text{Ra})$	581,3 (4)	0,0013 (4)					
$\gamma_{26,10}(\text{Ra})$	592,3 (2)	0,0032 (10)					
$\gamma_{26,9}(\text{Ra})$	596,9 (4)	0,0008 (3)					
$\gamma_{28,11}(\text{Ra})$	600,7 (4)	0,00054 (14)					
$\gamma_{22,6}(\text{Ra})$	607,6 (3)	0,0022 (7)					
$\gamma_{28,9}(\text{Ra})$	613,6 (4)	0,0011 (4)					
$\gamma_{24,6}(\text{Ra})$	632,7 (3)	0,0022 (7)					
$\gamma_{17,5}(\text{Ra})$	663,7 (3)	0,0011 (4)					
$\gamma_{29,8}(\text{Ra})$	671,9 (4)	0,00054 (14)					
$\gamma_{17,4}(\text{Ra})$	708,3 (3)	0,0013 (4)					
$\gamma_{23,5}(\text{Ra})$	722,65 (5)	0,038 (9)					
$\gamma_{18,4}(\text{Ra})$	724,15 (5)	0,014 (4)					
$\gamma_{17,2}(\text{Ra})$	737,4 (3)	0,0009 (3)					
$\gamma_{18,3}(\text{Ra})$	742,4 (3)	0,0011 (4)					
$\gamma_{21,4}(\text{Ra})$	746,30 (5)	0,020 (5)					
$\gamma_{18,2}(\text{Ra})$	753,65 (5)	0,0094 (22)					
$\gamma_{17,1}(\text{Ra})$	757,20 (5)	0,0076 (20)					
$\gamma_{22,4}(\text{Ra})$	762,6 (2)	0,0024 (7)					
$\gamma_{23,4}(\text{Ra})$	766,64 (5)	0,022 (5)					
$\gamma_{21,2}(\text{Ra})$	775,83 (5)	0,45 (9)					
$\gamma_{22,3}(\text{Ra})$	780,8 (1)	0,003 (1)					
$\gamma_{23,3}(\text{Ra})$	784,93 (5)	0,0086 (21)					
$\gamma_{17,0}(\text{Ra})$	787,13 (5)	0,0003 (3)					
$\gamma_{24,4}(\text{Ra})$	787,6 (2)	0,0024 (7)					
$\gamma_{22,2}(\text{Ra})$	792,2 (3)	0,00054 (14)					
$\gamma_{23,2}(\text{Ra})$	796,22 (5)	0,0108 (25)					
$\gamma_{18,0}(\text{Ra})$	803,77 (5)	0,059 (14)					
$\gamma_{19,0}(\text{Ra})$	806,0 (2)	0,0013 (4)					
$\gamma_{22,1}(\text{Ra})$	812,40 (6)	0,021 (5)					
$\gamma_{27,5}(\text{Ra})$	816,5 (2)	0,0013 (4)					
$\gamma_{20,0}(\text{Ra})$	823,20 (7)	0,0070 (16)					
$\gamma_{21,0}(\text{Ra})$	825,95 (7)	0,054 (13)					
$\gamma_{29,5}(\text{Ra})$	833,9 (2)	0,0013 (4)					
$\gamma_{24,1}(\text{Ra})$	837,5 (1)	0,0097 (21)					
$\gamma_{22,0}(\text{Ra})$	842,2 (1)	0,0049 (11)					
$\gamma_{26,4}(\text{Ra})$	846,85 (10)	0,049 (13)					
$\gamma_{23,0}(\text{Ra})$	846,85 (10)	0,005 (3)					
$\gamma_{28,4}(\text{Ra})$	863,6 (1)	0,0038 (9)					

	Energy keV	$P_{\gamma+ce}$ $\times 100$	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{24,0}(\text{Ra})$	867,4 (1)	0,0016 (4)					
$\gamma_{26,2}(\text{Ra})$	876,5 (1)	0,038 (9)					
$\gamma_{29,4}(\text{Ra})$	878,1 (2)	0,0032 (8)					
$\gamma_{28,2}(\text{Ra})$	893,1 (2)	0,0024 (7)					
$\gamma_{26,1}(\text{Ra})$	896,7 (2)	0,013 (3)					
$\gamma_{29,2}(\text{Ra})$	907,6 (2)	0,014 (3)					
$\gamma_{27,1}(\text{Ra})$	911,3 (3)	0,0008 (3)					
$\gamma_{28,1}(\text{Ra})$	913,6 (3)	0,00041 (14)					
$\gamma_{26,0}(\text{Ra})$	926,5 (3)	0,0016 (4)					
$\gamma_{27,0}(\text{Ra})$	941,2 (3)	0,0030 (8)					
$\gamma_{32,4}(\text{Ra})$	949,3 (4)	0,00032 (8)					
$\gamma_{29,0}(\text{Ra})$	958,0 (7)	0,00035 (8)					
$\gamma_{30,2}(\text{Ra})$	969,2 (4)	0,00032 (8)					
$\gamma_{31,2}(\text{Ra})$	975,2 (5)	0,00016 (5)					
$\gamma_{32,2}(\text{Ra})$	978,7 (4)	0,00067 (12)					
$\gamma_{30,1}(\text{Ra})$	989,4 (5)	0,00014 (3)					
$\gamma_{31,1}(\text{Ra})$	994,3 (3)	0,00011 (3)					
$\gamma_{32,1}(\text{Ra})$	999,3 (5)	0,00019 (4)					
$\gamma_{31,0}(\text{Ra})$	1025,1 (5)	0,00014 (3)					

3 Atomic Data

3.1 Ra

- ω_K : 0,968 (4)
- $\bar{\omega}_L$: 0,452 (18)
- n_{KL} : 0,801 (5)

3.1.1 X Radiations

	Energy keV	Relative probability	
X_K	$K\alpha_2$	85,43	
	$K\alpha_1$	88,47	
	$K\beta_3$	99,432	}
	$K\beta_1$	100,13	}
	$K\beta_5''$	100,738	}
	$K\beta_2$	102,89	}
	$K\beta_4$	103,295	}
	$KO_{2,3}$	103,74	}
X_L	$L\ell$	10,6241	
	$L\alpha$	12,1957 – 12,3381	
	$L\eta$	13,6624	
	$L\beta$	14,2373 – 16,1261	
	$L\gamma$	17,2756 – 18,3539	

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	65,149 – 72,729	100
KLX	79,721 – 88,466	57,8
KXY	94,27 – 103,91	8,35
Auger L	5,71 – 12,04	

3.2 At

$$\begin{aligned} \omega_K &: 0,966 \quad (4) \\ \bar{\omega}_L &: 0,416 \quad (17) \\ n_{KL} &: 0,805 \quad (5) \end{aligned}$$

3.2.1 X Radiations

	Energy keV	Relative probability
X _K		
K α_2	78,94	60,33
K α_1	81,51	100
K β_3	91,73	}
K β_1	92,315	}
K β_5''	92,883	}
		34,63
K β_2	94,846	}
K β_4	95,211	}
K $O_{2,3}$	95,595	}
		10,91
X _L		
L ℓ	9,8964	
L α	11,3052 – 11,426	
L η	12,4653	
L β	13,1704 – 14,6997	
L γ	15,7394 – 16,7291	

4 α Emissions

	Energy keV	Alpha per 100 disint.
$\alpha_{0,4}$	5172 (5)	0,0009 (5)
$\alpha_{0,3}$	5291 (4)	0,0060 (26)
$\alpha_{0,2}$	5314 (4)	0,0053 (23)
$\alpha_{0,1}$	5403 (3)	0,0044 (20)
$\alpha_{0,0}$	5462 (3)	0,0033 (15)

5 Electron Emissions

		Energy keV	Electrons per 100 disint.
eAL	(Ra)	5,71 - 12,04	29 (4)
eAK	(Ra)		0,159 (21)
	KLL	65,149 - 72,729	}
	KLX	79,721 - 88,466	}
	KXY	94,27 - 103,91	}
ec _{2,1} L	(Ra)	1,04 - 4,83	8,1 (17)
ec _{1,0} L	(Ra)	10,55 - 14,34	20 (6)
ec _{3,1} L	(Ra)	12,46 - 16,25	0,26 (8)
ec _{2,1} M	(Ra)	15,45 - 17,16	2,10 (45)
ec _{5,4} L	(Ra)	24,768 - 28,556	0,131 (12)
ec _{1,0} M	(Ra)	24,96 - 26,68	5,0 (14)
ec _{4,1} L	(Ra)	30,6 - 34,4	1,34 (32)
ec _{2,0} L	(Ra)	30,9 - 34,7	17,4 (37)
ec _{3,0} L	(Ra)	42,20 - 45,99	0,25 (5)
ec _{4,1} M	(Ra)	45,0 - 46,7	0,33 (8)
ec _{2,0} M	(Ra)	45,3 - 47,0	4,3 (9)
ec _{4,0} L	(Ra)	60,42 - 64,21	1,38 (28)
ec _{6,3} K	(Ra)	69,43 (5)	0,16 (14)
ec _{4,0} M	(Ra)	74,83 - 76,54	0,33 (7)
ec _{6,1} K	(Ra)	100,93 (5)	1,47 (28)
ec _{6,0} K	(Ra)	130,78 (5)	3,0 (6)
ec _{6,1} L	(Ra)	185,62 - 189,41	0,28 (5)
ec _{13,2} K	(Ra)	215,33 (5)	0,215 (42)
ec _{6,0} L	(Ra)	215,5 - 219,3	0,56 (10)
ec _{6,0} M	(Ra)	229,9 - 231,6	0,134 (25)

		Energy keV		Electrons per 100 disint.
$\beta_{0,32}^-$	max:	120,3	(10)	0,0012 (3)
$\beta_{0,32}^-$	avg:	31,5	(3)	
$\beta_{0,31}^-$	max:	124,6	(10)	0,0004 (1)
$\beta_{0,31}^-$	avg:	32,7	(3)	
$\beta_{0,30}^-$	max:	129,9	(10)	0,00046 (12)
$\beta_{0,30}^-$	avg:	34,1	(3)	
$\beta_{0,29}^-$	max:	191,5	(9)	0,020 (4)
$\beta_{0,29}^-$	avg:	51,5	(3)	
$\beta_{0,28}^-$	max:	205,9	(9)	0,0082 (18)
$\beta_{0,28}^-$	avg:	55,6	(3)	
$\beta_{0,27}^-$	max:	208,4	(9)	0,0051 (12)
$\beta_{0,27}^-$	avg:	56,3	(3)	
$\beta_{0,26}^-$	max:	222,6	(9)	0,106 (22)
$\beta_{0,26}^-$	avg:	60,5	(3)	
$\beta_{0,25}^-$	max:	243,3	(10)	0,0011 (4)
$\beta_{0,25}^-$	avg:	66,6	(3)	
$\beta_{0,24}^-$	max:	281,9	(9)	0,025 (5)
$\beta_{0,24}^-$	avg:	78,1	(3)	
$\beta_{0,23}^-$	max:	302,8	(9)	0,088 (18)
$\beta_{0,23}^-$	avg:	84,4	(3)	
$\beta_{0,22}^-$	max:	306,9	(9)	0,035 (7)
$\beta_{0,22}^-$	avg:	85,7	(3)	
$\beta_{0,21}^-$	max:	323,3	(9)	0,54 (10)
$\beta_{0,21}^-$	avg:	90,7	(3)	
$\beta_{0,20}^-$	max:	326,0	(9)	0,014 (3)
$\beta_{0,20}^-$	avg:	91,5	(3)	
$\beta_{0,19}^-$	max:	343,8	(9)	0,0040 (8)
$\beta_{0,19}^-$	avg:	97,0	(3)	
$\beta_{0,18}^-$	max:	345,4	(9)	0,14 (3)
$\beta_{0,18}^-$	avg:	97,5	(3)	
$\beta_{0,17}^-$	max:	362,1	(9)	0,019 (4)
$\beta_{0,17}^-$	avg:	102,7	(3)	
$\beta_{0,16}^-$	max:	366,7	(10)	0,00111 (22)
$\beta_{0,16}^-$	avg:	104,1	(3)	
$\beta_{0,15}^-$	max:	555,3	(9)	0,013 (3)
$\beta_{0,15}^-$	avg:	165,6	(4)	
$\beta_{0,14}^-$	max:	773,1	(10)	0,0046 (12)
$\beta_{0,14}^-$	avg:	241,3	(4)	
$\beta_{0,13}^-$	max:	779,9	(9)	1,8 (4)
$\beta_{0,13}^-$	avg:	243,7	(4)	
$\beta_{0,11}^-$	max:	806,7	(9)	0,037 (8)
$\beta_{0,11}^-$	avg:	253,3	(4)	

		Energy keV		Electrons per 100 disint.
$\beta_{0,10}^-$	max:	814,9	(9)	0,042 (9)
$\beta_{0,10}^-$	avg:	256,3	(4)	
$\beta_{0,9}^-$	max:	819,4	(9)	0,049 (10)
$\beta_{0,9}^-$	avg:	257,9	(4)	
$\beta_{0,8}^-$	max:	863,1	(9)	0,032 (9)
$\beta_{0,8}^-$	avg:	273,8	(4)	
$\beta_{0,7}^-$	max:	869,0	(9)	0,004 (4)
$\beta_{0,7}^-$	avg:	275,9	(4)	
$\beta_{0,6}^-$	max:	914,5	(9)	9,1 (17)
$\beta_{0,6}^-$	avg:	292,6	(4)	
$\beta_{0,5}^-$	max:	1025,5	(9)	0,24 (6)
$\beta_{0,5}^-$	avg:	333,9	(4)	
$\beta_{0,4}^-$	max:	1069,6	(9)	15 (3)
$\beta_{0,4}^-$	avg:	350,5	(4)	
$\beta_{0,3}^-$	max:	1087,8	(9)	0,27 (19)
$\beta_{0,3}^-$	avg:	357,4	(4)	
$\beta_{0,2}^-$	max:	1099,1	(9)	67 (13)
$\beta_{0,2}^-$	avg:	361,7	(4)	
$\beta_{0,1}^-$	max:	1119,3	(9)	6 (6)
$\beta_{0,1}^-$	avg:	369,4	(4)	
$\beta_{0,0}^-$	max:	1149,2	(9)	1
$\beta_{0,0}^-$	avg:	380,8	(4)	

6 Photon Emissions

6.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.
XL	(Ra)	10,6241 — 18,3539		24 (3)
XK α_2	(Ra)	85,43		1,44 (19) } K α
XK α_1	(Ra)	88,47		2,3 (3) }
XK β_3	(Ra)	99,432		} }
XK β_1	(Ra)	100,13		} 0,83 (11) K' β_1
XK β_5''	(Ra)	100,738		} }
XK β_2	(Ra)	102,89		} }
XK β_4	(Ra)	103,295		} 0,27 (4) K' β_2
XK $O_{2,3}$	(Ra)	103,74		} }

		Energy keV	Photons per 100 disint.	
XL	(At)	9,8964 — 16,7291	0,0054 (13)	
XK α_2	(At)	78,94	0,00056 (15)	} K α
XK α_1	(At)	81,51	0,00092 (25)	
XK β_3	(At)	91,73	}	} K' β_1
XK β_1	(At)	92,315	}	
XK β_5''	(At)	92,883	}	
XK β_2	(At)	94,846	}	} K' β_2
XK β_4	(At)	95,211	}	
XKO _{2,3}	(At)	95,595	}	

6.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{2,1}$ (Ra)	20,27 (5)	1,4 (3)
$\gamma_{1,0}$ (Ra)	29,78 (4)	0,070 (17)
$\gamma_{3,1}$ (Ra)	31,69 (5)	0,00135
$\gamma_{9,8}$ (Ra)	43,5 (2)	0,0022
$\gamma_{5,4}$ (Ra)	44,0 (1)	0,00135
$\gamma_{4,1}$ (Ra)	49,80 (5)	2,5 (6)
$\gamma_{2,0}$ (Ra)	50,10 (2)	33 (7)
$\gamma_{1,0}$ (At)	58,9 (2)	0,0008 (3)
$\gamma_{3,0}$ (Ra)	61,43 (5)	0,0035 (7)
$\gamma_{5,3}$ (Ra)	62,31 (6)	0,016 (7)
$\gamma_{5,2}$ (Ra)	73,5 (1)	0,0013 (9)
$\gamma_{4,0}$ (Ra)	79,65 (2)	9,0 (18)
$\gamma_{13,7}$ (Ra)	89,08 (10)	0,054 (11)
$\gamma_{5,1}$ (Ra)	93,88 (5)	0,059 (14)
$\gamma_{6,5}$ (Ra)	111,05 (3)	0,0049 (14)
$\gamma_{13,6}$ (Ra)	134,60 (2)	0,5 (1)
$\gamma_{4,2}$ (At)	145,3 (3)	0,0002 (1)
$\gamma_{2,0}$ (At)	150,9 (2)	0,0056 (5)
$\gamma_{6,4}$ (Ra)	155,5 (5)	0,0027
$\gamma_{6,3}$ (Ra)	173,35 (5)	0,115 (22)
$\gamma_{6,2}$ (Ra)	184,65 (5)	0,22 (5)
$\gamma_{7,4}$ (Ra)	200,7 (2)	0,0027 (10)
$\gamma_{6,1}$ (Ra)	204,85 (5)	0,92 (18)
$\gamma_{9,5}$ (Ra)	205,6 (2)	0,0059 (11)
$\gamma_{10,5}$ (Ra)	210,60 (5)	0,0097 (19)
$\gamma_{7,3}$ (Ra)	218,80 (5)	0,0086 (17)
$\gamma_{6,0}$ (Ra)	234,70 (5)	2,7 (5)
$\gamma_{8,2}$ (Ra)	236,05 (5)	0,027 (8)

	Energy keV	Photons per 100 disint.
$\gamma_{13,5}$ (Ra)	245,60 (5)	0,019 (4)
$\gamma_{7,1}$ (Ra)	250,25 (5)	0,016
$\gamma_{9,4}$ (Ra)	250,25 (5)	0,003
$\gamma_{10,4}$ (Ra)	254,6 (2)	0,0057 (12)
$\gamma_{8,1}$ (Ra)	256,18 (5)	0,020 (4)
$\gamma_{11,4}$ (Ra)	262,9 (2)	0,0035 (11)
$\gamma_{10,3}$ (Ra)	272,8 (2)	0,004 (1)
$\gamma_{11,3}$ (Ra)	280,7 (5)	0,0003
$\gamma_{7,0}$ (Ra)	280,7 (5)	0,0003
$\gamma_{8,0}$ (Ra)	286,0 (2)	0,0046 (10)
$\gamma_{13,4}$ (Ra)	289,67 (5)	0,21
$\gamma_{14,4}$ (Ra)	296,5 (2)	0,0013 (4)
$\gamma_{9,1}$ (Ra)	299,95 (5)	0,020 (4)
$\gamma_{10,1}$ (Ra)	304,40 (5)	0,0086 (17)
$\gamma_{13,3}$ (Ra)	307,93 (5)	0,0013 (13)
$\gamma_{15,8}$ (Ra)	307,93 (5)	0,012 (3)
$\gamma_{11,1}$ (Ra)	312,65 (5)	0,016 (4)
$\gamma_{14,3}$ (Ra)	314,6 (2)	0,0022 (7)
$\gamma_{13,2}$ (Ra)	319,25 (5)	0,46 (9)
$\gamma_{9,0}$ (Ra)	329,80 (5)	0,024 (5)
$\gamma_{10,0}$ (Ra)	334,30 (6)	0,0084 (17)
$\gamma_{13,1}$ (Ra)	339,50 (5)	0,062 (13)
$\gamma_{11,0}$ (Ra)	342,50 (7)	0,0116 (24)
$\gamma_{12,0}$ (Ra)	350,5 (2)	0,0027 (15)
$\gamma_{13,0}$ (Ra)	369,32 (5)	0,089 (18)
$\gamma_{18,13}$ (Ra)	434,4 (1)	0,0022 (7)
$\gamma_{16,11}$ (Ra)	439,6 (3)	0,00030 (8)
$\gamma_{17,11}$ (Ra)	444,5 (3)	0,0011 (4)
$\gamma_{16,9}$ (Ra)	452,9 (2)	0,0008
$\gamma_{17,10}$ (Ra)	452,9 (2)	0,0008
$\gamma_{17,9}$ (Ra)	457,5 (2)	0,0008
$\gamma_{15,5}$ (Ra)	469,3 (2)	0,001
$\gamma_{18,10}$ (Ra)	469,3 (2)	0,001
$\gamma_{19,9}$ (Ra)	475,4 (1)	0,0027
$\gamma_{21,12}$ (Ra)	475,4 (1)	0,003
$\gamma_{20,11}$ (Ra)	480,9 (3)	0,0013 (4)
$\gamma_{20,9}$ (Ra)	493,4 (2)	0,0024 (7)
$\gamma_{17,7}$ (Ra)	506,9 (2)	0,0022 (7)
$\gamma_{23,9}$ (Ra)	516,7 (2)	0,0032 (8)
$\gamma_{24,11}$ (Ra)	524,8 (2)	0,0043 (12)
$\gamma_{24,10}$ (Ra)	533,1 (3)	0,0019 (7)
$\gamma_{24,9}$ (Ra)	537,2 (2)	0,0019
$\gamma_{20,8}$ (Ra)	537,2 (2)	0,0032
$\gamma_{21,8}$ (Ra)	539,8 (2)	0,0059 (18)
$\gamma_{21,7}$ (Ra)	545,4 (4)	0,00030 (8)
$\gamma_{17,6}$ (Ra)	552,3 (2)	0,0027 (8)
$\gamma_{22,8}$ (Ra)	556,3 (3)	0,0011 (4)

	Energy keV	Photons per 100 disint.
$\gamma_{18,6}$ (Ra)	569,03 (8)	0,049 (11)
$\gamma_{25,9}$ (Ra)	576,1 (4)	0,0011 (4)
$\gamma_{24,8}$ (Ra)	581,3 (4)	0,0013 (4)
$\gamma_{26,10}$ (Ra)	592,3 (2)	0,0032 (10)
$\gamma_{26,9}$ (Ra)	596,9 (4)	0,0008 (3)
$\gamma_{28,11}$ (Ra)	600,7 (4)	0,00054 (14)
$\gamma_{22,6}$ (Ra)	607,6 (3)	0,0022 (7)
$\gamma_{28,9}$ (Ra)	613,6 (4)	0,0011 (4)
$\gamma_{24,6}$ (Ra)	632,7 (3)	0,0022 (7)
$\gamma_{17,5}$ (Ra)	663,7 (3)	0,0011 (4)
$\gamma_{29,8}$ (Ra)	671,9 (4)	0,00054 (14)
$\gamma_{17,4}$ (Ra)	708,3 (3)	0,0013 (4)
$\gamma_{23,5}$ (Ra)	722,65 (5)	0,038 (9)
$\gamma_{18,4}$ (Ra)	724,15 (5)	0,014 (4)
$\gamma_{17,2}$ (Ra)	737,4 (3)	0,0009 (3)
$\gamma_{18,3}$ (Ra)	742,4 (3)	0,0011 (4)
$\gamma_{21,4}$ (Ra)	746,30 (5)	0,020 (5)
$\gamma_{18,2}$ (Ra)	753,65 (5)	0,0094 (22)
$\gamma_{17,1}$ (Ra)	757,20 (5)	0,0076 (20)
$\gamma_{22,4}$ (Ra)	762,6 (2)	0,0024 (7)
$\gamma_{23,4}$ (Ra)	766,64 (5)	0,022 (5)
$\gamma_{21,2}$ (Ra)	775,83 (5)	0,45 (9)
$\gamma_{22,3}$ (Ra)	780,8 (1)	0,003 (1)
$\gamma_{23,3}$ (Ra)	784,93 (5)	0,0086 (21)
$\gamma_{24,4}$ (Ra)	787,6 (2)	0,0024 (7)
$\gamma_{17,0}$ (Ra)	787,6 (2)	0,0003 (3)
$\gamma_{22,2}$ (Ra)	792,2 (3)	0,00054 (14)
$\gamma_{23,2}$ (Ra)	796,22 (5)	0,0108 (25)
$\gamma_{18,0}$ (Ra)	803,77 (5)	0,059 (14)
$\gamma_{19,0}$ (Ra)	806,0 (2)	0,0013 (4)
$\gamma_{22,1}$ (Ra)	812,40 (6)	0,021 (5)
$\gamma_{27,5}$ (Ra)	816,5 (2)	0,0013 (4)
$\gamma_{20,0}$ (Ra)	823,20 (7)	0,0070 (16)
$\gamma_{21,0}$ (Ra)	825,95 (7)	0,054 (13)
$\gamma_{29,5}$ (Ra)	833,9 (2)	0,0013 (4)
$\gamma_{24,1}$ (Ra)	837,5 (1)	0,0097 (21)
$\gamma_{22,0}$ (Ra)	842,2 (1)	0,0049 (11)
$\gamma_{26,4}$ (Ra)	846,85 (10)	0,049 (13)
$\gamma_{23,0}$ (Ra)	846,85 (10)	0,005 (3)
$\gamma_{28,4}$ (Ra)	863,6 (1)	0,0038 (9)
$\gamma_{24,0}$ (Ra)	867,4 (1)	0,0016 (4)
$\gamma_{26,2}$ (Ra)	876,5 (1)	0,038 (9)
$\gamma_{29,4}$ (Ra)	878,1 (2)	0,0032 (8)
$\gamma_{28,2}$ (Ra)	893,1 (2)	0,0024 (7)
$\gamma_{26,1}$ (Ra)	896,7 (2)	0,013 (3)
$\gamma_{29,2}$ (Ra)	907,6 (2)	0,014 (3)
$\gamma_{27,1}$ (Ra)	911,3 (3)	0,0008 (3)

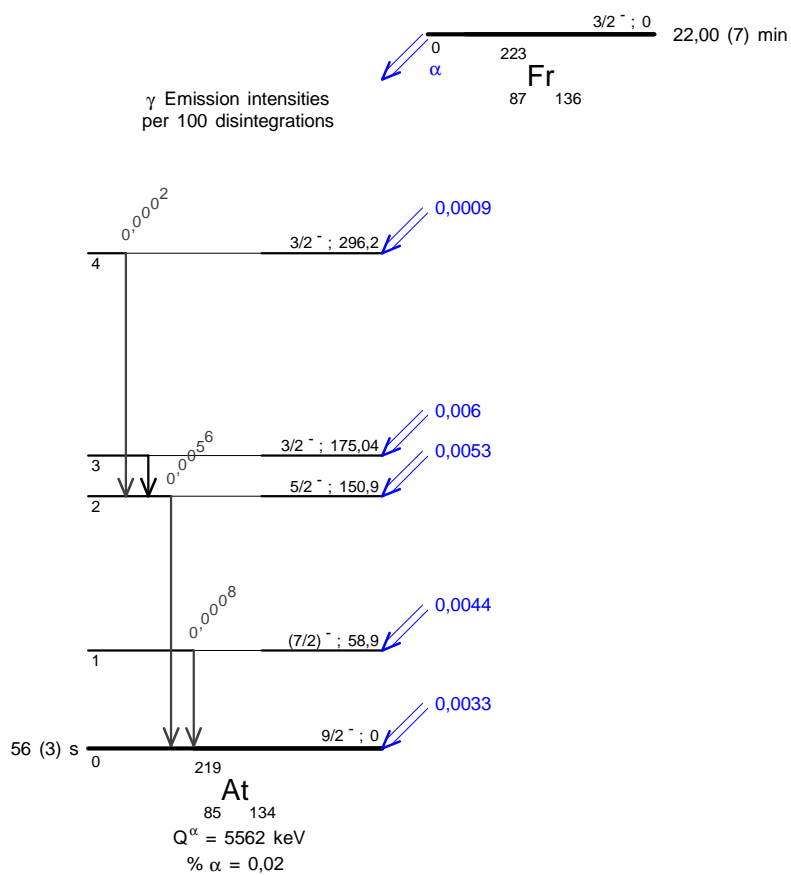
	Energy keV	Photons per 100 disint.
$\gamma_{28,1}$ (Ra)	913,6 (3)	0,00041 (14)
$\gamma_{26,0}$ (Ra)	926,5 (3)	0,0016 (4)
$\gamma_{27,0}$ (Ra)	941,2 (3)	0,0030 (8)
$\gamma_{32,4}$ (Ra)	949,3 (4)	0,00032 (8)
$\gamma_{29,0}$ (Ra)	958,0 (7)	0,00035 (8)
$\gamma_{30,2}$ (Ra)	969,2 (4)	0,00032 (8)
$\gamma_{31,2}$ (Ra)	975,2 (5)	0,00016 (5)
$\gamma_{32,2}$ (Ra)	978,7 (4)	0,00067 (12)
$\gamma_{30,1}$ (Ra)	989,4 (5)	0,00014 (3)
$\gamma_{31,1}$ (Ra)	994,3 (3)	0,00011 (3)
$\gamma_{32,1}$ (Ra)	999,3 (5)	0,00019 (4)
$\gamma_{31,0}$ (Ra)	1025,1 (5)	0,00014 (3)

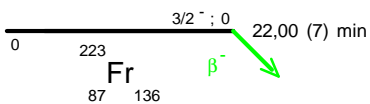
7 Main Production Modes

U – 235 decay chain

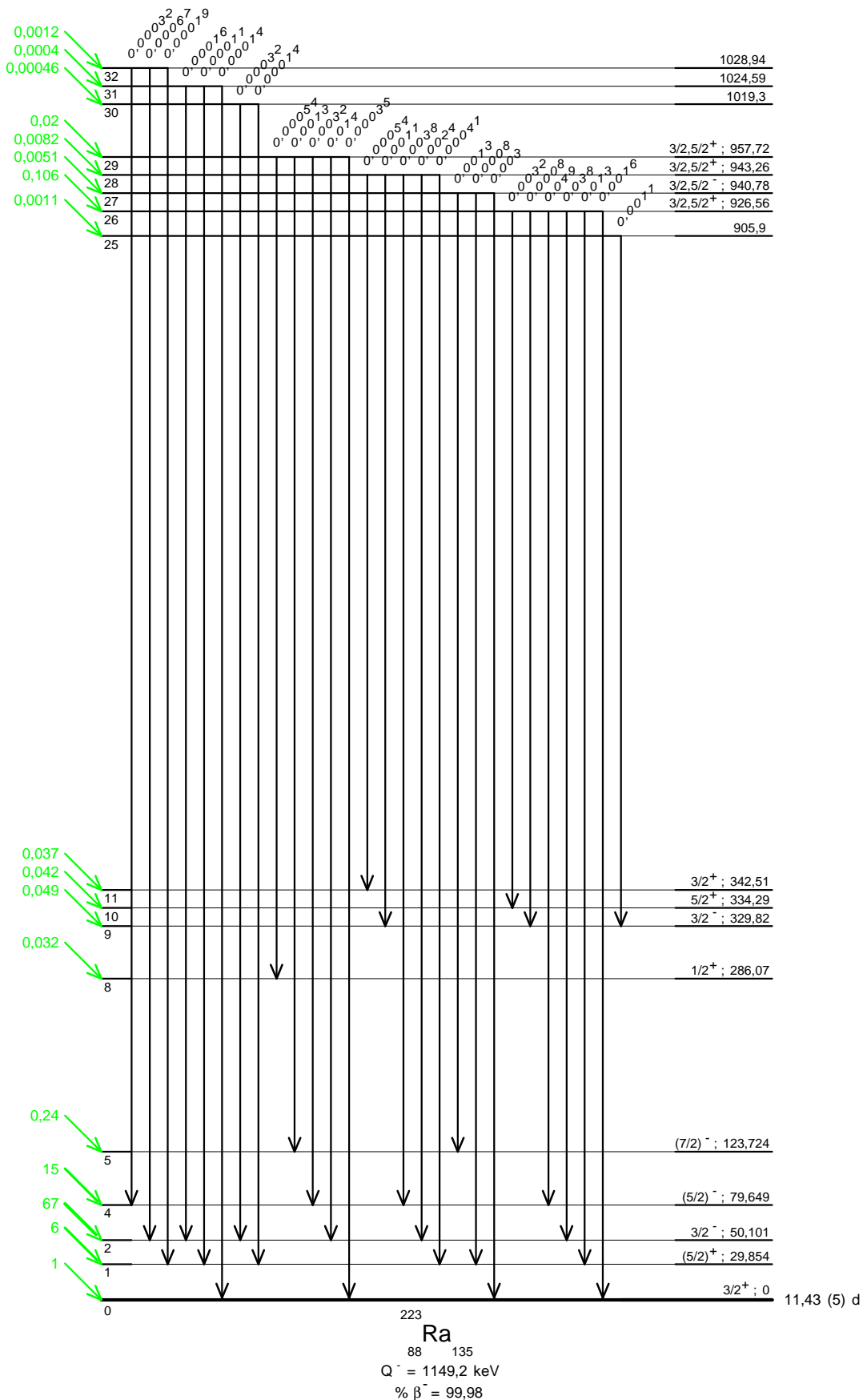
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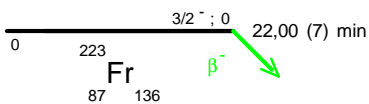
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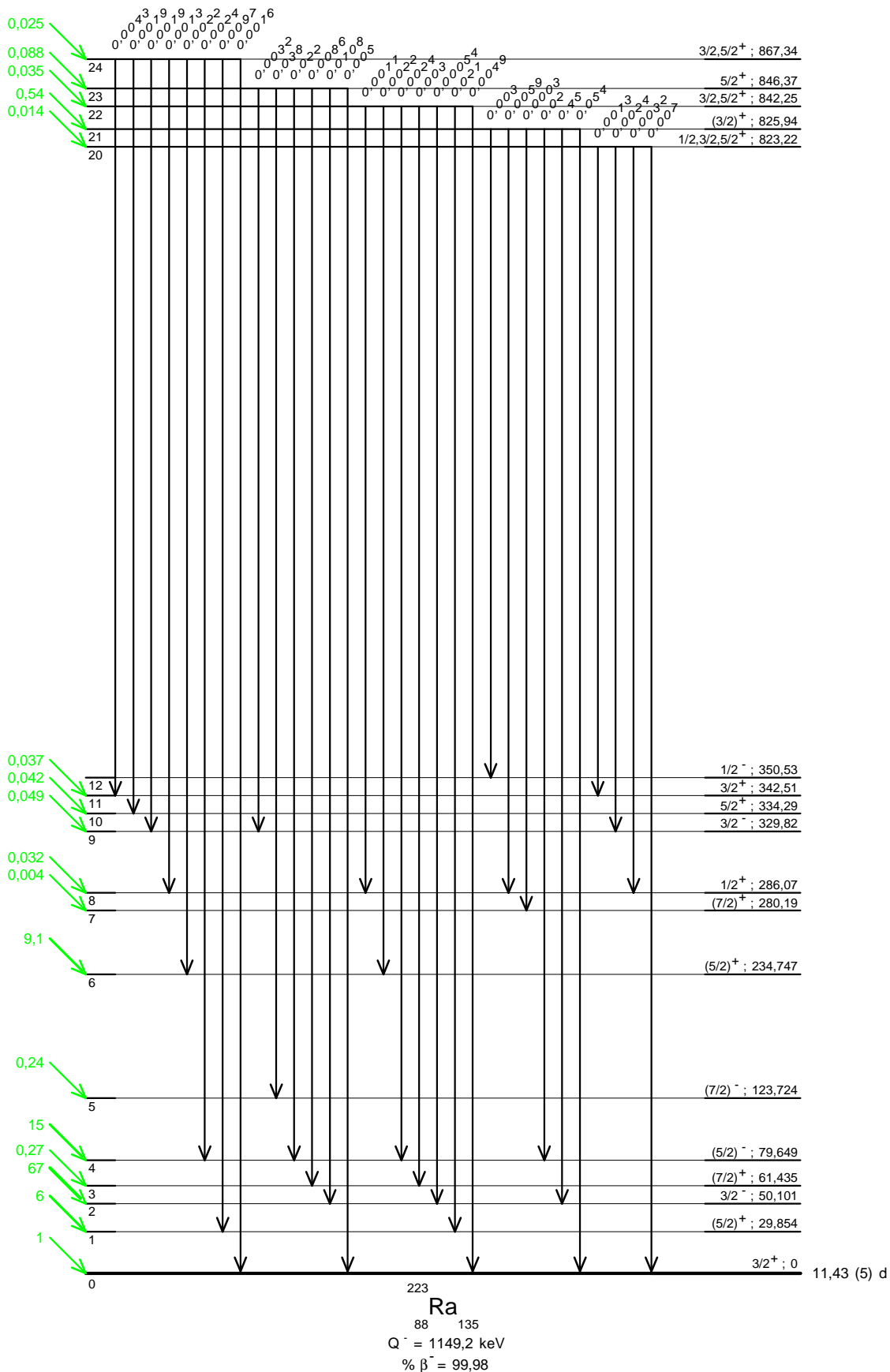


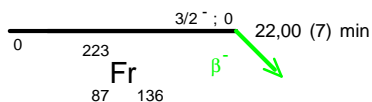
γ Emission intensities per 100 disintegrations



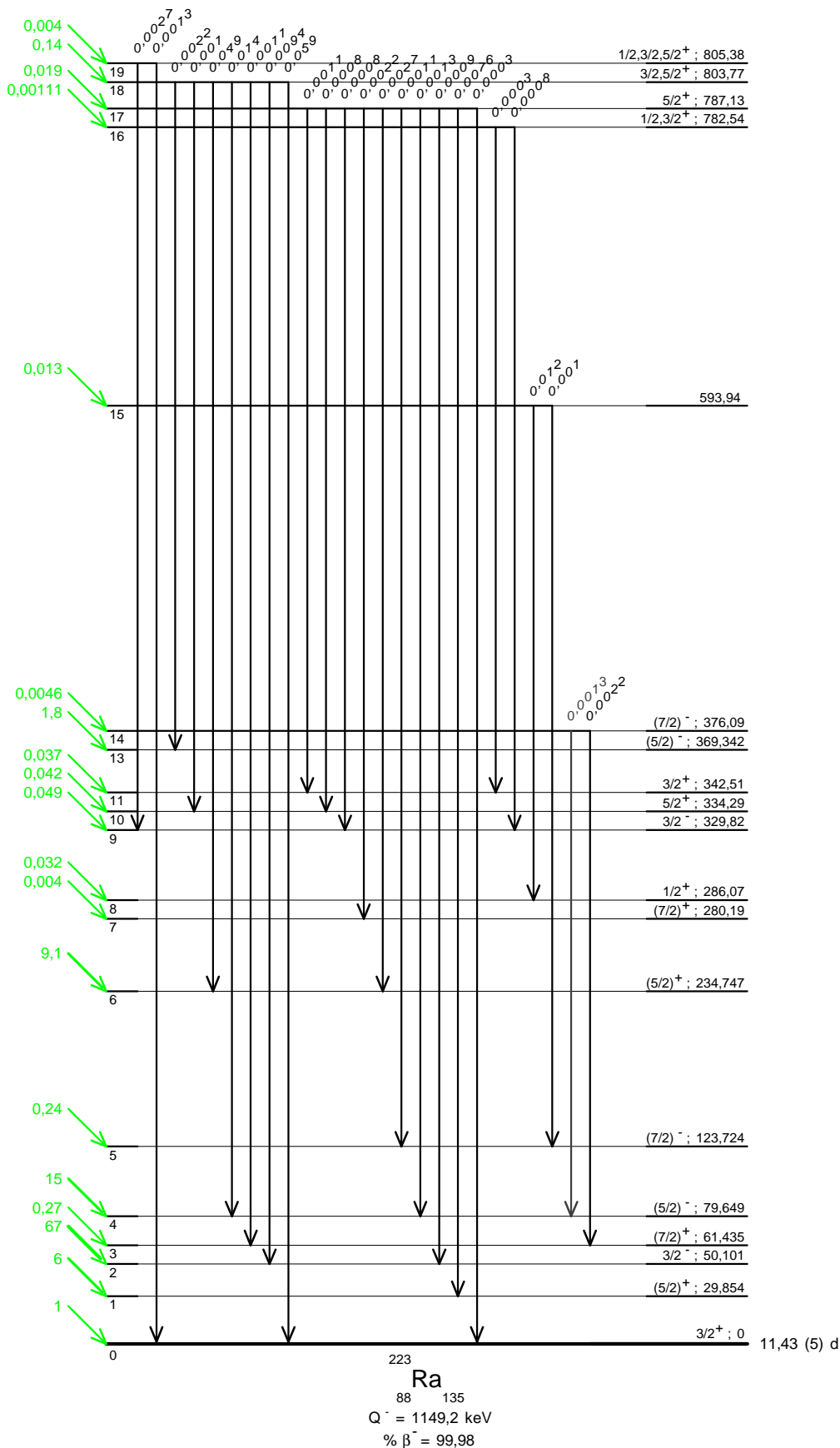


γ Emission intensities per 100 disintegrations



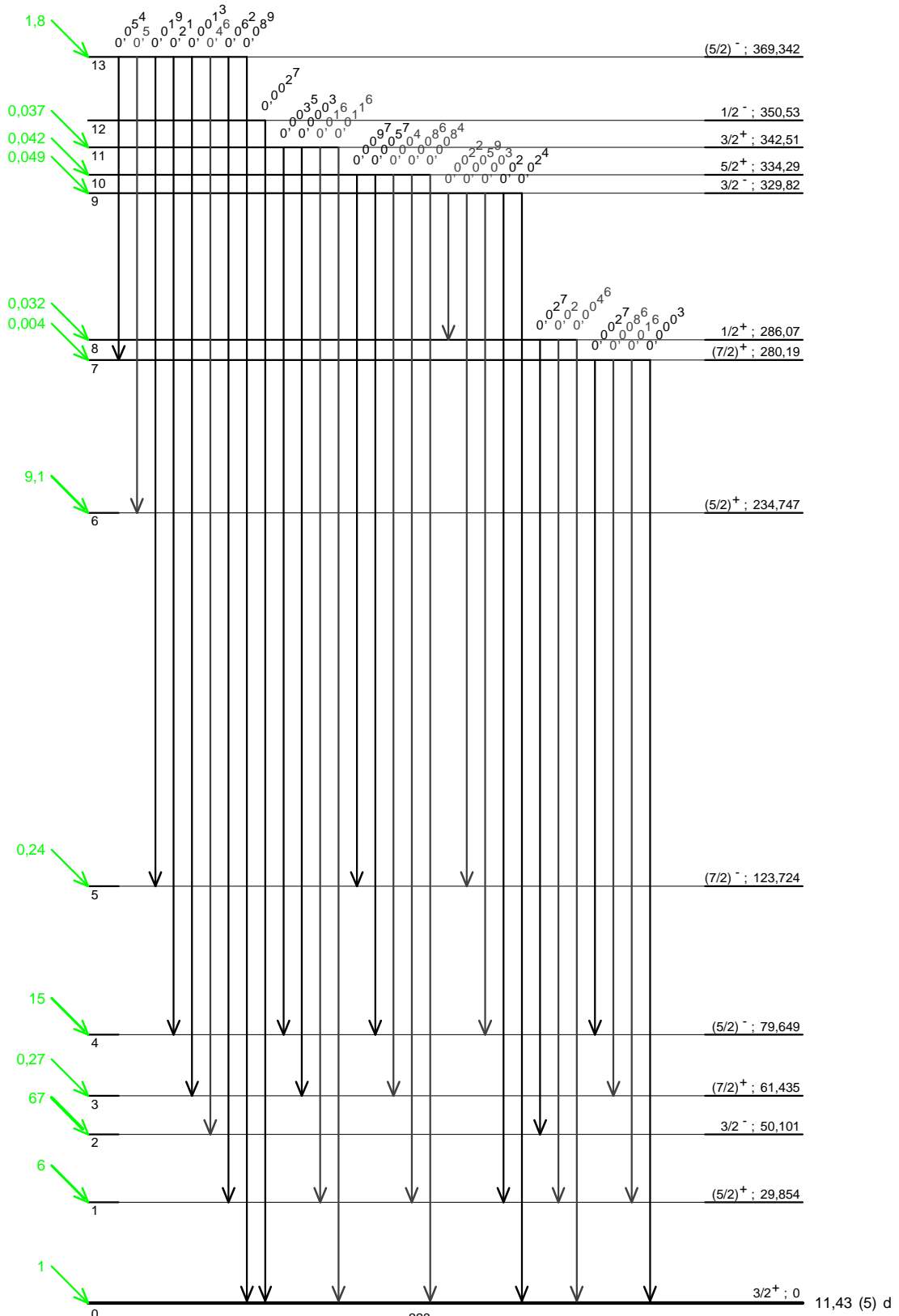


γ Emission intensities per 100 disintegrations

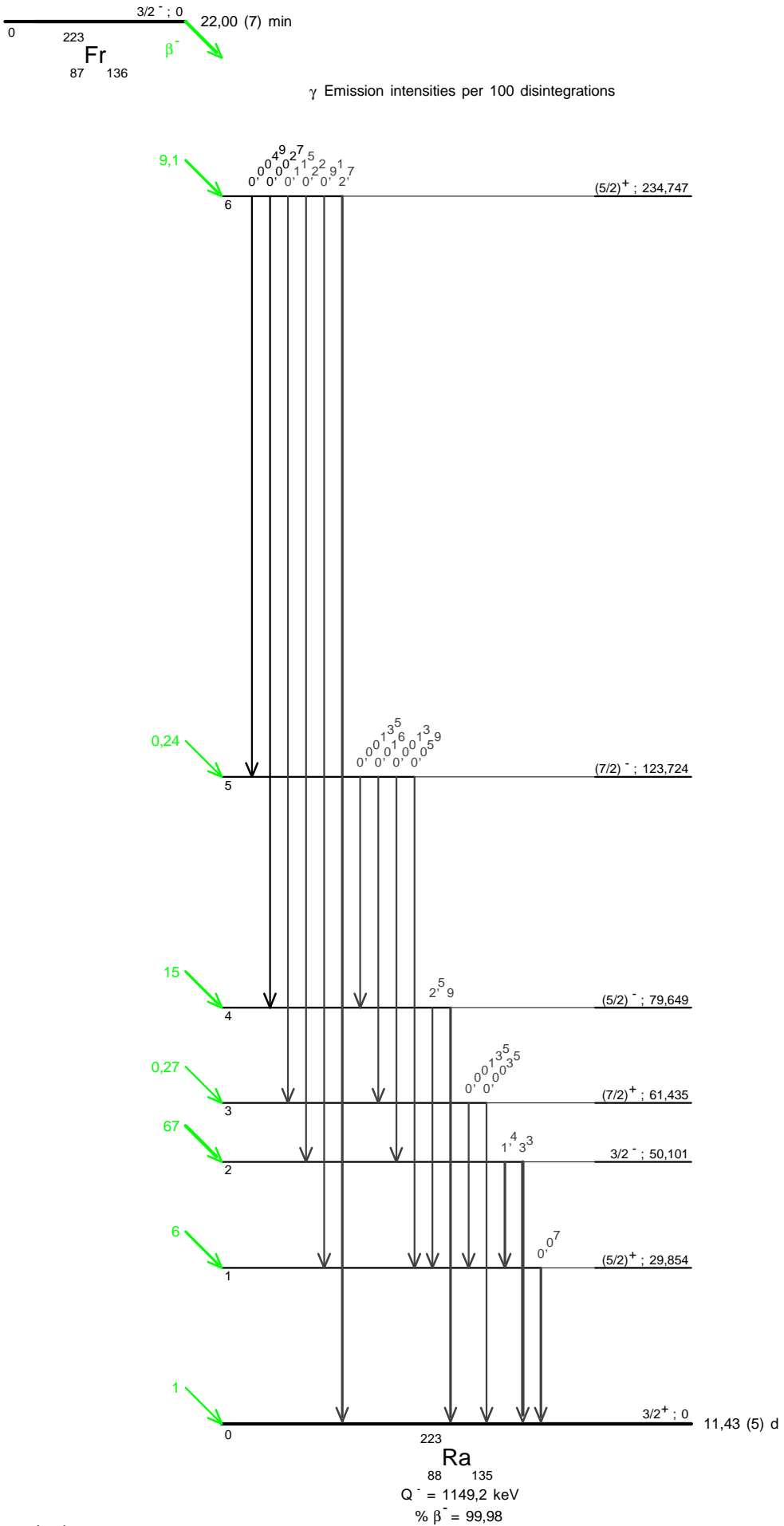


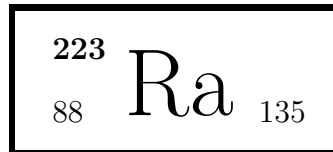
²²³Fr ₈₇ 136
 3/2⁻; 0
 22,00 (7) min
 β⁻

γ Emission intensities per 100 disintegrations



²²³Ra ₈₈ 135
 Q⁻ = 1149,2 keV
 % β⁻ = 99,98





1 Decay Scheme

Ra-223 decays by alpha emissions to excited levels in Rn-219.

Le radium 223 se désintègre par émissions alpha vers des niveaux excités du radon 219.

2 Nuclear Data

$T_{1/2}(^{223}\text{Ra})$:	11,43	(3)	d
$T_{1/2}(^{219}\text{Rn})$:	3,98	(3)	s
$Q^\alpha(^{223}\text{Ra})$:	5978,99	(21)	keV

2.1 α Transitions

	Energy keV	Probability $\times 100$	F
$\alpha_{0,30}$	5106	$\sim 0,00044$	~ 117
$\alpha_{0,29}$	5118	$\sim 0,00063$	~ 97
$\alpha_{0,28}$	5128	$\sim 0,0004$	~ 175
$\alpha_{0,27}$	5149	$\sim 0,0002$	~ 468
$\alpha_{0,26}$	5179	$\sim 0,0003$	~ 470
$\alpha_{0,25}$	5206	$\sim 0,0006$	~ 339
$\alpha_{0,24}$	5231	$\sim 0,0017$	~ 168
$\alpha_{0,23}$	5246,19 (23)	0,021	16,6
$\alpha_{0,22}$	5267,69 (23)	0,026	17,9
$\alpha_{0,21}$	5306,4 (5)	0,0053	147
$\alpha_{0,20}$	5332,89 (23)	0,041	27
$\alpha_{0,19}$	5355,31 (21)	0,042	35
$\alpha_{0,18}$	5380,27 (21)	0,093	21,8
$\alpha_{0,17}$	5384,89 (23)	0,16 (4)	13
$\alpha_{0,16}$	5437,00 (21)	$\sim 0,13$	~ 32
$\alpha_{0,14}$	5464,49 (23)	$\sim 0,13$	~ 45
$\alpha_{0,12}$	5532,17 (21)	0,50 (8)	27
$\alpha_{0,11}$	5533,96 (21)	1,60 (24)	9

	Energy keV	Probability × 100	F
$\alpha_{0,10}$	5581,9 (5)	~ 0,008	~ 3150
$\alpha_{0,8}$	5602,73 (21)	0,74 (25)	44
$\alpha_{0,6}$	5640,72 (21)	10,6 (10)	4,8
$\alpha_{0,5}$	5709,51 (21)	25,8 (11)	4,5
$\alpha_{0,4}$	5820,35 (21)	49,6 (12)	8,4
$\alpha_{0,3}$	5852,22 (21)	10,0 (3)	60
$\alpha_{0,2}$	5964,62 (21)	0,32 (4)	6480
$\alpha_{0,0}$	5978,99 (21)	1,0 (2)	2420

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{1,0}(\text{Rn})$	4,47 (1)	54,9 (23)	E2			510000	860000
$\gamma_{2,1}(\text{Rn})$	9,90 (2)	15,7 (21)	M1+E2			750 (30)	990 (40)
$\gamma_{2,0}(\text{Rn})$	14,37 (1)	10,0 (8)	M1+E2			409 (11)	539 (15)
$\gamma_{4,3}(\text{Rn})$	31,87 (2)	0,21 (4)	(E2)		1490 (22)	398 (6)	2010 (30)
$\gamma_{9,7}(\text{Rn})$	34,5 (2)	0,14 (6)					
$\gamma_{12,9}(\text{Rn})$	69,5 (1)	0,059 (25)	M1		5,60 (9)	1,33 (2)	7,36 (11)
$\gamma_{15,12}(\text{Rn})$	70,9 (2)	0,0036 (11)					
$\gamma_{11,7}(\text{Rn})$	102,2 (2)	0,0008 (4)					
$\gamma_{17,13}(\text{Rn})$	103,2 (2)	0,064 (35)	M1+E2	5 (5)	3,5 (17)	0,9 (5)	9,6 (24)
$\gamma_{12,7}(\text{Rn})$	104,04 (4)	0,20 (5)	M1+E2	5 (5)	3,3 (16)	0,9 (5)	9,4 (24)
$\gamma_{11,6}(\text{Rn})$	106,78 (3)	0,277 (17)	(M1)	8,77 (13)	1,608 (23)	0,382 (6)	10,89 (16)
$\gamma_{12,6}(\text{Rn})$	108,5 (2)	0,006 (3)					
$\gamma_{5,4}(\text{Rn})$	110,856 (10)	0,369 (26)	E2	0,363 (5)	3,69 (6)	0,994 (14)	5,36 (8)
$\gamma_{22,18}(\text{Rn})$	112,6	0,045					
$\gamma_{13,8}(\text{Rn})$	114,7 (2)	0,010 (4)					
$\gamma_{3,1}(\text{Rn})$	122,319 (10)	10,32 (21)	M1+E2	5,88 (9)	1,109 (17)	0,265 (4)	7,34 (11)
$\gamma_{20,14}(\text{Rn})$	131,6 (2)	0,006 (3)					
$\gamma_{14,8}(\text{Rn})$	138,3 (3)	0,0017 (7)					
$\gamma_{4,2}(\text{Rn})$	144,27 (2)	18,8 (5)	M1+E2	3,69 (6)	0,684 (10)	0,1629 (23)	4,59 (7)
$\gamma_{17,12}(\text{Rn})$	147,2 (3)	0,006 (3)					
$\gamma_{4,1}(\text{Rn})$	154,208 (10)	28,2 (7)	M1	3,09 (5)	0,560 (8)	0,1331 (19)	3,83 (6)
$\gamma_{4,0}(\text{Rn})$	158,635 (10)	3,18 (11)	M1+E2	2,77 (13)	0,523 (13)	0,125 (4)	3,46 (12)
$\gamma_{16,8}(\text{Rn})$	165,8 (2)	0,0054 (28)					
$\gamma_{11,5}(\text{Rn})$	175,65 (15)	0,017 (4)					
$\gamma_{12,5}(\text{Rn})$	177,3 (1)	0,047 (4)					
$\gamma_{6,4}(\text{Rn})$	179,54 (6)	0,480 (45)	M1+E2	1,62 (7)	0,376 (6)	0,0922 (16)	2,12 (7)
$\gamma_{20,12}(\text{Rn})$	199,3 (3)	0,0030 (14)					
$\gamma_{18,9}(\text{Rn})$	221,32 (24)	0,038 (6)	E1	0,0543 (8)	0,01005 (15)	0,00239 (4)	0,0675 (10)
$\gamma_{19,8}(\text{Rn})$	247,2 (5)	0,0097 (28)					
$\gamma_{8,3}(\text{Rn})$	249,49 (3)	0,061 (22)	M1+E2	0,5 (4)	0,125 (20)	0,031 (4)	0,6 (4)
$\gamma_{17,7}(\text{Rn})$	251,6 (3)	0,088 (27)	M1+E2	0,4 (4)	0,122 (20)	0,030 (4)	0,6 (4)
$\gamma_{5,2}(\text{Rn})$	255,2 (2)	0,048 (7)					
$\gamma_{17,6}(\text{Rn})$	255,7 (3)	0,0055 (28)					
$\gamma_{18,6}(\text{Rn})$	260,4 (3)	0,0067 (28)					
$\gamma_{5,0}(\text{Rn})$	269,463 (10)	25,5 (6)	M1+E2	0,637 (12)	0,1157 (17)	0,0275 (4)	0,789 (14)
$\gamma_{10,3}(\text{Rn})$	270,3 (4)	0,0007 (4)					
$\gamma_{23,12}(\text{Rn})$	286,0 (4)	0,0011 (6)					

	Energy keV	P _{γ+ce} × 100	Multipolarity	α _K	α _L	α _M	α _T
γ _{12,4} (Rn)	288,18 (3)	0,167 (5)	E1	0,0295 (5)	0,00527 (8)	0,001249 (18)	0,0364 (6)
γ _{6,2} (Rn)	323,871 (10)	5,98 (14)	M1+E2	0,382 (15)	0,0691 (17)	0,0164 (4)	0,473 (17)
γ _{7,2} (Rn)	328,38 (3)	0,209 (10)	(E1)	0,0220 (3)	0,00387 (6)	0,000916 (13)	0,0271 (4)
γ _{6,1} (Rn)	334,01 (6)	0,110 (7)	(E2)	0,0546 (8)	0,0343 (5)	0,00895 (13)	0,1007 (15)
γ _{6,0} (Rn)	338,282 (10)	4,08 (9)	M1	0,348 (5)	0,0622 (9)	0,01475 (21)	0,430 (6)
γ _{7,0} (Rn)	342,78 (2)	0,232 (13)	E1	0,0200 (3)	0,00351 (5)	0,000828 (12)	0,0246 (4)
γ _{23,9} (Rn)	355,5 (2)	0,0043 (14)					
γ _{14,4} (Rn)	355,7 (2)	0,0028 (14)					
γ _{8,2} (Rn)	361,89 (2)	0,028 (7)					
γ _{9,2} (Rn)	362,9 (2)	0,016 (7)					
γ _{22,7} (Rn)	368,56 (12)	0,009 (4)					
γ _{8,1} (Rn)	371,676 (15)	0,665 (15)	M1	0,270 (4)	0,0481 (7)	0,01139 (16)	0,333 (5)
γ _{9,1} (Rn)	372,86 (6)	0,052	E1	0,01667 (24)	0,00289 (4)	0,000682 (10)	0,0205 (3)
γ _{8,0} (Rn)	376,26 (2)	0,013 (4)					
γ _{16,4} (Rn)	383,35 (2)	0,007 (4)					
γ _{14,3} (Rn)	387,7 (2)	0,016 (6)					
γ _{23,7} (Rn)	390,1 (2)	0,0046 (21)					
γ _{11,2} (Rn)	430,6 (3)	0,020 (6)					
γ _{12,2} (Rn)	432,45 (3)	0,0356 (29)					
γ _{11,0} (Rn)	445,033 (12)	1,542 (48)	M1	0,1661 (24)	0,0295 (5)	0,00698 (10)	0,205 (3)
γ _{20,4} (Rn)	487,5 (2)	0,011 (2)					
γ _(-1,1) (Rn)	490,8 (3)	0,0017 (7)					
γ _{14,2} (Rn)	500,0 (4)	0,0014 (6)					
γ _{14,1} (Rn)	510,0 (4)	0,0004 (3)					
γ _(-1,2) (Rn)	523,2 (4)	0,0014 (6)					
γ _{16,2} (Rn)	527,611 (13)	0,073 (4)					
γ _(-1,3) (Rn)	532,9 (4)	0,0014 (6)					
γ _{16,1} (Rn)	537,6 (1)	0,0021 (7)					
γ _{16,0} (Rn)	541,99 (2)	0,0014 (6)					
γ _{21,3} (Rn)	545,8 (5)	0,0011 (6)					
γ _{23,4} (Rn)	574,1 (7)	0,0011 (6)					
γ _{17,2} (Rn)	579,6 (3)	0,0014 (6)					
γ _{18,2} (Rn)	584,3 (3)	0,0014 (6)					
γ _{17,0} (Rn)	594,0 (3)	0,0014 (6)					
γ _{18,0} (Rn)	598,721 (24)	0,092 (4)					
γ _{19,2} (Rn)	609,31 (4)	0,057 (3)					
γ _{19,1} (Rn)	619,1 (4)	0,0036 (11)					
γ _{19,0} (Rn)	623,68 (4)	0,009 (4)					
γ _{20,2} (Rn)	631,7 (7)	0,0004 (3)					
γ _{20,1} (Rn)	641,7 (4)	0,0017 (7)					
γ _{20,0} (Rn)	646,1 (5)	0,0004 (4)					
γ _{22,2} (Rn)	696,9 (7)	0,0007 (3)					
γ _{22,0} (Rn)	711,3 (2)	0,0037 (10)					
γ _{23,2} (Rn)	718,4 (4)	0,0014 (6)					
γ _{23,1} (Rn)	728,4 (8)	0,00028 (14)					
γ _{23,0} (Rn)	732,8 (6)	0,0006 (3)					
γ _(-1,25) (Rn)	737,2 (8)	0,00028 (14)					

3 Atomic Data

3.1 Rn

$$\begin{aligned}\omega_K &: 0,967 \quad (4) \\ \bar{\omega}_L &: 0,428 \quad (17) \\ n_{KL} &: 0,804 \quad (5)\end{aligned}$$

3.1.1 X Radiations

	Energy keV	Relative probability		
X_K	$K\alpha_2$	81,07	60,62	
	$K\alpha_1$	83,78	100	
	$K\beta_3$	94,247	}	
	$K\beta_1$	94,868	}	
	$K\beta_5''$	95,449	}	34,68
	$K\beta_2$	97,48	}	
	$K\beta_4$	97,853	}	11,097
	$KO_{2,3}$	98,357	}	
	X_L	$L\ell$	10,1372	
		$L\alpha$	11,5981 – 11,7259	
$L\eta$		12,8551		
$L\beta$		13,5219 – 14,5189		
$L\gamma$		16,2398 – 17,2578		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	62,017 – 68,885	100
KLX	75,744 – 83,785	57
KXY	89,45 – 98,39	8,12
Auger L	5,66 – 17,95	

4 α Emissions

	Energy keV	alpha per 100 disint.
$\alpha_{0,30}$	5014,3	~ 0,00044
$\alpha_{0,29}$	5026,1	~ 0,00063
$\alpha_{0,28}$	5035,9	~ 0,0004
$\alpha_{0,27}$	5056,5	~ 0,0002
$\alpha_{0,26}$	5086	~ 0,0003
$\alpha_{0,25}$	5112,5	~ 0,0006
$\alpha_{0,24}$	5137,1	~ 0,0017
$\alpha_{0,23}$	5151,98 (23)	0,021
$\alpha_{0,22}$	5173,10 (23)	0,026
$\alpha_{0,21}$	5211,1 (5)	0,0053
$\alpha_{0,20}$	5237,12 (23)	0,041
$\alpha_{0,19}$	5259,14 (21)	0,042
$\alpha_{0,18}$	5283,65 (21)	0,093
$\alpha_{0,17}$	5288,19 (23)	0,16 (4)
$\alpha_{0,16}$	5339,37 (21)	~ 0,13
$\alpha_{0,14}$	5366,37 (23)	~ 0,13
$\alpha_{0,12}$	5432,83 (21)	0,50 (8)
$\alpha_{0,11}$	5434,60 (21)	1,60 (24)
$\alpha_{0,10}$	5481,7 (5)	~ 0,008
$\alpha_{0,8}$	5502,12 (21)	0,74 (25)
$\alpha_{0,6}$	5539,43 (21)	10,6 (10)
$\alpha_{0,5}$	5606,99 (21)	25,8 (11)
$\alpha_{0,4}$	5715,84 (21)	49,6 (12)
$\alpha_{0,3}$	5747,14 (21)	10,0 (3)
$\alpha_{0,2}$	5857,52 (21)	0,32 (4)
$\alpha_{0,0}$	5871,63 (21)	1,0 (2)

5 Electron Emissions

		Energy keV	Electrons per 100 disint.
e _{AL}	(Rn)	5,66 - 17,95	30,1 (4)
e _{AK}	(Rn)		1,73 (21)
	KLL	62,017 - 68,885	}
	KLX	75,744 - 83,785	}
	KXY	89,45 - 98,39	}
ec _{17,13} K	(Rn)	4,8 (2)	0,03 (3)
ec _{2,1} M	(Rn)	5,4 - 7,0	11,8 (16)

		Energy keV		Electrons per 100 disint.
ec _{12,7} K	(Rn)	5,64	(4)	0,1 (1)
ec _{11,6} K	(Rn)	8,38	(3)	0,204 (13)
ec _{2,1} N	(Rn)	8,8 - 9,7		3,05 (41)
ec _{2,0} M	(Rn)	9,90 - 11,49		7,6 (6)
ec _{5,4} K	(Rn)	12,46	(1)	0,0211 (15)
ec _{2,0} N	(Rn)	13,28 - 14,15		1,96 (15)
ec _{4,3} L	(Rn)	13,82 - 17,26		0,156 (31)
ec _{3,1} K	(Rn)	23,92	(1)	7,28 (16)
ec _{3,1} T	(Rn)	23,922 - 122,276		9,09 (19)
ec _{4,3} M	(Rn)	27,40 - 28,99		0,042 (8)
ec _{4,3} N	(Rn)	30,78 - 31,65		0,0108 (22)
ec _{4,2} T	(Rn)	45,87 - 144,23		15,42 (44)
ec _{4,2} K	(Rn)	45,87	(2)	12,40 (36)
ec _{12,9} L	(Rn)	51,5 - 54,9		0,039 (17)
ec _{4,1} K	(Rn)	55,81	(1)	18,0 (5)
ec _{4,1} T	(Rn)	55,811 - 154,165		22,4 (6)
ec _{4,0} T	(Rn)	60,238 - 158,592		2,47 (10)
ec _{4,0} K	(Rn)	60,24	(1)	1,98 (10)
ec _{6,4} K	(Rn)	81,14	(6)	0,249 (25)
ec _{17,13} L	(Rn)	85,2 - 88,6		0,021 (15)
ec _{12,7} L	(Rn)	85,99 - 89,43		0,064 (32)
ec _{11,6} L	(Rn)	88,73 - 92,17		0,0375 (23)
ec _{5,4} L	(Rn)	92,808 - 96,250		0,214 (15)
ec _{12,7} M	(Rn)	99,57 - 101,16		0,017 (10)
ec _{3,1} L	(Rn)	104,271 - 107,710		1,373 (30)
ec _{5,4} M	(Rn)	106,383 - 107,972		0,0577 (41)
ec _{5,4} N	(Rn)	109,770 - 110,634		0,0150 (11)
ec _{3,1} M	(Rn)	117,846 - 119,435		0,328 (7)
ec _{3,1} N	(Rn)	121,230 - 122,097		0,0854 (19)
ec _{4,2} L	(Rn)	126,22 - 129,66		2,30 (6)
ec _{4,1} L	(Rn)	136,16 - 139,60		3,27 (9)
ec _{4,2} M	(Rn)	139,80 - 141,39		0,547 (15)
ec _{4,0} L	(Rn)	140,587 - 144,020		0,373 (12)
ec _{4,2} N	(Rn)	143,18 - 144,05		0,143 (4)
ec _{4,1} M	(Rn)	149,735 - 151,324		0,777 (21)
ec _{8,3} K	(Rn)	151,09	(3)	0,019 (16)
ec _{4,1} N	(Rn)	153,120 - 153,986		0,203 (5)
ec _{17,7} K	(Rn)	153,2	(3)	0,022 (22)
ec _{4,0} M	(Rn)	154,162 - 155,751		0,0891 (35)
ec _{4,0} N	(Rn)	157,540 - 158,413		0,0232 (9)
ec _{6,4} L	(Rn)	161,49 - 164,93		0,058 (5)
ec _{5,0} T	(Rn)	171,066 - 269,420		11,23 (32)
ec _{5,0} K	(Rn)	171,07	(1)	9,06 (27)
ec _{6,4} M	(Rn)	175,07 - 176,66		0,0142 (13)
ec _{6,2} K	(Rn)	225,47	(1)	1,55 (7)
ec _{6,2} T	(Rn)	225,474 - 323,828		1,92 (8)
ec _{6,0} K	(Rn)	239,88	(1)	0,992 (25)

		Energy keV	Electrons per 100 disint.
ec _{6,0} T	(Rn)	239,885 - 338,239	1,226 (31)
ec _{5,0} L	(Rn)	251,415 - 254,850	1,65 (4)
ec _{5,0} M	(Rn)	264,990 - 266,579	0,391 (10)
ec _{5,0} N	(Rn)	268,370 - 269,241	0,1019 (28)
ec _{8,1} K	(Rn)	273,279 (15)	0,135 (4)
ec _{6,2} L	(Rn)	305,823 - 309,260	0,281 (9)
ec _{6,2} M	(Rn)	319,398 - 320,987	0,0666 (21)
ec _{6,0} L	(Rn)	320,234 - 323,670	0,177 (5)
ec _{6,2} N	(Rn)	322,780 - 323,649	0,0174 (5)
ec _{6,0} M	(Rn)	333,809 - 335,398	0,0420 (11)
ec _{6,0} N	(Rn)	337,19 - 338,06	0,0109 (3)
ec _{11,0} K	(Rn)	346,636 (12)	0,213 (7)
ec _{8,1} L	(Rn)	353,628 - 357,070	0,0240 (6)
ec _{11,0} L	(Rn)	426,985 - 430,420	0,0378 (13)

6 Photon Emissions

6.1 X-Ray Emissions

		Energy keV	Photons per 100 disint.	
XL	(Rn)	10,1372 — 17,2578	22,1 (4)	
XK α_2	(Rn)	81,07	14,86 (23)	} K α
XK α_1	(Rn)	83,78	24,5 (4)	
XK β_3	(Rn)	94,247	}	K' β_1
XK β_1	(Rn)	94,868	}	
XK β_5''	(Rn)	95,449	}	
XK β_2	(Rn)	97,48	}	K' β_2
XK β_4	(Rn)	97,853	}	
XKO _{2,3}	(Rn)	98,357	}	

6.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$ (Rn)	4,47 (1)	0,0000064
$\gamma_{2,1}$ (Rn)	9,90 (2)	0,0158 (20)
$\gamma_{2,0}$ (Rn)	14,37 (1)	0,0185 (13)

	Energy keV	Photons per 100 disint.
$\gamma_{4,3}(\text{Rn})$	31,87 (2)	0,000105 (21)
$\gamma_{12,9}(\text{Rn})$	69,5 (1)	0,007 (3)
$\gamma_{15,12}(\text{Rn})$	70,9 (2)	0,0036 (11)
$\gamma_{11,7}(\text{Rn})$	102,2 (2)	0,0008 (4)
$\gamma_{17,13}(\text{Rn})$	103,2 (2)	0,006 (3)
$\gamma_{12,7}(\text{Rn})$	104,04 (4)	0,0194 (21)
$\gamma_{11,6}(\text{Rn})$	106,78 (3)	0,0233 (14)
$\gamma_{12,6}(\text{Rn})$	108,5 (2)	0,006 (3)
$\gamma_{5,4}(\text{Rn})$	110,856 (10)	0,058 (4)
$\gamma_{13,8}(\text{Rn})$	114,7 (2)	0,010 (4)
$\gamma_{3,1}(\text{Rn})$	122,319 (10)	1,238 (19)
$\gamma_{20,14}(\text{Rn})$	131,6 (2)	0,006 (3)
$\gamma_{14,8}(\text{Rn})$	138,3 (3)	0,0017 (7)
$\gamma_{4,2}(\text{Rn})$	144,27 (2)	3,36 (8)
$\gamma_{17,12}(\text{Rn})$	147,2 (3)	0,006 (3)
$\gamma_{4,1}(\text{Rn})$	154,208 (10)	5,84 (13)
$\gamma_{4,0}(\text{Rn})$	158,635 (10)	0,713 (16)
$\gamma_{16,8}(\text{Rn})$	165,8 (2)	0,0054 (28)
$\gamma_{11,5}(\text{Rn})$	175,65 (15)	0,017 (4)
$\gamma_{12,5}(\text{Rn})$	177,3 (1)	0,047 (4)
$\gamma_{6,4}(\text{Rn})$	179,54 (6)	0,154 (14)
$\gamma_{20,12}(\text{Rn})$	199,3 (3)	0,0030 (14)
$\gamma_{18,9}(\text{Rn})$	221,32 (24)	0,036 (6)
$\gamma_{19,8}(\text{Rn})$	247,2 (5)	0,0097 (28)
$\gamma_{8,3}(\text{Rn})$	249,49 (3)	0,038 (10)
$\gamma_{17,7}(\text{Rn})$	251,6 (3)	0,055 (10)
$\gamma_{5,2}(\text{Rn})$	255,2 (2)	0,048 (7)
$\gamma_{17,6}(\text{Rn})$	255,7 (3)	0,0055 (28)
$\gamma_{18,6}(\text{Rn})$	260,4 (3)	0,0067 (28)
$\gamma_{5,0}(\text{Rn})$	269,463 (10)	14,23 (32)
$\gamma_{10,3}(\text{Rn})$	270,3 (4)	0,0007 (4)
$\gamma_{23,12}(\text{Rn})$	286,0 (4)	0,0011 (6)
$\gamma_{12,4}(\text{Rn})$	288,18 (3)	0,161 (5)
$\gamma_{6,2}(\text{Rn})$	323,871 (10)	4,06 (8)
$\gamma_{7,2}(\text{Rn})$	328,38 (3)	0,203 (10)
$\gamma_{6,1}(\text{Rn})$	334,01 (6)	0,100 (6)
$\gamma_{6,0}(\text{Rn})$	338,282 (10)	2,85 (6)
$\gamma_{7,0}(\text{Rn})$	342,78 (2)	0,226 (13)
$\gamma_{23,9}(\text{Rn})$	355,5 (2)	0,0043 (14)
$\gamma_{14,4}(\text{Rn})$	355,7 (2)	0,0028 (14)
$\gamma_{8,2}(\text{Rn})$	361,89 (2)	0,028 (7)
$\gamma_{9,2}(\text{Rn})$	362,9 (2)	0,016 (7)
$\gamma_{22,7}(\text{Rn})$	368,56 (12)	0,009 (4)
$\gamma_{8,1}(\text{Rn})$	371,676 (15)	0,499 (11)
$\gamma_{9,1}(\text{Rn})$	372,86 (6)	0,051
$\gamma_{8,0}(\text{Rn})$	376,26 (2)	0,013 (4)
$\gamma_{16,4}(\text{Rn})$	383,35 (2)	0,007 (4)

	Energy keV	Photons per 100 disint.
$\gamma_{14,3}$ (Rn)	387,7 (2)	0,016 (6)
$\gamma_{23,7}$ (Rn)	390,1 (2)	0,0046 (21)
$\gamma_{11,2}$ (Rn)	430,6 (3)	0,020 (6)
$\gamma_{12,2}$ (Rn)	432,45 (3)	0,0356 (29)
$\gamma_{11,0}$ (Rn)	445,033 (12)	1,28 (4)
$\gamma_{20,4}$ (Rn)	487,5 (2)	0,011 (2)
$\gamma_{(-1,1)}$ (Rn)	490,8 (3)	0,0017 (7)
$\gamma_{14,2}$ (Rn)	500,0 (4)	0,0014 (6)
$\gamma_{14,1}$ (Rn)	510,0 (4)	0,0004 (3)
$\gamma_{(-1,2)}$ (Rn)	523,2 (4)	0,0014 (6)
$\gamma_{16,2}$ (Rn)	527,611 (13)	0,073 (4)
$\gamma_{(-1,3)}$ (Rn)	532,9 (4)	0,0014 (6)
$\gamma_{16,1}$ (Rn)	537,6 (1)	0,0021 (7)
$\gamma_{16,0}$ (Rn)	541,99 (2)	0,0014 (6)
$\gamma_{21,3}$ (Rn)	545,8 (5)	0,0011 (6)
$\gamma_{23,4}$ (Rn)	574,1 (7)	0,0011 (6)
$\gamma_{17,2}$ (Rn)	579,6 (3)	0,0014 (6)
$\gamma_{18,2}$ (Rn)	584,3 (3)	0,0014 (6)
$\gamma_{17,0}$ (Rn)	594,0 (3)	0,0014 (6)
$\gamma_{18,0}$ (Rn)	598,721 (24)	0,092 (4)
$\gamma_{19,2}$ (Rn)	609,31 (4)	0,057 (3)
$\gamma_{19,1}$ (Rn)	619,1 (4)	0,0036 (11)
$\gamma_{19,0}$ (Rn)	623,68 (4)	0,009 (4)
$\gamma_{20,2}$ (Rn)	631,7 (7)	0,0004 (3)
$\gamma_{20,1}$ (Rn)	641,7 (4)	0,0017 (7)
$\gamma_{20,0}$ (Rn)	646,1 (5)	0,0004 (4)
$\gamma_{22,2}$ (Rn)	696,9 (7)	0,0007 (3)
$\gamma_{22,0}$ (Rn)	711,3 (2)	0,0037 (10)
$\gamma_{23,2}$ (Rn)	718,4 (4)	0,0014 (6)
$\gamma_{23,1}$ (Rn)	728,4 (8)	0,00028 (14)
$\gamma_{23,0}$ (Rn)	732,8 (6)	0,0006 (3)
$\gamma_{(-1,25)}$ (Rn)	737,2 (8)	0,00028 (14)

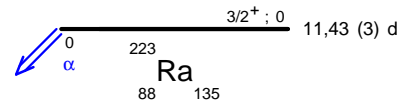
7 Main Production Modes

U – 235 decay chain

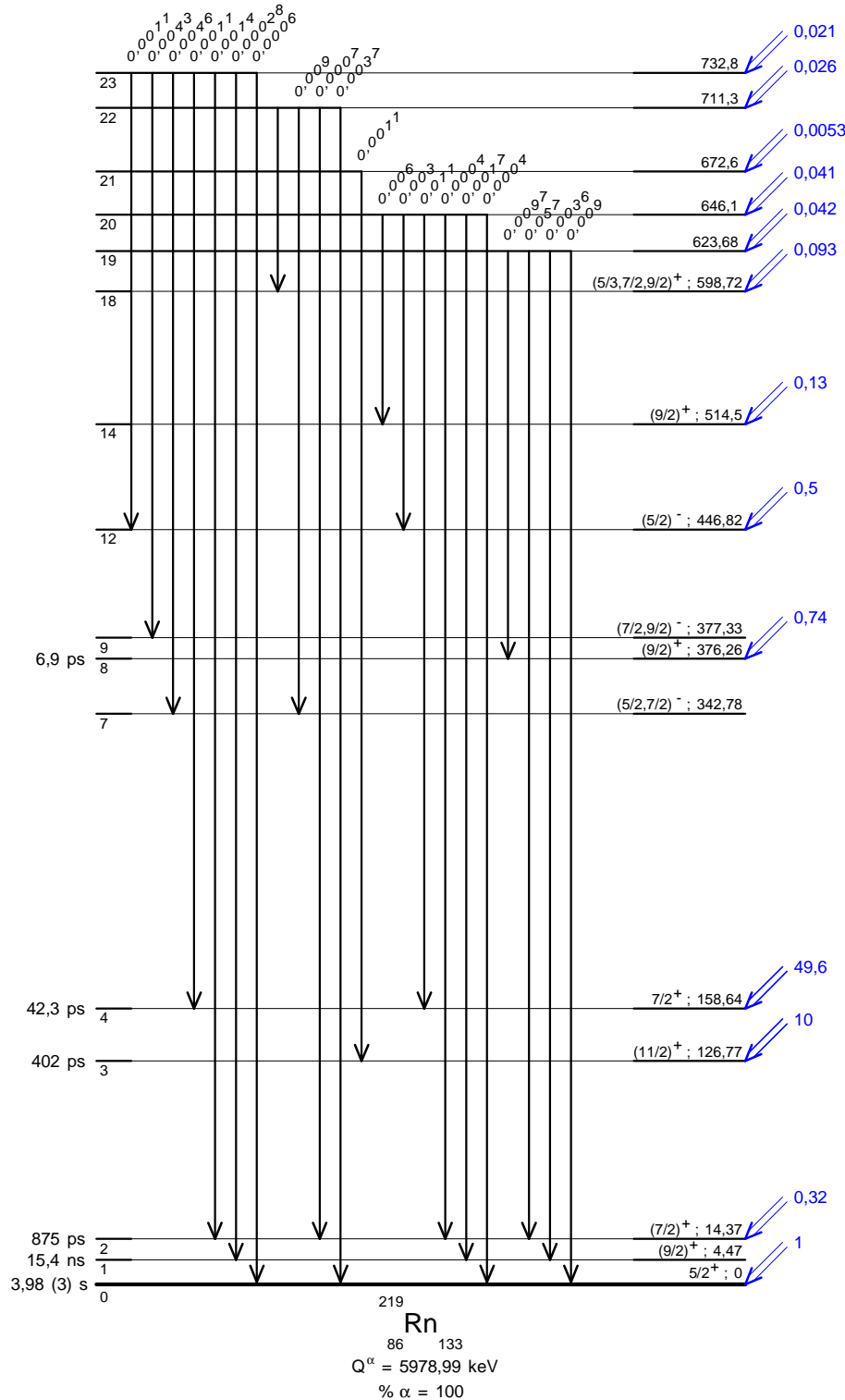
8 References

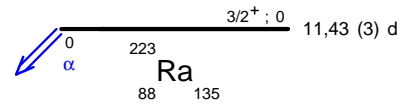
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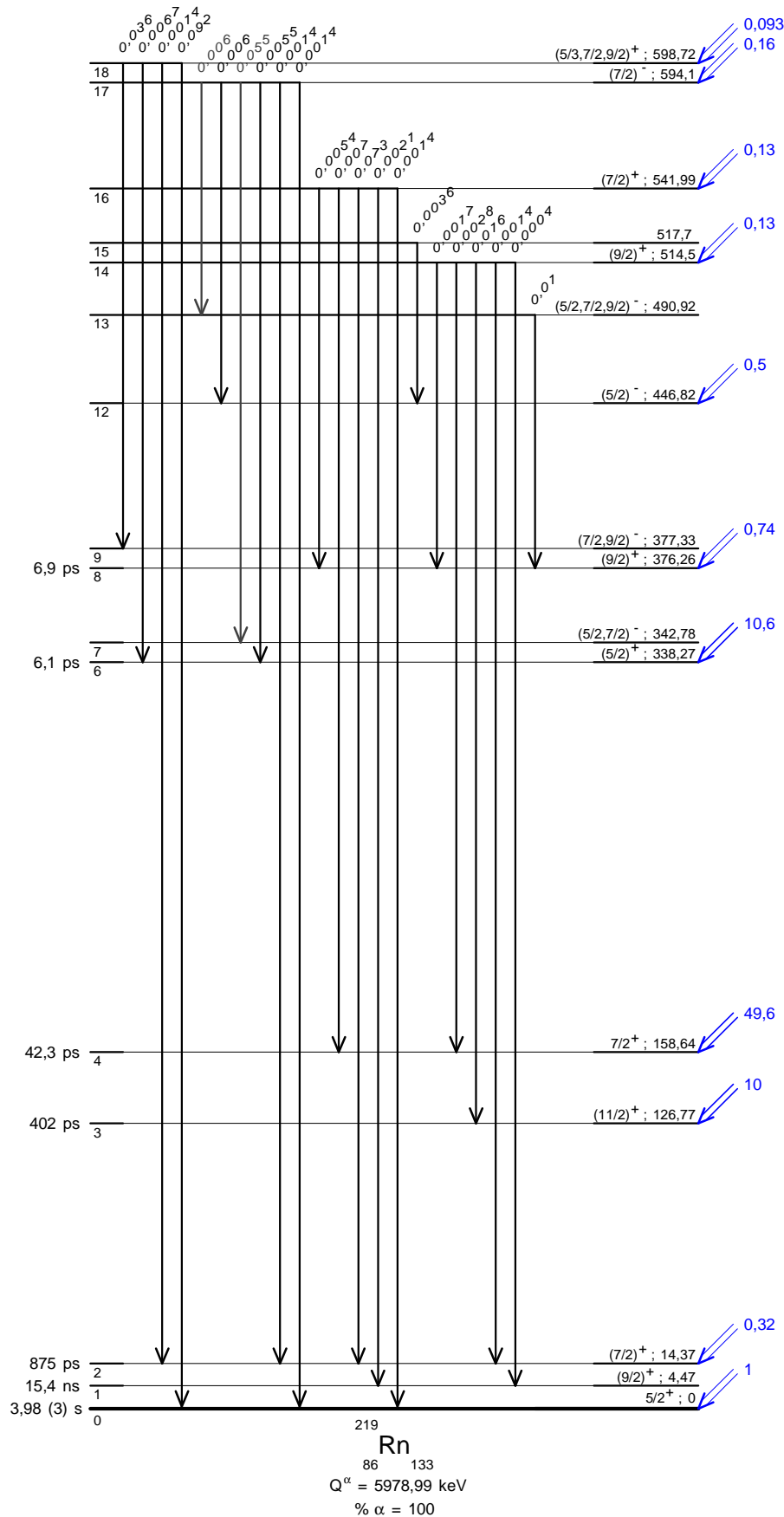


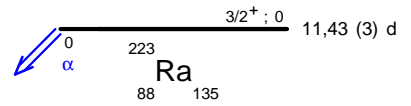
γ Emission intensities per 100 disintegrations



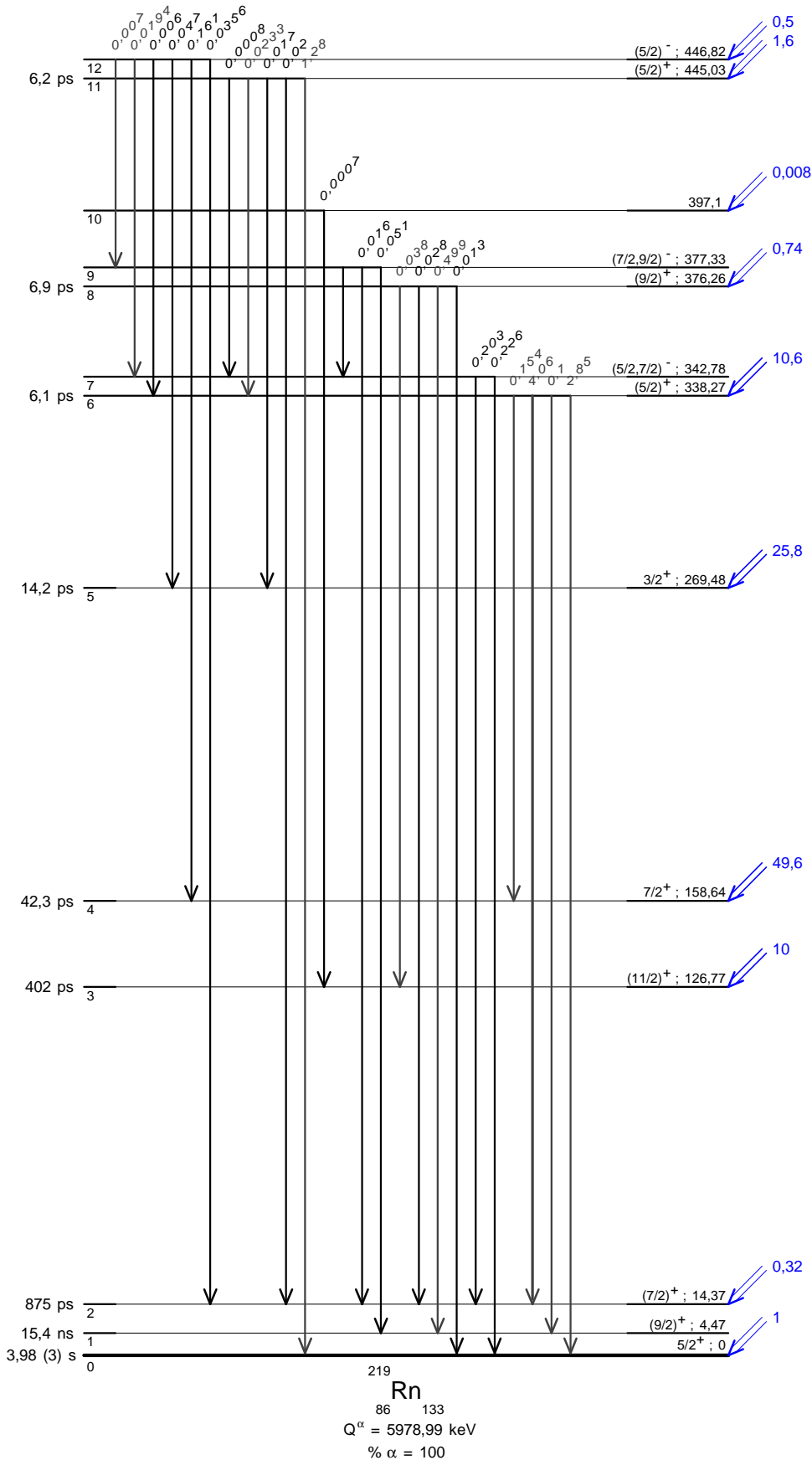


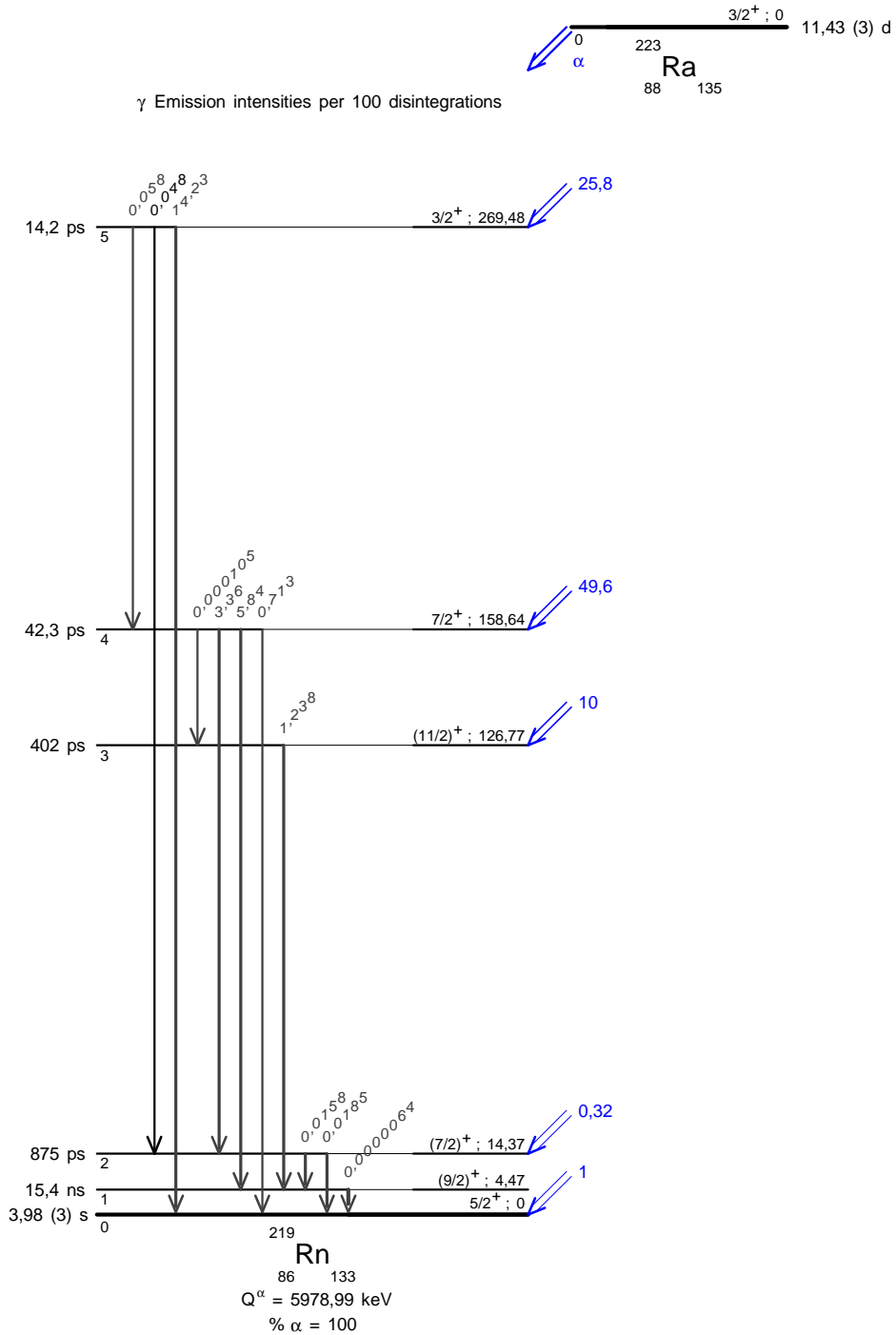
γ Emission intensities per 100 disintegrations





γ Emission intensities per 100 disintegrations







1 Decay Scheme

Actinium 228 is the naturally occurring decay daughter of thorium 232 and radium 228. The existence of an alpha branch to francium 224 is unconfirmed.

L'actinium 228 est un radionucléide naturel descendant du thorium 232 et du radium 228. Il se désintègre par transition bêta moins vers le thorium 228. L'existence d'un branchement par transition alpha n'a pas été démontré.

2 Nuclear Data

$T_{1/2}({}^{228}\text{Ac})$:	6,15	(3)	h
$T_{1/2}({}^{228}\text{Th})$:	1,9127	(6)	a
$Q^\alpha({}^{228}\text{Ac})$:	4814	(50)	keV
$Q^-({}^{228}\text{Ac})$:	2123,8	(27)	keV

2.1 β^- Transitions

	Energy keV	Probability × 100	Nature	lg <i>ft</i>
$\beta_{0,60}^-$	0,7 (27)	0,0047 (11)	Allowed	3,3
$\beta_{0,59}^-$	86,8 (27)	0,0069 (11)	Allowed	7,38
$\beta_{0,58}^-$	94,0 (27)	0,026 (4)	Allowed	6,91
$\beta_{0,57}^-$	101,0 (27)	0,061 (6)	Allowed or 1st Forbidden	6,64
$\beta_{0,56}^-$	110,2 (27)	0,0032 (10)	Allowed	8,03
$\beta_{0,55}^-$	113,7 (27)	0,238 (15)	Allowed	6,2
$\beta_{0,54}^-$	136,3 (27)	0,07 (4)	Allowed	7
$\beta_{0,53}^-$	158,8 (27)	0,0132 (14)	Allowed	7,91
$\beta_{0,52}^-$	165,1 (27)	0,0038 (8)	Allowed	8,5
$\beta_{0,51}^-$	178,9 (27)	0,307 (22)	Allowed	6,7
$\beta_{0,50}^-$	186,6 (27)	0,053 (6)	Allowed	7,52
$\beta_{0,49}^-$	195,2 (27)	0,061 (8)	Allowed	7,52
$\beta_{0,48}^-$	217,2 (27)	0,025 (5)	Allowed	8,05

	Energy keV	Probability × 100	Nature	lg <i>ft</i>
$\beta_{0,47}^-$	223,9 (27)	0,069 (8)	Allowed	7,65
$\beta_{0,46}^-$	230,8 (27)	0,109 (8)	Allowed	7,5
$\beta_{0,45}^-$	326,2 (27)	0,051 (8)	Allowed	8,3
$\beta_{0,44}^-$	327,9 (27)	0,035 (6)	Allowed	8,48
$\beta_{0,43}^-$	363,6 (27)	0,139 (12)	Allowed	8,02
$\beta_{0,42}^-$	365,6 (27)	0,060 (8)	Allowed	8,39
$\beta_{0,41}^-$	379,9 (27)	0,378 (16)	Allowed	7,65
$\beta_{0,40}^-$	388,4 (27)	0,149 (11)	Allowed	8,08
$\beta_{0,39}^-$	399,5 (27)	1,93 (8)	Allowed	7,01
$\beta_{0,38}^-$	435,4 (27)	2,50 (16)	Allowed	7,02
$\beta_{0,37}^-$	440,0 (27)	0,20 (3)	1st Forbidden	8,13
$\beta_{0,36}^-$	441,0 (27)	1,21 (4)	Allowed	7,35
$\beta_{0,35}^-$	477,8 (27)	4,12 (20)	Allowed	6,94
$\beta_{0,34}^-$	480,7 (27)	0,82 (3)	1st Forbidden	7,64
$\beta_{0,33}^-$	485,5 (27)	1,23 (6)	Allowed	7,48
$\beta_{0,32}^-$	506,0 (27)	0,071 (10)	Allowed	8,78
$\beta_{0,31}^-$	535,5 (27)	8,8 (23)	1st Forbidden	6,77
$\beta_{0,30}^-$	584,6 (27)	0,030 (6)	Allowed	9,36
$\beta_{0,27}^-$	691,8 (27)	1,6 (5)	Allowed	7,88
$\beta_{0,26}^-$	707,7 (27)	0,060 (8)	Allowed or First Forbidden	9,34
$\beta_{0,25}^-$	779,7 (27)	0,208 (18)	1st Forbidden	8,94
$\beta_{0,24}^-$	826,4 (27)	1,46 (11)	1st Forbidden Unique	8,18
$\beta_{0,23}^-$	897,2 (27)	0,67 (8)	1st Forbidden	8,65
$\beta_{0,22}^-$	948,4 (27)	0,166 (19)	Allowed	9,34
$\beta_{0,20}^-$	955,4 (27)	3,39 (13)	1st Forbidden	8,04
$\beta_{0,19}^-$	970,3 (27)	6 (3)	Allowed	7,8
$\beta_{0,18}^-$	1000,8 (27)	6,67 (18)	1st Forbidden	7,81
$\beta_{0,16}^-$	1063,9 (27)	0,099 (11)	1st Forbidden	9,74
$\beta_{0,15}^-$	1101,3 (27)	3,0 (4)	Allowed	8,31
$\beta_{0,14}^-$	1107,4 (27)	0,39 (6)	Allowed or 1st Forbidden	9,2
$\beta_{0,13}^-$	1144,3 (27)	0,238 (20)	Allowed	9,47
$\beta_{0,12}^-$	1154,8 (27)	31 (4)	Allowed	7,37
$\beta_{0,11}^-$	1155,4 (27)	0,18 (3)	1st Forbidden	9,6
$\beta_{0,10}^-$	1179,6 (27)	0,087 (16)	Allowed or 1st Forbidden	9,95
$\beta_{0,8}^-$	1249,3 (27)	0,17 (10)	Allowed	9,7
$\beta_{0,5}^-$	1727,7 (27)	12,4 (5)	1st Forbidden	8,4
$\beta_{0,4}^-$	1745,6 (27)	0,147 (21)	Unique 2nd Forbidden	12,29
$\beta_{0,3}^-$	1795,8 (27)	0,72 (23)	Unique 1st Forbidden	10,65
$\beta_{0,2}^-$	1937,0 (27)	0,6 (5)	Allowed	10
$\beta_{0,1}^-$	2066,0 (27)	6 (4)	Allowed	9

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ $\times 100$	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{28,27}(\text{Th})$	18,415 (12)	0,142 (30)	E1		3,82 (6)	2,00 (3)	6,46 (10)
$\gamma_{38,35}(\text{Th})$	42,440 (16)	0,43 (14)	M1		35,0 (5)	8,43 (13)	46,3 (7)
$\gamma_{31,29}(\text{Th})$	56,861 (15)	8 (8)	E1+[M2]		260 (160)	70 (50)	360 (220)
$\gamma_{1,0}(\text{Th})$	57,759 (4)	72,5 (28)	E2		112,2 (16)	30,7 (5)	153,2 (22)
$\gamma_{20,17}(\text{Th})$	77,358 (9)	0,027 (6)	E1		0,1747 (25)	0,0426 (6)	0,232 (4)
$\gamma_{29,27}(\text{Th})$	99,495 (8)	6,10 (21)	M1		2,90 (4)	0,699 (10)	3,84 (6)
$\gamma_{18,15}(\text{Th})$	100,424 (8)	0,114 (6)	E1+M2		2,27 (4)	0,615 (9)	3,10 (5)
$\gamma_{35,29}(\text{Th})$	114,480 (13)	0,102 (46)	M1+E2	5 (5)	3,2 (13)	0,8 (4)	9 (4)
$\gamma_{2,1}(\text{Th})$	129,064 (6)	11,85 (36)	E2	0,264 (4)	2,54 (4)	0,697 (10)	3,74 (6)
$\gamma_{23,17}(\text{Th})$	135,548 (11)	0,024 (6)	E1	0,185 (3)	0,0401 (6)	0,00971 (14)	0,238 (4)
$\gamma_{31,28}(\text{Th})$	137,941 (17)	0,239 (34)	M1	6,00 (9)	1,146 (16)	0,276 (4)	7,52 (11)
$\gamma_{6,4}(\text{Th})$	141,013 (12)	0,055 (11)	E1	0,1690 (24)	0,0362 (5)	0,00876 (13)	0,217 (3)
$\gamma_{20,15}(\text{Th})$	145,848 (8)	0,169 (6)	E1	0,1562 (22)	0,0332 (5)	0,00803 (12)	0,200 (3)
$\gamma_{18,12}(\text{Th})$	153,983 (8)	0,754 (23)	E1	0,1375 (20)	0,0289 (4)	0,00698 (10)	0,1757 (25)
$\gamma_{49,43}(\text{Th})$	168,35 (6)	0,0093 (46)	M1+E2	1,8 (16)	0,70 (7)	0,18 (3)	2,7 (15)
$\gamma_{25,22}(\text{Th})$	168,69 (5)	0,0127 (31)	M1+E2	1,8 (16)	0,70 (7)	0,18 (3)	2,7 (15)
$\gamma_{19,13}(\text{Th})$	173,968 (17)	0,036 (5)	M1+E2	1,6 (15)	0,63 (5)	0,162 (22)	2,5 (14)
$\gamma_{19,12}(\text{Th})$	184,499 (11)	5,5 (29)	E0+M1	80 (30)			100 (40)
$\gamma_{4,2}(\text{Th})$	191,356 (11)	0,236 (14)	E2	0,1710 (24)	0,443 (7)	0,1209 (17)	0,776 (11)
$\gamma_{20,12}(\text{Th})$	199,407 (7)	0,299 (23)	E1	0,0752 (11)	0,01502 (21)	0,00362 (5)	0,0950 (14)
$\gamma_{24,15}(\text{Th})$	204,038 (9)	0,114 (8)	M2	7,26 (11)	2,51 (4)	0,653 (10)	10,65 (15)
$\gamma_{5,2}(\text{Th})$	209,255 (6)	4,31 (14)	E1	0,0672 (10)	0,01333 (19)	0,00321 (5)	0,0848 (12)
$\gamma_{19,9}(\text{Th})$	214,89 (7)	0,047 (8)	E2	0,1399 (20)	0,274 (4)	0,0746 (11)	0,514 (8)
$\gamma_{28,23}(\text{Th})$	223,829 (12)	0,058 (6)	M1+E2	1,48 (4)	0,286 (5)	0,0688 (10)	1,85 (4)
$\gamma_{22,10}(\text{Th})$	231,19 (5)	0,026 (4)	E2	0,1211 (17)	0,199 (3)	0,0539 (8)	0,392 (6)
$\gamma_{27,21}(\text{Th})$	257,471 (19)	0,0286 (19)	M1	1,029 (15)	0,194 (3)	0,0466 (7)	1,285 (18)
$\gamma_{27,20}(\text{Th})$	263,604 (8)	0,0451 (31)	E1	0,0397 (6)	0,00760 (11)	0,00182 (3)	0,0498 (7)
$\gamma_{3,1}(\text{Th})$	270,244 (6)	3,72 (10)	E1	0,0376 (6)	0,00716 (10)	0,001717 (24)	0,0470 (7)
$\gamma_{27,19}(\text{Th})$	278,512 (12)	0,038 (6)	E2	0,0843 (12)	0,0937 (14)	0,0252 (4)	0,212 (3)
$\gamma_{19,8}(\text{Th})$	278,994 (21)	0,33 (9)	M1+E2	0,5 (4)	0,12 (3)	0,031 (6)	0,6 (4)
$\gamma_{28,20}(\text{Th})$	282,019 (11)	0,14 (6)	M1+E2	0,4 (4)	0,12 (3)	0,030 (6)	0,6 (4)
$\gamma_{19,7}(\text{Th})$	321,644 (14)	0,232 (14)	E2	0,0635 (9)	0,0540 (8)	0,01444 (21)	0,1369 (20)
$\gamma_{42,27}(\text{Th})$	326,26 (12)	0,035 (6)	E2	0,0618 (9)	0,0513 (8)	0,01372 (20)	0,1315 (19)
$\gamma_{3,0}(\text{Th})$	328,003 (4)	3,13 (11)	E1	0,0245 (4)	0,00455 (7)	0,001089 (16)	0,0305 (5)
$\gamma_{6,2}(\text{Th})$	332,369 (7)	0,38 (6)	E1	0,0238 (4)	0,00441 (7)	0,001056 (15)	0,0297 (5)
$\gamma_{5,1}(\text{Th})$	338,319 (6)	11,72 (41)	E1	0,0229 (4)	0,00424 (6)	0,001014 (15)	0,0285 (4)
$\gamma_{27,17}(\text{Th})$	340,962 (10)	0,405 (20)	E2+M1	0,071 (19)	0,0451 (21)	0,0119 (5)	0,133 (21)
$\gamma_{51,31}(\text{Th})$	356,560 (18)	0,032 (15)	E1+M2	0,6 (6)	0,17 (17)	0,04 (5)	0,8 (8)
$\gamma_{55,33}(\text{Th})$	371,83 (5)	0,0070 (17)	E2	0,0475 (7)	0,0315 (5)	0,00834 (12)	0,0902 (13)
$\gamma_{29,19}(\text{Th})$	378,007 (12)	0,033 (6)	M1+E2	0,20 (16)	0,049 (19)	0,012 (5)	0,27 (18)
$\gamma_{57,33}(\text{Th})$	384,56 (10)	0,0070 (17)	E2	0,0447 (7)	0,0282 (4)	0,00745 (11)	0,0828 (12)
$\gamma_{49,30}(\text{Th})$	389,36 (11)	0,0108 (17)	M1+E2	0,19 (15)	0,044 (18)	0,011 (4)	0,25 (17)
$\gamma_{50,30}(\text{Th})$	397,95 (13)	0,029 (3)					
$\gamma_{41,25}(\text{Th})$	399,812 (32)	0,0316 (41)	E1	0,01611 (23)	0,00291 (4)	0,000696 (10)	0,0200 (3)
$\gamma_{27,15}(\text{Th})$	409,452 (8)	2,02 (6)	E2+M1	0,16 (13)	0,038 (16)	0,009 (4)	0,21 (15)
$\gamma_{30,18}(\text{Th})$	416,26 (9)	0,0138 (23)	E1	0,01485 (21)	0,00267 (4)	0,000638 (9)	0,0184 (3)
$\gamma_{35,23}(\text{Th})$	419,389 (14)	0,0224 (31)	E1	0,01460 (21)	0,00263 (4)	0,000626 (9)	0,0181 (3)
$\gamma_{29,17}(\text{Th})$	440,457 (10)	0,166 (13)	M1	0,237 (4)	0,0442 (7)	0,01061 (15)	0,295 (5)
$\gamma_{11,6}(\text{Th})$	449,177 (21)	0,053 (6)	E2	0,0331 (5)	0,01653 (24)	0,00432 (6)	0,0554 (8)
$\gamma_{27,13}(\text{Th})$	452,480 (15)	0,0199 (19)	E2	0,0326 (5)	0,01613 (23)	0,00422 (6)	0,0544 (8)
$\gamma_{37,23}(\text{Th})$	457,25 (5)	0,0186 (39)	M1+E2	0,12 (10)	0,028 (13)	0,007 (3)	0,16 (11)
$\gamma_{27,12}(\text{Th})$	463,011 (8)	4,45 (24)	E2	0,0312 (5)	0,01495 (21)	0,00390 (6)	0,0514 (8)
$\gamma_{33,20}(\text{Th})$	469,909 (10)	0,0142 (30)	E1	0,01157 (17)	0,00205 (3)	0,000489 (7)	0,01428 (20)
$\gamma_{26,10}(\text{Th})$	471,91 (6)	0,0357 (42)	E2	0,0301 (5)	0,01407 (20)	0,00367 (6)	0,0491 (7)
$\gamma_{34,20}(\text{Th})$	474,750 (16)	0,026 (5)	M1+E2	0,11 (9)	0,025 (12)	0,006 (3)	0,14 (10)
$\gamma_{8,5}(\text{Th})$	478,395 (19)	0,227 (19)	E1	0,01118 (16)	0,00198 (3)	0,000471 (7)	0,01379 (20)
$\gamma_{48,26}(\text{Th})$	490,53 (12)	0,0116 (25)	E2	0,0280 (4)	0,01242 (18)	0,00323 (5)	0,0447 (7)

	Energy keV	$P_{\gamma+ce}$ $\times 100$	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{35,19}$ (Th)	492,487 (16)	0,0282 (41)	M1+E2	0,10 (8)	0,022 (11)	0,0055 (24)	0,13 (9)
$\gamma_{39,23}$ (Th)	497,718 (9)	0,0062 (19)	M2	0,437 (7)	0,1074 (15)	0,0268 (4)	0,581 (9)
$\gamma_{7,3}$ (Th)	503,820 (11)	0,173 (19)	E1	0,01009 (15)	0,001775 (25)	0,000422 (6)	0,01243 (18)
$\gamma_{29,15}$ (Th)	508,947 (8)	0,568 (45)	E2+M1	0,0870 (13)	0,0196 (3)	0,00481 (7)	0,1130 (16)
$\gamma_{33,18}$ (Th)	515,333 (11)	0,051 (6)	E1	0,00966 (14)	0,001694 (24)	0,000403 (6)	0,01189 (17)
$\gamma_{34,18}$ (Th)	520,174 (16)	0,070 (7)	M1+E2	0,09 (7)	0,019 (9)	0,0047 (21)	0,11 (8)
$\gamma_{35,18}$ (Th)	523,003 (13)	0,129 (10)	E1	0,00937 (14)	0,001641 (23)	0,000390 (6)	0,01153 (17)
$\gamma_{16,6}$ (Th)	540,738 (31)	0,0297 (38)	M1+E2	0,08 (6)	0,017 (9)	0,0042 (19)	0,10 (7)
$\gamma_{8,3}$ (Th)	546,470 (18)	0,201 (16)	E1	0,00861 (12)	0,001500 (21)	0,000357 (5)	0,01058 (15)
$\gamma_{39,22}$ (Th)	548,89 (5)	0,0264 (47)	M1+E2	0,08 (6)	0,017 (8)	0,0041 (18)	0,10 (7)
$\gamma_{35,17}$ (Th)	554,937 (14)	0,048 (6)	M1+E2				
$\gamma_{29,12}$ (Th)	562,506 (8)	0,97 (7)	E2+M1	0,07 (5)	0,015 (8)	0,0038 (17)	0,09 (6)
$\gamma_{39,19}$ (Th)	570,816 (12)	0,22 (6)	M1	0,1182 (17)	0,0219 (3)	0,00525 (8)	0,1472 (21)
$\gamma_{11,5}$ (Th)	572,291 (21)	0,170 (22)	M1+E2	0,07 (5)	0,015 (7)	0,0036 (17)	0,09 (6)
$\gamma_{13,5}$ (Th)	583,421 (15)	0,120 (11)	E1	0,00759 (11)	0,001313 (19)	0,000312 (5)	0,00932 (13)
$\gamma_{9,3}$ (Th)	610,58 (7)	0,024 (5)	E1	0,00695 (10)	0,001198 (17)	0,000284 (4)	0,00853 (12)
$\gamma_{10,3}$ (Th)	616,193 (14)	0,085 (7)	E1	0,00683 (10)	0,001176 (17)	0,000279 (4)	0,00838 (12)
$\gamma_{14,5}$ (Th)	620,328 (22)	0,084 (7)					
$\gamma_{35,15}$ (Th)	623,427 (13)	0,0128 (33)	M1+E2	0,06 (4)	0,012 (6)	0,0028 (13)	0,07 (5)
$\gamma_{34,14}$ (Th)	626,719 (26)	0,015 (3)					
$\gamma_{35,14}$ (Th)	629,548 (24)	0,047 (5)	E2	0,01754 (25)	0,00584 (9)	0,001489 (21)	0,0254 (4)
$\gamma_{11,3}$ (Th)	640,366 (20)	0,058 (6)	E2	0,01700 (24)	0,00556 (8)	0,001416 (20)	0,0245 (4)
$\gamma_{32,12}$ (Th)	648,81 (7)	0,0086 (9)					
$\gamma_{20,6}$ (Th)	649,183 (8)	0,043 (11)	E2	0,01658 (24)	0,00536 (8)	0,001362 (19)	0,0238 (4)
$\gamma_{13,3}$ (Th)	651,496 (15)	0,094 (10)	E1	0,00615 (9)	0,001053 (15)	0,000250 (4)	0,00754 (11)
$\gamma_{36,15}$ (Th)	660,283 (31)	0,00572 (38)	M1+E2	0,05 (4)	0,010 (5)	0,0024 (12)	0,06 (4)
$\gamma_{16,5}$ (Th)	663,852 (30)	0,029 (6)	M1+E2	0,05 (4)	0,010 (5)	0,0024 (12)	0,06 (4)
$\gamma_{46,23}$ (Th)	666,431 (18)	0,0068 (7)	E1	0,00590 (9)	0,001007 (14)	0,000239 (4)	0,00722 (11)
$\gamma_{35,13}$ (Th)	666,455 (18)	0,061 (7)	M1+E2	0,05 (4)	0,010 (5)	0,0024 (11)	0,06 (4)
$\gamma_{38,14}$ (Th)	671,988 (24)	0,027 (8)					
$\gamma_{34,12}$ (Th)	674,157 (16)	0,105 (10)	M1+E2	0,05 (3)	0,009 (5)	0,0023 (11)	0,06 (4)
$\gamma_{35,12}$ (Th)	676,986 (13)	0,065 (6)	M1+E2	0,05 (3)	0,009 (5)	0,0023 (11)	0,06 (4)
$\gamma_{14,3}$ (Th)	688,403 (21)	0,070 (7)					
$\gamma_{34,10}$ (Th)	698,929 (20)	0,038 (6)	E2	0,01448 (21)	0,00436 (7)	0,001103 (16)	0,0203 (3)
$\gamma_{39,15}$ (Th)	701,756 (8)	0,181 (15)	M1	0,0684 (10)	0,01261 (18)	0,00302 (5)	0,0850 (12)
$\gamma_{23,6}$ (Th)	707,373 (9)	0,162 (18)	E2	0,01417 (20)	0,00422 (6)	0,001067 (15)	0,0198 (3)
$\gamma_{51,23}$ (Th)	718,330 (13)	0,0191 (40)	E1	0,00513 (8)	0,000870 (13)	0,000206 (3)	0,00628 (9)
$\gamma_{18,5}$ (Th)	726,873 (8)	0,68 (8)	E2	0,01349 (19)	0,00393 (6)	0,000990 (14)	0,0187 (3)
$\gamma_{43,15}$ (Th)	737,691 (25)	0,039 (5)	M1+E2	0,037 (24)	0,007 (4)	0,0018 (9)	0,05 (3)
$\gamma_{39,12}$ (Th)	755,315 (8)	1,102 (43)	M1	0,0563 (8)	0,01036 (15)	0,00248 (4)	0,070 (1)
$\gamma_{20,5}$ (Th)	772,297 (7)	1,52 (6)	M1+E2	0,0186 (11)	0,00437 (18)	0,00108 (5)	0,0244 (14)
$\gamma_{7,1}$ (Th)	774,064 (11)	0,0630 (41)	E2	0,01204 (17)	0,00333 (5)	0,000835 (12)	0,01649 (23)
$\gamma_{51,20}$ (Th)	776,520 (12)	0,020 (6)					
$\gamma_{12,2}$ (Th)	782,145 (6)	0,508 (41)	E2	0,01182 (17)	0,00324 (5)	0,000812 (12)	0,01615 (23)
$\gamma_{43,12}$ (Th)	791,250 (25)	0,0104 (31)	M1+E2	0,031 (19)	0,006 (3)	0,0015 (7)	0,039 (23)
$\gamma_{51,19}$ (Th)	791,428 (15)	0,0149 (42)	M1	0,0498 (7)	0,00915 (13)	0,00219 (3)	0,0618 (9)
$\gamma_{13,2}$ (Th)	792,676 (15)	0,082 (5)	E2	0,01154 (17)	0,00313 (5)	0,000784 (11)	0,01572 (22)
$\gamma_{18,3}$ (Th)	794,948 (7)	4,31 (14)	E2+M1	0,0133 (12)	0,00340 (19)	0,00085 (5)	0,0179 (14)
$\gamma_{38,8}$ (Th)	813,921 (21)	0,0073 (17)	M1+E2	0,029 (18)	0,006 (3)	0,0014 (7)	0,036 (22)
$\gamma_{8,1}$ (Th)	816,714 (18)	0,0321 (42)	M1+E2	0,028 (18)	0,006 (3)	0,0014 (7)	0,036 (21)
$\gamma_{25,6}$ (Th)	824,886 (13)	0,054 (6)	E2	0,01074 (15)	0,00283 (4)	0,000706 (10)	0,01452 (21)
$\gamma_{23,5}$ (Th)	830,487 (9)	0,61 (6)	E2+M1	0,01117 (22)	0,00287 (5)	0,000715 (12)	0,0150 (3)
$\gamma_{15,2}$ (Th)	835,704 (7)	1,70 (7)	E2	0,01050 (15)	0,00274 (4)	0,000683 (10)	0,01415 (20)
$\gamma_{20,3}$ (Th)	840,372 (6)	0,984 (41)	E2	0,01039 (15)	0,00270 (4)	0,000673 (10)	0,0140 (2)
$\gamma_{51,17}$ (Th)	853,878 (14)	0,0128 (21)	M1+E2	0,025 (16)	0,0050 (25)	0,0012 (6)	0,032 (19)
$\gamma_{46,15}$ (Th)	870,469 (18)	0,046 (5)	M1	0,0387 (6)	0,0071 (1)	0,001699 (24)	0,0481 (7)
$\gamma_{16,2}$ (Th)	873,107 (30)	0,032 (7)	E1	0,00361 (5)	0,000601 (9)	0,0001422 (20)	0,00440 (7)
$\gamma_{8,0}$ (Th)	874,473 (18)	0,051 (11)	E2	0,00968 (14)	0,00245 (4)	0,000608 (9)	0,01294 (19)
$\gamma_{47,15}$ (Th)	877,423 (40)	0,0144 (31)	M1+E2	0,024 (15)	0,0047 (23)	0,0011 (6)	0,030 (18)

	Energy keV	$P_{\gamma+ce}$ $\times 100$	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{9,1}$ (Th)	880,82 (7)	0,0066 (19)	E2	0,00956 (14)	0,00240 (4)	0,000597 (9)	0,01276 (18)
$\gamma_{55,18}$ (Th)	887,16 (5)	0,029 (3)	M1+E2	0,023 (14)	0,0046 (22)	0,0011 (6)	0,029 (17)
$\gamma_{24,5}$ (Th)	901,345 (11)	0,0172 (40)	E2	0,00917 (13)	0,00227 (4)	0,000564 (8)	0,01220 (17)
$\gamma_{17,2}$ (Th)	904,194 (9)	0,78 (4)	E2	0,00912 (13)	0,00225 (4)	0,000559 (8)	0,01212 (17)
$\gamma_{12,1}$ (Th)	911,209 (6)	26,5 (8)	E2	0,00900 (13)	0,00221 (3)	0,000549 (8)	0,01194 (17)
$\gamma_{55,17}$ (Th)	919,09 (5)	0,028 (3)					
$\gamma_{13,1}$ (Th)	921,740 (15)	0,0158 (24)	M1+E2	0,021 (13)	0,0041 (20)	0,0010 (5)	0,027 (15)
$\gamma_{47,12}$ (Th)	930,982 (40)	0,004 (1)					
$\gamma_{28,6}$ (Th)	931,202 (12)	0,0026 (24)	M1+E2	0,021 (12)	0,004 (2)	0,0010 (5)	0,026 (15)
$\gamma_{58,17}$ (Th)	938,82 (16)	0,009 (3)					
$\gamma_{10,0}$ (Th)	944,196 (13)	0,102 (10)	E1+M2	0,020 (12)	0,0039 (19)	0,0009 (5)	0,025 (14)
$\gamma_{25,5}$ (Th)	948,000 (12)	0,111 (10)	M1+E2	0,020 (12)	0,0038 (19)	0,0009 (5)	0,025 (14)
$\gamma_{14,1}$ (Th)	958,647 (21)	0,29 (5)					
$\gamma_{15,1}$ (Th)	964,768 (7)	4,99 (17)	E2+M1	0,00853 (19)	0,00199 (4)	0,000492 (9)	0,01119 (23)
$\gamma_{12,0}$ (Th)	968,968 (5)	16,1 (5)	E2	0,00806 (12)	0,00191 (3)	0,000472 (7)	0,01061 (15)
$\gamma_{51,12}$ (Th)	975,927 (12)	0,052 (6)	M1	0,0287 (4)	0,00524 (8)	0,001254 (18)	0,0356 (5)
$\gamma_{13,0}$ (Th)	979,499 (14)	0,0283 (30)	E2	0,00791 (11)	0,00186 (3)	0,000459 (7)	0,01039 (15)
$\gamma_{21,2}$ (Th)	987,685 (18)	0,14 (6)	M1+E2	0,018 (10)	0,0034 (17)	0,0008 (4)	0,022 (13)
$\gamma_{22,2}$ (Th)	988,57 (5)	0,081 (14)	E2	0,00778 (11)	0,00182 (3)	0,000449 (7)	0,01021 (15)
$\gamma_{51,10}$ (Th)	1000,699 (17)	0,0054 (3)					
$\gamma_{58,14}$ (Th)	1013,43 (16)	0,0097 (16)					
$\gamma_{14,0}$ (Th)	1016,406 (21)	0,0194 (31)	M1+E2	0,017 (10)	0,0032 (15)	0,0008 (4)	0,021 (12)
$\gamma_{54,12}$ (Th)	1018,49 (10)	0,032 (32)	E2+M3	0,05 (5)	0,014 (12)	0,003 (3)	0,07 (7)
$\gamma_{26,5}$ (Th)	1020,03 (6)	0,022 (5)					
$\gamma_{17,1}$ (Th)	1033,258 (9)	0,204 (12)	E2	0,0072 (1)	0,001643 (23)	0,000404 (6)	0,00938 (14)
$\gamma_{23,2}$ (Th)	1039,742 (8)	0,056 (18)					
$\gamma_{55,12}$ (Th)	1041,14 (5)	0,047 (10)	E2+M3	0,05 (5)	0,013 (12)	0,003 (3)	0,07 (6)
$\gamma_{57,12}$ (Th)	1053,87 (10)	0,0143 (41)	M1+E2	0,015 (9)	0,0029 (14)	0,0007 (4)	0,019 (10)
$\gamma_{28,5}$ (Th)	1054,316 (11)	0,019 (6)	M1+E2	0,015 (9)	0,0029 (14)	0,0007 (4)	0,019 (10)
$\gamma_{50,8}$ (Th)	1062,69 (9)	0,011 (4)					
$\gamma_{18,1}$ (Th)	1065,192 (7)	0,135 (8)					
$\gamma_{48,7}$ (Th)	1074,82 (10)	0,011 (4)					
$\gamma_{26,3}$ (Th)	1088,11 (6)	0,0062 (14)					
$\gamma_{19,1}$ (Th)	1095,708 (11)	0,126 (10)	M1+E2	0,014 (8)	0,0026 (13)	0,0006 (3)	0,017 (9)
$\gamma_{27,3}$ (Th)	1103,976 (7)	0,0102 (11)	E3	0,01377 (20)	0,00429 (6)	0,001090 (16)	0,0195 (3)
$\gamma_{24,2}$ (Th)	1110,600 (11)	0,0273 (21)	E1	0,00237 (4)	0,000388 (6)	0,0000915 (13)	0,00288 (4)
$\gamma_{20,1}$ (Th)	1110,616 (6)	0,285 (22)	E1	0,00237 (4)	0,000388 (6)	0,0000915 (13)	0,00288 (4)
$\gamma_{22,1}$ (Th)	1117,63 (5)	0,061 (7)					
$\gamma_{29,5}$ (Th)	1135,396 (8)	0,0102 (17)					
$\gamma_{30,5}$ (Th)	1143,13 (9)	0,0108 (22)					
$\gamma_{57,8}$ (Th)	1148,37 (10)	0,0062 (14)	M1+E2	0,012 (7)	0,0023 (11)	0,00057 (25)	0,015 (8)
$\gamma_{19,0}$ (Th)	1153,467 (10)	0,148 (13)	E1+M2	0,022 (20)	0,004 (5)	0,0011 (10)	0,03 (3)
$\gamma_{25,2}$ (Th)	1157,255 (12)	0,0073 (14)	E1+M2	0,022 (20)	0,004 (4)	0,0011 (10)	0,03 (3)
$\gamma_{37,6}$ (Th)	1164,63 (5)	0,067 (7)	M1+E2	0,012 (6)	0,0023 (11)	0,00055 (24)	0,015 (8)
$\gamma_{22,0}$ (Th)	1175,39 (5)	0,0257 (42)	E1+M2	0,021 (19)	0,004 (4)	0,001 (1)	0,027 (24)
$\gamma_{57,7}$ (Th)	1191,02 (10)	0,0065 (17)	M1+E2	0,011 (6)	0,0021 (10)	0,00052 (23)	0,014 (7)
$\gamma_{40,6}$ (Th)	1216,258 (26)	0,022 (4)					
$\gamma_{26,2}$ (Th)	1229,29 (6)	0,0078 (25)					
$\gamma_{27,2}$ (Th)	1245,156 (7)	0,110 (8)	M1+E2	0,010 (5)	0,0019 (9)	0,00046 (20)	0,013 (6)
$\gamma_{34,5}$ (Th)	1247,047 (16)	0,524 (24)	M1	0,01505 (21)	0,00274 (4)	0,000654 (10)	0,0187 (3)
$\gamma_{35,5}$ (Th)	1249,876 (13)	0,065 (6)					
$\gamma_{44,6}$ (Th)	1276,71 (10)	0,015 (3)					
$\gamma_{25,1}$ (Th)	1286,319 (12)	0,052 (11)	E1+M2				
$\gamma_{37,5}$ (Th)	1287,74 (5)	0,109 (25)	M1+E2	0,009 (5)	0,0018 (8)	0,00042 (18)	0,012 (6)
$\gamma_{33,3}$ (Th)	1310,281 (10)	0,020 (7)	E1+M2	0,016 (15)	0,003 (3)	0,0008 (7)	0,020 (18)
$\gamma_{34,3}$ (Th)	1315,122 (16)	0,0152 (30)	M1+E2	0,009 (5)	0,0017 (7)	0,00040 (17)	0,011 (6)
$\gamma_{29,2}$ (Th)	1344,651 (7)	0,0094 (20)	M1+E2	0,008 (4)	0,0016 (7)	0,00038 (16)	0,011 (5)
$\gamma_{41,5}$ (Th)	1347,812 (30)	0,0163 (41)	E1+M2	0,015 (14)	0,003 (3)	0,0007 (7)	0,019 (17)
$\gamma_{40,4}$ (Th)	1357,271 (27)	0,021 (5)					

	Energy keV	$P_{\gamma+ce}$ $\times 100$	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{41,4}$ (Th)	1365,711 (32)	0,0144 (31)	E2+M3	0,025 (21)	0,006 (5)	0,0014 (12)	0,03 (3)
$\gamma_{27,1}$ (Th)	1374,220 (7)	0,0196 (14)	E2+M3	0,024 (20)	0,005 (5)	0,0014 (12)	0,03 (3)
$\gamma_{45,5}$ (Th)	1401,57 (8)	0,0132 (31)	E1+M2	0,013 (12)	0,0026 (24)	0,0006 (6)	0,017 (15)
$\gamma_{41,3}$ (Th)	1415,887 (30)	0,022 (5)	E3	0,00849 (12)	0,00218 (3)	0,000543 (8)	0,01141 (16)
$\gamma_{32,2}$ (Th)	1430,96 (7)	0,037 (8)					
$\gamma_{28,0}$ (Th)	1450,394 (10)	0,0111 (22)	M1+E2	0,007 (3)	0,0013 (6)	0,00031 (13)	0,009 (4)
$\gamma_{35,2}$ (Th)	1459,131 (13)	0,89 (6)	E2	0,00391 (6)	0,000771 (11)	0,000187 (3)	0,00498 (7)
$\gamma_{45,3}$ (Th)	1469,65 (8)	0,021 (5)	E1+M2	0,012 (11)	0,0023 (21)	0,0006 (5)	0,015 (14)
$\gamma_{36,2}$ (Th)	1495,987 (30)	0,924 (30)	E2	0,00374 (6)	0,000732 (11)	0,0001769 (25)	0,00477 (7)
$\gamma_{38,2}$ (Th)	1501,571 (12)	0,513 (17)					
$\gamma_{39,2}$ (Th)	1537,460 (7)	0,049 (6)	E2+M3	0,018 (15)	0,004 (4)	0,0010 (8)	0,023 (19)
$\gamma_{40,2}$ (Th)	1548,627 (25)	0,040 (5)					
$\gamma_{41,2}$ (Th)	1557,067 (30)	0,173 (9)	E2+M1	0,0055 (5)	0,00102 (8)	0,000245 (19)	0,0070 (6)
$\gamma_{32,1}$ (Th)	1560,02 (7)	0,021 (5)					
$\gamma_{42,2}$ (Th)	1571,42 (12)	0,0059 (17)					
$\gamma_{43,2}$ (Th)	1573,395 (24)	0,0341 (40)	E2	0,00342 (5)	0,00066 0(1)	0,0001592 (23)	0,00438 (7)
$\gamma_{33,1}$ (Th)	1580,525 (10)	0,624 (40)	M1+E2	0,0057 (24)	0,0011 (4)	0,00025 (10)	0,007 (3)
$\gamma_{35,1}$ (Th)	1588,195 (13)	3,06 (12)	E2	0,0057 (23)	0,0010 (4)	0,00025 (10)	0,007 (3)
$\gamma_{54,4}$ (Th)	1609,28 (10)	0,0081 (17)	E2	0,00329 (5)	0,000630 (9)	0,0001518 (22)	0,00422 (6)
$\gamma_{36,1}$ (Th)	1625,051 (30)	0,270 (23)	E2+M3	0,016 (13)	0,003 (3)	0,0008 (7)	0,020 (17)
$\gamma_{38,1}$ (Th)	1630,635 (12)	1,52 (6)	M1+E2	0,0053 (22)	0,0010 (4)	0,00023 (9)	0,007 (3)
$\gamma_{33,0}$ (Th)	1638,284 (9)	0,462 (30)	E2	0,00319 (5)	0,000608 (9)	0,0001463 (21)	0,00410 (6)
$\gamma_{39,1}$ (Th)	1666,524 (7)	0,173 (9)	M1	0,00702 (10)	0,001269 (18)	0,000303 (5)	0,00895 (13)
$\gamma_{40,1}$ (Th)	1677,691 (25)	0,057 (6)					
$\gamma_{41,1}$ (Th)	1686,131 (30)	0,094 (7)	E2	0,00303 (5)	0,000573 (8)	0,0001378 (20)	0,00391 (6)
$\gamma_{42,1}$ (Th)	1700,48 (12)	0,0105 (25)					
$\gamma_{43,1}$ (Th)	1702,459 (24)	0,055 (7)	E2+M3	0,014 (11)	0,0030 (25)	0,0007 (6)	0,018 (15)
$\gamma_{46,2}$ (Th)	1706,173 (17)	0,0089 (12)	M1+E2	0,0061 (10)	0,00110 (16)	0,00026 (4)	0,0078 (12)
$\gamma_{47,2}$ (Th)	1713,127 (40)	0,0057 (11)	E2+M3	0,014 (11)	0,0029 (24)	0,0007 (6)	0,018 (14)
$\gamma_{39,0}$ (Th)	1724,283 (6)	0,030 (4)	E1+M2				
$\gamma_{44,1}$ (Th)	1738,14 (10)	0,018 (4)					
$\gamma_{45,1}$ (Th)	1739,89 (8)	0,011 (4)					
$\gamma_{49,2}$ (Th)	1741,75 (6)	0,0084 (25)	M1+E2				
$\gamma_{50,2}$ (Th)	1750,34 (9)	0,0084 (9)					
$\gamma_{51,2}$ (Th)	1758,072 (12)	0,0361 (40)	E2+M1	0,00285 (4)	0,000533 (8)	0,0001281 (18)	0,00371 (6)
$\gamma_{52,2}$ (Th)	1771,90 (22)	0,0019 (5)	E2+M3	0,013 (10)	0,0027 (22)	0,0007 (6)	0,016 (13)
$\gamma_{60,3}$ (Th)	1795,1 (3)	0,0022 (8)					
$\gamma_{45,0}$ (Th)	1797,65 (8)	0,0022 (8)	E1+M2	0,007 (7)	0,0014 (13)	0,0003 (3)	0,009 (8)
$\gamma_{54,2}$ (Th)	1800,64 (10)	0,0046 (8)					
$\gamma_{55,2}$ (Th)	1823,29 (5)	0,046 (5)					
$\gamma_{56,2}$ (Th)	1826,78 (30)	0,0022 (8)					
$\gamma_{46,1}$ (Th)	1835,237 (17)	0,0381 (40)	E2+M1	0,00291 (8)	0,000536 (14)	0,000128 (4)	0,00382 (10)
$\gamma_{47,1}$ (Th)	1842,191 (40)	0,037 (6)	M1+E2	0,00420 (25)	0,00076 (5)	0,000182 (11)	0,0055 (4)
$\gamma_{59,2}$ (Th)	1850,17 (17)	0,0046 (8)					
$\gamma_{49,1}$ (Th)	1870,81 (6)	0,0257 (24)	M1+E2	0,0038 (14)	0,00070 (24)	0,00017 (6)	0,0051 (18)
$\gamma_{50,1}$ (Th)	1879,40 (9)	0,0013 (5)					
$\gamma_{51,1}$ (Th)	1887,136 (12)	0,094 (7)	E2+M1	0,0038 (13)	0,00068 (23)	0,00016 (6)	0,0050 (17)
$\gamma_{47,0}$ (Th)	1899,95 (4)	0,0030 (6)	E1+M2	0,006 (6)	0,0012 (11)	0,0003 (3)	0,008 (7)
$\gamma_{53,1}$ (Th)	1907,22 (7)	0,0124 (13)					
$\gamma_{54,1}$ (Th)	1929,7 (1)	0,0208 (14)	E2+M3	0,010 (8)	0,0021 (17)	0,0005 (5)	0,013 (10)
$\gamma_{60,2}$ (Th)	1936,28 (30)	0,0022 (6)					
$\gamma_{55,1}$ (Th)	1952,35 (5)	0,062 (5)	E2+M3	0,010 (8)	0,0020 (17)	0,0005 (4)	0,013 (10)
$\gamma_{56,1}$ (Th)	1955,84 (30)	0,0008 (3)					
$\gamma_{52,0}$ (Th)	1958,72 (22)	0,0016 (5)	E1+M2				
$\gamma_{57,1}$ (Th)	1965,08 (10)	0,0223 (22)	M1+E2	0,0034 (12)	0,00062 (20)	0,00015 (5)	0,0046 (15)
$\gamma_{58,1}$ (Th)	1972,08 (16)	0,0038 (8)					
$\gamma_{59,1}$ (Th)	1979,23 (17)	0,0019 (5)					
$\gamma_{58,0}$ (Th)	2029,84 (16)	0,0019 (5)	E1+M2	0,005 (5)	0,0010 (9)	0,00024 (22)	0,007 (6)

3 Atomic Data

3.1 Th

ω_K	:	0,969	(4)
$\bar{\omega}_L$:	0,476	(18)
n_{KL}	:	0,797	(5)

3.1.1 X Radiations

	Energy keV	Relative probability
X _K		
K α_2	89,954	61,82
K α_1	93,351	100
K β_3	104,819	}
K β_1	105,604	}
K β_5''	106,239	}
		35,58
K β_2	108,509	}
K β_4	108,955	}
K $O_{2,3}$	109,442	}
		11,99
X _L		
L ℓ	11,1177	
L α	12,8085 – 12,967	
L η	14,509	
L β	14,972 – 16,4253	
L γ	18,3633 – 19,5043	

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	68,406 – 76,745	100
KLX	83,857 – 93,345	58,8
KXY	99,29 – 109,64	8,64
Auger L	5,8 – 20,3	

4 Electron Emissions

		Energy keV	Electrons per 100 disint.
e _{AL}	(Th)	5,8 - 20,3	40 (8)
e _{AK}	(Th)		27 (8)
	KLL	68,406 - 76,745	}
	KLX	83,857 - 93,345	}
	KXY	99,29 - 109,64	}
ec _{2,1} K	(Th)	19,414 (6)	0,660 (21)
ec _{38,35} L	(Th)	21,97 - 26,10	0,32 (11)
ec _{31,28} K	(Th)	28,291 (17)	0,168 (24)
ec _{31,29} L	(Th)	36,389 - 40,600	5,2 (35)
ec _{1,0} L	(Th)	37,287 - 41,500	52,7 (21)
ec _{18,12} K	(Th)	44,333 (8)	0,104 (4)
ec _{31,29} M	(Th)	51,679 - 53,529	1,4 (11)
ec _{1,0} M	(Th)	52,577 - 54,427	14,4 (6)
ec _{31,29} N	(Th)	55,530 - 56,526	0,40 (26)
ec _{1,0} N	(Th)	56,430 - 57,424	3,87 (15)
ec _{19,12} K	(Th)	74,849 (11)	4,3 (22)
ec _{29,27} L	(Th)	79,023 - 83,200	3,65 (13)
ec _{18,15} L	(Th)	79,952 - 84,100	0,259 (14)
ec _{29,27} M	(Th)	94,313 - 96,163	0,881 (31)
ec _{24,15} K	(Th)	94,388 (9)	0,83 (6)
ec _{29,27} N	(Th)	98,16 - 99,16	0,234 (8)
ec _{5,2} K	(Th)	99,605 (6)	0,267 (10)
ec _{2,1} L	(Th)	108,592 - 112,800	6,35 (20)
ec _{2,1} M	(Th)	123,882 - 125,732	1,74 (5)
ec _{2,1} N	(Th)	127,730 - 128,729	0,468 (15)
ec _{3,1} K	(Th)	160,594 (6)	0,1335 (43)
ec _{19,8} K	(Th)	169,344 (21)	0,10 (8)
ec _{24,15} L	(Th)	183,566 - 187,700	0,286 (21)
ec _{5,1} K	(Th)	228,669 (6)	0,261 (10)
ec _{27,15} K	(Th)	299,802 (8)	0,32 (26)
ec _{27,12} K	(Th)	353,361 (8)	0,139 (8)
ec _{12,1} K	(Th)	801,559 (6)	0,236 (8)
ec _{12,0} K	(Th)	859,318 (5)	0,128 (5)
$\beta_{0,60}^-$	max:	0,7 (27)	0,0047 (11)
$\beta_{0,60}^-$	avg:	0,18 (68)	
$\beta_{0,59}^-$	max:	86,8 (27)	0,0069 (11)
$\beta_{0,59}^-$	avg:	22,4 (8)	
$\beta_{0,58}^-$	max:	94,0 (27)	0,026 (4)
$\beta_{0,58}^-$	avg:	24,3 (7)	
$\beta_{0,57}^-$	max:	101,0 (27)	0,061 (6)
$\beta_{0,57}^-$	avg:	26,2 (7)	

		Energy keV		Electrons per 100 disint.
$\beta_{0,56}^-$	max:	110,2	(27)	0,0032 (10)
$\beta_{0,56}^-$	avg:	28,7	(7)	
$\beta_{0,55}^-$	max:	113,7	(27)	0,238 (15)
$\beta_{0,55}^-$	avg:	29,7	(8)	
$\beta_{0,54}^-$	max:	136,3	(27)	0,07 (4)
$\beta_{0,54}^-$	avg:	35,9	(8)	
$\beta_{0,53}^-$	max:	158,8	(27)	0,0132 (14)
$\beta_{0,53}^-$	avg:	42,2	(8)	
$\beta_{0,52}^-$	max:	165,1	(27)	0,0038 (8)
$\beta_{0,52}^-$	avg:	43,9	(8)	
$\beta_{0,51}^-$	max:	178,9	(27)	0,307 (22)
$\beta_{0,51}^-$	avg:	47,8	(8)	
$\beta_{0,50}^-$	max:	186,6	(27)	0,053 (6)
$\beta_{0,50}^-$	avg:	50,0	(8)	
$\beta_{0,49}^-$	max:	195,2	(27)	0,061 (8)
$\beta_{0,49}^-$	avg:	52,5	(8)	
$\beta_{0,48}^-$	max:	217,2	(27)	0,025 (5)
$\beta_{0,48}^-$	avg:	58,8	(8)	
$\beta_{0,47}^-$	max:	223,9	(27)	0,069 (8)
$\beta_{0,47}^-$	avg:	60,8	(8)	
$\beta_{0,46}^-$	max:	230,8	(27)	0,109 (8)
$\beta_{0,46}^-$	avg:	62,8	(8)	
$\beta_{0,45}^-$	max:	326,2	(27)	0,051 (8)
$\beta_{0,45}^-$	avg:	91,4	(8)	
$\beta_{0,44}^-$	max:	327,9	(27)	0,035 (6)
$\beta_{0,44}^-$	avg:	91,9	(8)	
$\beta_{0,43}^-$	max:	363,6	(27)	0,139 (12)
$\beta_{0,43}^-$	avg:	103,0	(9)	
$\beta_{0,42}^-$	max:	365,6	(27)	0,060 (8)
$\beta_{0,42}^-$	avg:	103,6	(9)	
$\beta_{0,41}^-$	max:	379,9	(27)	0,378 (16)
$\beta_{0,41}^-$	avg:	108,1	(9)	
$\beta_{0,40}^-$	max:	388,4	(27)	0,149 (11)
$\beta_{0,40}^-$	avg:	110,7	(9)	
$\beta_{0,39}^-$	max:	399,5	(27)	1,93 (8)
$\beta_{0,39}^-$	avg:	114,3	(9)	
$\beta_{0,38}^-$	max:	435,4	(27)	2,50 (16)
$\beta_{0,38}^-$	avg:	125,7	(9)	
$\beta_{0,37}^-$	max:	440,0	(27)	0,20 (3)
$\beta_{0,37}^-$	avg:	127,2	(9)	
$\beta_{0,36}^-$	max:	441,0	(27)	1,21 (4)
$\beta_{0,36}^-$	avg:	127,5	(9)	

		Energy keV		Electrons per 100 disint.
$\beta_{0,35}^-$	max:	477,8	(27)	4,12 (20)
$\beta_{0,35}^-$	avg:	139,5	(9)	
$\beta_{0,34}^-$	max:	480,7	(27)	0,82 (3)
$\beta_{0,34}^-$	avg:	140,4	(9)	
$\beta_{0,33}^-$	max:	485,5	(27)	1,23 (6)
$\beta_{0,33}^-$	avg:	142,0	(9)	
$\beta_{0,32}^-$	max:	506,0	(27)	0,071 (10)
$\beta_{0,32}^-$	avg:	148,7	(9)	
$\beta_{0,31}^-$	max:	535,5	(27)	8,8 (23)
$\beta_{0,31}^-$	avg:	158,5	(9)	
$\beta_{0,30}^-$	max:	584,6	(27)	0,030 (6)
$\beta_{0,30}^-$	avg:	175,0	(9)	
$\beta_{0,27}^-$	max:	691,8	(27)	1,6 (5)
$\beta_{0,27}^-$	avg:	211,8	(10)	
$\beta_{0,26}^-$	max:	707,7	(27)	0,060 (8)
$\beta_{0,26}^-$	avg:	217,3	(10)	
$\beta_{0,25}^-$	max:	779,7	(27)	0,208 (18)
$\beta_{0,25}^-$	avg:	242,7	(10)	
$\beta_{0,24}^-$	max:	826,4	(27)	1,46 (11)
$\beta_{0,24}^-$	avg:	259,4	(10)	
$\beta_{0,23}^-$	max:	897,2	(27)	0,67 (8)
$\beta_{0,23}^-$	avg:	285,1	(10)	
$\beta_{0,22}^-$	max:	948,4	(27)	0,166 (19)
$\beta_{0,22}^-$	avg:	303,9	(10)	
$\beta_{0,20}^-$	max:	955,4	(27)	3,39 (13)
$\beta_{0,20}^-$	avg:	306,4	(10)	
$\beta_{0,19}^-$	max:	970,3	(27)	6 (3)
$\beta_{0,19}^-$	avg:	311,9	(10)	
$\beta_{0,18}^-$	max:	1000,8	(27)	6,67 (18)
$\beta_{0,18}^-$	avg:	323,2	(10)	
$\beta_{0,16}^-$	max:	1063,9	(27)	0,099 (11)
$\beta_{0,16}^-$	avg:	346,7	(11)	
$\beta_{0,15}^-$	max:	1101,3	(27)	3,0 (4)
$\beta_{0,15}^-$	avg:	360,8	(11)	
$\beta_{0,14}^-$	max:	1107,4	(27)	0,39 (6)
$\beta_{0,14}^-$	avg:	363,1	(11)	
$\beta_{0,13}^-$	max:	1144,3	(27)	0,238 (20)
$\beta_{0,13}^-$	avg:	377,1	(11)	
$\beta_{0,12}^-$	max:	1154,8	(27)	31 (4)
$\beta_{0,12}^-$	avg:	381,1	(11)	
$\beta_{0,11}^-$	max:	1155,4	(27)	0,18 (3)
$\beta_{0,11}^-$	avg:	381,4	(11)	

		Energy keV		Electrons per 100 disint.
$\beta_{0,10}^-$	max:	1179,6	(27)	0,087 (16)
$\beta_{0,10}^-$	avg:	390,6	(11)	
$\beta_{0,8}^-$	max:	1249,3	(27)	0,17 (10)
$\beta_{0,8}^-$	avg:	417,2	(11)	
$\beta_{0,5}^-$	max:	1727,7	(27)	12,4 (5)
$\beta_{0,5}^-$	avg:	605,7	(11)	
$\beta_{0,4}^-$	max:	1745,6	(27)	0,147 (21)
$\beta_{0,4}^-$	avg:	587,3	(11)	
$\beta_{0,3}^-$	max:	1795,8	(27)	0,72 (23)
$\beta_{0,3}^-$	avg:	605,4	(11)	
$\beta_{0,2}^-$	max:	1937,0	(27)	0,6 (5)
$\beta_{0,2}^-$	avg:	690,2	(11)	
$\beta_{0,1}^-$	max:	2066,0	(27)	6 (4)
$\beta_{0,1}^-$	avg:	742,8	(11)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV	Photons per 100 disint.	
XL	(Th)	11,1177 — 19,5043	37 (4)	
XK α_2	(Th)	89,954	2,5 (7)	} K α
XK α_1	(Th)	93,351	4,1 (11)	
XK β_3	(Th)	104,819	}	K' β_1
XK β_1	(Th)	105,604	}	
XK β_5''	(Th)	106,239	}	
XK β_2	(Th)	108,509	}	
XK β_4	(Th)	108,955	}	
XKO _{2,3}	(Th)	109,442	}	K' β_2

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{28,27}$ (Th)	18,415 (12)	0,019 (4)
$\gamma_{38,35}$ (Th)	42,46 (5)	0,009 (3)
$\gamma_{31,29}$ (Th)	56,88 (5)	0,020 (5)
$\gamma_{1,0}$ (Th)	57,752 (13)	0,470 (17)
$\gamma_{20,17}$ (Th)	77,34 (3)	0,027 (6)
$\gamma_{29,27}$ (Th)	99,505 (12)	1,26 (4)
$\gamma_{18,15}$ (Th)	100,41 (3)	0,114 (6)
$\gamma_{35,29}$ (Th)	114,56 (7)	0,0102 (22)
$\gamma_{2,1}$ (Th)	129,065 (3)	2,50 (7)
$\gamma_{23,17}$ (Th)	135,507 (22)	0,024 (6)
$\gamma_{31,28}$ (Th)	137,936 (22)	0,028 (4)
$\gamma_{6,4}$ (Th)	140,999 (20)	0,045 (9)
$\gamma_{20,15}$ (Th)	145,842 (20)	0,169 (6)
$\gamma_{18,12}$ (Th)	153,967 (11)	0,754 (23)
$\gamma_{25,22}$ (Th)	168,53 (12)	0,0111 (27)
$\gamma_{49,43}$ (Th)	168,53 (12)	0,0025 (7)
$\gamma_{19,13}$ (Th)	173,96 (3)	0,036 (5)
$\gamma_{19,12}$ (Th)	184,547 (19)	0,054 (19)
$\gamma_{4,2}$ (Th)	191,351 (17)	0,133 (8)
$\gamma_{20,12}$ (Th)	199,402 (15)	0,299 (23)
$\gamma_{24,15}$ (Th)	204,029 (11)	0,114 (8)
$\gamma_{5,2}$ (Th)	209,248 (7)	3,97 (13)
$\gamma_{19,9}$ (Th)	214,89 (10)	0,031 (5)
$\gamma_{28,23}$ (Th)	223,793 (21)	0,058 (6)
$\gamma_{22,10}$ (Th)	231,42 (10)	0,026 (4)

	Energy keV	Photons per 100 disint.
$\gamma_{27,21}(\text{Th})$	257,482 (21)	0,0286 (19)
$\gamma_{27,20}(\text{Th})$	263,58 (10)	0,043 (3)
$\gamma_{3,1}(\text{Th})$	270,245 (7)	3,55 (10)
$\gamma_{27,19}(\text{Th})$	278,80 (15)	0,031 (5)
$\gamma_{19,8}(\text{Th})$	278,80 (15)	0,204 (28)
$\gamma_{28,20}(\text{Th})$	282,02 (4)	0,09 (3)
$\gamma_{19,7}(\text{Th})$	321,646 (8)	0,232 (14)
$\gamma_{42,27}(\text{Th})$	326,04 (20)	0,035 (6)
$\gamma_{3,0}(\text{Th})$	328,004 (7)	3,04 (11)
$\gamma_{6,2}(\text{Th})$	332,371 (6)	0,37 (6)
$\gamma_{5,1}(\text{Th})$	338,320 (5)	11,4 (4)
$\gamma_{27,17}(\text{Th})$	340,969 (21)	0,405 (20)
$\gamma_{51,31}(\text{Th})$	356,7 (3)	0,0178 (21)
$\gamma_{55,33}(\text{Th})$	372,59 (3)	0,0070 (17)
$\gamma_{29,19}(\text{Th})$	377,99 (10)	0,026 (3)
$\gamma_{57,33}(\text{Th})$	384,47 (9)	0,0070 (17)
$\gamma_{49,30}(\text{Th})$	389,32 (13)	0,0108 (17)
$\gamma_{50,30}(\text{Th})$	397,95 (10)	0,029 (3)
$\gamma_{41,25}(\text{Th})$	399,83 (14)	0,031 (4)
$\gamma_{27,15}(\text{Th})$	409,460 (13)	2,02 (6)
$\gamma_{30,18}(\text{Th})$	415,96 (14)	0,0138 (23)
$\gamma_{35,23}(\text{Th})$	419,38 (7)	0,022 (3)
$\gamma_{29,17}(\text{Th})$	440,450 (24)	0,128 (10)
$\gamma_{11,6}(\text{Th})$	449,11 (6)	0,050 (6)
$\gamma_{27,13}(\text{Th})$	452,50 (6)	0,0199 (19)
$\gamma_{37,23}(\text{Th})$	457,18 (15)	0,016 (3)
$\gamma_{27,12}(\text{Th})$	463,002 (6)	4,45 (24)
$\gamma_{33,20}(\text{Th})$	470,21 (20)	0,014 (3)
$\gamma_{26,10}(\text{Th})$	471,77 (15)	0,034 (4)
$\gamma_{34,20}(\text{Th})$	474,79 (10)	0,023 (4)
$\gamma_{8,5}(\text{Th})$	478,40 (5)	0,224 (19)
$\gamma_{48,26}(\text{Th})$	490,33 (15)	0,0116 (25)
$\gamma_{35,19}(\text{Th})$	492,29 (8)	0,025 (3)
$\gamma_{39,23}(\text{Th})$	497,64 (10)	0,0062 (19)
$\gamma_{7,3}(\text{Th})$	503,819 (23)	0,171 (19)
$\gamma_{29,15}(\text{Th})$	508,955 (13)	0,51 (4)
$\gamma_{33,18}(\text{Th})$	515,12 (7)	0,051 (6)
$\gamma_{34,18}(\text{Th})$	520,16 (3)	0,070 (7)
$\gamma_{35,18}(\text{Th})$	523,129 (22)	0,129 (10)
$\gamma_{16,6}(\text{Th})$	540,67 (5)	0,027 (3)
$\gamma_{8,3}(\text{Th})$	546,445 (21)	0,199 (16)
$\gamma_{39,22}(\text{Th})$	548,73 (11)	0,024 (4)
$\gamma_{35,17}(\text{Th})$	555,07 (16)	0,048 (6)
$\gamma_{29,12}(\text{Th})$	562,496 (7)	0,89 (4)
$\gamma_{39,19}(\text{Th})$	570,88 (4)	0,19 (5)
$\gamma_{11,5}(\text{Th})$	572,10 (5)	0,156 (18)
$\gamma_{13,5}(\text{Th})$	583,391 (10)	0,120 (11)

	Energy keV	Photons per 100 disint.
$\gamma_{9,3}(\text{Th})$	610,65 (10)	0,024 (5)
$\gamma_{10,3}(\text{Th})$	616,21 (3)	0,084 (7)
$\gamma_{14,5}(\text{Th})$	620,32 (7)	0,084 (7)
$\gamma_{35,15}(\text{Th})$	623,48 (22)	0,012 (3)
$\gamma_{34,14}(\text{Th})$	626,80 (22)	0,015 (3)
$\gamma_{35,14}(\text{Th})$	629,41 (5)	0,047 (5)
$\gamma_{11,3}(\text{Th})$	640,32 (4)	0,057 (6)
$\gamma_{32,12}(\text{Th})$	649,02 (12)	0,0086 (9)
$\gamma_{20,6}(\text{Th})$	649,02 (12)	0,0332 (36)
$\gamma_{13,3}(\text{Th})$	651,53 (3)	0,094 (10)
$\gamma_{36,15}(\text{Th})$	660,1 (3)	0,0054 (3)
$\gamma_{16,5}(\text{Th})$	663,88 (8)	0,029 (6)
$\gamma_{35,13}(\text{Th})$	666,45 (5)	0,058 (6)
$\gamma_{46,23}(\text{Th})$	666,45 (5)	0,0068 (7)
$\gamma_{38,14}(\text{Th})$	671,95 (8)	0,027 (8)
$\gamma_{34,12}(\text{Th})$	674,63 (4)	0,105 (10)
$\gamma_{35,12}(\text{Th})$	677,08 (10)	0,065 (6)
$\gamma_{14,3}(\text{Th})$	688,12 (4)	0,070 (7)
$\gamma_{34,10}(\text{Th})$	698,99 (10)	0,038 (6)
$\gamma_{39,15}(\text{Th})$	701,742 (15)	0,181 (15)
$\gamma_{23,6}(\text{Th})$	707,42 (5)	0,162 (18)
$\gamma_{51,23}(\text{Th})$	718,30 (3)	0,019 (4)
$\gamma_{18,5}(\text{Th})$	726,88 (10)	0,68 (8)
$\gamma_{43,15}(\text{Th})$	737,74 (5)	0,039 (5)
$\gamma_{39,12}(\text{Th})$	755,313 (9)	1,03 (4)
$\gamma_{20,5}(\text{Th})$	772,291 (7)	1,52 (6)
$\gamma_{7,1}(\text{Th})$	774,07 (10)	0,062 (4)
$\gamma_{51,20}(\text{Th})$	776,51 (3)	0,020 (6)
$\gamma_{12,2}(\text{Th})$	782,140 (6)	0,50 (4)
$\gamma_{51,19}(\text{Th})$	791,43 (9)	0,014 (4)
$\gamma_{43,12}(\text{Th})$	791,43 (9)	0,010 (3)
$\gamma_{13,2}(\text{Th})$	792,69 (10)	0,081 (5)
$\gamma_{18,3}(\text{Th})$	794,942 (14)	4,31 (14)
$\gamma_{38,8}(\text{Th})$	813,88 (10)	0,0073 (17)
$\gamma_{8,1}(\text{Th})$	816,82 (10)	0,031 (4)
$\gamma_{25,6}(\text{Th})$	824,931 (25)	0,053 (6)
$\gamma_{23,5}(\text{Th})$	830,481 (8)	0,61 (6)
$\gamma_{15,2}(\text{Th})$	835,704 (8)	1,70 (7)
$\gamma_{20,3}(\text{Th})$	840,372 (9)	0,97 (4)
$\gamma_{51,17}(\text{Th})$	853,96 (8)	0,0124 (20)
$\gamma_{46,15}(\text{Th})$	870,47 (7)	0,046 (5)
$\gamma_{16,2}(\text{Th})$	873,10 (15)	0,032 (7)
$\gamma_{8,0}(\text{Th})$	874,45 (8)	0,050 (11)
$\gamma_{47,15}(\text{Th})$	877,38 (7)	0,014 (3)
$\gamma_{9,1}(\text{Th})$	880,76 (10)	0,0065 (19)
$\gamma_{55,18}(\text{Th})$	887,26 (10)	0,029 (3)
$\gamma_{24,5}(\text{Th})$	901,38 (3)	0,017 (4)

	Energy keV	Photons per 100 disint.
$\gamma_{17,2}(\text{Th})$	904,20 (5)	0,78 (4)
$\gamma_{12,1}(\text{Th})$	911,196 (6)	26,2 (8)
$\gamma_{55,17}(\text{Th})$	919,03 (12)	0,028 (3)
$\gamma_{13,1}(\text{Th})$	921,87 (12)	0,0154 (23)
$\gamma_{47,12}(\text{Th})$	930,99 (7)	0,004 (1)
$\gamma_{28,6}(\text{Th})$	930,99 (7)	0,0025 (23)
$\gamma_{58,17}(\text{Th})$	939,89 (15)	0,009 (3)
$\gamma_{10,0}(\text{Th})$	944,19 (3)	0,10 (1)
$\gamma_{25,5}(\text{Th})$	947,976 (24)	0,111 (10)
$\gamma_{14,1}(\text{Th})$	958,59 (4)	0,29 (5)
$\gamma_{15,1}(\text{Th})$	964,786 (8)	4,99 (17)
$\gamma_{12,0}(\text{Th})$	968,960 (9)	15,9 (5)
$\gamma_{51,12}(\text{Th})$	975,98 (5)	0,052 (6)
$\gamma_{13,0}(\text{Th})$	979,49 (10)	0,028 (3)
$\gamma_{21,2}(\text{Th})$	987,87 (10)	0,14 (6)
$\gamma_{22,2}(\text{Th})$	988,65 (20)	0,081 (14)
$\gamma_{51,10}(\text{Th})$	1000,68 (10)	0,0054 (3)
$\gamma_{58,14}(\text{Th})$	1013,55 (13)	0,0097 (16)
$\gamma_{14,0}(\text{Th})$	1016,44 (10)	0,019 (3)
$\gamma_{54,12}(\text{Th})$	1017,94 (20)	0,03 (3)
$\gamma_{26,5}(\text{Th})$	1019,88 (10)	0,022 (5)
$\gamma_{17,1}(\text{Th})$	1033,244 (23)	0,204 (12)
$\gamma_{23,2}(\text{Th})$	1039,83 (7)	0,056 (18)
$\gamma_{55,12}(\text{Th})$	1040,94 (15)	0,047 (10)
$\gamma_{57,12}(\text{Th})$	1053,11 (20)	0,014 (4)
$\gamma_{28,5}(\text{Th})$	1054,13 (20)	0,019 (6)
$\gamma_{50,8}(\text{Th})$	1062,57 (15)	0,011 (4)
$\gamma_{18,1}(\text{Th})$	1065,168 (15)	0,135 (8)
$\gamma_{48,7}(\text{Th})$	1074,73 (15)	0,011 (4)
$\gamma_{26,3}(\text{Th})$	1088,20 (15)	0,0062 (14)
$\gamma_{19,1}(\text{Th})$	1095,671 (23)	0,126 (10)
$\gamma_{27,3}(\text{Th})$	1103,43 (10)	0,0102 (11)
$\gamma_{20,1}(\text{Th})$	1110,604 (9)	0,284 (22)
$\gamma_{24,2}(\text{Th})$	1110,604 (9)	0,0272 (21)
$\gamma_{22,1}(\text{Th})$	1117,65 (10)	0,061 (7)
$\gamma_{29,5}(\text{Th})$	1135,26 (15)	0,0102 (17)
$\gamma_{30,5}(\text{Th})$	1142,87 (15)	0,0108 (22)
$\gamma_{57,8}(\text{Th})$	1148,17 (14)	0,0062 (14)
$\gamma_{19,0}(\text{Th})$	1153,27 (4)	0,148 (13)
$\gamma_{25,2}(\text{Th})$	1157,16 (15)	0,0073 (14)
$\gamma_{37,6}(\text{Th})$	1164,55 (7)	0,067 (7)
$\gamma_{22,0}(\text{Th})$	1175,33 (10)	0,025 (4)
$\gamma_{57,7}(\text{Th})$	1190,83 (20)	0,0065 (17)
$\gamma_{40,6}(\text{Th})$	1217,03 (10)	0,022 (4)
$\gamma_{26,2}(\text{Th})$	1229,42 (15)	0,0078 (25)
$\gamma_{27,2}(\text{Th})$	1245,15 (6)	0,110 (8)
$\gamma_{34,5}(\text{Th})$	1247,10 (5)	0,524 (24)

	Energy keV	Photons per 100 disint.
$\gamma_{35,5}(\text{Th})$	1250,06 (5)	0,065 (6)
$\gamma_{44,6}(\text{Th})$	1276,72 (10)	0,015 (3)
$\gamma_{25,1}(\text{Th})$	1286,29 (20)	0,052 (11)
$\gamma_{37,5}(\text{Th})$	1287,77 (8)	0,109 (25)
$\gamma_{33,3}(\text{Th})$	1309,76 (20)	0,020 (7)
$\gamma_{34,3}(\text{Th})$	1315,33 (10)	0,015 (3)
$\gamma_{29,2}(\text{Th})$	1344,62 (15)	0,0094 (20)
$\gamma_{41,5}(\text{Th})$	1347,50 (15)	0,016 (4)
$\gamma_{40,4}(\text{Th})$	1357,81 (15)	0,021 (5)
$\gamma_{41,4}(\text{Th})$	1365,71 (12)	0,014 (3)
$\gamma_{27,1}(\text{Th})$	1374,24 (7)	0,0196 (14)
$\gamma_{45,5}(\text{Th})$	1401,52 (10)	0,013 (3)
$\gamma_{41,3}(\text{Th})$	1415,55 (14)	0,022 (5)
$\gamma_{32,2}(\text{Th})$	1430,99 (10)	0,037 (8)
$\gamma_{28,0}(\text{Th})$	1451,43 (15)	0,0111 (22)
$\gamma_{35,2}(\text{Th})$	1459,131 (22)	0,87 (5)
$\gamma_{45,3}(\text{Th})$	1469,74 (15)	0,021 (5)
$\gamma_{36,2}(\text{Th})$	1495,904 (16)	0,92 (3)
$\gamma_{38,2}(\text{Th})$	1501,59 (5)	0,513 (17)
$\gamma_{39,2}(\text{Th})$	1537,89 (10)	0,049 (6)
$\gamma_{40,2}(\text{Th})$	1548,65 (6)	0,040 (5)
$\gamma_{41,2}(\text{Th})$	1557,13 (7)	0,173 (9)
$\gamma_{32,1}(\text{Th})$	1560,02 (7)	0,021 (5)
$\gamma_{42,2}(\text{Th})$	1571,55 (20)	0,0059 (17)
$\gamma_{43,2}(\text{Th})$	1573,389 (24)	0,034 (4)
$\gamma_{33,1}(\text{Th})$	1580,531 (25)	0,62 (4)
$\gamma_{35,1}(\text{Th})$	1588,200 (25)	3,06 (12)
$\gamma_{54,4}(\text{Th})$	1609,44 (15)	0,0081 (17)
$\gamma_{36,1}(\text{Th})$	1625,09 (4)	0,270 (23)
$\gamma_{38,1}(\text{Th})$	1630,618 (20)	1,52 (6)
$\gamma_{33,0}(\text{Th})$	1638,272 (23)	0,46 (3)
$\gamma_{39,1}(\text{Th})$	1666,514 (13)	0,173 (9)
$\gamma_{40,1}(\text{Th})$	1677,66 (6)	0,057 (6)
$\gamma_{41,1}(\text{Th})$	1686,22 (11)	0,094 (7)
$\gamma_{42,1}(\text{Th})$	1700,62 (20)	0,0105 (25)
$\gamma_{43,1}(\text{Th})$	1702,40 (8)	0,055 (7)
$\gamma_{46,2}(\text{Th})$	1706,17 (7)	0,0089 (12)
$\gamma_{47,2}(\text{Th})$	1713,49 (20)	0,0057 (11)
$\gamma_{39,0}(\text{Th})$	1724,19 (5)	0,030 (4)
$\gamma_{44,1}(\text{Th})$	1738,46 (5)	0,018 (4)
$\gamma_{45,1}(\text{Th})$	1740,5 (3)	0,011 (4)
$\gamma_{49,2}(\text{Th})$	1742,1 (3)	0,0084 (25)
$\gamma_{50,2}(\text{Th})$	1750,58 (20)	0,0084 (9)
$\gamma_{51,2}(\text{Th})$	1758,11 (5)	0,036 (4)
$\gamma_{52,2}(\text{Th})$	1772,2 (3)	0,0019 (5)
$\gamma_{60,3}(\text{Th})$	1795,13 (6)	0,0022 (8)
$\gamma_{45,0}(\text{Th})$	1797,5 (5)	0,0022 (8)

	Energy keV	Photons per 100 disint.
$\gamma_{54,2}(\text{Th})$	1800,9 (2)	0,0046 (8)
$\gamma_{55,2}(\text{Th})$	1823,22 (10)	0,046 (5)
$\gamma_{56,2}(\text{Th})$	1826,8 (3)	0,0022 (8)
$\gamma_{46,1}(\text{Th})$	1835,29 (10)	0,038 (4)
$\gamma_{47,1}(\text{Th})$	1842,15 (8)	0,037 (6)
$\gamma_{59,2}(\text{Th})$	1850,17 (20)	0,0046 (8)
$\gamma_{49,1}(\text{Th})$	1870,82 (9)	0,0257 (24)
$\gamma_{50,1}(\text{Th})$	1879,6 (3)	0,0013 (5)
$\gamma_{51,1}(\text{Th})$	1887,13 (5)	0,094 (7)
$\gamma_{47,0}(\text{Th})$	1900,16 (20)	0,0030 (6)
$\gamma_{53,1}(\text{Th})$	1907,14 (11)	0,0124 (13)
$\gamma_{54,1}(\text{Th})$	1929,78 (20)	0,0208 (14)
$\gamma_{60,2}(\text{Th})$	1936,3 (3)	0,0022 (6)
$\gamma_{55,1}(\text{Th})$	1952,37 (10)	0,062 (5)
$\gamma_{56,1}(\text{Th})$	1955,9 (5)	0,0008 (3)
$\gamma_{52,0}(\text{Th})$	1958,4 (3)	0,0016 (5)
$\gamma_{57,1}(\text{Th})$	1965,22 (12)	0,0223 (22)
$\gamma_{58,1}(\text{Th})$	1972,0 (3)	0,0038 (8)
$\gamma_{59,1}(\text{Th})$	1979,3 (3)	0,0019 (5)
$\gamma_{58,0}(\text{Th})$	2029,4 (5)	0,0019 (5)

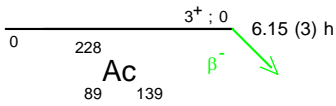
6 Main Production Modes

Th – 232 decay chain

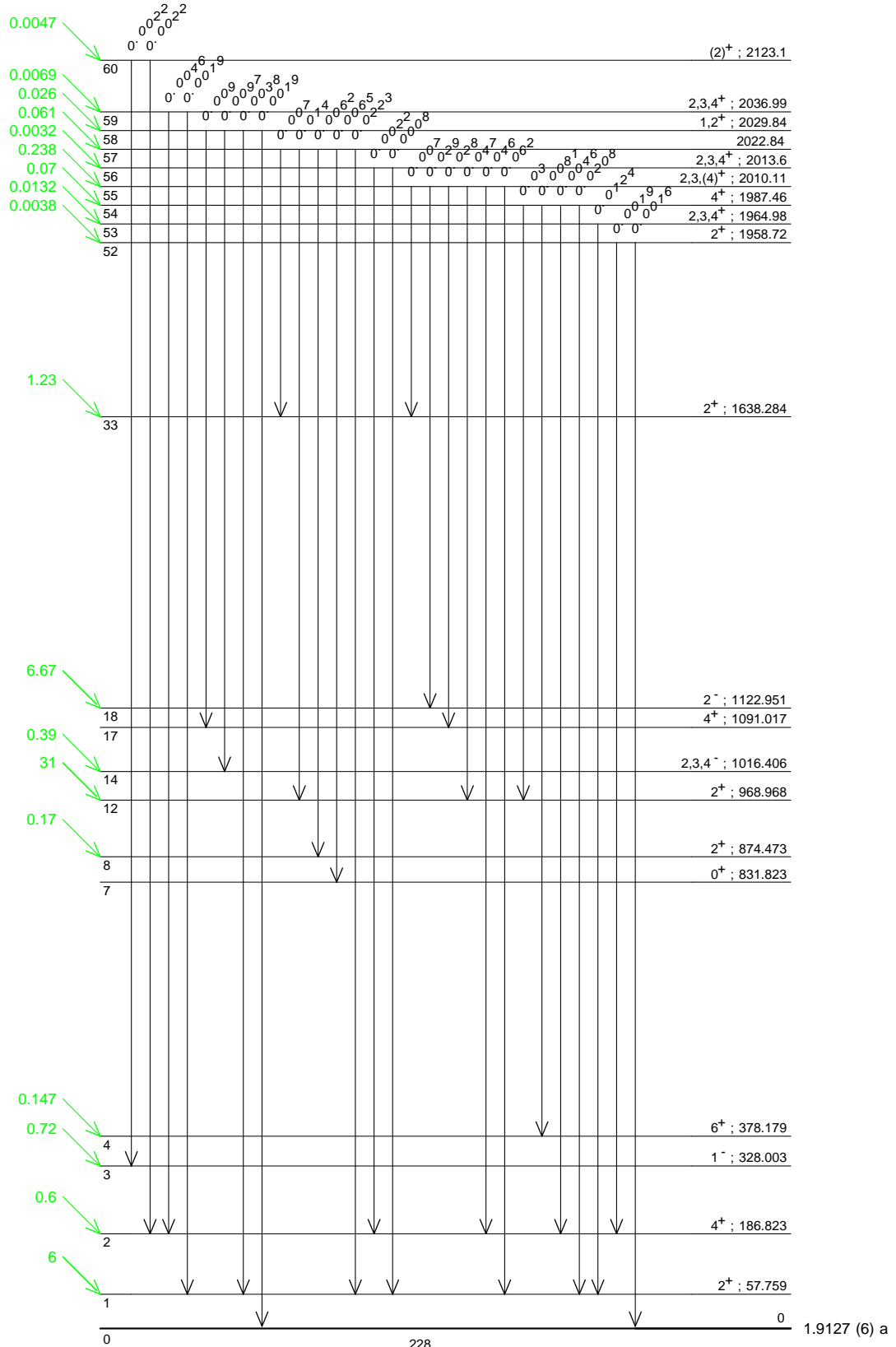
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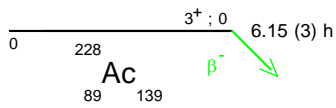
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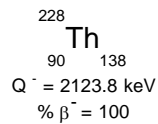
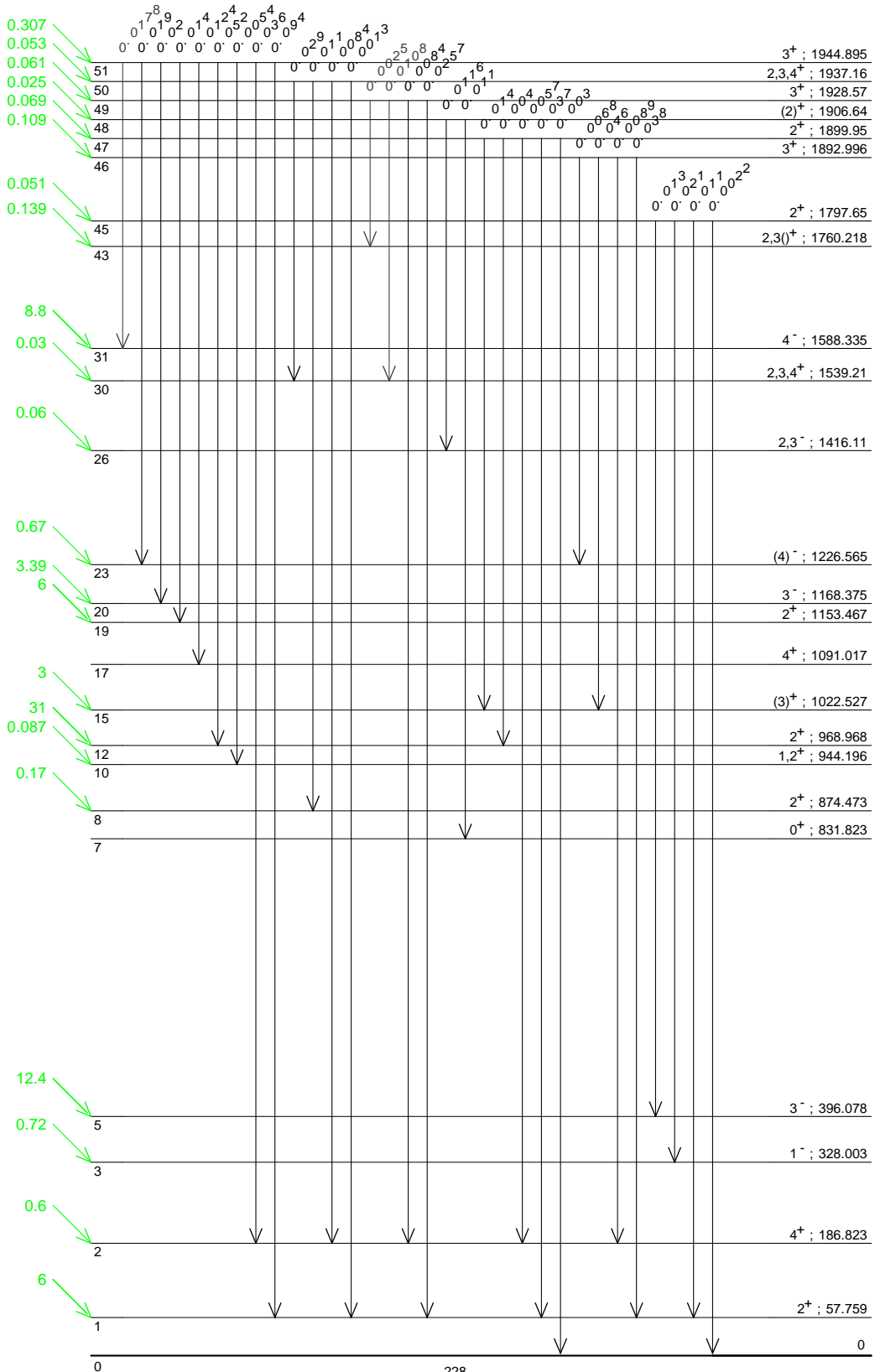
γ Emission intensities per 100 disintegrations

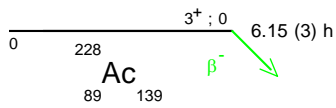


²²⁸Th₉₀¹³⁸
 Q⁻ = 2123.8 keV
 % β⁻ = 100

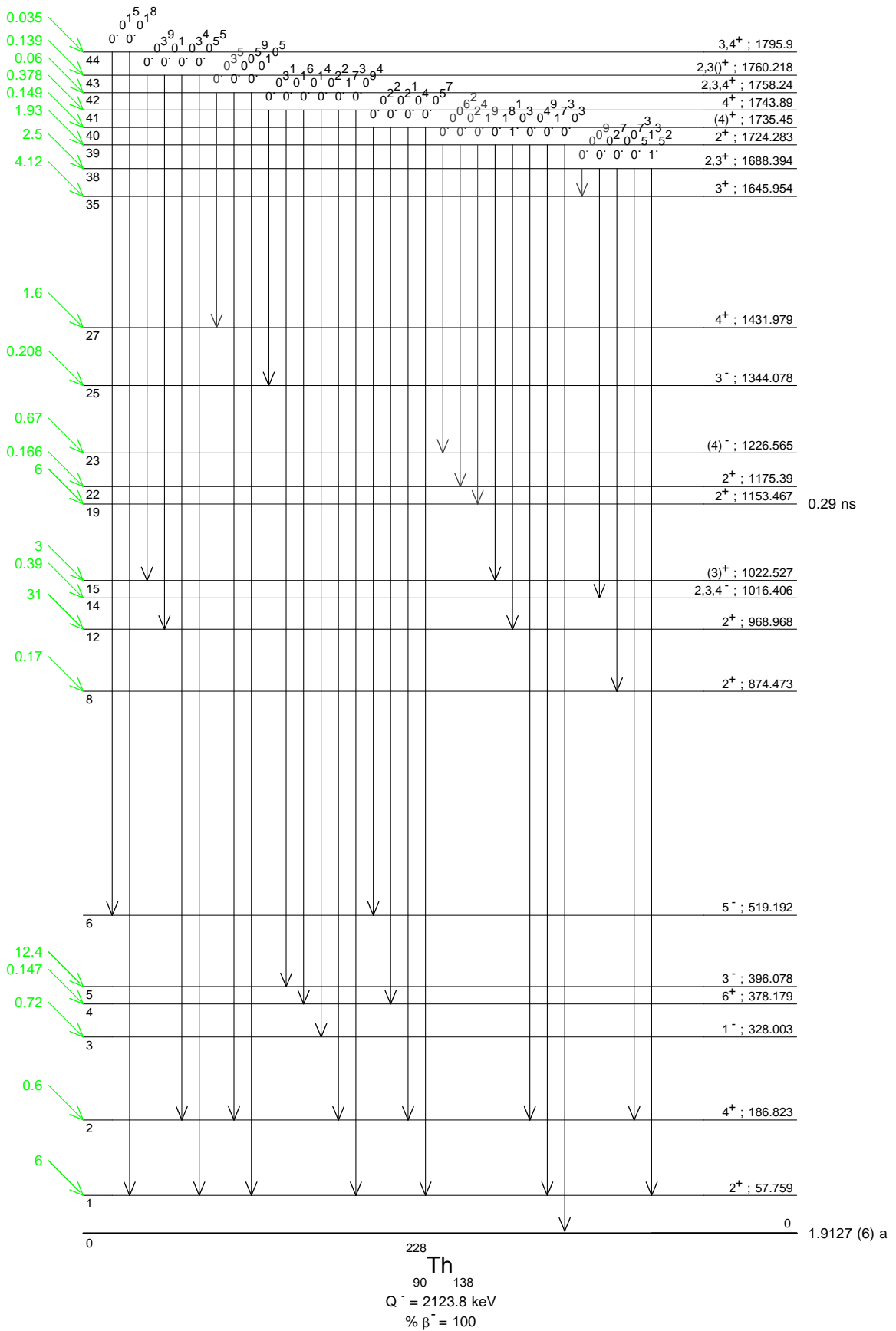


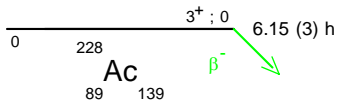
γ Emission intensities per 100 disintegrations



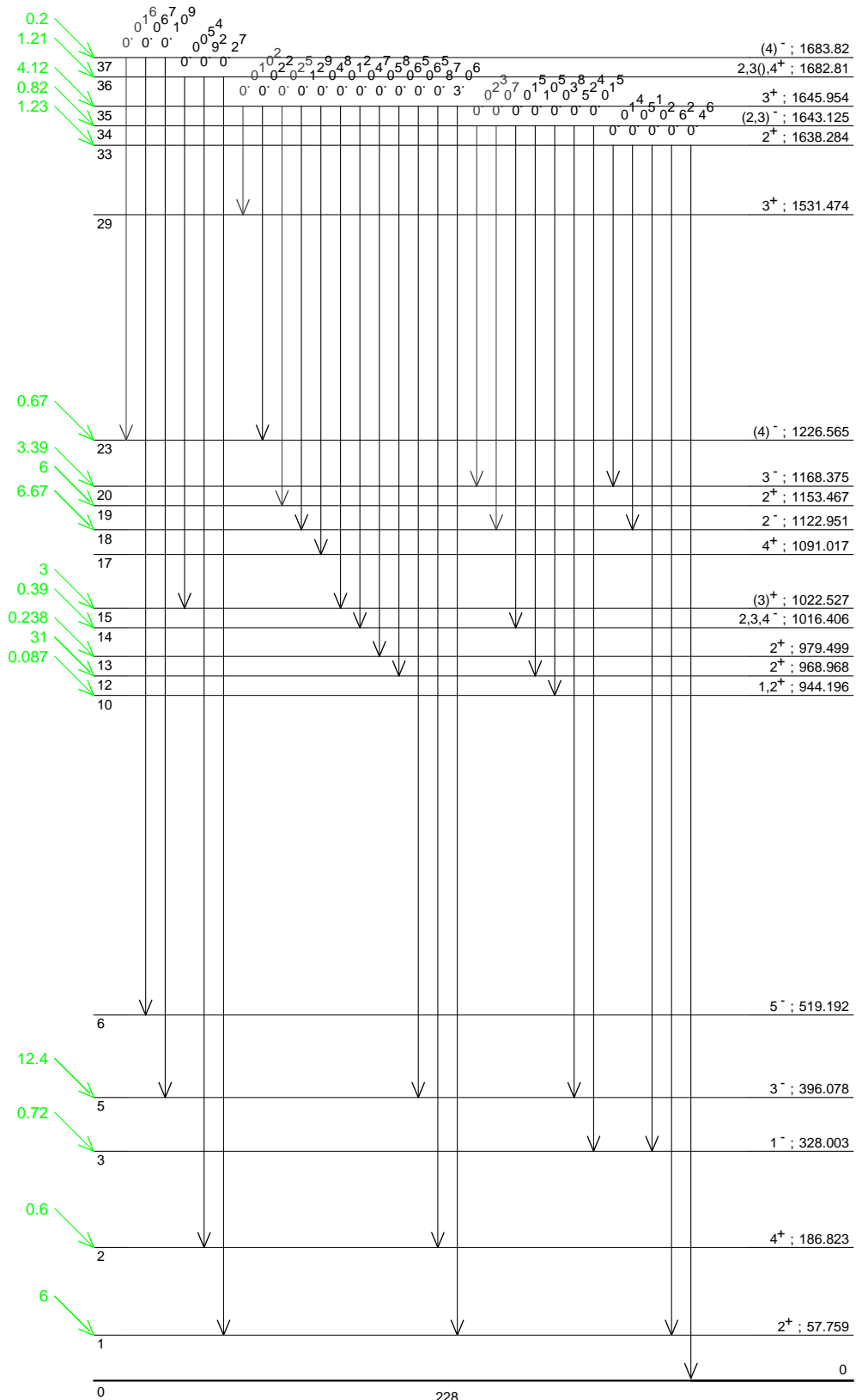


γ Emission intensities per 100 disintegrations

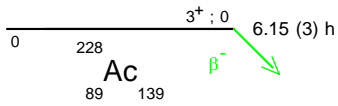




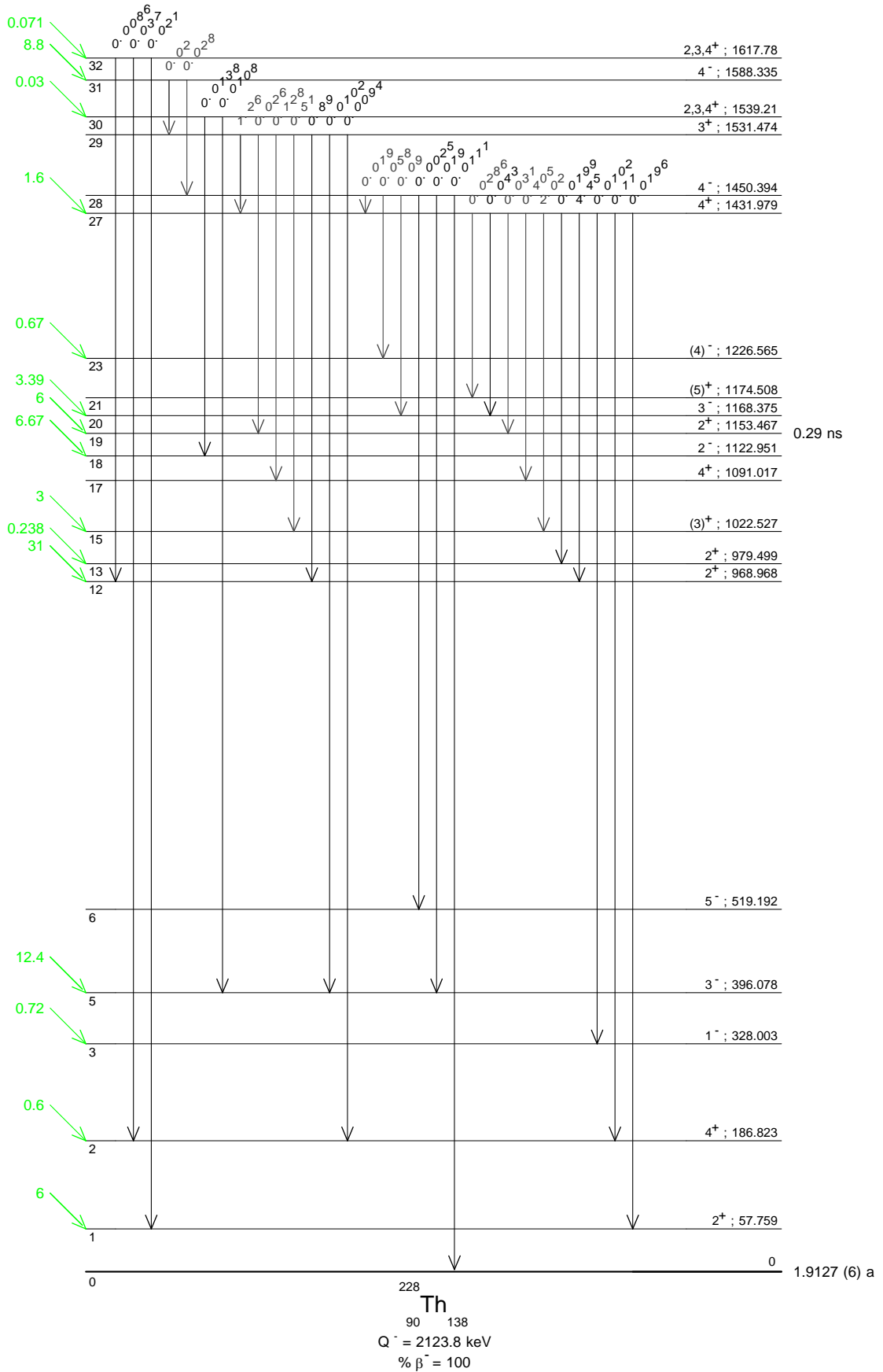
γ Emission intensities per 100 disintegrations

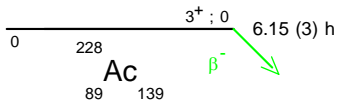


$^{228}_{90}\text{Th}$
 $Q^- = 2123.8 \text{ keV}$
 $\% \beta^- = 100$

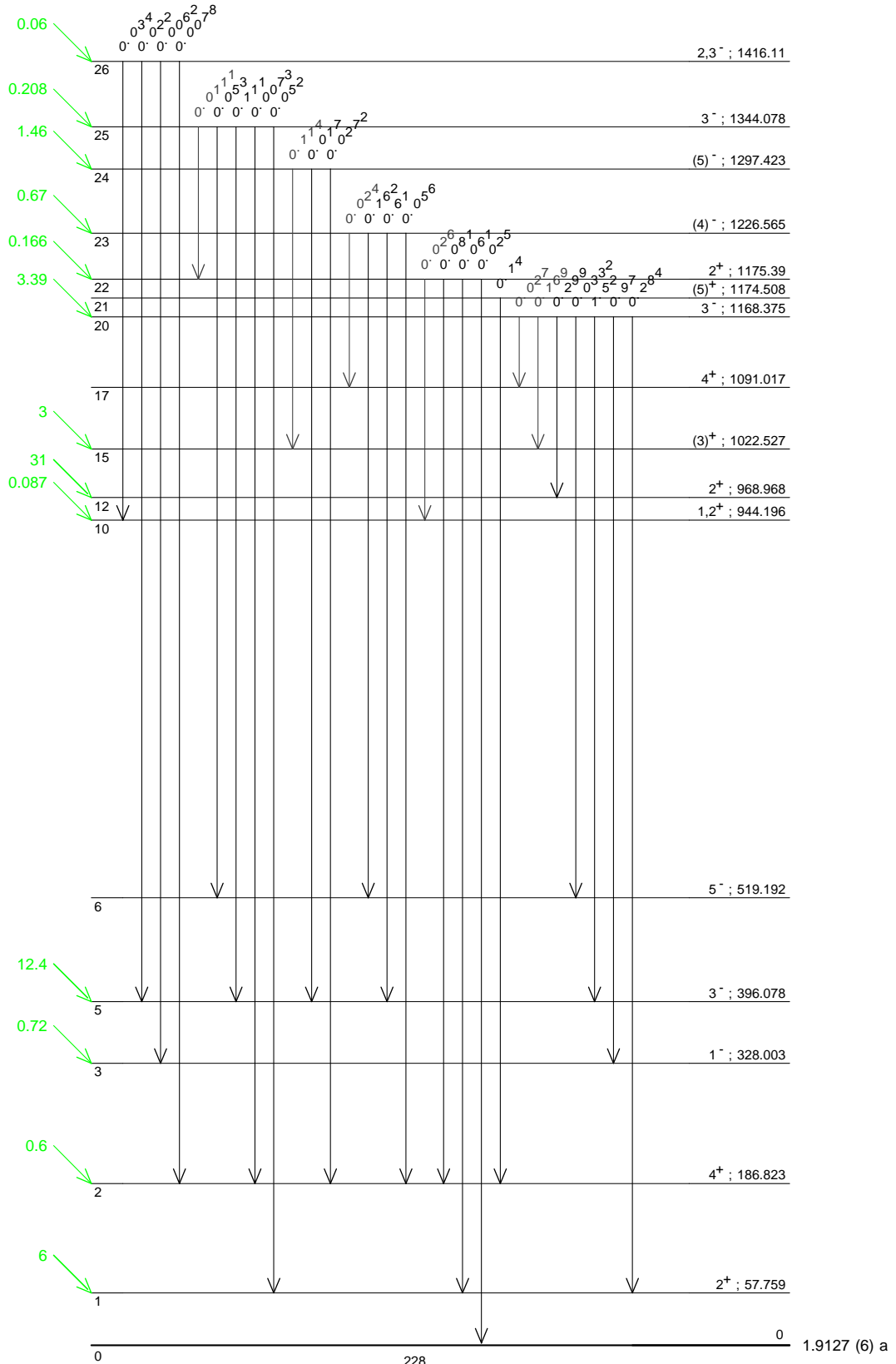


γ Emission intensities per 100 disintegrations

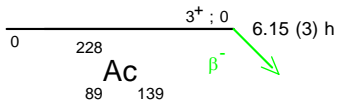




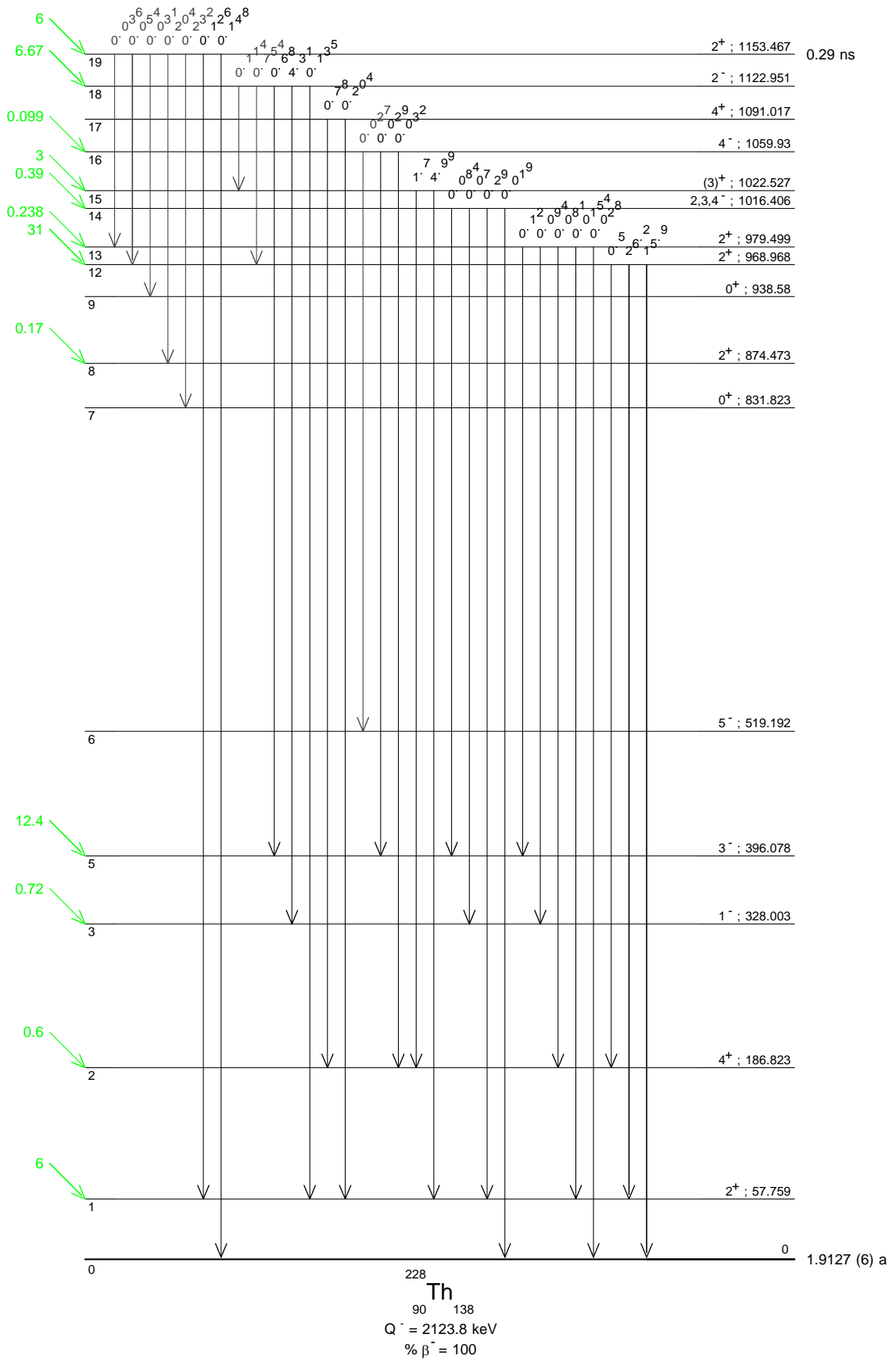
γ Emission intensities per 100 disintegrations

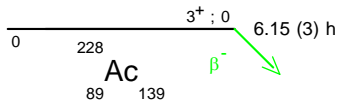


²²⁸Th₉₀¹³⁸
 $Q^- = 2123.8$ keV
 $\% \beta^- = 100$

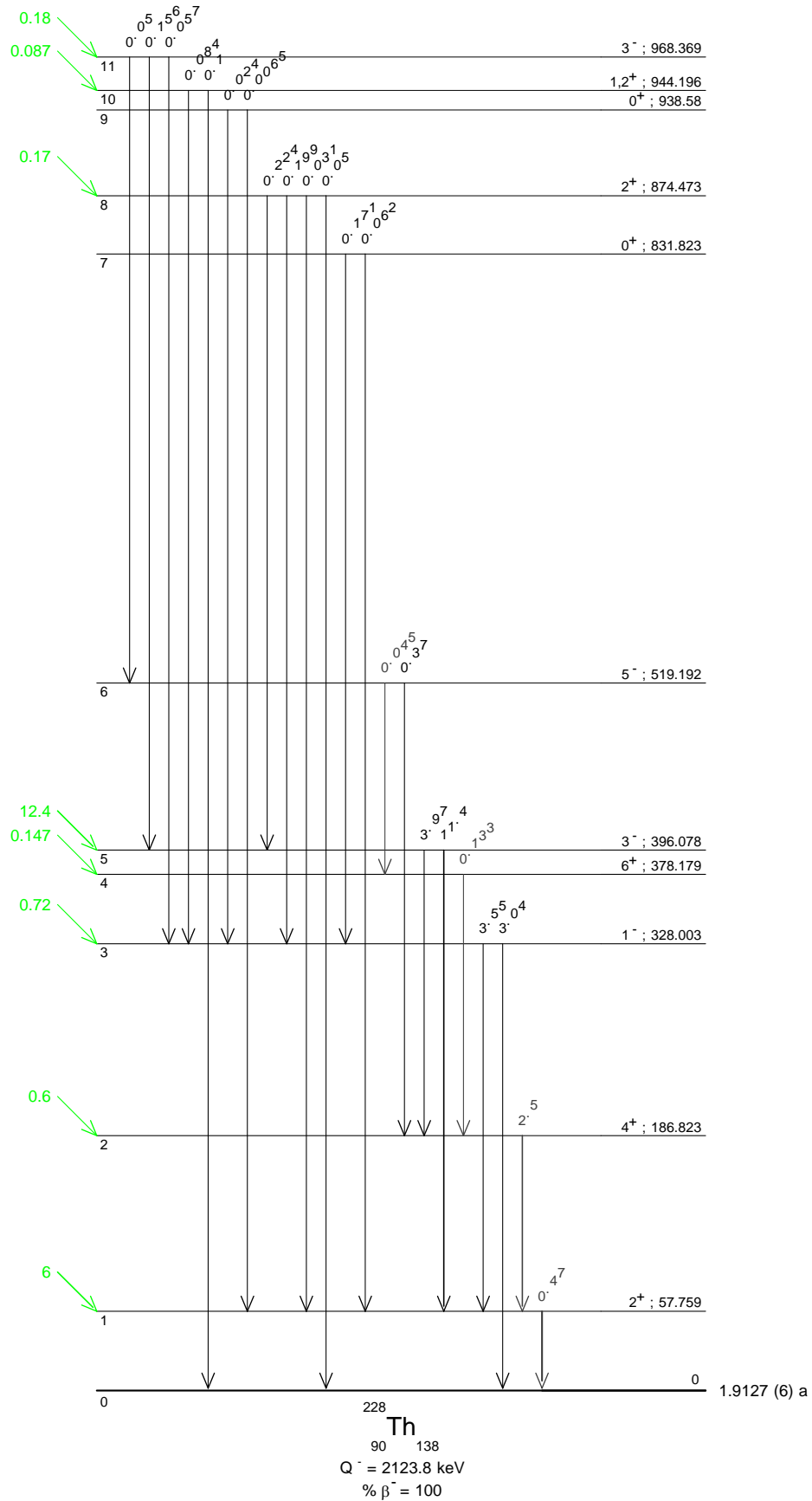


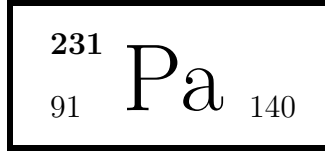
γ Emission intensities per 100 disintegrations





γ Emission intensities per 100 disintegrations





1 Decay Scheme

Pa-231 is a member of the natural U-235 decay chain. Pa-231 disintegrates by alpha emission to various excited levels and the ground state of Ac-227.

Le protactinium 231 se désintègre par émissions alpha vers des niveaux excités et le niveau fondamental de l'actinium 227.

2 Nuclear Data

$T_{1/2}(^{231}\text{Pa})$:	32670	(260)	a
$T_{1/2}(^{227}\text{Ac})$:	21,772	(3)	a
$Q^\alpha(^{231}\text{Pa})$:	5149,9	(8)	keV

2.1 α Transitions

	Energy keV	Probability $\times 100$	F
$\alpha_{0,25}$	4493,5 (9)	0,0021 (5)	43
$\alpha_{0,24}$	4587,1 (8)	0,0036 (3)	126
$\alpha_{0,23}$	4612,9 (8)	0,00076 (20)	930
$\alpha_{0,22}$	4648,6 (9)	0,008 (4)	160
$\alpha_{0,21}$	4680,6 (8)	0,015 (7)	146
$\alpha_{0,20}$	4711,9 (8)	0,078 (21)	47
$\alpha_{0,19}$	4714,7 (8)	0,0504 (11)	75,8
$\alpha_{0,18}$	4724,3 (8)	0,080 (6)	56
$\alpha_{0,17}$	4762,6 (8)	1,8 (3)	4,6
$\alpha_{0,16}$	4795,4 (8)	1,20 (22)	11,7
$\alpha_{0,15}$	4819,8 (8)	8,4 (4)	2,46
$\alpha_{0,14}$	4845,1 (8)	0,0032 (9)	9600
$\alpha_{0,12}$	4878,6 (8)	0,040 (15)	1300
$\alpha_{0,11}$	4939,1 (8)	1,40 (15)	94
$\alpha_{0,8}$	4989,9 (22)	0,002 (1)	141000
$\alpha_{0,7}$	5023,0 (8)	2,9 (3)	160

	Energy keV	Probability × 100	F
$\alpha_{0,6}$	5039,9 (8)	22,5 (5)	26,5
$\alpha_{0,5}$	5065,3 (8)	0,4 (1)	2160
$\alpha_{0,4}$	5075,7 (8)	1,6 (2)	629
$\alpha_{0,3}$	5103,5 (8)	25,3 (5)	59,5
$\alpha_{0,2}$	5119,9 (8)	20 (2)	95
$\alpha_{0,1}$	5122,5 (8)	2,8 (3)	707
$\alpha_{0,0}$	5149,9 (8)	11,7 (5)	250

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{3,2}(Ac)$	16,370 (14)	2,12 (9)	E1		5,06 (7)	2,68 (4)	8,58 (12)
$\gamma_{3,1}(Ac)$	18,980 (14)	42 (4)	M1		2,35 (4)	82,7 (12)	113,2 (16)
$\gamma_{11,9}(Ac)$	23,46 (6)	1,16 (15)	M1		182 (3)	44,1 (7)	241 (4)
$\gamma_{16,15}(Ac)$	24,46 (4)	1,05 (21)	M1		161,3 (24)	39,0 (6)	214 (4)
$\gamma_{6,5}(Ac)$	25,390 (22)	18,3 (14)	M1		144,6 (21)	34,9 (5)	191 (3)
$\gamma_{1,0}(Ac)$	27,37 (1)	59 (7)	E1		3,3 (4)	0,87 (13)	4,5 (6)
$\gamma_{2,0}(Ac)$	29,98 (1)	26 (3)	M1+E2		202 (21)	52 (6)	270 (30)
$\gamma_{6,4}(Ac)$	35,800 (22)	0,045 (3)	E1		1,313 (19)	0,327 (5)	1,746 (25)
$\gamma_{5,3}(Ac)$	38,200 (14)	13 (3)	M1+E2		66 (14)	17 (4)	89 (19)
$\gamma_{4,2}(Ac)$	44,160 (14)	2,11 (16)	M1		28,3 (4)	6,79 (10)	37,4 (6)
$\gamma_{3,0}(Ac)$	46,35 (1)	0,357 (19)	E1		0,663 (10)	0,1634 (23)	0,879 (13)
$\gamma_{20,17}(Ac)$	50,73 (5)	0,057 (21)	M1		18,8 (3)	4,52 (7)	24,9 (4)
$\gamma_{7,4}(Ac)$	52,720 (22)	1,77 (10)	M1		16,81 (24)	4,03 (6)	22,2 (4)
$\gamma_{5,2}(Ac)$	54,570 (14)	0,110 (6)	E1		0,430 (6)	0,1053 (15)	0,569 (8)
$\gamma_{15,13}(Ac)$	56,90 (3)	0,18 (4)	M1+E2		28 (5)	7,1 (12)	37 (6)
$\gamma_{5,1}(Ac)$	57,180 (14)	4,6 (5)	E2		108,6 (16)	29,6 (5)	148,1 (21)
$\gamma_{17,15}(Ac)$	57,190 (22)	0,7 (3)	E2		108,5 (16)	29,6 (5)	148,0 (21)
$\gamma_{9,7}(Ac)$	60,46 (4)	0,0076 (10)	E1		0,327 (5)	0,0800 (12)	0,433 (7)
$\gamma_{6,3}(Ac)$	63,590 (22)	3,99 (16)	E2		65,1 (10)	17,8 (3)	88,8 (13)
$\gamma_{(-1,1)}(Ac)$	70,49 (5)	0,0051 (8)					
$\gamma_{10,7}(Ac)$	71,85 (5)	0,019 (7)	M1		6,79 (10)	1,630 (23)	8,98 (13)
$\gamma_{12,10}(Ac)$	72,58 (7)	0,029 (7)	M1		6,59 (10)	1,582 (23)	8,71 (13)
$\gamma_{4,0}(Ac)$	74,14 (1)	0,97 (4)	E2		31,2 (5)	8,53 (12)	42,6 (6)
$\gamma_{9,6}(Ac)$	77,38 (4)	0,50 (4)	M1		5,47 (8)	1,313 (19)	7,23 (11)
$\gamma_{7,2}(Ac)$	96,880 (22)	1,10 (4)	E2		8,81 (13)	2,41 (4)	12,02 (17)
$\gamma_{11,6}(Ac)$	100,84 (5)	0,248 (10)	E2		7,30 (11)	2,00 (3)	9,97 (15)
$\gamma_{9,5}(Ac)$	102,77 (3)	0,20 (4)	E2		6,69 (10)	1,83 (3)	9,12 (13)
$\gamma_{10,4}(Ac)$	124,57 (4)	0,0217 (20)	E2	0,285 (4)	2,75 (4)	0,752 (11)	4,04 (6)
$\gamma_{12,7}(Ac)$	144,43 (6)	0,037 (3)	E2	0,263 (4)	1,407 (20)	0,384 (6)	2,18 (3)
$\gamma_{13,4}(Ac)$	199,00 (3)	0,0030 (12)					
$\gamma_{14,4}(Ac)$	230,59 (5)	0,0017 (8)					
$\gamma_{(-1,2)}(Ac)$	242,18 (8)	0,0099 (10)					
$\gamma_{13,2}(Ac)$	243,16 (3)	0,065 (11)	M1+E2	0,56 (16)	0,176 (10)	0,0445 (16)	0,80 (17)
$\gamma_{15,5}(Ac)$	245,490 (14)	0,042 (3)	M2	3,70 (6)	1,143 (16)	0,293 (5)	5,24 (8)
$\gamma_{13,1}(Ac)$	245,77 (3)	0,013 (4)	E1	0,0455 (7)	0,00867 (13)	0,00208 (3)	0,0570 (8)
$\gamma_{15,4}(Ac)$	255,900 (14)	0,134 (3)	E2	0,0992 (14)	0,1216 (17)	0,0327 (5)	0,264 (4)
$\gamma_{14,3}(Ac)$	258,38 (5)	0,0015 (4)					

	Energy keV	P _{γ+ce} × 100	Multipolarity	α _K	α _L	α _M	α _T
γ _{17,7} (Ac)	260,37 (3)	0,282 (21)	M1+E2	0,37 (10)	0,133 (7)	0,0340 (13)	0,55 (11)
γ _{13,0} (Ac)	273,14 (3)	0,101 (7)	M1+E2	0,57 (10)	0,131 (8)	0,0323 (15)	0,74 (11)
γ _{17,6} (Ac)	277,29 (3)	0,10 (6)	E1+M2	0,4 (7)	0,11 (19)	0,03 (5)	0,5 (9)
γ _{15,3} (Ac)	283,690 (14)	1,72 (3)	E1	0,0329 (5)	0,00614 (9)	0,001468 (21)	0,0410 (6)
γ _(-1,3) (Ac)	286,58 (10)	0,0104 (5)					
γ _{15,2} (Ac)	300,060 (14)	4,25 (10)	M1+E2	0,613 (15)	0,1146 (20)	0,0275 (5)	0,764 (17)
γ _{15,1} (Ac)	302,670 (14)	2,4 (3)	E1	0,0285 (4)	0,00527 (8)	0,001260 (18)	0,0355 (5)
γ _{17,5} (Ac)	302,680 (22)	0,22 (10)	E1	0,0285 (4)	0,00527 (8)	0,001260 (18)	0,0355 (5)
γ _(-1,4) (Ac)	310,0 (1)	0,00092 (20)					
γ _{17,4} (Ac)	313,090 (22)	0,129 (9)	M1+E2	0,22 (8)	0,070 (8)	0,0177 (16)	0,31 (9)
γ _{16,1} (Ac)	327,13 (4)	0,0372 (11)	E1	0,0240 (4)	0,00440 (7)	0,001050 (15)	0,0298 (5)
γ _{15,0} (Ac)	330,04 (1)	2,09 (5)	M1+E2	0,430 (16)	0,0836 (20)	0,0202 (5)	0,541 (19)
γ _{17,3} (Ac)	340,880 (22)	0,196 (7)	E1+M2	0,081 (22)	0,020 (6)	0,0050 (15)	0,11 (3)
γ _{18,4} (Ac)	351,45 (3)	0,0029 (12)	E1	0,0206 (3)	0,00373 (6)	0,000891 (13)	0,0255 (4)
γ _{16,0} (Ac)	354,50 (4)	0,1094 (23)	M1+E2	0,0855 (12)	0,0386 (6)	0,01003 (14)	0,1375 (20)
γ _{17,2} (Ac)	357,250 (22)	0,240 (18)	M1+E2	0,34 (9)	0,066 (10)	0,0159 (21)	0,43 (10)
γ _{17,1} (Ac)	359,860 (22)	0,0085 (3)					
γ _{20,4} (Ac)	363,82 (4)	0,0080 (3)					
γ _(-1,5) (Ac)	374,95 (10)	0,0045 (3)					
γ _{18,3} (Ac)	379,24 (3)	0,066 (6)	M1+E2	0,25 (10)	0,052 (11)	0,0125 (24)	0,32 (11)
γ _{21,5} (Ac)	384,69 (6)	0,00365 (22)					
γ _{17,0} (Ac)	387,23 (2)	0,00032 (11)	E2	0,0430 (6)	0,0254 (4)	0,00667 (10)	0,0773 (11)
γ _{20,3} (Ac)	391,61 (4)	0,00687 (22)	E1	0,01636 (23)	0,00293 (5)	0,000697 (10)	0,0202 (3)
γ _{18,2} (Ac)	395,61 (3)	0,00230 (22)	E1	0,01601 (23)	0,00286 (4)	0,000682 (10)	0,0198 (3)
γ _{18,1} (Ac)	398,22 (3)	0,0095 (3)					
γ _{19,1} (Ac)	407,820 (22)	0,0475 (11)	M1	0,269 (4)	0,0496 (7)	0,01187 (17)	0,334 (5)
γ _{20,1} (Ac)	410,59 (4)	0,00183 (22)	E1	0,01482 (21)	0,00264 (4)	0,000628 (9)	0,0183 (3)
γ _{22,4} (Ac)	427,14 (7)	0,0007 (4)					
γ _{19,0} (Ac)	435,19 (2)	0,00294 (17)					
γ _{20,0} (Ac)	437,96 (4)	0,0045 (3)					
γ _(-1,6) (Ac)	438,72 (10)	0,0013 (4)					
γ _{24,4} (Ac)	488,66 (10)	0,00165 (17)					
γ _{23,3} (Ac)	490,65 (10)	0,0004 (1)					
γ _{22,0} (Ac)	501,28 (7)	0,00076 (18)					
γ _{23,1} (Ac)	509,63 (10)	0,00036 (17)					
γ _{24,3} (Ac)	516,45 (10)	0,00137 (15)					
γ _{24,1} (Ac)	535,43 (10)	0,00061 (12)					
γ _{25,6} (Ac)	546,5 (3)	0,00083 (13)					
γ _{25,5} (Ac)	571,9 (3)	0,00048 (20)					
γ _{25,4} (Ac)	582,3 (3)	0,00031 (17)					
γ _{25,3} (Ac)	610,1 (3)	0,0005 (4)					

3 Atomic Data

3.1 Ac

ω_K	:	0,969	(4)
$\bar{\omega}_L$:	0,464	(18)
n_{KL}	:	0,799	(5)

3.1.1 X Radiations

	Energy keV	Relative probability
X_K		
$K\alpha_2$	87,768	61,52
$K\alpha_1$	90,885	100
$K\beta_3$	102,101	}
$K\beta_1$	102,841	}
$K\beta_5''$	103,462	}
		35,26
$K\beta_2$	105,679	}
$K\beta_4$	106,098	}
$KO_{2,3}$	106,563	}
		11,74
X_L		
$L\ell$	10,8701	
$L\alpha$	12,5002 – 12,6505	
$L\eta$	14,0807	
$L\beta$	14,6024 – 15,9311	
$L\gamma$	17,813 – 18,9228	

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	66,769 – 74,715	100
KLX	81,775 – 90,882	58,2
KXY	96,76 – 106,75	8,47
Auger L	5,87 – 19,69	

4 α Emissions

	Energy keV	Probability $\times 100$
$\alpha_{0,25}$	4415,6 (9)	0,0021 (5)
$\alpha_{0,24}$	4507,6 (8)	0,0036 (3)
$\alpha_{0,23}$	4533,0 (8)	0,00076 (20)
$\alpha_{0,22}$	4568,1 (9)	0,008 (4)
$\alpha_{0,21}$	4599,6 (8)	0,015 (7)
$\alpha_{0,20}$	4630,3 (8)	0,078 (21)
$\alpha_{0,19}$	4633,0 (8)	0,0504 (11)
$\alpha_{0,18}$	4642,5 (8)	0,080 (6)
$\alpha_{0,17}$	4680,1 (8)	1,8 (3)
$\alpha_{0,16}$	4712,3 (8)	1,20 (22)
$\alpha_{0,15}$	4736,3 (8)	8,4 (4)
$\alpha_{0,14}$	4761,2 (8)	0,0032 (9)
$\alpha_{0,12}$	4794,1 (8)	0,040 (15)
$\alpha_{0,11}$	4853,5 (8)	1,40 (15)
$\alpha_{0,8}$	4903,4 (22)	0,002 (1)
$\alpha_{0,7}$	4936,0 (8)	2,9 (3)
$\alpha_{0,6}$	4952,6 (8)	22,5 (5)
$\alpha_{0,5}$	4977,6 (8)	0,4 (1)
$\alpha_{0,4}$	4987,8 (8)	1,6 (2)
$\alpha_{0,3}$	5015,1 (8)	25,3 (5)
$\alpha_{0,2}$	5031,2 (8)	20 (2)
$\alpha_{0,1}$	5033,8 (8)	2,8 (3)
$\alpha_{0,0}$	5060,7 (8)	11,7 (5)

5 Electron Emissions

		Energy keV	Electrons per 100 disint.
eAL	(Ac)	5,87 - 19,69	52,6 (15)
eAK	(Ac)		0,078 (11)
	KLL	66,769 - 74,715	}
	KLX	81,775 - 90,882	}
	KXY	96,76 - 106,75	}

6 Photon Emissions

6.1 X-Ray Emissions

		Energy keV	Photons per 100 disint.	
XL	(Ac)	10,8701 — 18,9228	44,3 (13)	
XK α_2	(Ac)	87,768	0,715 (23)	} K α
XK α_1	(Ac)	90,885	1,16 (4)	}
XK β_3	(Ac)	102,101	}	
XK β_1	(Ac)	102,841	}	K' β_1
XK β_5''	(Ac)	103,462	}	
XK β_2	(Ac)	105,679	}	
XK β_4	(Ac)	106,098	}	K' β_2
XKO $_{2,3}$	(Ac)	106,563	}	

6.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{3,2}(\text{Ac})$	16,370 (14)	0,221 (9)
$\gamma_{3,1}(\text{Ac})$	18,980 (14)	0,37 (3)
$\gamma_{11,9}(\text{Ac})$	23,46 (6)	0,0048 (6)
$\gamma_{16,15}(\text{Ac})$	24,46 (4)	0,0049 (10)
$\gamma_{6,5}(\text{Ac})$	25,390 (22)	0,095 (7)
$\gamma_{1,0}(\text{Ac})$	27,37 (1)	10,8 (4)
$\gamma_{2,0}(\text{Ac})$	29,98 (1)	0,097 (4)
$\gamma_{6,4}(\text{Ac})$	35,800 (22)	0,0163 (10)
$\gamma_{5,3}(\text{Ac})$	38,200 (14)	0,144 (6)
$\gamma_{4,2}(\text{Ac})$	44,160 (14)	0,055 (4)
$\gamma_{3,0}(\text{Ac})$	46,35 (1)	0,19 (1)
$\gamma_{20,17}(\text{Ac})$	50,73 (5)	0,0022 (8)
$\gamma_{7,4}(\text{Ac})$	52,720 (22)	0,076 (4)
$\gamma_{5,2}(\text{Ac})$	54,570 (14)	0,070 (4)
$\gamma_{15,13}(\text{Ac})$	56,90 (3)	0,0047 (7)
$\gamma_{5,1}(\text{Ac})$	57,180 (14)	0,031 (3)
$\gamma_{17,15}(\text{Ac})$	57,190 (22)	0,0046 (21)
$\gamma_{9,7}(\text{Ac})$	60,46 (4)	0,0053 (7)
$\gamma_{6,3}(\text{Ac})$	63,590 (22)	0,0446 (17)
$\gamma_{(-1,1)}(\text{Ac})$	70,49 (5)	0,0051 (8)
$\gamma_{10,7}(\text{Ac})$	71,85 (5)	0,0019 (7)

	Energy keV	Photons per 100 disint.
$\gamma_{12,10}(\text{Ac})$	72,58 (7)	0,0030 (7)
$\gamma_{4,0}(\text{Ac})$	74,14 (1)	0,0223 (9)
$\gamma_{9,6}(\text{Ac})$	77,38 (4)	0,061 (4)
$\gamma_{7,2}(\text{Ac})$	96,880 (22)	0,084 (3)
$\gamma_{11,6}(\text{Ac})$	100,84 (5)	0,0226 (9)
$\gamma_{9,5}(\text{Ac})$	102,77 (3)	0,019 (4)
$\gamma_{10,4}(\text{Ac})$	124,57 (4)	0,0043 (4)
$\gamma_{12,7}(\text{Ac})$	144,43 (6)	0,0115 (9)
$\gamma_{13,4}(\text{Ac})$	199,00 (3)	0,0030 (12)
$\gamma_{14,4}(\text{Ac})$	230,59 (5)	0,0017 (8)
$\gamma_{(-1,2)}(\text{Ac})$	242,18 (8)	0,0099 (10)
$\gamma_{13,2}(\text{Ac})$	243,16 (3)	0,036 (5)
$\gamma_{15,5}(\text{Ac})$	245,490 (14)	0,0067 (5)
$\gamma_{13,1}(\text{Ac})$	245,77 (3)	0,012 (4)
$\gamma_{15,4}(\text{Ac})$	255,900 (14)	0,1059 (22)
$\gamma_{14,3}(\text{Ac})$	258,38 (5)	0,0015 (4)
$\gamma_{17,7}(\text{Ac})$	260,37 (3)	0,182 (4)
$\gamma_{13,0}(\text{Ac})$	273,14 (3)	0,0579 (12)
$\gamma_{17,6}(\text{Ac})$	277,29 (3)	0,0680 (15)
$\gamma_{15,3}(\text{Ac})$	283,690 (14)	1,65 (3)
$\gamma_{(-1,3)}(\text{Ac})$	286,58 (10)	0,0104 (5)
$\gamma_{15,2}(\text{Ac})$	300,060 (14)	2,41 (5)
$\gamma_{15,1}(\text{Ac})$	302,670 (14)	2,3 (3)
$\gamma_{17,5}(\text{Ac})$	302,680 (22)	0,21 (10)
$\gamma_{(-1,4)}(\text{Ac})$	310,0 (1)	0,00092 (20)
$\gamma_{17,4}(\text{Ac})$	313,090 (22)	0,0987 (20)
$\gamma_{16,1}(\text{Ac})$	327,13 (4)	0,0361 (11)
$\gamma_{15,0}(\text{Ac})$	330,04 (1)	1,36 (3)
$\gamma_{17,3}(\text{Ac})$	340,880 (22)	0,177 (4)
$\gamma_{18,4}(\text{Ac})$	351,45 (3)	0,0028 (12)
$\gamma_{16,0}(\text{Ac})$	354,50 (4)	0,0962 (20)
$\gamma_{17,2}(\text{Ac})$	357,250 (22)	0,168 (4)
$\gamma_{17,1}(\text{Ac})$	359,860 (22)	0,0085 (3)
$\gamma_{20,4}(\text{Ac})$	363,82 (4)	0,0080 (3)
$\gamma_{(-1,5)}(\text{Ac})$	374,95 (10)	0,0045 (3)
$\gamma_{18,3}(\text{Ac})$	379,24 (3)	0,0498 (11)
$\gamma_{21,5}(\text{Ac})$	384,69 (6)	0,00365 (22)
$\gamma_{17,0}(\text{Ac})$	387,23 (2)	0,0003 (1)
$\gamma_{20,3}(\text{Ac})$	391,61 (4)	0,00673 (22)
$\gamma_{18,2}(\text{Ac})$	395,61 (3)	0,00226 (22)
$\gamma_{18,1}(\text{Ac})$	398,22 (3)	0,0095 (3)
$\gamma_{19,1}(\text{Ac})$	407,820 (22)	0,0356 (8)
$\gamma_{20,1}(\text{Ac})$	410,59 (4)	0,00180 (22)
$\gamma_{22,4}(\text{Ac})$	427,14 (7)	0,0007 (4)
$\gamma_{19,0}(\text{Ac})$	435,19 (2)	0,00294 (17)
$\gamma_{20,0}(\text{Ac})$	437,96 (4)	0,0045 (3)
$\gamma_{(-1,6)}(\text{Ac})$	438,72 (10)	0,0013 (4)

	Energy keV	Photons per 100 disint.
$\gamma_{24,4}(\text{Ac})$	488,66 (10)	0,00165 (17)
$\gamma_{23,3}(\text{Ac})$	490,65 (10)	0,0004 (1)
$\gamma_{22,0}(\text{Ac})$	501,28 (7)	0,00076 (18)
$\gamma_{23,1}(\text{Ac})$	509,63 (10)	0,00036 (17)
$\gamma_{24,3}(\text{Ac})$	516,45 (10)	0,00137 (15)
$\gamma_{24,1}(\text{Ac})$	535,43 (10)	0,00061 (12)
$\gamma_{25,6}(\text{Ac})$	546,5 (3)	0,00083 (13)
$\gamma_{25,5}(\text{Ac})$	571,9 (3)	0,00048 (20)
$\gamma_{25,4}(\text{Ac})$	582,3 (3)	0,00031 (17)
$\gamma_{25,3}(\text{Ac})$	610,1 (3)	0,0005 (4)

7 Main Production Modes

Th – $^{232}(\text{n}, 2\text{n})\text{Th} - ^{231}$

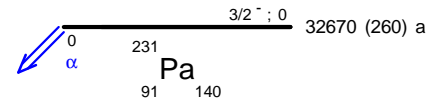
Th – $^{231}(\beta^-)\text{Pa} - ^{231}$

U – 235 decay chain

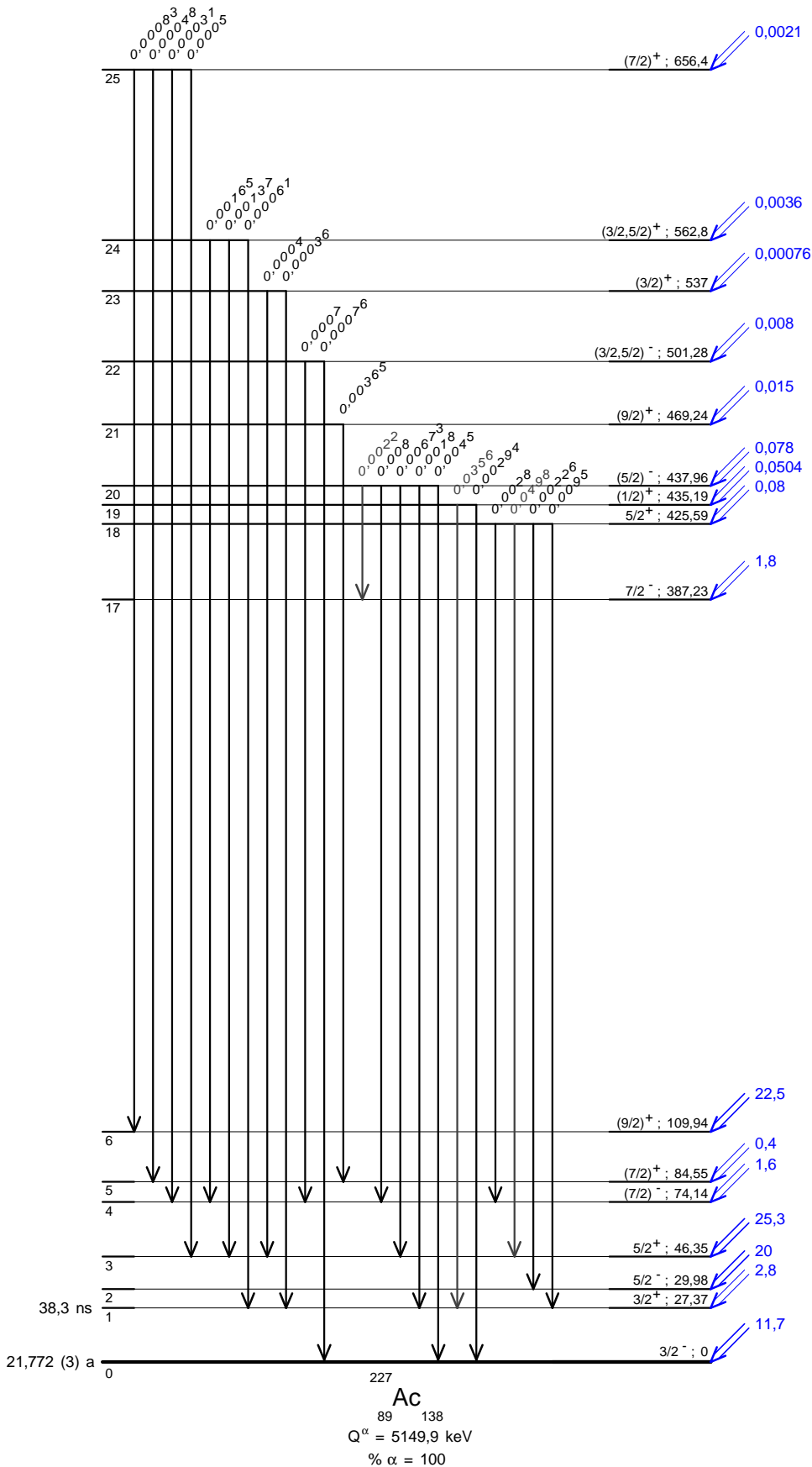
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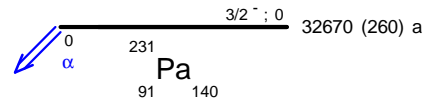
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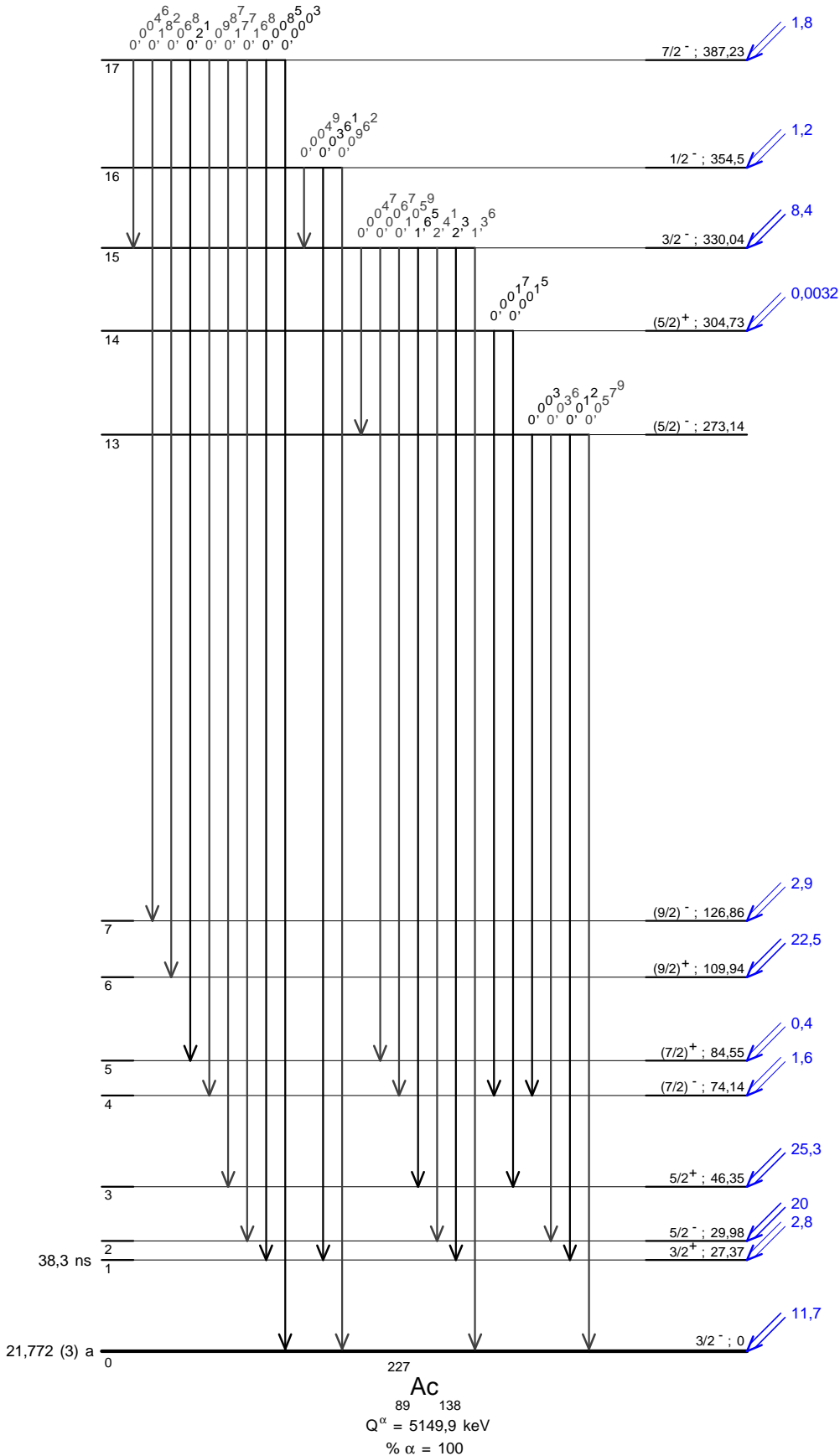


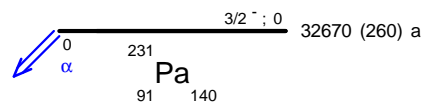
γ Emission intensities per 100 disintegrations



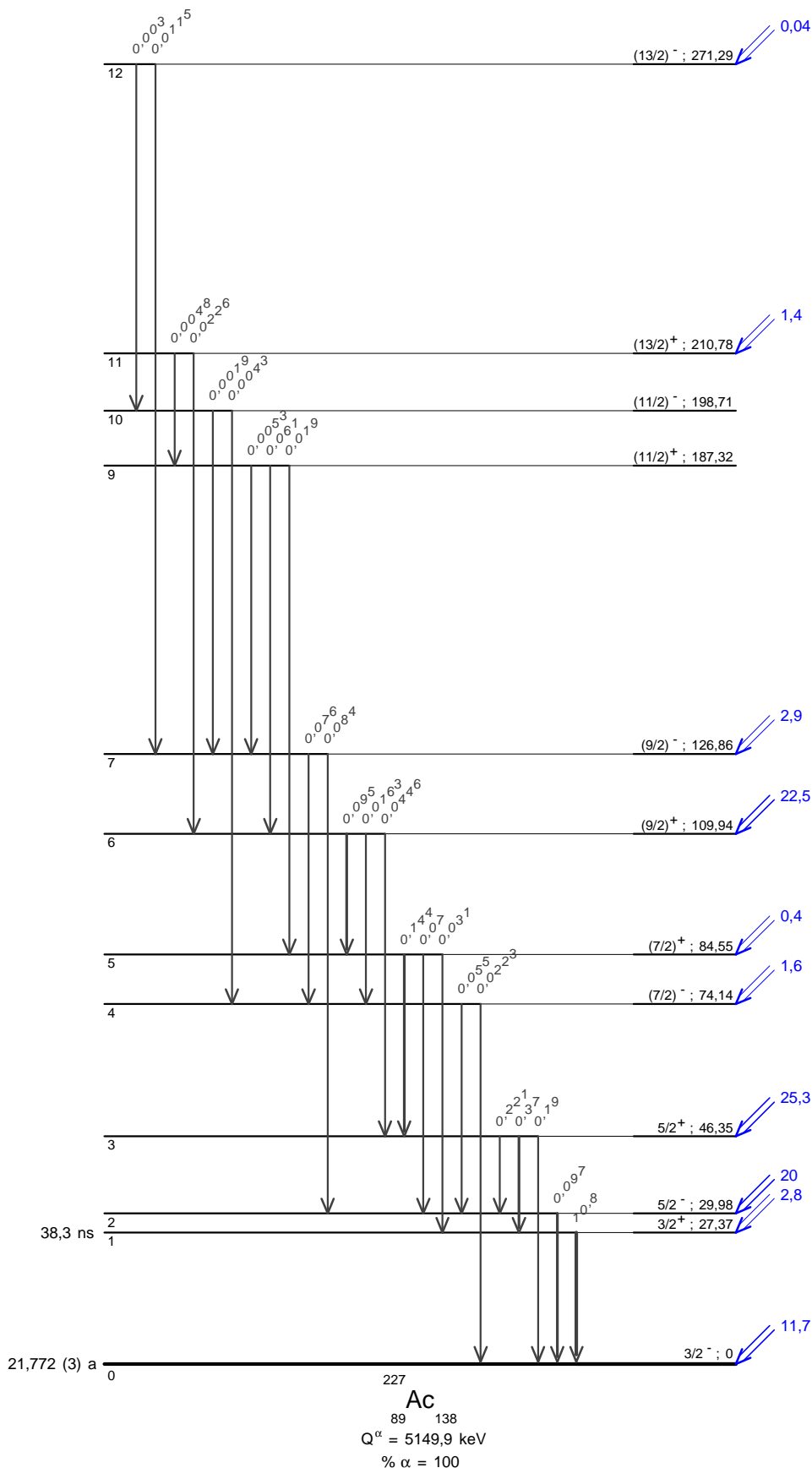


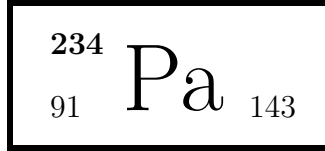
γ Emission intensities per 100 disintegrations





γ Emission intensities per 100 disintegrations





1 Decay Scheme

Pa-234 disintegrates 100% by beta minus emissions to levels in U-234.

Le protactinium 234 se désintègre par émissions bêta moins vers des niveaux excités de l'uranium 234.

2 Nuclear Data

$$T_{1/2}(^{234}\text{Pa}) : 6,70 \quad (5) \quad \text{h}$$

$$Q^-(^{234}\text{Pa}) : 2195 \quad (4) \quad \text{keV}$$

2.1 β^- Transitions

	Energy keV	Probability $\times 100$	Nature	lg ft
$\beta_{0,77}^-$	51 (4)	0,42 (5)		4,98
$\beta_{0,76}^-$	79 (4)	0,21 (3)		5,87
$\beta_{0,75}^-$	94 (4)	0,064 (11)		6,6
$\beta_{0,74}^-$	126 (4)	0,40 (7)		6,21
$\beta_{0,73}^-$	129 (4)	0,140 (24)		6,69
$\beta_{0,72}^-$	158 (4)	0,055 (8)		7,37
$\beta_{0,71}^-$	161 (4)	0,90 (15)		6,19
$\beta_{0,70}^-$	175 (4)	0,112 (16)		7,2
$\beta_{0,69}^-$	195 (4)	0,122 (16)		7,31
$\beta_{0,68}^-$	214 (4)	0,59 (8)		6,75
$\beta_{0,67}^-$	226 (4)	0,044 (12)		7,95
$\beta_{0,66}^-$	236 (4)	0,44 (19)		7,01
$\beta_{0,65}^-$	254 (4)	0,35 (5)		7,22
$\beta_{0,64}^-$	267 (4)	0,22 (4)		7,49
$\beta_{0,63}^-$	279 (4)	0,21 (3)		7,56
$\beta_{0,62}^-$	313 (4)	0,25 (3)		7,65
$\beta_{0,61}^-$	332 (4)	0,029 (7)		8,66
$\beta_{0,60}^-$	351 (4)	0,17 (3)		7,97

	Energy keV	Probability $\times 100$	Nature	lg <i>ft</i>
$\beta_{0,59}^-$	383 (4)	1,43 (15)		7,17
$\beta_{0,58}^-$	402 (4)	0,41 (8)		7,78
$\beta_{0,57}^-$	411 (4)	0,061 (11)		8,64
$\beta_{0,56}^-$	412 (4)	8 (3)		6,53
$\beta_{0,55}^-$	424 (4)	0,129 (17)		8,36
$\beta_{0,54}^-$	433 (4)	2,8 (4)		7,05
$\beta_{0,53}^-$	457 (4)	0,78 (19)		7,68
$\beta_{0,52}^-$	458 (4)	1,16 (14)		7,51
$\beta_{0,50}^-$	472 (4)	8,4 (9)	1st Forbidden	6,7
$\beta_{0,51}^-$	472 (4)	36 (5)	Allowed	6,06
$\beta_{0,49}^-$	502 (4)	6,9 (8)	1st Forbidden	6,87
$\beta_{0,48}^-$	542 (4)	0,95 (13)		7,84
$\beta_{0,47}^-$	545 (4)	0,18 (4)		8,64
$\beta_{0,46}^-$	576 (4)	0,035 (20)		9,36
$\beta_{0,45}^-$	606 (4)	< 0,7		> 8,1
$\beta_{0,44}^-$	613 (4)	0,05 (3)		9,3
$\beta_{0,43}^-$	642 (4)	19,6 (18)	Allowed	6,77
$\beta_{0,42}^-$	647 (4)	0,078 (20)		9,18
$\beta_{0,41}^-$	651 (4)	0,10 (9)		9,1
$\beta_{0,40}^-$	658 (4)	< 0,9		> 8,1
$\beta_{0,39}^-$	662 (4)	0,21 (4)		8,79
$\beta_{0,38}^-$	693 (4)	0,25 (4)		8,78
$\beta_{0,37}^-$	699 (4)	< 2,7		> 7,8
$\beta_{0,36}^-$	709 (4)	0,12 (3)		9,14
$\beta_{0,34}^-$	747 (4)	0,11 (3)		9,25
$\beta_{0,31}^-$	883 (4)	0,109 (18)		9,5
$\beta_{0,26}^-$	980 (4)	0,30 (12)		9,22
$\beta_{0,25}^-$	1000 (4)	< 1,5		> 8,5
$\beta_{0,22}^-$	1067 (4)	1,9 (10)		8,54
$\beta_{0,18}^-$	1104 (4)	0,69 (20)		9,04
$\beta_{0,16}^-$	1126 (4)	< 8	1st Forbidden	> 8
$\beta_{0,15}^-$	1171 (4)	1,5 (13)		8,8
$\beta_{0,14}^-$	1171 (4)	< 5	1st Forbidden	> 8,3
$\beta_{0,13}^-$	1206 (4)	< 3,1	Unique 1st Forbidden	> 8,5
$\beta_{0,12}^-$	1227 (4)	< 2,5	Allowed	> 8,6
$\beta_{0,11}^-$	1232 (4)	< 0,4		> 9,4
$\beta_{0,10}^-$	1247 (4)	< 0,8	Allowed	> 9,2
$\beta_{0,7}^-$	1346 (4)	< 0,8	1st Forbidden	> 9,3
$\beta_{0,2}^-$	2052 (4)	< 5	Allowed	> 9,2

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ $\times 100$	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{14,13}(U)$	34,30 (4)	8,4 (9)	(E2)		1660 (30)	457 (7)	2270 (40)
$\gamma_{8,6}(U)$	41,82 (11)	0,28 (8)					
$\gamma_{1,0}(U)$	43,49 (2)	86 (23)	E2		520 (8)	143,7 (21)	713 (11)
$\gamma_{16,14}(U)$	45,45 (5)	6,8 (44)	M1+E2		190 (100)	50 (30)	250 (140)
$\gamma_{14,12}(U)$	54,96 (10)	$\sim 0,0094$	[E1]		0,453 (7)	0,1123 (17)	0,603 (9)
$\gamma_{15,12}(U)$	54,96 (10)	$\sim 1,23$	[M1+E2]		90 (80)	26 (21)	130 (110)
$\gamma_{45,39}(U)$	55,45 (5)	0,043 (14)	(E1)		0,443 (7)	0,1097 (16)	0,589 (9)
$\gamma_{22,16}(U)$	58,20 (6)	0,47 (16)	(E2)		126,9 (19)	35,1 (6)	174 (3)
$\gamma_{56,51}(U)$	59,19 (5)	2,9 (25)	[M1+E2]		70 (50)	18 (15)	90 (70)
$\gamma_{13,9}(U)$	62,70 (1)	2,3 (7)	E1		0,320 (5)	0,0791 (11)	0,426 (6)
$\gamma_{25,22}(U)$	67,25 (10)	2,1 (8)	M1+E2		42 (8)	11,5 (22)	57 (11)
$\gamma_{25,20}(U)$	69,46 (5)	0,7 (6)	[E2,M1]		32 (23)	9 (7)	40 (30)
$\gamma_{31,27}(U)$	75,0 (3)	0,031 (7)					
$\gamma_{16,13}(U)$	79,84 (2)	2,4 (9)	E2		28,0 (4)	7,76 (11)	38,4 (6)
$\gamma_{14,9}(U)$	97,17 (10)	0,27 (10)	[E1]		0,1012 (15)	0,0248 (4)	0,1343 (20)
$\gamma_{2,1}(U)$	99,86 (2)	46 (9)	E2		9,77 (14)	2,71 (4)	13,42 (19)
$\gamma_{16,12}(U)$	100,89 (2)	0,140 (27)	[E1]		0,0917 (13)	0,0224 (4)	0,1218 (17)
$\gamma_{22,14}(U)$	103,77 (2)	2,93 (49)	(E2)		8,17 (12)	2,27 (4)	11,22 (16)
$\gamma_{16,11}(U)$	106,68 (5)	0,17 (5)	[M1]		2,89 (4)	0,699 (10)	3,83 (6)
$\gamma_{25,16}(U)$	125,46 (1)	4,7 (7)	E2	0,216 (3)	3,41 (5)	0,945 (14)	4,89 (7)
$\gamma_{43,33}(U)$	131,30 (1)	23 (2)	E1	0,204 (3)	0,0463 (7)	0,01128 (16)	0,265 (4)
$\gamma_{51,45}(U)$	134,61 (2)	1,20 (24)	M1	7,54 (11)	1,480 (21)	0,358 (5)	9,50 (14)
$\gamma_{21,13}(U)$	137,23 (5)	0,033 (11)	[E1]	0,184 (3)	0,0413 (6)	0,01006 (15)	0,239 (4)
$\gamma_{13,7}(U)$	140,15 (2)	3,2 (10)	M1+E2	2,9 (22)	1,76 (25)	0,47 (9)	5,3 (18)
$\gamma_{49,43}(U)$	140,91 (3)	0,38 (6)	[E1]	0,1732 (25)	0,0386 (6)	0,00940 (14)	0,224 (4)
$\gamma_{33,30}(U)$	143,78 (2)	2,02 (32)	(M1+E2)	3,24	1,532	0,403	5,31
$\gamma_{30,22}(U)$	149,88 (3)	0,24 (7)	[E2]	0,220 (3)	1,526 (22)	0,422 (6)	2,31 (4)
$\gamma_{3,2}(U)$	152,71 (2)	18,8 (22)	E2	0,217 (3)	1,404 (20)	0,388 (6)	2,14 (3)
$\gamma_{33,28}(U)$	159,48 (2)	0,77 (12)	[E1]	0,1303 (19)	0,0282 (4)	0,00684 (10)	0,1676 (24)
$\gamma_{22,11}(U)$	164,94 (5)	0,23 (14)	[E2,M1]	2,2 (21)	0,91 (9)	0,24 (4)	3,5 (19)
$\gamma_{64,54}(U)$	165,61 (5)	0,084 (25)	[E1]	0,1194 (17)	0,0256 (4)	0,00622 (9)	0,1533 (22)
$\gamma_{51,43}(U)$	170,85 (2)	2,97 (41)	M1	3,84 (6)	0,749 (11)	0,181 (3)	4,83 (7)
$\gamma_{14,7}(U)$	174,55 (3)	0,66 (31)	[M1+E2]	1,9 (18)	0,74 (4)	0,193 (23)	2,9 (17)
$\gamma_{51,41}(U)$	179,80 (8)	0,23 (8)	[M1]	3,33 (5)	0,648 (10)	0,1567 (22)	4,19 (6)
$\gamma_{51,40}(U)$	186,15 (2)	8,5 (9)	M1	3,02 (5)	0,587 (9)	0,142 (2)	3,79 (6)
$\gamma_{56,45}(U)$	193,73 (3)	1,6 (7)	[M1+E2]	1,4 (13)	0,510 (16)	0,132 (6)	2,1 (13)
$\gamma_{23,12}(U)$	196,80 (5)	0,22 (12)	E0+E2+M1	1,4 (13)	0,483 (21)	0,124 (4)	2,0 (13)
$\gamma_{21,9}(U)$	199,95 (5)	0,22 (12)	(E0+E2+M1)	1,4 (13)	0,483 (21)	0,124 (4)	2,0 (13)
$\gamma_{4,3}(U)$	200,97 (3)	1,56 (23)	E2	0,1534 (22)	0,424 (6)	0,1166 (17)	0,734 (11)
$\gamma_{13,5}(U)$	203,12 (3)	3,0 (6)	M1+E2	0,8 (4)	0,422 (10)	0,1113 (16)	1,4 (4)
$\gamma_{16,7}(U)$	220,00 (8)	0,49 (8)	(M1)	1,89 (3)	0,366 (6)	0,0886 (13)	2,37 (4)
$\gamma_{66,53}(U)$	221,15 (10)	0,056 (24)	[E1]	0,0615 (9)	0,01248 (18)	0,00302 (5)	0,0780 (11)
$\gamma_{37,29}(U)$	221,83 (10)	0,110 (33)	[E2]	0,1301 (19)	0,280 (4)	0,0767 (11)	0,513 (8)
$\gamma_{33,25}(U)$	226,50 (3)	11,3 (20)	M1+E2	0,9 (3)	0,297 (15)	0,0759 (23)	1,3 (3)
$\gamma_{51,37}(U)$	227,25 (3)	18,4 (19)	M1	1,724 (25)	0,335 (5)	0,0809 (12)	2,17 (3)
$\gamma_{25,11}(U)$	232,21 (3)	0,40 (16)	[E2,M1]	0,9 (8)	0,27 (5)	0,070 (7)	1,2 (8)
$\gamma_{17,8}(U)$	233,6 (2)	$\sim 0,019$					
$\gamma_{66,51}(U)$	235,11 (3)	0,122 (25)	[E1]	0,0536 (8)	0,01075 (15)	0,00260 (4)	0,0678 (10)
$\gamma_{17,7}(U)$	235,9 (30)	0,005 (3)					
$\gamma_{58,43}(U)$	240,2 (1)	0,11 (6)	[M1,E2]	0,8 (7)	0,24 (5)	0,062 (8)	1,1 (8)
$\gamma_{56,40}(U)$	245,37 (2)	2,09 (30)	M1	1,392 (20)	0,270 (4)	0,0652 (10)	1,749 (25)
$\gamma_{27,13}(U)$	247,79 (7)	0,00037 (4)					
$\gamma_{33,24}(U)$	249,22 (1)	2,65 (42)	E1	0,0470 (7)	0,00935 (13)	0,00226 (4)	0,0594 (9)
$\gamma_{68,51}(U)$	257,2 (1)	0,10 (6)	[M1,E2]	0,7 (6)	0,19 (5)	0,049 (8)	0,9 (7)
$\gamma_{26,10}(U)$	267,12 (5)	0,32 (12)	[E2,M1]	0,6 (5)	0,17 (5)	0,044 (8)	0,8 (6)
$\gamma_{49,33}(U)$	272,28 (5)	2,18 (28)	M1+E2	0,766 (11)	0,1783 (25)	0,0442 (7)	1,004 (14)
$\gamma_{21,8}(U)$	275,04 (10)	0,17 (7)	[M1,E2]	0,6 (5)	0,16 (4)	0,040 (8)	0,8 (6)

	Energy keV	P _{γ+ce} × 100	Multipolarity	α _K	α _L	α _M	α _T
γ _{22,7} (U)	278,3 (1)	0,052 (14)	[E2]	0,0863 (13)	0,1112 (16)	0,0303 (5)	0,238 (4)
γ _{33,22} (U)	293,79 (5)	4,3 (6)	M1+E2	0,28 (9)	0,109 (9)	0,0283 (18)	0,42 (10)
γ _{33,20} (U)	295,91 (8)	0,23 (8)	[M1+E2]	0,5 (4)	0,12 (4)	0,031 (8)	0,6 (5)
γ _{17,5} (U)	298,7 (2)	0,015 (6)	[E1]	0,0315 (5)	0,00610 (9)	0,001470 (21)	0,0396 (6)
γ _{64,46} (U)	308,6 (2)	0,025 (7)	[E2]	0,0711 (10)	0,0744 (11)	0,0201 (3)	0,1726 (25)
γ _{71,51} (U)	310,2 (1)	0,109 (35)	[M1,E2]	0,4 (4)	0,11 (4)	0,027 (7)	0,5 (4)
γ _{27,9} (U)	310,52 (10)	0,000135 (15)					
γ _{23,8} (U)	313,5 (1)	0,156 (47)	[E2,M1]	0,4 (4)	0,10 (4)	0,026 (7)	0,5 (4)
γ _{21,6} (U)	316,7 (1)	0,121 (16)	[E2]	0,0677 (10)	0,0674 (10)	0,0182 (3)	0,1597 (23)
γ _{34,22} (U)	320,4 (1)	0,078 (24)	[E2,M1]	0,4 (3)	0,10 (4)	0,024 (7)	0,5 (4)
γ _{33,18} (U)	330,40 (5)	0,80 (9)	[E1]	0,0254 (4)	0,00484 (7)	0,001165 (17)	0,0318 (5)
γ _{37,23} (U)	330,40 (5)		M1+E2	0,431 (6)	0,0980 (14)	0,0242 (4)	0,562 (8)
γ _{74,52} (U)	331,4 (1)	0,073 (13)					
γ _{21,5} (U)	340,2 (1)	0,042 (9)	[E1]	0,0239 (4)	0,00453 (7)	0,001090 (16)	0,0298 (5)
γ _{31,12} (U)	343,8 (2)	0,035 (8)	[E1]	0,0233 (4)	0,00442 (7)	0,001064 (15)	0,0292 (5)
γ _{33,16} (U)	351,9 (1)	0,47 (6)	E2	0,0555 (8)	0,0455 (7)	0,01222 (18)	0,1175 (17)
γ _{46,28} (U)	357,9 (1)	0,050 (19)	[M1,E2]	0,27 (22)	0,07 (3)	0,017 (6)	0,4 (3)
γ _{56,33} (U)	360,6 (3)	0,018 (7)	[E1]	0,0211 (3)	0,00397 (6)	0,000955 (14)	0,0264 (4)
γ _{31,10} (U)	365,0 (3)						
γ _{26,7} (U)	365,0 (3)	0,018 (7)	[E1]	0,0206 (3)	0,00387 (6)	0,000930 (14)	0,0257 (4)
γ _{37,21} (U)	369,50 (5)	3,91 (47)	M1	0,450 (7)	0,0866 (13)	0,0209 (3)	0,565 (8)
γ _{40,23} (U)	372,0 (1)	1,87 (21)	M1(+E2)	0,410 (6)	0,0811 (12)	0,0197 (3)	0,517 (8)
γ _{32,11} (U)	379,1 (1)	0,043 (11)	[E1]	0,0190 (3)	0,00356 (5)	0,000854 (12)	0,0237 (4)
γ _{31,9} (U)	385,4 (1)	0,043 (11)	[E1]	0,0184 (3)	0,00343 (5)	0,000824 (12)	0,0229 (4)
γ _{27,7} (U)	387,94 (6)	0,00072 (6)					
γ _{45,25} (U)	394,1 (1)	0,096 (14)	[E1]	0,01755 (25)	0,00326 (5)	0,000784 (11)	0,0219 (3)
γ _{33,15} (U)	397,7 (3)	0,063 (16)	[M2]	0,986 (14)	0,270 (4)	0,0687 (10)	1,349 (20)
γ _{40,22} (U)	409,8 (1)	0,35 (5)	[E1]	0,01620 (23)	0,00300 (5)	0,00072 0(1)	0,0202 (3)
γ _{49,30} (U)	416,1 (1)	0,039 (12)	[E2]	0,0405 (6)	0,0251 (4)	0,00666 (10)	0,0746 (11)
γ _{37,16} (U)	426,95 (5)	0,47 (5)	[E1]	0,01491 (21)	0,00274 (4)	0,000658 (10)	0,0185 (3)
γ _{27,6} (U)	427,4 (4)	0,000031 (10)					
γ _{68,42} (U)	433,1 (1)	0,094 (14)					
γ _{40,18} (U)	446,6 (1)	0,153 (20)	[M1]	0,269 (4)	0,0516 (8)	0,01245 (18)	0,338 (5)
γ _{46,24} (U)	446,6 (1)						
γ _{27,5} (U)	450,93 (4)	0,0050 (24)	M1+E2	0,187 (3)	0,0400 (6)	0,00980 (14)	0,241 (4)
γ _{42,19} (U)	452,4 (3)	0,027 (9)					
γ _{33,11} (U)	458,68 (5)	1,30 (15)	M1+E2	0,11 (4)	0,028 (5)	0,0071 (11)	0,14 (5)
γ _{43,18} (U)	461,5 (1)						
γ _{45,22} (U)	461,5 (1)	0,045 (14)	[M1]	0,246 (4)	0,0472 (7)	0,01138 (16)	0,309 (5)
γ _{39,16} (U)	464,2 (1)	0,040 (14)	[M1]	0,243 (4)	0,0464 (7)	0,01120 (16)	0,304 (5)
γ _{40,16} (U)	468,0 (1)	0,223 (30)	[E1]	0,01241 (18)	0,00226 (4)	0,000541 (8)	0,01539 (22)
γ _{37,15} (U)	472,3 (1)	0,46 (5)	[M1]	0,231 (4)	0,0443 (7)	0,01069 (15)	0,290 (4)
γ _{41,16} (U)	474,2 (2)	0,037 (11)	[E1]	0,01209 (17)	0,00219 (3)	0,000526 (8)	0,01499 (21)
γ _{49,26} (U)	478,6 (1)						
γ _{42,16} (U)	478,6 (1)	0,127 (15)	[E1]	0,01187 (17)	0,00215 (3)	0,000516 (8)	0,01472 (21)
γ _{71,43} (U)	481,0 (1)	0,36 (6)	[M1,E2]	0,13 (10)	0,029 (14)	0,007 (3)	0,16 (12)
γ _{49,25} (U)	498,0 (1)						
γ _{45,18} (U)	498,0 (1)	0,078 (15)	[M1]	0,201 (3)	0,0384 (6)	0,00925 (13)	0,252 (4)
γ _{66,35} (U)	502,2 (1)	0,03 (10)	[E2,M1]	0,11 (9)	0,026 (12)	0,006 (3)	0,15 (10)
γ _{37,13} (U)	506,76 (5)	1,32 (14)	[E1]	0,01061 (15)	0,00191 (3)	0,000457 (7)	0,01314 (19)
γ _{40,15} (U)	513,4 (1)	~0,468	[M1]	0,185 (3)	0,0353 (5)	0,00852 (12)	0,232 (4)
γ _{40,14} (U)	513,5 (1)	~0,77	[E1]	0,01035 (15)	0,00186 (3)	0,000445 (7)	0,01280 (18)
γ _{45,16} (U)	519,64 (10)	0,41 (5)	[E1]	0,01011 (15)	0,00181 (3)	0,000434 (6)	0,01251 (18)
γ _{49,24} (U)	521,43 (10)	0,76 (9)	[E1]	0,01004 (14)	0,00180 (3)	0,000431 (6)	0,01242 (18)
γ _{37,12} (U)	527,99 (10)	0,49 (6)	(M1)	0,1716 (24)	0,0328 (5)	0,00790 (11)	0,215 (3)
γ _{46,18} (U)	529,2 (3)						
γ _{43,15} (U)	529,2 (3)	0,102 (46)	[E2,M1]	0,10 (8)	0,022 (11)	0,0054 (25)	0,13 (9)
γ _{76,44} (U)	534,2 (1)	0,084 (13)	[E1]	0,00958 (14)	0,001715 (24)	0,000410 (6)	0,01185 (17)
γ _{71,37} (U)	537,4 (1)	0,093 (16)	[M1,E2]	0,09 (7)	0,021 (11)	0,0052 (24)	0,12 (9)

	Energy keV	$P_{\gamma+ce}$ $\times 100$	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{39,13}$ (U)	543,9 (1)	0,140 (25)	[E2]	0,0247 (4)	0,01049 (15)	0,00273 (4)	0,0389 (6)
$\gamma_{47,19}$ (U)	553,87 (10)	0,045 (16)	[E1]	0,00894 (13)	0,001594 (23)	0,000381 (6)	0,01105 (16)
$\gamma_{44,14}$ (U)	558,1 (2)	0,097 (24)	[E2]	0,0236 (4)	0,00970 (14)	0,00252 (4)	0,0367 (6)
$\gamma_{51,23}$ (U)	558,1 (2)						
$\gamma_{36,9}$ (U)	559,4 (2)	0,074 (22)	[E1]	0,00877 (13)	0,001562 (22)	0,000373 (6)	0,01084 (16)
$\gamma_{76,43}$ (U)	562,9 (3)	0,040 (13)	[M1,E2]	0,08 (6)	0,018 (9)	0,0045 (21)	0,11 (8)
$\gamma_{49,22}$ (U)	565,4 (1)						
$\gamma_{45,15}$ (U)	565,4 (1)	1,23 (13)	(M1)	0,1429 (20)	0,0272 (4)	0,00656 (10)	0,179 (3)
$\gamma_{40,12}$ (U)	569,1 (2)	4,2 (7)	M1	0,1404 (20)	0,0268 (4)	0,00645 (9)	0,1759 (25)
$\gamma_{37,9}$ (U)	569,7 (1)	10,9 (14)	M1	0,1401 (20)	0,0267 (4)	0,00643 (9)	0,1754 (25)
$\gamma_{41,12}$ (U)	575,7 (1)	0,03 (1)	[E2,M1]	0,08 (6)	0,017 (9)	0,0043 (20)	0,10 (7)
$\gamma_{43,12}$ (U)	584,3 (1)	0,19 (31)	[E2]	0,0217 (3)	0,00845 (12)	0,00219 (3)	0,0331 (5)
$\gamma_{64,32}$ (U)	586,5 (1)	0,075 (13)	[E2]	0,0216 (3)	0,00836 (12)	0,00216 (3)	0,0328 (5)
$\gamma_{40,10}$ (U)	590,5 (10)	0,040 (12)	[E2,M1]	0,07 (6)	0,016 (8)	0,0040 (19)	0,10 (7)
$\gamma_{50,22}$ (U)	595,6 (2)	0,097 (24)	[E2]	0,0210 (3)	0,00799 (12)	0,00207 (3)	0,0317 (5)
$\gamma_{59,26}$ (U)	597,1 (1)	0,231 (35)	[M1]	0,1235 (18)	0,0235 (4)	0,00566 (8)	0,1547 (22)
$\gamma_{51,21}$ (U)	597,1 (1)						
$\gamma_{49,18}$ (U)	602,8 (1)	0,55 (6)	[E1]	0,00762 (11)	0,001345 (19)	0,000321 (5)	0,00939 (14)
$\gamma_{43,10}$ (U)	604,8 (3)	0,057 (24)	[E2,M1]	0,07 (5)	0,015 (8)	0,0037 (18)	0,09 (6)
$\gamma_{53,21}$ (U)	612,2 (1)	0,43 (6)	(M1)	0,1156 (17)	0,0220 (3)	0,00530 (8)	0,1447 (21)
$\gamma_{41,9}$ (U)	617,2 (2)	0,054 (23)	[E2]	0,0197 (3)	0,00720 (11)	0,00186 (3)	0,0294 (5)
$\gamma_{56,23}$ (U)	617,2 (2)						
$\gamma_{44,11}$ (U)	619,2 (2)	0,039 (12)	[M1+E2]	0,07 (5)	0,014 (7)	0,0035 (17)	0,08 (6)
$\gamma_{49,16}$ (U)	624,4 (1)	0,39 (6)	(M1+E2)	0,0799 (12)	0,01627 (23)	0,00396 (6)	0,1015 (15)
$\gamma_{20,4}$ (U)	628,3 (1)	0,24 (5)	[E1]	0,00705 (10)	0,001239 (18)	0,000296 (5)	0,00868 (13)
$\gamma_{48,15}$ (U)	629,6 (1)	0,40 (7)	(M1)	0,1072 (15)	0,0204 (3)	0,00491 (7)	0,1342 (19)
$\gamma_{51,18}$ (U)	632,8 (2)	0,039 (12)	[E2,M1]	0,06 (5)	0,013 (7)	0,0033 (16)	0,08 (6)
$\gamma_{44,10}$ (U)	634,5 (2)						
$\gamma_{54,22}$ (U)	634,5 (2)	0,153 (27)	[M1]	0,1050 (15)	0,0200 (3)	0,00481 (7)	0,1315 (19)
$\gamma_{37,7}$ (U)	646,7 (1)	0,115 (15)	[E1]	0,00668 (10)	0,001170 (17)	0,000279 (4)	0,00822 (12)
$\gamma_{50,16}$ (U)	653,9 (1)	0,53 (9)	M1	0,0969 (14)	0,0184 (3)	0,00443 (7)	0,1213 (17)
$\gamma_{64,29}$ (U)	653,9 (1)						
$\gamma_{56,22}$ (U)	655,4 (2)	0,136 (24)	[E1]	0,00651 (10)	0,001140 (16)	0,000272 (4)	0,00802 (12)
$\gamma_{46,11}$ (U)	657,6 (1)	0,40 (5)					
$\gamma_{48,13}$ (U)	664,1 (1)	0,54 (9)	[E1]	0,00636 (9)	0,001111 (16)	0,000265 (4)	0,00782 (11)
$\gamma_{11,3}$ (U)	666,7 (1)	1,19 (13)	[E1]	0,00631 (9)	0,001103 (16)	0,000263 (4)	0,00777 (11)
$\gamma_{35,5}$ (U)	669,9 (1)	<0,0006					
$\gamma_{49,15}$ (U)	669,9 (1)	1,01 (10)	[E1]	0,00626 (9)	0,001092 (16)	0,000260 (4)	0,00770 (11)
$\gamma_{24,4}$ (U)	675,3 (1)	0,103 (14)	[E2]	0,01674 (24)	0,00558 (8)	0,001427 (20)	0,0242 (4)
$\gamma_{59,22}$ (U)	684,1 (2)	0,161 (40)	[E1]	0,00602 (9)	0,001049 (15)	0,000250 (4)	0,00740 (11)
$\gamma_{59,21}$ (U)	685,3 (2)		[E2]	0,01631 (23)	0,00535 (8)	0,001369 (20)	0,0235 (4)
$\gamma_{40,8}$ (U)	685,3 (1)	0,15 (4)					
$\gamma_{54,16}$ (U)	692,8 (1)	1,38 (14)	(M1)	0,0831 (12)	0,01575 (22)	0,00379 (6)	0,1040 (15)
$\gamma_{51,15}$ (U)	699,25 (5)	3,6 (4)					
$\gamma_{50,14}$ (U)	699,25 (5)		M1	0,0811 (12)	0,01537 (22)	0,00370 (6)	0,1015 (15)
$\gamma_{7,2}$ (U)	706,2 (1)	2,31 (23)	[E1]	0,00568 (8)	0,000987 (14)	0,000235 (4)	0,00698 (10)
$\gamma_{8,2}$ (U)	708,6 (2)	0,024 (9)	[E2]	0,01537 (22)	0,00489 (7)	0,001246 (18)	0,0219 (3)
$\gamma_{52,14}$ (U)	714,0 (1)	0,147 (25)	[E1]	0,00557 (8)	0,000966 (14)	0,000230 (4)	0,00684 (10)
$\gamma_{64,26}$ (U)	714,0 (1)						
$\gamma_{62,23}$ (U)	716,8 (2)	0,033 (10)	[M1,E2]	0,05 (3)	0,010 (5)	0,0023 (12)	0,06 (4)
$\gamma_{15,3}$ (U)	728,1 (2)	0,116 (15)	[E2]	0,01464 (21)	0,00454 (7)	0,001156 (17)	0,0207 (3)
$\gamma_{49,11}$ (U)	731,2 (2)	0,67 (11)	[M1,E2]	0,04 (3)	0,009 (5)	0,0022 (11)	0,06 (4)
$\gamma_{50,13}$ (U)	733,56 (5)	7,6 (9)	M1	0,0714 (10)	0,01351 (19)	0,00325 (5)	0,0893 (13)
$\gamma_{54,14}$ (U)	738,3 (1)	1,26 (14)	(M1)	0,0702 (10)	0,01329 (19)	0,00320 (5)	0,0878 (13)
$\gamma_{5,1}$ (U)	743,084 (5)	2,09 (21)	E1	0,00518 (8)	0,000895 (13)	0,000213 (3)	0,00636 (9)
$\gamma_{49,10}$ (U)	746,2 (1)	0,32 (5)	[E1]	0,00514 (8)	0,000888 (13)	0,000211 (3)	0,00631 (9)
$\gamma_{52,13}$ (U)	748,4 (3)	0,105 (23)	[E1]	0,00511 (8)	0,000883 (13)	0,000210 (3)	0,00628 (9)
$\gamma_{62,22}$ (U)	755,3 (1)						
$\gamma_{51,12}$ (U)	755,3 (1)	1,29 (15)	(E2,M1)	0,04 (3)	0,008 (5)	0,002 (1)	0,05 (4)

	Energy keV	$P_{\gamma+ce}$ $\times 100$	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{56,15}(U)$	759,2 (1)	0,262 (33)	[M1,E2]	0,04 (3)	0,008 (5)	0,002 (1)	0,05 (4)
$\gamma_{50,11}(U)$	761,3 (2)	0,074 (22)	[E2]	0,01353 (19)	0,00403 (6)	0,001023 (15)	0,0189 (3)
$\gamma_{28,4}(U)$	765,1 (2)	0,21 (5)	[M1,E2]	0,04 (3)	0,008 (4)	0,002 (1)	0,05 (3)
$\gamma_{6,1}(U)$	766,7 (2)	0,26 (5)	(E2)	0,01336 (19)	0,00396 (6)	0,001003 (14)	0,0187 (3)
$\gamma_{58,15}(U)$	769,4 (1)	0,196 (22)	[M1,E2]	0,038 (25)	0,008 (4)	0,0019 (10)	0,05 (3)
$\gamma_{54,13}(U)$	772,7 (2)	0,074 (22)	[E2]	0,01318 (19)	0,00388 (6)	0,000983 (14)	0,0184 (3)
$\gamma_{30,4}(U)$	780,7 (2)	0,91 (9)	[E1]	0,00474 (7)	0,000815 (12)	0,000194 (3)	0,00581 (9)
$\gamma_{9,2}(U)$	783,7 (1)	0,305 (41)	[E2]	0,01285 (18)	0,00374 (6)	0,000946 (14)	0,0179 (3)
$\gamma_{5,0}(U)$	786,595 (22)	1,22 (13)	(E1)	0,00467 (7)	0,000804 (12)	0,000191 (3)	0,00573 (8)
$\gamma_{54,12}(U)$	793,1 (3)	0,045 (11)	[E1]	0,00460 (7)	0,000791 (11)	0,000188 (3)	0,00565 (8)
$\gamma_{18,3}(U)$	795,2 (2)	0,69 (11)	[E2]	0,01253 (18)	0,00360 (5)	0,000910 (13)	0,01735 (25)
$\gamma_{51,9}(U)$	796,4 (1)	2,64 (31)	[E2]	0,01249 (18)	0,00359 (5)	0,000906 (13)	0,01730 (25)
$\gamma_{19,3}(U)$	800,0 (2)		E0+E2				
$\gamma_{55,12}(U)$	802,6 (2)	0,033 (10)	[M1]	0,0563 (8)	0,01062 (15)	0,00256 (4)	0,0703 (10)
$\gamma_{10,2}(U)$	804,5 (1)	0,85 (30)	E0+E2	0,1559 (8)	0,11056 (15)	0,10254 (4)	0,37
$\gamma_{7,1}(U)$	806,20 (5)	2,51 (30)	[E1]	0,00447 (7)	0,000768 (11)	0,000183 (3)	0,00549 (8)
$\gamma_{8,1}(U)$	808,8 (3)	0,19 (6)	E0+E2	3,30000 (7)	0,93 (100)		4,2
$\gamma_{6,0}(U)$	810,4 (7)	0,20 (7)	E0				
$\gamma_{53,9}(U)$	811,9 (1)	0,130 (16)	[M1,E2]	0,033 (22)	0,007 (4)	0,0017 (9)	0,04 (3)
$\gamma_{56,12}(U)$	814,6 (1)	0,315 (41)	[E2]	0,01201 (17)	0,00338 (5)	0,000854 (12)	0,01654 (24)
$\gamma_{11,2}(U)$	819,6 (1)	1,91 (20)	[E1]	0,00434 (6)	0,000744 (11)	0,0001770 (25)	0,00533 (8)
$\gamma_{12,2}(U)$	825,5 (2)	1,93 (20)	[E2]	0,01173 (17)	0,00327 (5)	0,000825 (12)	0,01611 (23)
$\gamma_{20,3}(U)$	829,7 (2)	0,36 (11)	[E1]	0,00425 (6)	0,000727 (11)	0,0001729 (25)	0,00521 (8)
$\gamma_{22,3}(U)$	831,9 (1)	4,2 (5)	[E1]	0,00423 (6)	0,000724 (11)	0,0001721 (24)	0,00518 (8)
$\gamma_{75,28}(U)$	839,9 (1)	0,031 (8)					
$\gamma_{49,7}(U)$	844,5 (1)	0,44 (5)	[E2]	0,01127 (16)	0,00309 (5)	0,000777 (11)	0,01540 (22)
$\gamma_{59,11}(U)$	849,4 (2)	0,027 (8)	[E1]	0,00408 (6)	0,000696 (10)	0,0001655 (24)	0,00500 (7)
$\gamma_{8,0}(U)$	852,2 (1)	0,074 (22)	[E2]	0,01109 (16)	0,00302 (5)	0,000759 (11)	0,01513 (22)
$\gamma_{57,9}(U)$	858,1 (2)	0,037 (8)	[E2]	0,01095 (16)	0,00297 (5)	0,000746 (11)	0,01493 (21)
$\gamma_{59,10}(U)$	863,6 (2)	0,076 (23)	[E2,M1]	0,029 (18)	0,006 (3)	0,0014 (7)	0,036 (22)
$\gamma_{77,29}(U)$	870,1 (1)	0,20 (3)					
$\gamma_{50,7}(U)$	874,4 (3)	0,037 (8)	[E2,M1]	0,028 (18)	0,006 (3)	0,0014 (7)	0,035 (21)
$\gamma_{24,3}(U)$	876,4 (1)	2,59 (23)	(E2)	0,01055 (15)	0,00282 (4)	0,000706 (10)	0,01432 (20)
$\gamma_{14,2}(U)$	880,92 (4)	4,3 (6)	[E1]	0,00382 (6)	0,000651 (10)	0,0001547 (22)	0,00468 (7)
$\gamma_{15,2}(U)$	880,92 (4)	6,3 (8)	[E2]	0,01046 (15)	0,00278 (4)	0,000697 (10)	0,01418 (20)
$\gamma_{9,1}(U)$	883,66 (4)	9,8 (11)	E2	0,01040 (15)	0,00276 (4)	0,000692 (10)	0,01409 (20)
$\gamma_{66,16}(U)$	890,5 (4)	0,027 (8)					
$\gamma_{25,3}(U)$	899,06 (5)	3,31 (40)	[E1]	0,00369 (6)	0,000627 (9)	0,0001489 (21)	0,00451 (7)
$\gamma_{10,1}(U)$	904,6 (1)	0,345 (41)	[E2]	0,00998 (14)	0,00260 (4)	0,000652 (10)	0,01346 (19)
$\gamma_{65,15}(U)$	916,9 (2)	0,024 (7)					
$\gamma_{26,3}(U)$	918,8 (1)	0,101 (14)	[E2]	0,00971 (14)	0,00251 (4)	0,000627 (9)	0,01306 (19)
$\gamma_{12,1}(U)$	925,4 (1)	8,0 (9)	(E2)	0,00959 (14)	0,00246 (4)	0,000616 (9)	0,01288 (18)
$\gamma_{16,2}(U)$	926,4 (2)	1,8 (13)	[E1]	0,00350 (5)	0,000594 (9)	0,0001409 (20)	0,00428 (6)
$\gamma_{9,0}(U)$	927,1 (1)	7,4 (12)	(E2)	0,00956 (14)	0,00245 (4)	0,000613 (9)	0,01284 (18)
$\gamma_{66,15}(U)$	936,2 (2)	0,067 (10)					
$\gamma_{17,2}(U)$	942,4 (3)	0,047 (9)	[E2]	0,00929 (13)	0,00236 (4)	0,000589 (9)	0,01244 (18)
$\gamma_{13,1}(U)$	946,39 (3)	13,6 (15)	(E1)	0,00337 (5)	0,000571 (8)	0,0001355 (19)	0,00412 (6)
$\gamma_{18,2}(U)$	948,1 (2)	1,65 (21)	[E2]	0,00919 (13)	0,00232 (4)	0,000580 (9)	0,01230 (18)
$\gamma_{19,2}(U)$	953,1 (1)	0,083 (13)					
$\gamma_{59,8}(U)$	960,4 (1)	0,074 (13)	[E2]	0,00899 (13)	0,00225 (4)	0,000562 (8)	0,01199 (17)
$\gamma_{28,3}(U)$	966,2 (1)	0,49 (6)	[M1,E2]	0,022 (13)	0,0043 (22)	0,0011 (5)	0,027 (16)
$\gamma_{73,18}(U)$	975,5 (1)	0,027 (8)					
$\gamma_{29,3}(U)$	978,6 (3)	0,090 (23)					
$\gamma_{14,1}(U)$	980,7 (1)	~2,71	[E1]	0,00317 (5)	0,000535 (8)	0,0001270 (18)	0,00387 (6)
$\gamma_{15,1}(U)$	980,7 (1)	~1,79	[E2]	0,00866 (13)	0,00214 (3)	0,000534 (8)	0,01152 (17)
$\gamma_{30,3}(U)$	982,0 (3)	0,73 (22)	[E1]	0,00316 (5)	0,000534 (8)	0,0001267 (18)	0,00387 (6)
$\gamma_{22,2}(U)$	984,6 (1)	1,64 (21)	[E1]	0,00315 (5)	0,000531 (8)	0,0001261 (18)	0,00385 (6)
$\gamma_{63,9}(U)$	989,9 (1)	0,104 (14)					
$\gamma_{60,7}(U)$	995,0 (3)	0,062 (22)					

	Energy keV	P _{γ+ce} × 100	Multipolarity	α _K	α _L	α _M	α _T
γ _{73,16} (U)	998,1 (3)	0,046 (12)					
γ _{71,15} (U)	1010,3 (3)	0,067 (12)					
γ _{75,18} (U)	1010,3 (3)						
γ _{76,19} (U)	1019,9 (4)	0,027 (8)					
γ _{23,2} (U)	1022,2 (2)	0,156 (41)	[M1]	0,0297 (5)	0,00557 (8)	0,001340 (19)	0,0370 (6)
γ _{24,2} (U)	1029,1 (1)	0,58 (6)	[E2]	0,00796 (12)	0,00191 (3)	0,000475 (7)	0,01051 (15)
γ _{75,16} (U)	1033,2 (2)	0,018 (5)					
γ _{69,11} (U)	1038,3 (2)	0,018 (7)					
γ _{17,1} (U)	1041,6 (2)	0,033 (11)	[E2,M1]	0,018 (11)	0,0036 (18)	0,0009 (4)	0,023 (13)
γ _{32,3} (U)	1045,0 (2)	0,031 (3)					
γ _{70,12} (U)	1052,0 (2)	0,062 (12)					
γ _{70,11} (U)	1058,4 (3)	0,0177 (16)					
γ _{71,12} (U)	1065,7 (1)	0,027 (8)					
γ _{69,9} (U)	1074,2 (2)	0,104 (14)					
γ _{21,1} (U)	1083,8 (1)	0,53 (6)	(M1)	0,0254 (4)	0,00477 (7)	0,001147 (16)	0,0317 (5)
γ _{17,0} (U)	1085,9 (3)	0,027 (8)	[E2]	0,00725 (11)	0,001690 (24)	0,000418 (6)	0,00950 (14)
γ _{71,9} (U)	1107,5 (2)	0,083 (13)					
γ _{66,7} (U)	1111,2 (1)	0,062 (12)					
γ _{23,1} (U)	1122,4 (1)	0,257 (41)	M1	0,0232 (4)	0,00434 (6)	0,001045 (15)	0,0289 (4)
γ _{33,3} (U)	1125,9 (1)	0,36 (8)	[E1]	0,00250 (4)	0,000418 (6)	0,0000991 (14)	0,00305 (5)
γ _{21,0} (U)	1127,5 (1)	0,303 (40)	[E2]	0,00679 (10)	0,001552 (22)	0,000383 (6)	0,00885 (13)
γ _{69,7} (U)	1152,1 (3)						
γ _{34,3} (U)	1152,1 (3)	0,032 (10)	[E1]	0,00240 (4)	0,000402 (6)	0,0000951 (14)	0,00294 (5)
γ _{76,11} (U)	1154,2 (3)	0,046 (9)					
γ _{26,1} (U)	1172,0 (1)	0,091 (13)	[E2]	0,00634 (9)	0,001423 (20)	0,000350 (5)	0,00824 (12)
γ _{66,5} (U)	1173,8 (1)	0,046 (9)					
γ _{71,8} (U)	1182,8 (2)	~0,0094					
γ _{27,1} (U)	1194,53 (3)	0,021 (6)	E1	0,00226 (4)	0,000377 (6)	0,0000892 (13)	0,00277 (4)
γ _{77,9} (U)	1218,1 (1)	0,22 (3)					
γ _{27,0} (U)	1238,1 (3)	<0,0094	E1	0,00213 (3)	0,000354 (5)	0,0000838 (12)	0,00262 (4)
γ _{40,3} (U)	1242,0 (1)	0,232 (30)	(E2)	0,00573 (8)	0,001251 (18)	0,000307 (5)	0,00740 (11)
γ _{41,3} (U)	1248,6 (2)	0,022 (6)	[E2]	0,00567 (8)	0,001237 (18)	0,000304 (5)	0,00733 (11)
γ _{42,3} (U)	1253,4 (2)	0,018 (8)					
γ _{43,3} (U)	1257,3 (1)	0,060 (8)	[M1,E2]	0,011 (6)	0,0022 (10)	0,00054 (24)	0,014 (8)
γ _{33,2} (U)	1278,6 (2)	0,047 (9)	[M2]	0,0370 (6)	0,00771 (11)	0,00188 (3)	0,0473 (7)
γ _{45,3} (U)	1293,7 (1)	0,48 (6)	M1	0,01592 (23)	0,00297 (5)	0,000715 (10)	0,0199 (3)
γ _{36,2} (U)	1343,9 (2)	0,012 (5)	[E1]	0,00185 (3)	0,000307 (5)	0,0000726 (11)	0,00232 (4)
γ _{37,2} (U)	1353,9 (1)	1,18 (12)	M1	0,01412 (20)	0,00263 (4)	0,000633 (9)	0,01766 (25)
γ _{47,3} (U)	1355,6 (2)	0,14 (4)	[E1]	0,00183 (3)	0,000302 (5)	0,0000715 (10)	0,00229 (4)
γ _{38,2} (U)	1360,0 (1)	0,156 (25)					
γ _{39,2} (U)	1390,6 (2)	0,073 (22)	[E1]	0,001749 (25)	0,000289 (4)	0,0000684 (10)	0,00222 (4)
γ _{40,2} (U)	1394,9 (1)	2,11 (21)	M1	0,01304 (19)	0,00243 (4)	0,000585 (9)	0,01634 (23)
γ _{49,3} (U)	1398,5 (2)	0,083 (22)	[E1]	0,001733 (25)	0,000286 (4)	0,0000678 (10)	0,00220 (3)
γ _{41,2} (U)	1401,4 (1)	0,182 (30)	[E2,M1]	0,009 (5)	0,0017 (8)	0,00041 (18)	0,011 (6)
γ _{43,2} (U)	1410,2 (2)	0,045 (10)					
γ _{35,1} (U)	1415,5 (2)	<0,0028					
γ _{51,3} (U)	1428,0 (1)	0,17 (3)					
γ _{36,1} (U)	1443,9 (2)	0,031 (7)	[E1]	0,001643 (23)	0,000271 (4)	0,0000641 (9)	0,00212 (3)
γ _{45,2} (U)	1446,5 (1)	0,32 (5)	[M1]	0,01185 (17)	0,00221 (3)	0,000531 (8)	0,01488 (21)
γ _{37,1} (U)	1453,8 (1)	0,82 (9)	[M1]	0,01169 (17)	0,00218 (3)	0,000524 (8)	0,01468 (21)
γ _{38,1} (U)	1460,0 (1)	0,094 (23)					
γ _{46,2} (U)	1476,9 (2)	0,008 (4)					
γ _{56,3} (U)	1486,5 (2)	0,030 (7)	[M1]	0,01102 (16)	0,00205 (3)	0,000494 (7)	0,01387 (20)
γ _{57,3} (U)	1489,2 (2)	0,014 (6)					
γ _{40,1} (U)	1494,8 (1)	0,105 (14)	[E2]	0,00414 (6)	0,000842 (12)	0,000205 (3)	0,00531 (8)
γ _{58,3} (U)	1497,2 (2)	0,036 (9)					
γ _{41,1} (U)	1501,2 (2)	0,0111 (40)	[E2]	0,00411 (6)	0,000835 (12)	0,000203 (3)	0,00528 (8)
γ _{48,2} (U)	1511,3 (2)	<0,0094					
γ _{59,3} (U)	1516,8 (2)	0,073 (13)					

	Energy keV	$P_{\gamma+ce}$ $\times 100$	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{49,2}(\text{U})$	1551,3 (1)	0,073 (13)	[E1]	0,001460 (21)	0,000240 (4)	0,0000568 (8)	0,00196 (3)
$\gamma_{61,3}(\text{U})$	1568,3 (2)	0,0114 (23)					
$\gamma_{51,2}(\text{U})$	1581,2 (1)	0,073 (22)					
$\gamma_{62,3}(\text{U})$	1587,2 (1)	0,146 (17)					
$\gamma_{52,2}(\text{U})$	1595,3 (1)	0,312 (40)	M1,E2	0,006 (3)	0,0012 (5)	0,00029 (12)	0,008 (4)
$\gamma_{54,2}(\text{U})$	1619,6 (2)	0,009 (4)					
$\gamma_{55,2}(\text{U})$	1628,7 (1)	0,076 (11)					
$\gamma_{56,2}(\text{U})$	1639,5 (1)	0,210 (21)	(M1)	0,00850 (12)	0,001581 (23)	0,000380 (6)	0,01083 (16)
$\gamma_{57,2}(\text{U})$	1641,9 (3)	0,010 (4)					
$\gamma_{65,3}(\text{U})$	1646,3 (2)	0,010 (4)					
$\gamma_{58,2}(\text{U})$	1651,6 (2)	<0,006					
$\gamma_{59,2}(\text{U})$	1669,8 (1)	0,78 (9)	(M1)	0,00809 (12)	0,001505 (21)	0,000362 (5)	0,01035 (15)
$\gamma_{67,3}(\text{U})$	1674,3 (1)	0,034 (11)					
$\gamma_{50,1}(\text{U})$	1681,0 (1)	0,077 (18)					
$\gamma_{68,3}(\text{U})$	1687,2 (1)	0,31 (4)					
$\gamma_{52,1}(\text{U})$	1695,3 (2)	0,7 (1)					
$\gamma_{53,1}(\text{U})$	1696,5 (3)	0,27 (7)					
$\gamma_{60,2}(\text{U})$	1702,0 (2)	0,104 (14)					
$\gamma_{61,2}(\text{U})$	1721,3 (2)	0,018 (6)					
$\gamma_{70,3}(\text{U})$	1724,8 (2)	0,016 (4)					
$\gamma_{55,1}(\text{U})$	1729,4 (2)	0,020 (5)					
$\gamma_{62,2}(\text{U})$	1739,3 (2)	0,075 (11)					
$\gamma_{72,3}(\text{U})$	1742,7 (2)	0,049 (8)					
$\gamma_{58,1}(\text{U})$	1751,6 (1)	0,064 (10)					
$\gamma_{59,1}(\text{U})$	1769,6 (3)	0,020 (5)					
$\gamma_{73,3}(\text{U})$	1772,5 (2)	0,068 (17)					
$\gamma_{63,2}(\text{U})$	1774,7 (2)	0,068 (17)					
$\gamma_{64,2}(\text{U})$	1785,4 (2)	0,025 (7)					
$\gamma_{65,2}(\text{U})$	1798,8 (1)	0,24 (3)					
$\gamma_{75,3}(\text{U})$	1807,5 (3)	0,0052 (22)					
$\gamma_{66,2}(\text{U})$	1817,0 (3)	0,009 (4)					
$\gamma_{76,3}(\text{U})$	1821,6 (3)	0,0042 (11)					
$\gamma_{67,2}(\text{U})$	1826,9 (3)	0,009 (4)					
$\gamma_{68,2}(\text{U})$	1839,8 (2)	0,0042 (11)					
$\gamma_{62,1}(\text{U})$	1839,8 (2)						
$\gamma_{63,1}(\text{U})$	1874,7 (2)	0,035 (9)					
$\gamma_{64,1}(\text{U})$	1886,0 (3)	0,016 (5)					
$\gamma_{71,2}(\text{U})$	1892,0 (2)	0,146 (17)					
$\gamma_{72,2}(\text{U})$	1895,3 (3)	$\sim 0,0062$					
$\gamma_{65,1}(\text{U})$	1898,6 (2)	0,104 (23)					
$\gamma_{66,1}(\text{U})$	1917,5 (3)	0,020 (5)					
$\gamma_{74,2}(\text{U})$	1927,4 (2)	0,30 (5)					
$\gamma_{68,1}(\text{U})$	1939,7 (3)	0,042 (11)					
$\gamma_{75,2}(\text{U})$	1960,0 (4)	0,010 (3)					
$\gamma_{76,2}(\text{U})$	1973,2 (4)	$\sim 0,0027$					
$\gamma_{70,1}(\text{U})$	1979,4 (4)	0,017 (5)					
$\gamma_{71,1}(\text{U})$	1991,6 (1)	0,007 (4)					
$\gamma_{76,1}(\text{U})$	2074,5 (4)	0,0042 (22)					

3 Atomic Data

3.1

ω_K	:	0,970	(4)
$\bar{\omega}_L$:	0,500	(19)
n_{KL}	:	0,794	(5)

3.1.1 X Radiations

	Energy keV	Relative probability
X_K		
$K\alpha_2$	94,666	62,47
$K\alpha_1$	98,44	100
$K\beta_3$	110,421	}
$K\beta_1$	111,298	}
$K\beta_5''$	111,964	}
		36,08
$K\beta_2$	114,407	}
$K\beta_4$	115,012	}
$KO_{2,3}$	115,377	}
X_L		
$L\ell$	11,6185	
$L\alpha$	13,4382 – 13,6146	
$L\eta$	15,399	
$L\beta$	15,7268 – 18,2061	
$L\gamma$	19,5072 – 20,7141	

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	71,776 – 80,954	100
KLX	88,153 – 98,429	59,6
KXY	104,51 – 115,59	8,88
Auger L	5,9 – 21,6	

4 Electron Emissions

		Energy keV	Electrons per 100 disint.
eAL	(U)	5,9 - 21,6	77 (10)
eAK	(U)		1,08 (6)
	KLL	71,776 - 80,954	}
	KLX	88,153 - 98,429	}
	KXY	104,51 - 115,59	}
ec _{25,16} K	(U)	9,86 (1)	0,171 (26)
ec _{14,13} L	(U)	12,5 - 17,1	6,1 (7)
ec _{43,33} K	(U)	15,70 (1)	3,71 (33)
ec _{51,45} K	(U)	19,01 (2)	0,86 (17)
ec _{1,0} L	(U)	21,73 - 26,32	62 (16)
ec _{16,14} L	(U)	23,69 - 28,28	5,1 (32)
ec _{13,7} K	(U)	24,55 (2)	1,5 (11)
ec _{33,30} K	(U)	28,18 (2)	1,04 (16)
ec _{14,13} M	(U)	28,8 - 30,7	1,69 (18)
ec _{14,13} N	(U)	32,9 - 33,9	0,46 (5)
ec _{15,12} L	(U)	33,20 - 37,79	0,8 (8)
ec _{22,16} L	(U)	36,4 - 41,0	0,34 (11)
ec _{3,2} K	(U)	37,11 (2)	1,30 (15)
ec _{56,51} L	(U)	37,43 - 42,02	2,2 (18)
ec _{1,0} M	(U)	37,94 - 39,94	17,2 (43)
ec _{16,14} M	(U)	39,9 - 41,9	1,4 (9)
ec _{13,9} L	(U)	40,9 - 45,5	0,51 (16)
ec _{1,0} N	(U)	42,05 - 43,11	4,7 (12)
ec _{16,14} N	(U)	44,01 - 45,07	0,38 (25)
ec _{25,22} L	(U)	45,49 - 50,08	1,5 (5)
ec _{25,20} L	(U)	47,70 - 52,29	0,58 (49)
ec _{22,11} K	(U)	49,34 (5)	0,11 (12)
ec _{15,12} M	(U)	49,41 - 51,41	0,24 (20)
ec _{56,51} M	(U)	53,64 - 55,64	0,6 (5)
ec _{51,43} K	(U)	55,25 (2)	1,96 (27)
ec _{13,9} M	(U)	57,2 - 59,2	0,127 (40)
ec _{56,51} N	(U)	57,75 - 58,81	0,16 (14)
ec _{16,13} L	(U)	58,08 - 62,67	1,7 (6)
ec _{14,7} K	(U)	58,95 (3)	0,32 (31)
ec _{25,22} M	(U)	61,7 - 63,7	0,41 (15)
ec _{25,20} M	(U)	63,91 - 65,91	0,16 (15)
ec _{51,41} K	(U)	64,20 (8)	0,15 (5)
ec _{25,22} N	(U)	65,81 - 66,87	0,112 (40)
ec _{51,40} K	(U)	70,55 (2)	5,4 (6)
ec _{16,13} M	(U)	74,29 - 76,29	0,48 (17)
ec _{2,1} L	(U)	78,10 - 82,69	31 (6)
ec _{56,45} K	(U)	78,13 (3)	0,7 (7)
ec _{16,13} N	(U)	78,40 - 79,46	0,131 (46)

		Energy keV	Electrons per 100 disint.
ec _{23,12} K	(U)	81,20 (5)	0,1 (1)
ec _{22,14} L	(U)	82,01 - 86,60	1,96 (33)
ec _{21,9} K	(U)	84,35 (5)	0,1 (1)
ec _{16,11} L	(U)	84,92 - 89,51	0,104 (32)
ec _{4,3} K	(U)	85,37 (3)	0,138 (20)
ec _{13,5} K	(U)	87,52 (3)	1,0 (5)
ec _{2,1} M	(U)	94,31 - 96,31	8,7 (16)
ec _{22,14} M	(U)	98,22 - 100,22	0,54 (9)
ec _{2,1} N	(U)	98,42 - 99,48	2,36 (44)
ec _{22,14} N	(U)	102,33 - 103,39	0,148 (25)
ec _{25,16} L	(U)	103,70 - 108,29	2,69 (41)
ec _{16,7} K	(U)	104,40 (8)	0,276 (47)
ec _{43,33} L	(U)	109,5 - 114,1	0,84 (8)
ec _{33,25} K	(U)	110,90 (3)	4,4 (16)
ec _{51,37} K	(U)	111,65 (3)	10 (1)
ec _{51,45} L	(U)	112,85 - 117,44	0,169 (34)
ec _{25,11} K	(U)	116,61 (3)	0,16 (15)
ec _{13,7} L	(U)	118,39 - 122,98	0,90 (18)
ec _{25,16} M	(U)	119,91 - 121,91	0,75 (11)
ec _{33,30} L	(U)	122,02 - 126,61	0,49 (8)
ec _{25,16} N	(U)	124,02 - 125,08	0,203 (31)
ec _{43,33} M	(U)	125,8 - 127,8	0,205 (18)
ec _{30,22} L	(U)	128,12 - 132,71	0,111 (34)
ec _{56,40} K	(U)	129,77 (2)	1,06 (15)
ec _{3,2} L	(U)	130,95 - 135,54	8,4 (10)
ec _{33,24} K	(U)	133,62 (1)	0,118 (19)
ec _{13,7} M	(U)	134,6 - 136,6	0,24 (6)
ec _{33,30} M	(U)	138,23 - 140,23	0,129 (20)
ec _{3,2} M	(U)	147,16 - 149,16	2,33 (27)
ec _{51,43} L	(U)	149,09 - 153,68	0,38 (5)
ec _{3,2} N	(U)	151,27 - 152,33	0,63 (7)
ec _{26,10} K	(U)	151,52 (5)	0,11 (9)
ec _{14,7} L	(U)	152,79 - 157,38	0,126 (23)
ec _{49,33} K	(U)	156,68 (5)	0,83 (11)
ec _{51,40} L	(U)	164,39 - 168,98	1,04 (11)
ec _{56,45} L	(U)	171,97 - 176,56	0,255 (42)
ec _{33,22} K	(U)	178,19 (5)	0,84 (29)
ec _{4,3} L	(U)	179,21 - 183,80	0,38 (6)
ec _{51,40} M	(U)	180,6 - 182,6	0,253 (27)
ec _{13,5} L	(U)	181,36 - 185,95	0,52 (6)
ec _{4,3} M	(U)	195,42 - 197,42	0,105 (15)
ec _{13,5} M	(U)	197,57 - 199,57	0,138 (17)
ec _{33,25} L	(U)	204,7 - 209,3	1,46 (19)
ec _{51,37} L	(U)	205,49 - 210,08	1,94 (20)
ec _{33,25} M	(U)	221 - 223	0,372 (47)
ec _{51,37} M	(U)	221,7 - 223,7	0,469 (49)
ec _{56,40} L	(U)	223,61 - 228,20	0,205 (30)

		Energy keV	Electrons per 100 disint.
ec _{33,25} N	(U)	225,1 - 226,1	0,100 (13)
ec _{51,37} N	(U)	225,81 - 226,87	0,126 (13)
ec _{49,33} L	(U)	250,52 - 255,11	0,194 (25)
ec _{37,21} K	(U)	253,90 (5)	1,12 (14)
ec _{40,23} K	(U)	256,4 (1)	0,50 (6)
ec _{33,22} L	(U)	272,03 - 276,62	0,33 (5)
ec _{33,11} K	(U)	343,08 (5)	0,125 (47)
ec _{37,21} L	(U)	347,7 - 352,3	0,216 (26)
ec _{40,23} L	(U)	350,242 - 354,832	0,100 (11)
ec _{45,15} K	(U)	449,8 (1)	0,149 (16)
ec _{40,12} K	(U)	453,5 (2)	0,51 (8)
ec _{37,9} K	(U)	454,1 (1)	1,30 (17)
ec _{37,9} L	(U)	547,9 - 552,5	0,248 (32)
ec _{54,16} K	(U)	577,2 (1)	0,104 (11)
ec _{50,13} K	(U)	617,96 (5)	0,50 (6)
ec _{9,1} K	(U)	768,06 (4)	0,101 (12)
$\beta_{0,77}^-$	max:	51 (4)	0,42 (5)
$\beta_{0,77}^-$	avg:	13,0 (11)	
$\beta_{0,76}^-$	max:	79 (4)	0,21 (3)
$\beta_{0,76}^-$	avg:	20,4 (11)	
$\beta_{0,75}^-$	max:	94 (4)	0,064 (11)
$\beta_{0,75}^-$	avg:	24,2 (11)	
$\beta_{0,74}^-$	max:	126 (4)	0,40 (7)
$\beta_{0,74}^-$	avg:	33,1 (11)	
$\beta_{0,73}^-$	max:	129 (4)	0,140 (24)
$\beta_{0,73}^-$	avg:	33,8 (11)	
$\beta_{0,72}^-$	max:	158 (4)	0,055 (8)
$\beta_{0,72}^-$	avg:	41,9 (12)	
$\beta_{0,71}^-$	max:	161 (4)	0,90 (15)
$\beta_{0,71}^-$	avg:	42,9 (12)	
$\beta_{0,70}^-$	max:	175 (4)	0,112 (16)
$\beta_{0,70}^-$	avg:	46,7 (12)	
$\beta_{0,69}^-$	max:	195 (4)	0,122 (16)
$\beta_{0,69}^-$	avg:	52,2 (12)	
$\beta_{0,68}^-$	max:	214 (4)	0,59 (8)
$\beta_{0,68}^-$	avg:	57,8 (12)	
$\beta_{0,67}^-$	max:	226 (4)	0,044 (12)
$\beta_{0,67}^-$	avg:	61,3 (12)	
$\beta_{0,66}^-$	max:	236 (4)	0,44 (19)
$\beta_{0,66}^-$	avg:	64,3 (12)	
$\beta_{0,65}^-$	max:	254 (4)	0,35 (5)
$\beta_{0,65}^-$	avg:	69,7 (12)	
$\beta_{0,64}^-$	max:	267 (4)	0,22 (4)

		Energy keV	Electrons per 100 disint.
$\beta_{0,64}^-$	avg:	73,5 (12)	
$\beta_{0,63}^-$	max:	279 (4)	0,21 (3)
$\beta_{0,63}^-$	avg:	76,9 (12)	
$\beta_{0,62}^-$	max:	313 (4)	0,25 (3)
$\beta_{0,62}^-$	avg:	87,3 (13)	
$\beta_{0,61}^-$	max:	332 (4)	0,029 (7)
$\beta_{0,61}^-$	avg:	93,0 (13)	
$\beta_{0,60}^-$	max:	351 (4)	0,17 (3)
$\beta_{0,60}^-$	avg:	98,9 (13)	
$\beta_{0,59}^-$	max:	383 (4)	1,43 (15)
$\beta_{0,59}^-$	avg:	108,9 (13)	
$\beta_{0,58}^-$	max:	402 (4)	0,41 (8)
$\beta_{0,58}^-$	avg:	114,8 (13)	
$\beta_{0,57}^-$	max:	411 (4)	0,061 (11)
$\beta_{0,57}^-$	avg:	117,6 (13)	
$\beta_{0,56}^-$	max:	412 (4)	8 (3)
$\beta_{0,56}^-$	avg:	118,1 (13)	
$\beta_{0,55}^-$	max:	424 (4)	0,129 (17)
$\beta_{0,55}^-$	avg:	121,8 (13)	
$\beta_{0,54}^-$	max:	433 (4)	2,8 (4)
$\beta_{0,54}^-$	avg:	124,7 (13)	
$\beta_{0,53}^-$	max:	457 (4)	0,78 (19)
$\beta_{0,53}^-$	avg:	132,3 (14)	
$\beta_{0,52}^-$	max:	458 (4)	1,16 (14)
$\beta_{0,52}^-$	avg:	132,5 (14)	
$\beta_{0,50}^-$	max:	472 (4)	8,4 (9)
$\beta_{0,50}^-$	avg:	137,2 (13)	
$\beta_{0,51}^-$	max:	472 (4)	36 (5)
$\beta_{0,51}^-$	avg:	137,1 (13)	
$\beta_{0,49}^-$	max:	502 (4)	6,9 (8)
$\beta_{0,49}^-$	avg:	146,8 (14)	
$\beta_{0,48}^-$	max:	542 (4)	0,95 (13)
$\beta_{0,48}^-$	avg:	160,1 (14)	
$\beta_{0,47}^-$	max:	545 (4)	0,18 (4)
$\beta_{0,47}^-$	avg:	164,6 (13)	
$\beta_{0,46}^-$	max:	576 (4)	0,035 (20)
$\beta_{0,46}^-$	avg:	171,4 (14)	
$\beta_{0,45}^-$	max:	606 (4)	< 0,7
$\beta_{0,45}^-$	avg:	181,7 (14)	
$\beta_{0,44}^-$	max:	613 (4)	0,05 (3)
$\beta_{0,44}^-$	avg:	184,1 (14)	
$\beta_{0,43}^-$	max:	642 (4)	19,6 (18)

		Energy keV	Electrons per 100 disint.
$\beta_{0,43}^-$	avg:	194,0 (14)	
$\beta_{0,42}^-$	max:	647 (4)	0,078 (20)
$\beta_{0,42}^-$	avg:	195,6 (14)	
$\beta_{0,41}^-$	max:	651 (4)	0,10 (9)
$\beta_{0,41}^-$	avg:	197,1 (14)	
$\beta_{0,40}^-$	max:	658 (4)	0,9
$\beta_{0,40}^-$	avg:	199,3 (14)	
$\beta_{0,39}^-$	max:	662 (4)	0,21 (4)
$\beta_{0,39}^-$	avg:	200,6 (14)	
$\beta_{0,38}^-$	max:	693 (4)	0,25 (4)
$\beta_{0,38}^-$	avg:	211,3 (14)	
$\beta_{0,37}^-$	max:	699 (4)	< 2,7
$\beta_{0,37}^-$	avg:	213,5 (14)	
$\beta_{0,36}^-$	max:	709 (4)	0,12 (3)
$\beta_{0,36}^-$	avg:	216,9 (14)	
$\beta_{0,34}^-$	max:	747 (4)	0,11 (3)
$\beta_{0,34}^-$	avg:	230,3 (14)	
$\beta_{0,31}^-$	max:	883 (4)	0,109 (18)
$\beta_{0,31}^-$	avg:	278,7 (15)	
$\beta_{0,26}^-$	max:	980 (4)	0,30 (12)
$\beta_{0,26}^-$	avg:	314,2 (15)	
$\beta_{0,25}^-$	max:	1000 (4)	< 1,5
$\beta_{0,25}^-$	avg:	312,6 (14)	
$\beta_{0,22}^-$	max:	1067 (4)	1,9 (10)
$\beta_{0,22}^-$	avg:	346,5 (15)	
$\beta_{0,18}^-$	max:	1104 (4)	0,69 (20)
$\beta_{0,18}^-$	avg:	360,2 (15)	
$\beta_{0,16}^-$	max:	1126 (4)	< 8
$\beta_{0,16}^-$	avg:	368,3 (15)	
$\beta_{0,15}^-$	max:	1171 (4)	1,5 (13)
$\beta_{0,15}^-$	avg:	385,4 (16)	
$\beta_{0,14}^-$	max:	1171,2 (40)	5
$\beta_{0,14}^-$	avg:	385,4 (16)	
$\beta_{0,13}^-$	max:	1206 (4)	< 3,1
$\beta_{0,13}^-$	avg:	398,5 (16)	
$\beta_{0,12}^-$	max:	1227 (4)	< 2,5
$\beta_{0,12}^-$	avg:	406,4 (16)	
$\beta_{0,11}^-$	max:	1232 (4)	< 0,4
$\beta_{0,11}^-$	avg:	408,7 (16)	
$\beta_{0,10}^-$	max:	1247 (4)	< 0,8
$\beta_{0,10}^-$	avg:	414,4 (16)	
$\beta_{0,7}^-$	max:	1346 (4)	< 0,8

		Energy keV	Electrons per 100 disint.
$\beta_{0,7}^-$	avg:	452,1 (16)	< 5
$\beta_{0,2}^-$	max:	2052 (4)	
$\beta_{0,2}^-$	avg:	732,2 (17)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV	Photons per 100 disint.	
XL	(U)	11,6185 — 20,7141	77 (10)	
XK α_2	(U)	94,666	10,5 (6)	} K α
XK α_1	(U)	98,44	16,8 (9)	}
XK β_3	(U)	110,421	}	
XK β_1	(U)	111,298	}	K' β_1
XK β_5''	(U)	111,964	}	
XK β_2	(U)	114,407	}	
XK β_4	(U)	115,012	}	K' β_2
XK $\beta_{2,3}$	(U)	115,377	}	

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{14,13}(U)$	34,30 (4)	0,0037 (4)
$\gamma_{1,0}(U)$	43,49 (2)	0,12 (3)
$\gamma_{16,14}(U)$	45,45 (5)	0,027 (9)
$\gamma_{14,12}(U)$	54,96 (10)	~ 0,0094
$\gamma_{15,12}(U)$	54,96 (10)	~ 0,0094
$\gamma_{45,39}(U)$	55,45 (5)	0,027 (9)
$\gamma_{22,16}(U)$	58,20 (6)	0,0027 (9)
$\gamma_{56,51}(U)$	59,19 (5)	0,032 (11)
$\gamma_{13,9}(U)$	62,70 (1)	1,6 (5)
$\gamma_{25,22}(U)$	67,25 (10)	0,036 (11)
$\gamma_{25,20}(U)$	69,46 (5)	0,018 (8)
$\gamma_{16,13}(U)$	79,84 (2)	0,062 (22)
$\gamma_{14,9}(U)$	97,17 (10)	0,24 (9)

	Energy keV	Photons per 100 disint.
$\gamma_{2,1}(\text{U})$	99,86 (2)	3,2 (6)
$\gamma_{16,12}(\text{U})$	100,89 (2)	0,125 (24)
$\gamma_{22,14}(\text{U})$	103,77 (2)	0,24 (4)
$\gamma_{16,11}(\text{U})$	106,68 (5)	0,036 (11)
$\gamma_{25,16}(\text{U})$	125,46 (1)	0,79 (12)
$\gamma_{43,33}(\text{U})$	131,30 (1)	18,2 (16)
$\gamma_{51,45}(\text{U})$	134,61 (2)	0,114 (23)
$\gamma_{21,13}(\text{U})$	137,23 (5)	0,027 (9)
$\gamma_{13,7}(\text{U})$	140,15 (2)	0,51 (7)
$\gamma_{49,43}(\text{U})$	140,91 (3)	0,31 (5)
$\gamma_{33,30}(\text{U})$	143,78 (2)	0,32 (5)
$\gamma_{30,22}(\text{U})$	149,88 (3)	0,073 (22)
$\gamma_{3,2}(\text{U})$	152,71 (2)	6,0 (7)
$\gamma_{33,28}(\text{U})$	159,48 (2)	0,66 (10)
$\gamma_{22,11}(\text{U})$	164,94 (5)	0,052 (22)
$\gamma_{64,54}(\text{U})$	165,61 (5)	0,073 (22)
$\gamma_{51,43}(\text{U})$	170,85 (2)	0,51 (7)
$\gamma_{14,7}(\text{U})$	174,55 (3)	0,17 (3)
$\gamma_{51,41}(\text{U})$	179,80 (8)	0,045 (16)
$\gamma_{51,40}(\text{U})$	186,15 (2)	1,78 (19)
$\gamma_{56,45}(\text{U})$	193,73 (3)	0,50 (8)
$\gamma_{23,12}(\text{U})$	196,80 (5)	0,073 (22)
$\gamma_{21,9}(\text{U})$	199,95 (5)	0,073 (22)
$\gamma_{4,3}(\text{U})$	200,97 (3)	0,90 (13)
$\gamma_{13,5}(\text{U})$	203,12 (3)	1,24 (15)
$\gamma_{16,7}(\text{U})$	220,00 (8)	0,146 (25)
$\gamma_{66,53}(\text{U})$	221,15 (10)	0,052 (22)
$\gamma_{37,29}(\text{U})$	221,83 (10)	0,073 (22)
$\gamma_{33,25}(\text{U})$	226,50 (3)	4,9 (6)
$\gamma_{51,37}(\text{U})$	227,25 (3)	5,8 (6)
$\gamma_{25,11}(\text{U})$	232,21 (3)	0,18 (3)
$\gamma_{66,51}(\text{U})$	235,11 (3)	0,114 (23)
$\gamma_{17,7}(\text{U})$	235,9 (30)	0,005 (3)
$\gamma_{58,43}(\text{U})$	240,2 (1)	0,052 (22)
$\gamma_{56,40}(\text{U})$	245,37 (2)	0,76 (11)
$\gamma_{27,13}(\text{U})$	247,79 (7)	0,00037 (4)
$\gamma_{33,24}(\text{U})$	249,22 (1)	2,5 (4)
$\gamma_{68,51}(\text{U})$	257,2 (1)	0,052 (22)
$\gamma_{26,10}(\text{U})$	267,12 (5)	0,18 (3)
$\gamma_{49,33}(\text{U})$	272,28 (5)	1,09 (14)
$\gamma_{21,8}(\text{U})$	275,04 (10)	0,094 (23)
$\gamma_{22,7}(\text{U})$	278,3 (1)	0,042 (11)
$\gamma_{33,22}(\text{U})$	293,79 (5)	3,0 (4)
$\gamma_{33,20}(\text{U})$	295,91 (8)	0,146 (25)
$\gamma_{17,5}(\text{U})$	298,7 (2)	0,014 (6)
$\gamma_{64,46}(\text{U})$	308,6 (2)	0,021 (6)
$\gamma_{71,51}(\text{U})$	310,2 (1)	0,073 (13)

	Energy keV	Photons per 100 disint.
$\gamma_{27,9}(U)$	310,52 (10)	0,000135 (15)
$\gamma_{23,8}(U)$	313,5 (1)	0,104 (14)
$\gamma_{21,6}(U)$	316,7 (1)	0,104 (14)
$\gamma_{34,22}(U)$	320,4 (1)	0,052 (8)
$\gamma_{33,18}(U)$	330,40 (5)	0,78 (9)
$\gamma_{74,52}(U)$	331,4 (1)	0,073 (13)
$\gamma_{21,5}(U)$	340,2 (1)	0,041 (9)
$\gamma_{31,12}(U)$	343,8 (2)	0,034 (8)
$\gamma_{33,16}(U)$	351,9 (1)	0,42 (5)
$\gamma_{46,28}(U)$	357,9 (1)	0,036 (11)
$\gamma_{56,33}(U)$	360,6 (3)	0,018 (7)
$\gamma_{26,7}(U)$	365,0 (3)	0,018 (7)
$\gamma_{37,21}(U)$	369,50 (5)	2,5 (3)
$\gamma_{40,23}(U)$	372,0 (1)	1,23 (14)
$\gamma_{32,11}(U)$	379,1 (1)	0,042 (11)
$\gamma_{31,9}(U)$	385,4 (1)	0,042 (11)
$\gamma_{27,7}(U)$	387,94 (6)	0,00072 (6)
$\gamma_{45,25}(U)$	394,1 (1)	0,094 (14)
$\gamma_{33,15}(U)$	397,7 (3)	0,027 (7)
$\gamma_{(-1,2)}(U)$	401,8 (2)	0,036 (11)
$\gamma_{40,22}(U)$	409,8 (1)	0,34 (5)
$\gamma_{49,30}(U)$	416,1 (1)	0,036 (11)
$\gamma_{(-1,3)}(U)$	425,3 (2)	0,036 (11)
$\gamma_{37,16}(U)$	426,95 (5)	0,46 (5)
$\gamma_{27,6}(U)$	427,4 (4)	0,000031 (10)
$\gamma_{68,42}(U)$	433,1 (1)	0,094 (14)
$\gamma_{40,18}(U)$	446,6 (1)	0,114 (15)
$\gamma_{27,5}(U)$	450,93 (4)	0,0040 (19)
$\gamma_{42,19}(U)$	452,4 (3)	0,027 (9)
$\gamma_{33,11}(U)$	458,68 (5)	1,14 (12)
$\gamma_{45,22}(U)$	461,5 (1)	0,034 (11)
$\gamma_{39,16}(U)$	464,2 (1)	0,031 (11)
$\gamma_{40,16}(U)$	468,0 (1)	0,22 (3)
$\gamma_{37,15}(U)$	472,3 (1)	0,36 (4)
$\gamma_{41,16}(U)$	474,2 (2)	0,036 (11)
$\gamma_{42,16}(U)$	478,6 (1)	0,125 (15)
$\gamma_{71,43}(U)$	481,0 (1)	0,31 (4)
$\gamma_{45,18}(U)$	498,0 (1)	0,062 (12)
$\gamma_{66,35}(U)$	502,0 (1)	0,027 (90)
$\gamma_{37,13}(U)$	506,75 (5)	1,30 (14)
$\gamma_{40,15}(U)$	513,4 (1)	~ 0,38
$\gamma_{40,14}(U)$	513,5 (1)	~ 0,76
$\gamma_{45,16}(U)$	519,6 (1)	0,40 (5)
$\gamma_{49,24}(U)$	521,4 (1)	0,75 (9)
$\gamma_{37,12}(U)$	527,9 (1)	0,40 (5)
$\gamma_{43,15}(U)$	529,1 (3)	0,09 (4)
$\gamma_{76,44}(U)$	534,1 (1)	0,083 (13)

	Energy keV	Photons per 100 disint.
$\gamma_{71,37}(\text{U})$	537,2 (1)	0,083 (13)
$\gamma_{39,13}(\text{U})$	543,8 (1)	0,135 (24)
$\gamma_{47,19}(\text{U})$	553,7 (1)	0,045 (16)
$\gamma_{44,14}(\text{U})$	558,0 (2)	0,094 (23)
$\gamma_{36,9}(\text{U})$	559,2 (2)	0,073 (22)
$\gamma_{76,43}(\text{U})$	562,8 (3)	0,036 (11)
$\gamma_{45,15}(\text{U})$	565,2 (1)	1,04 (11)
$\gamma_{40,12}(\text{U})$	568,9 (2)	3,6 (6)
$\gamma_{37,9}(\text{U})$	569,5 (1)	9,3 (12)
$\gamma_{41,12}(\text{U})$	575,5 (1)	0,027 (9)
$\gamma_{43,12}(\text{U})$	584,1 (1)	0,18 (30)
$\gamma_{64,32}(\text{U})$	586,3 (1)	0,073 (13)
$\gamma_{40,10}(\text{U})$	590,3 (10)	0,036 (11)
$\gamma_{50,22}(\text{U})$	595,4 (2)	0,094 (23)
$\gamma_{59,26}(\text{U})$	596,9 (1)	0,20 (3)
$\gamma_{49,18}(\text{U})$	602,6 (1)	0,54 (6)
$\gamma_{43,10}(\text{U})$	604,6 (3)	0,052 (22)
$\gamma_{53,21}(\text{U})$	612,0 (1)	0,38 (5)
$\gamma_{41,9}(\text{U})$	617,0 (2)	0,052 (22)
$\gamma_{44,11}(\text{U})$	619,0 (2)	0,036 (11)
$\gamma_{49,16}(\text{U})$	624,2 (1)	0,35 (5)
$\gamma_{20,4}(\text{U})$	628,1 (1)	0,24 (5)
$\gamma_{48,15}(\text{U})$	629,4 (1)	0,35 (6)
$\gamma_{51,18}(\text{U})$	632,6 (2)	0,036 (11)
$\gamma_{54,22}(\text{U})$	634,3 (2)	0,135 (24)
$\gamma_{(-1,4)}(\text{U})$	643,2 (2)	0,027 (9)
$\gamma_{37,7}(\text{U})$	646,5 (1)	0,114 (15)
$\gamma_{50,16}(\text{U})$	653,7 (1)	0,47 (8)
$\gamma_{56,22}(\text{U})$	655,2 (2)	0,135 (24)
$\gamma_{46,11}(\text{U})$	657,4 (1)	0,40 (5)
$\gamma_{(-1,5)}(\text{U})$	659,8 (1)	0,27 (4)
$\gamma_{48,13}(\text{U})$	663,9 (1)	0,54 (9)
$\gamma_{11,3}(\text{U})$	666,5 (1)	1,18 (13)
$\gamma_{49,15}(\text{U})$	669,7 (1)	1,0 (1)
$\gamma_{35,5}(\text{U})$	669,7 (1)	<0,0006
$\gamma_{24,4}(\text{U})$	675,1 (1)	0,101 (14)
$\gamma_{59,22}(\text{U})$	683,9 (2)	0,16 (4)
$\gamma_{40,8}(\text{U})$	685,1 (2)	0,15 (4)
$\gamma_{54,16}(\text{U})$	692,6 (1)	1,25 (13)
$\gamma_{51,15}(\text{U})$	699,03 (5)	3,6 (4)
$\gamma_{7,2}(\text{U})$	705,9 (1)	2,29 (23)
$\gamma_{8,2}(\text{U})$	708,3 (2)	0,023 (9)
$\gamma_{(-1,6)}(\text{U})$	711,5 (1)	0,156 (25)
$\gamma_{52,14}(\text{U})$	713,7 (1)	0,146 (25)
$\gamma_{62,23}(\text{U})$	716,5 (2)	0,031 (9)
$\gamma_{15,3}(\text{U})$	727,8 (2)	0,114 (15)
$\gamma_{49,11}(\text{U})$	730,9 (2)	0,63 (10)

	Energy keV	Photons per 100 disint.
$\gamma_{50,13}(\text{U})$	733,39 (5)	7,0 (8)
$\gamma_{54,14}(\text{U})$	738,0 (1)	1,16 (13)
$\gamma_{5,1}(\text{U})$	742,813 (5)	2,08 (21)
$\gamma_{49,10}(\text{U})$	745,9 (1)	0,32 (5)
$\gamma_{52,13}(\text{U})$	748,1 (3)	0,104 (23)
$\gamma_{51,12}(\text{U})$	755,0 (1)	1,23 (13)
$\gamma_{56,15}(\text{U})$	758,9 (1)	0,25 (3)
$\gamma_{50,11}(\text{U})$	761,0 (2)	0,073 (22)
$\gamma_{28,4}(\text{U})$	764,8 (2)	0,20 (5)
$\gamma_{6,1}(\text{U})$	766,4 (2)	0,26 (5)
$\gamma_{58,15}(\text{U})$	769,1 (1)	0,187 (20)
$\gamma_{54,13}(\text{U})$	772,4 (2)	0,073 (22)
$\gamma_{(-1,7)}(\text{U})$	778,6 (2)	0,046 (10)
$\gamma_{30,4}(\text{U})$	780,4 (2)	0,90 (9)
$\gamma_{9,2}(\text{U})$	783,4 (1)	0,30 (4)
$\gamma_{5,0}(\text{U})$	786,272 (22)	1,21 (13)
$\gamma_{54,12}(\text{U})$	792,8 (3)	0,045 (11)
$\gamma_{18,3}(\text{U})$	794,9 (2)	0,68 (11)
$\gamma_{51,9}(\text{U})$	796,1 (1)	2,6 (3)
$\gamma_{55,12}(\text{U})$	802,3 (2)	0,031 (9)
$\gamma_{10,2}(\text{U})$	804,1 (1)	0,62 (22)
$\gamma_{7,1}(\text{U})$	805,80 (5)	2,5 (3)
$\gamma_{8,1}(\text{U})$	808,4 (3)	0,036 (11)
$\gamma_{53,9}(\text{U})$	811,5 (1)	0,125 (15)
$\gamma_{56,12}(\text{U})$	814,2 (1)	0,31 (4)
$\gamma_{11,2}(\text{U})$	819,2 (1)	1,9 (2)
$\gamma_{(-1,8)}(\text{U})$	824,2 (2)	1,25 (15)
$\gamma_{12,2}(\text{U})$	825,1 (2)	1,9 (2)
$\gamma_{20,3}(\text{U})$	829,3 (2)	0,36 (11)
$\gamma_{22,3}(\text{U})$	831,5 (1)	4,2 (5)
$\gamma_{75,28}(\text{U})$	839,5 (1)	0,031 (8)
$\gamma_{49,7}(\text{U})$	844,1 (1)	0,43 (5)
$\gamma_{(-1,9)}(\text{U})$	846,1 (2)	0,052 (12)
$\gamma_{59,11}(\text{U})$	848,9 (2)	0,027 (8)
$\gamma_{8,0}(\text{U})$	851,8 (1)	0,073 (22)
$\gamma_{57,9}(\text{U})$	857,7 (2)	0,036 (8)
$\gamma_{59,10}(\text{U})$	863,2 (2)	0,073 (22)
$\gamma_{77,29}(\text{U})$	869,7 (1)	0,20 (3)
$\gamma_{50,7}(\text{U})$	874,0 (3)	0,036 (8)
$\gamma_{24,3}(\text{U})$	876,0 (1)	2,55 (23)
$\gamma_{14,2}(\text{U})$	880,52 (4)	4,3 (6)
$\gamma_{15,2}(\text{U})$	880,52 (4)	6,2 (8)
$\gamma_{9,1}(\text{U})$	883,24 (4)	9,7 (11)
$\gamma_{66,16}(\text{U})$	890,1 (4)	0,027 (8)
$\gamma_{25,3}(\text{U})$	898,67 (5)	3,3 (4)
$\gamma_{10,1}(\text{U})$	904,2 (1)	0,34 (4)
$\gamma_{65,15}(\text{U})$	916,5 (2)	0,024 (7)

	Energy keV	Photons per 100 disint.
$\gamma_{26,3}(\text{U})$	918,4 (1)	0,100 (14)
$\gamma_{(-1,10)}(\text{U})$	920,5 (2)	0,029 (8)
$\gamma_{12,1}(\text{U})$	925,0 (1)	7,9 (9)
$\gamma_{16,2}(\text{U})$	926,0 (2)	1,8 (13)
$\gamma_{9,0}(\text{U})$	926,7 (1)	7,3 (12)
$\gamma_{66,15}(\text{U})$	935,8 (2)	0,067 (10)
$\gamma_{17,2}(\text{U})$	942,0 (3)	0,046 (9)
$\gamma_{13,1}(\text{U})$	946,00 (3)	13,5 (15)
$\gamma_{18,2}(\text{U})$	947,7 (2)	1,63 (21)
$\gamma_{19,2}(\text{U})$	952,7 (1)	0,083 (13)
$\gamma_{59,8}(\text{U})$	960,0 (1)	0,073 (13)
$\gamma_{28,3}(\text{U})$	965,8 (1)	0,48 (6)
$\gamma_{73,18}(\text{U})$	975,1 (1)	0,027 (8)
$\gamma_{29,3}(\text{U})$	978,2 (3)	0,090 (23)
$\gamma_{14,1}(\text{U})$	980,3 (1)	$\sim 2,7$
$\gamma_{15,1}(\text{U})$	980,3 (1)	$\sim 1,77$
$\gamma_{30,3}(\text{U})$	981,6 (3)	0,73 (22)
$\gamma_{22,2}(\text{U})$	984,2 (1)	1,63 (21)
$\gamma_{63,9}(\text{U})$	989,5 (1)	0,104 (14)
$\gamma_{(-1,11)}(\text{U})$	992,0 (2)	0,083 (22)
$\gamma_{60,7}(\text{U})$	994,6 (3)	0,062 (22)
$\gamma_{73,16}(\text{U})$	997,7 (3)	0,046 (12)
$\gamma_{71,15}(\text{U})$	1009,9 (3)	0,067 (12)
$\gamma_{76,19}(\text{U})$	1019,5 (4)	0,027 (8)
$\gamma_{23,2}(\text{U})$	1021,8 (2)	0,15 (4)
$\gamma_{(-1,12)}(\text{U})$	1023,6 (2)	0,062 (22)
$\gamma_{(-1,13)}(\text{U})$	1025,3 (2)	0,052 (22)
$\gamma_{24,2}(\text{U})$	1028,7 (1)	0,57 (6)
$\gamma_{75,16}(\text{U})$	1032,8 (2)	0,018 (5)
$\gamma_{(-1,14)}(\text{U})$	1035,9 (2)	0,026 (10)
$\gamma_{69,11}(\text{U})$	1037,9 (2)	0,018 (7)
$\gamma_{17,1}(\text{U})$	1041,1 (2)	0,032 (11)
$\gamma_{32,3}(\text{U})$	1044,4 (2)	0,031 (3)
$\gamma_{70,12}(\text{U})$	1051,4 (2)	0,062 (12)
$\gamma_{70,11}(\text{U})$	1057,8 (3)	0,0177 (16)
$\gamma_{71,12}(\text{U})$	1065,1 (1)	0,027 (8)
$\gamma_{69,9}(\text{U})$	1073,6 (2)	0,104 (14)
$\gamma_{21,1}(\text{U})$	1083,2 (1)	0,51 (6)
$\gamma_{17,0}(\text{U})$	1085,3 (3)	0,027 (8)
$\gamma_{71,9}(\text{U})$	1106,9 (2)	0,083 (13)
$\gamma_{66,7}(\text{U})$	1110,6 (1)	0,062 (12)
$\gamma_{23,1}(\text{U})$	1121,7 (1)	0,25 (4)
$\gamma_{33,3}(\text{U})$	1125,2 (1)	0,36 (8)
$\gamma_{21,0}(\text{U})$	1126,8 (1)	0,30 (4)
$\gamma_{34,3}(\text{U})$	1151,4 (3)	0,032 (10)
$\gamma_{76,11}(\text{U})$	1153,5 (3)	0,046 (9)
$\gamma_{26,1}(\text{U})$	1171,3 (1)	0,090 (13)

	Energy keV	Photons per 100 disint.
$\gamma_{66,5}(\text{U})$	1173,1 (1)	0,046 (9)
$\gamma_{71,8}(\text{U})$	1182,1 (2)	$\sim 0,0094$
$\gamma_{27,1}(\text{U})$	1193,77 (2)	0,021 (6)
$\gamma_{77,9}(\text{U})$	1217,3 (1)	0,22 (3)
$\gamma_{(-1,15)}(\text{U})$	1220,4 (2)	0,062 (12)
$\gamma_{27,0}(\text{U})$	1237,3 (3)	$<0,0094$
$\gamma_{40,3}(\text{U})$	1241,2 (1)	0,23 (3)
$\gamma_{41,3}(\text{U})$	1247,8 (2)	0,022 (6)
$\gamma_{42,3}(\text{U})$	1252,6 (2)	0,018 (8)
$\gamma_{43,3}(\text{U})$	1256,5 (1)	0,059 (8)
$\gamma_{33,2}(\text{U})$	1277,7 (2)	0,045 (9)
$\gamma_{45,3}(\text{U})$	1292,8 (1)	0,47 (6)
$\gamma_{(-1,16)}(\text{U})$	1296,4 (2)	0,029 (7)
$\gamma_{(-1,17)}(\text{U})$	1301,2 (2)	0,018 (5)
$\gamma_{(-1,18)}(\text{U})$	1327,0 (2)	0,018 (5)
$\gamma_{36,2}(\text{U})$	1342,9 (2)	0,012 (5)
$\gamma_{37,2}(\text{U})$	1352,9 (1)	1,16 (12)
$\gamma_{47,3}(\text{U})$	1354,6 (2)	0,14 (4)
$\gamma_{38,2}(\text{U})$	1359,0 (1)	0,156 (25)
$\gamma_{39,2}(\text{U})$	1389,6 (2)	0,073 (22)
$\gamma_{40,2}(\text{U})$	1393,9 (1)	2,08 (21)
$\gamma_{49,3}(\text{U})$	1397,5 (2)	0,083 (22)
$\gamma_{41,2}(\text{U})$	1400,3 (1)	0,18 (3)
$\gamma_{43,2}(\text{U})$	1409,1 (2)	0,045 (10)
$\gamma_{35,1}(\text{U})$	1414,4 (2)	$<0,0028$
$\gamma_{51,3}(\text{U})$	1426,9 (1)	0,17 (3)
$\gamma_{36,1}(\text{U})$	1442,8 (2)	0,031 (7)
$\gamma_{45,2}(\text{U})$	1445,4 (1)	0,32 (5)
$\gamma_{37,1}(\text{U})$	1452,7 (1)	0,81 (9)
$\gamma_{38,1}(\text{U})$	1458,9 (1)	0,094 (23)
$\gamma_{46,2}(\text{U})$	1475,8 (2)	0,008 (4)
$\gamma_{56,3}(\text{U})$	1485,4 (2)	0,030 (7)
$\gamma_{57,3}(\text{U})$	1488,0 (2)	0,014 (6)
$\gamma_{40,1}(\text{U})$	1493,6 (1)	0,104 (14)
$\gamma_{58,3}(\text{U})$	1496,0 (2)	0,036 (9)
$\gamma_{41,1}(\text{U})$	1500,0 (2)	0,011 (4)
$\gamma_{(-1,19)}(\text{U})$	1507,3 (2)	0,020 (5)
$\gamma_{48,2}(\text{U})$	1510,1 (2)	$<0,0094$
$\gamma_{59,3}(\text{U})$	1515,6 (2)	0,073 (13)
$\gamma_{(-1,20)}(\text{U})$	1520,7 (2)	0,0094 (9)
$\gamma_{(-1,21)}(\text{U})$	1538,8 (2)	0,014 (4)
$\gamma_{49,2}(\text{U})$	1550,1 (1)	0,073 (13)
$\gamma_{61,3}(\text{U})$	1567,0 (2)	0,0114 (23)
$\gamma_{51,2}(\text{U})$	1579,9 (1)	0,073 (22)
$\gamma_{62,3}(\text{U})$	1585,9 (1)	0,146 (17)
$\gamma_{52,2}(\text{U})$	1594,0 (1)	0,31 (4)
$\gamma_{54,2}(\text{U})$	1618,3 (2)	0,009 (4)

	Energy keV	Photons per 100 disint.
$\gamma_{55,2}(\text{U})$	1627,3 (1)	0,076 (11)
$\gamma_{56,2}(\text{U})$	1638,1 (1)	0,208 (21)
$\gamma_{57,2}(\text{U})$	1640,5 (3)	0,010 (4)
$\gamma_{65,3}(\text{U})$	1644,9 (2)	0,010 (4)
$\gamma_{58,2}(\text{U})$	1650,2 (2)	<0,006
$\gamma_{(-1,22)}(\text{U})$	1655,7 (1)	0,026 (4)
$\gamma_{(-1,23)}(\text{U})$	1664,8 (3)	0,018 (7)
$\gamma_{59,2}(\text{U})$	1668,4 (1)	0,77 (9)
$\gamma_{67,3}(\text{U})$	1672,8 (1)	0,034 (11)
$\gamma_{50,1}(\text{U})$	1679,5 (1)	0,077 (18)
$\gamma_{68,3}(\text{U})$	1685,7 (1)	0,31 (4)
$\gamma_{52,1}(\text{U})$	1693,8 (2)	0,7 (1)
$\gamma_{53,1}(\text{U})$	1695,0 (3)	0,27 (7)
$\gamma_{60,2}(\text{U})$	1700,5 (2)	0,104 (14)
$\gamma_{61,2}(\text{U})$	1719,7 (2)	0,018 (6)
$\gamma_{70,3}(\text{U})$	1723,2 (2)	0,016 (4)
$\gamma_{55,1}(\text{U})$	1727,8 (2)	0,020 (5)
$\gamma_{62,2}(\text{U})$	1737,7 (2)	0,075 (11)
$\gamma_{72,3}(\text{U})$	1741,1 (2)	0,049 (8)
$\gamma_{(-1,24)}(\text{U})$	1743,2 (2)	0,033 (8)
$\gamma_{58,1}(\text{U})$	1750,0 (1)	0,064 (10)
$\gamma_{(-1,25)}(\text{U})$	1757,5 (1)	0,024 (6)
$\gamma_{59,1}(\text{U})$	1768,0 (3)	0,020 (5)
$\gamma_{73,3}(\text{U})$	1770,8 (2)	0,068 (17)
$\gamma_{63,2}(\text{U})$	1773,0 (2)	0,068 (17)
$\gamma_{64,2}(\text{U})$	1783,7 (2)	0,025 (7)
$\gamma_{65,2}(\text{U})$	1797,1 (1)	0,24 (3)
$\gamma_{75,3}(\text{U})$	1805,8 (3)	0,0052 (22)
$\gamma_{66,2}(\text{U})$	1815,3 (3)	0,009 (4)
$\gamma_{76,3}(\text{U})$	1819,8 (3)	0,0042 (11)
$\gamma_{67,2}(\text{U})$	1825,1 (3)	0,009 (4)
$\gamma_{(-1,26)}(\text{U})$	1830,8 (3)	0,0042 (11)
$\gamma_{68,2}(\text{U})$	1838,0 (2)	0,0042 (11)
$\gamma_{(-1,27)}(\text{U})$	1849,8 (2)	0,028 (7)
$\gamma_{63,1}(\text{U})$	1872,8 (2)	0,035 (9)
$\gamma_{64,1}(\text{U})$	1884,1 (3)	0,016 (5)
$\gamma_{71,2}(\text{U})$	1890,1 (2)	0,146 (17)
$\gamma_{72,2}(\text{U})$	1893,4 (3)	\sim 0,0062
$\gamma_{65,1}(\text{U})$	1896,7 (2)	0,104 (23)
$\gamma_{66,1}(\text{U})$	1915,5 (3)	0,020 (5)
$\gamma_{74,2}(\text{U})$	1925,4 (2)	0,30 (5)
$\gamma_{(-1,28)}(\text{U})$	1927,9 (4)	0,054 (12)
$\gamma_{(-1,29)}(\text{U})$	1935,2 (4)	\sim 0,0094
$\gamma_{68,1}(\text{U})$	1937,7 (3)	0,042 (11)
$\gamma_{75,2}(\text{U})$	1958,0 (4)	0,010 (3)
$\gamma_{76,2}(\text{U})$	1971,2 (4)	\sim 0,0027
$\gamma_{70,1}(\text{U})$	1977,4 (4)	0,017 (5)

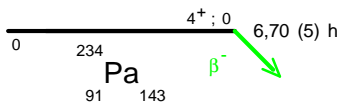
	Energy keV	Photons per 100 disint.
$\gamma_{71,1}(\text{U})$	1989,6 (4)	0,007 (4)
$\gamma_{76,1}(\text{U})$	2072,2 (4)	0,0042 (22)

6 Main Production Modes

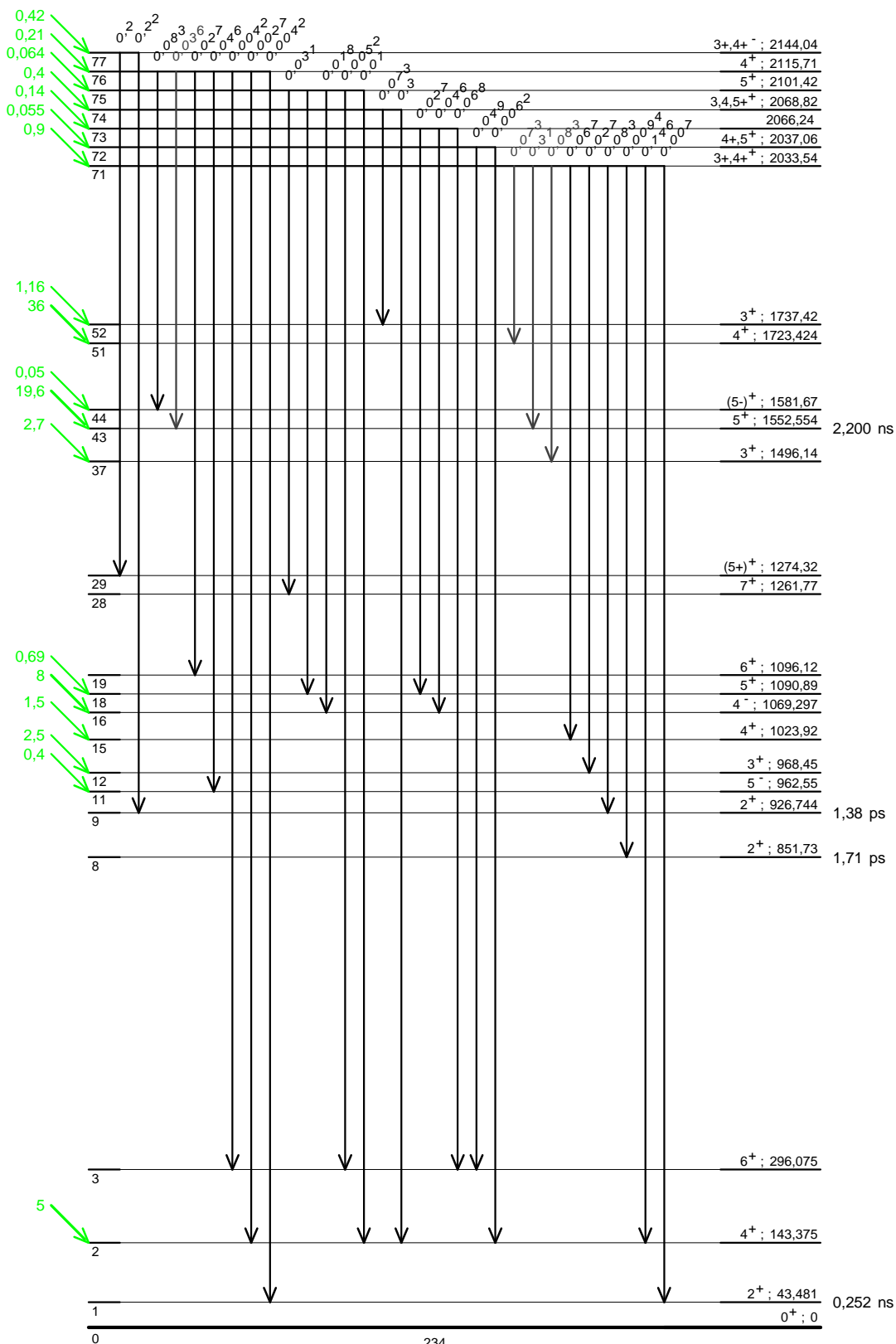
U – 238 decay chain member

7 References

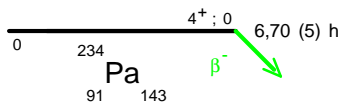
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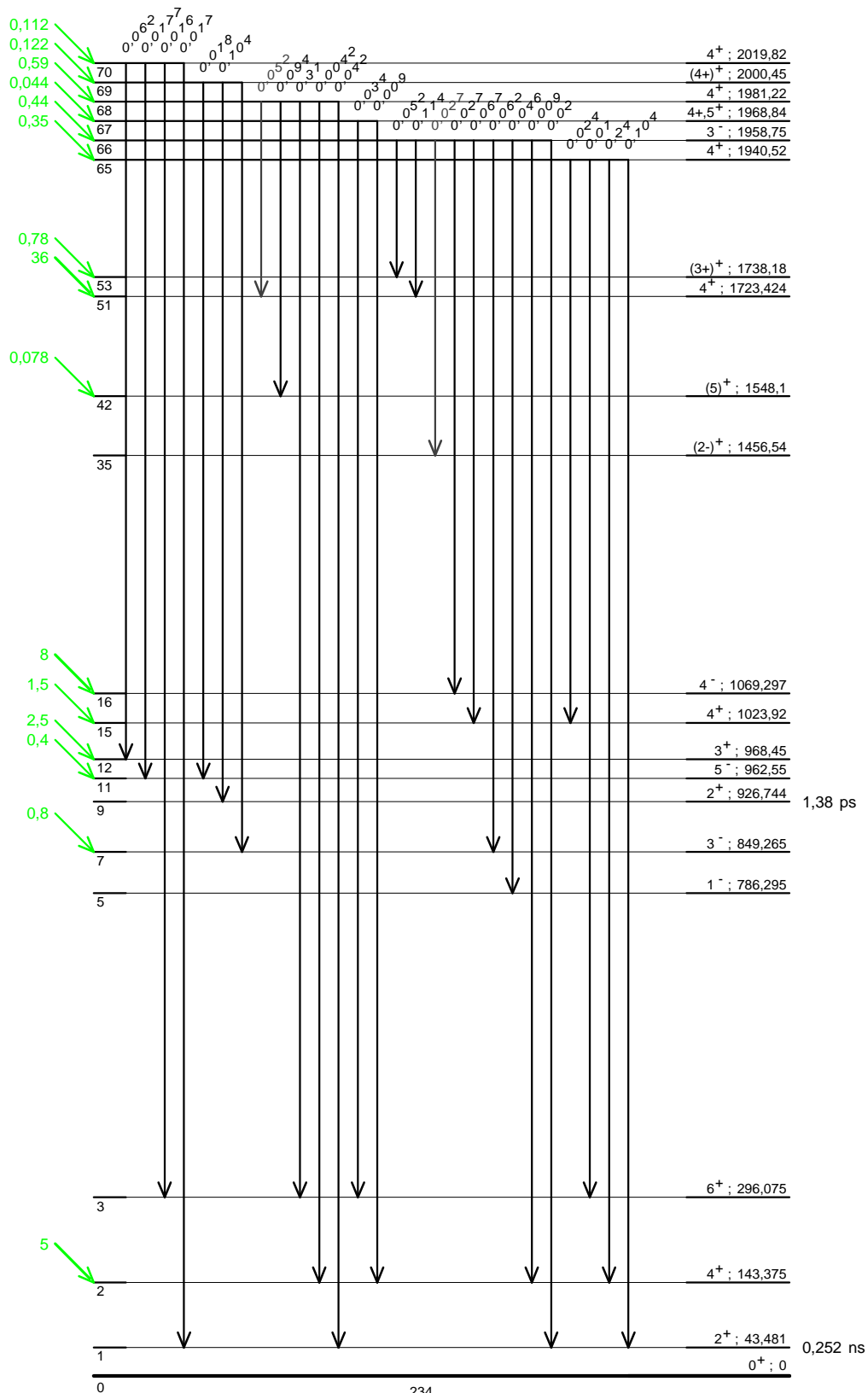
γ Emission intensities per 100 disintegrations

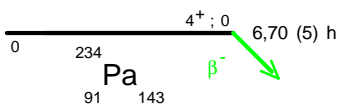


²³⁴U₉₂¹⁴²
Q⁻ = 2195 keV
% β⁻ = 100

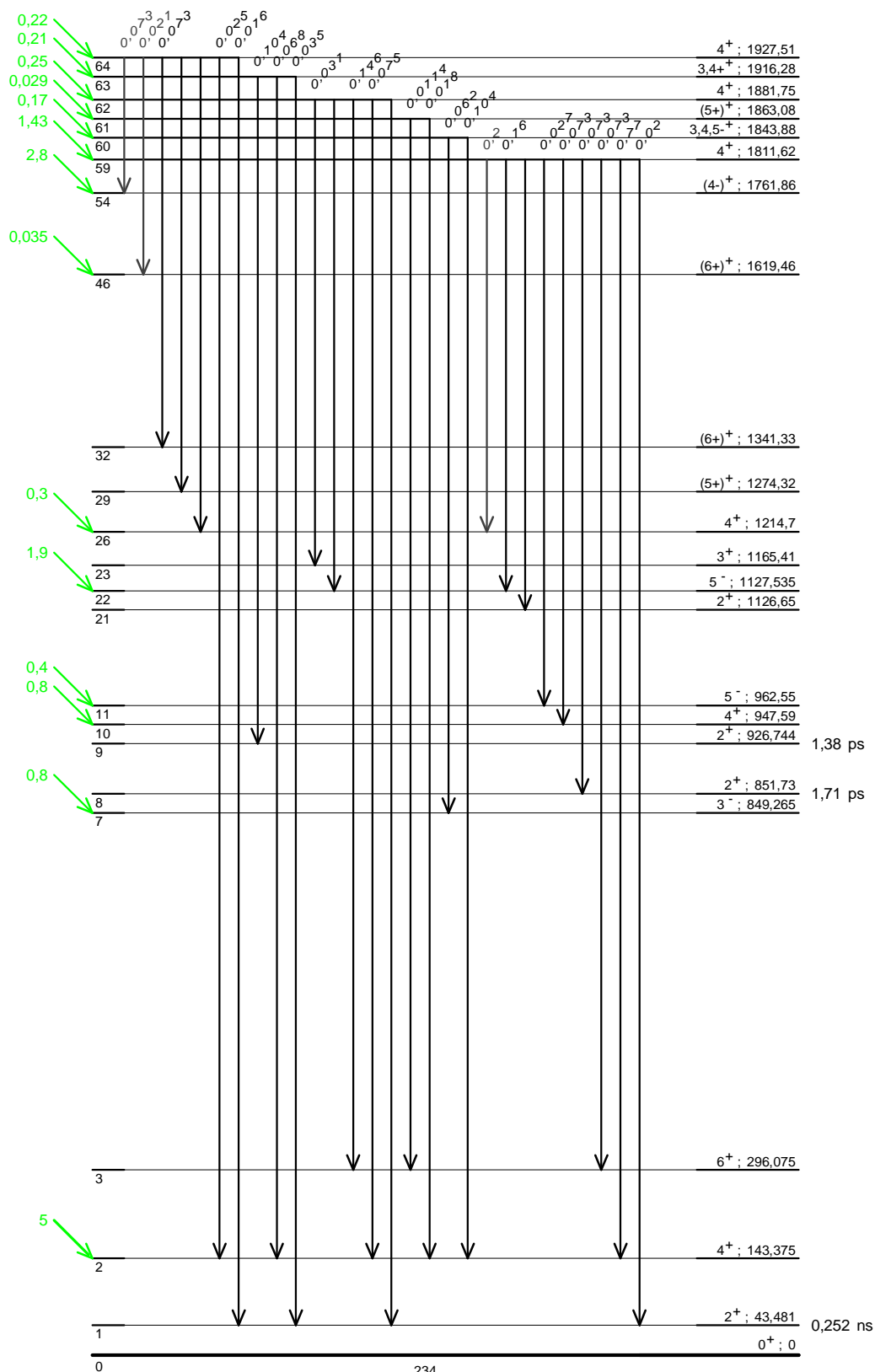


γ Emission intensities per 100 disintegrations

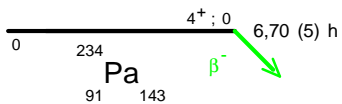




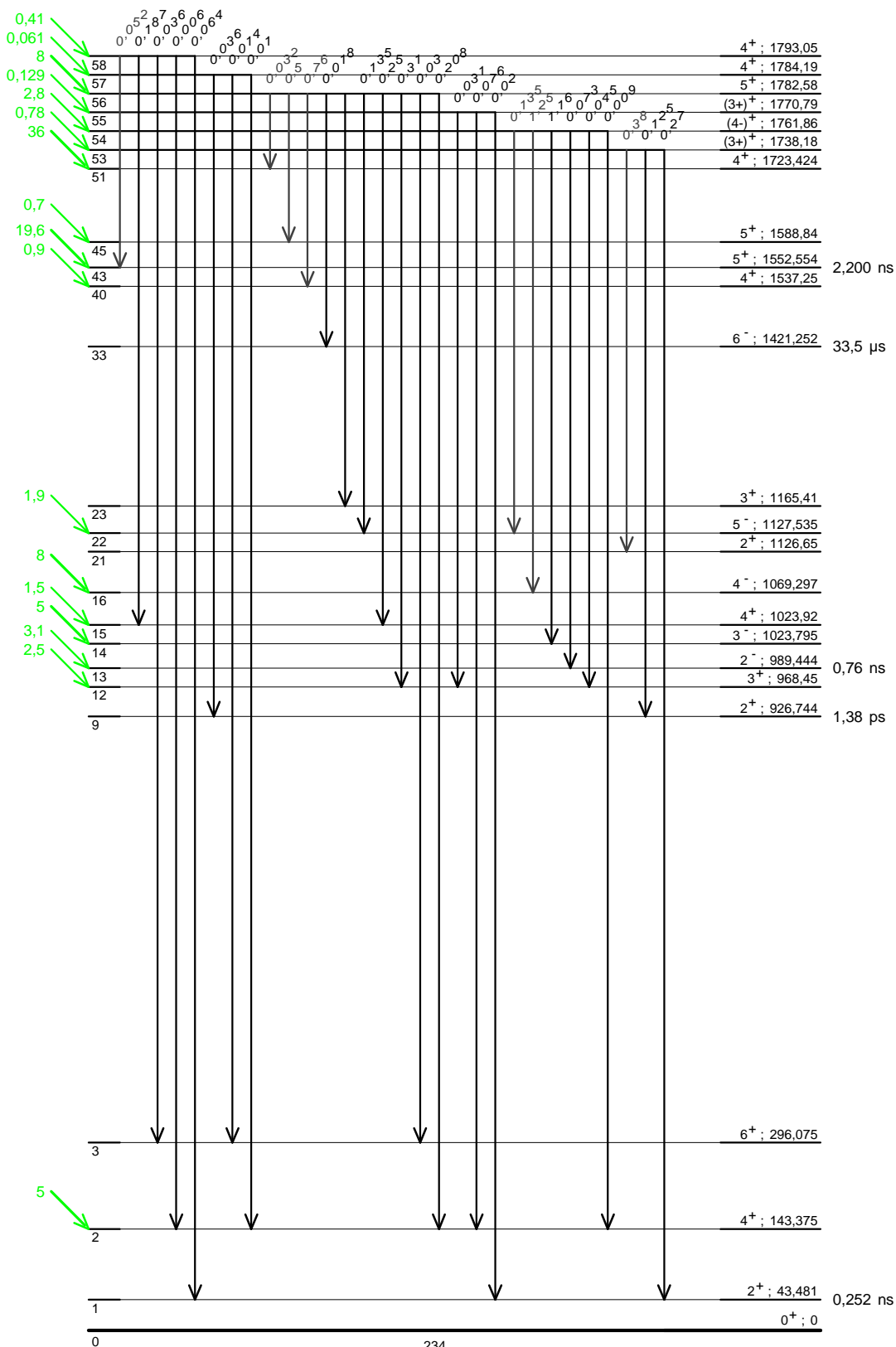
γ Emission intensities per 100 disintegrations



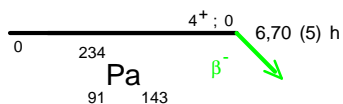
²³⁴U_{92 142}
 Q⁻ = 2195 keV
 % β⁻ = 100



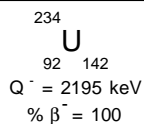
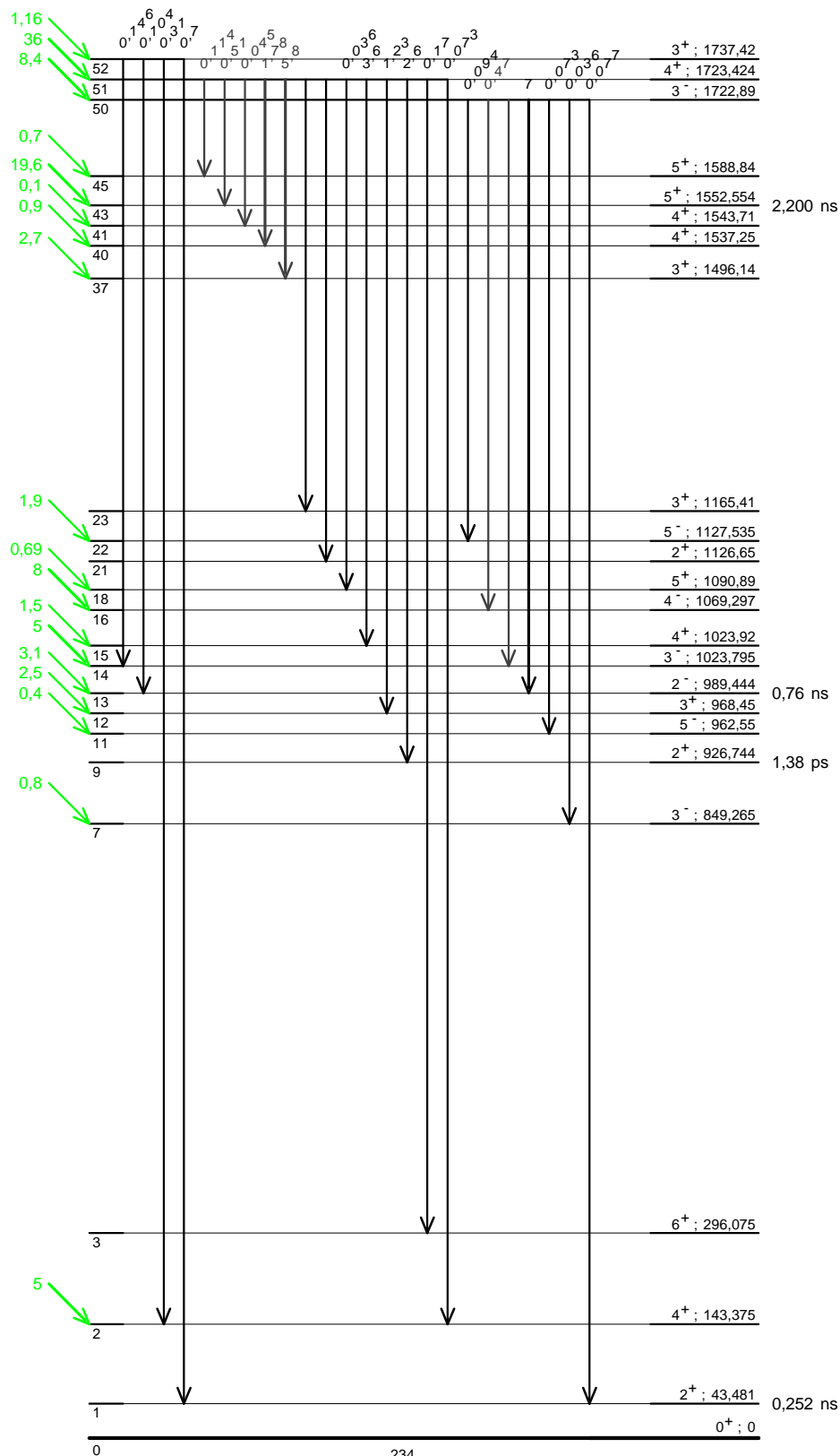
γ Emission intensities per 100 disintegrations

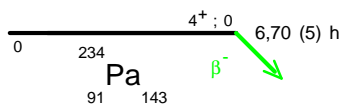


²³⁴U₉₂¹⁴²
 Q⁻ = 2195 keV
 % β⁻ = 100

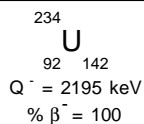
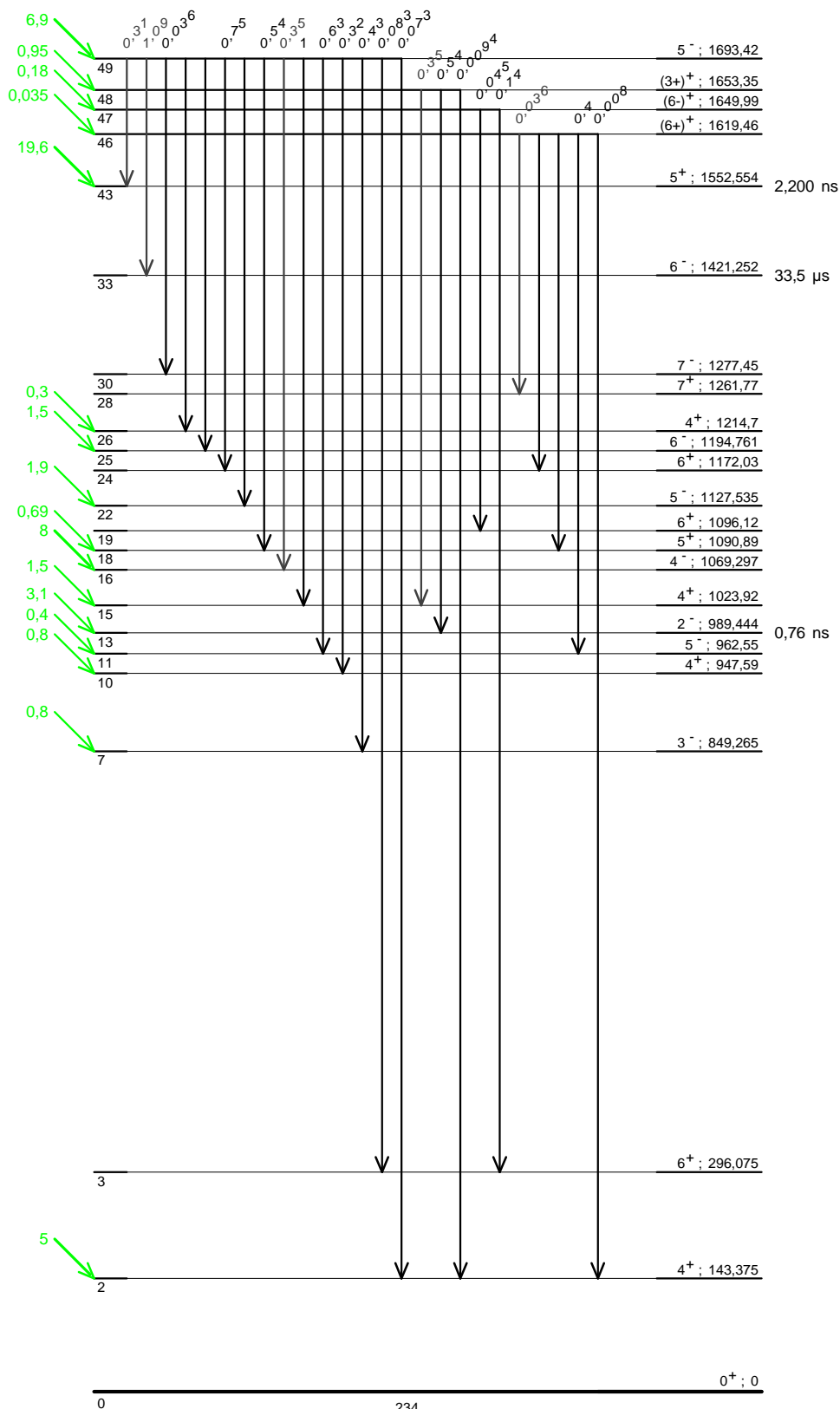


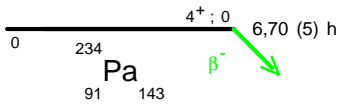
γ Emission intensities per 100 disintegrations



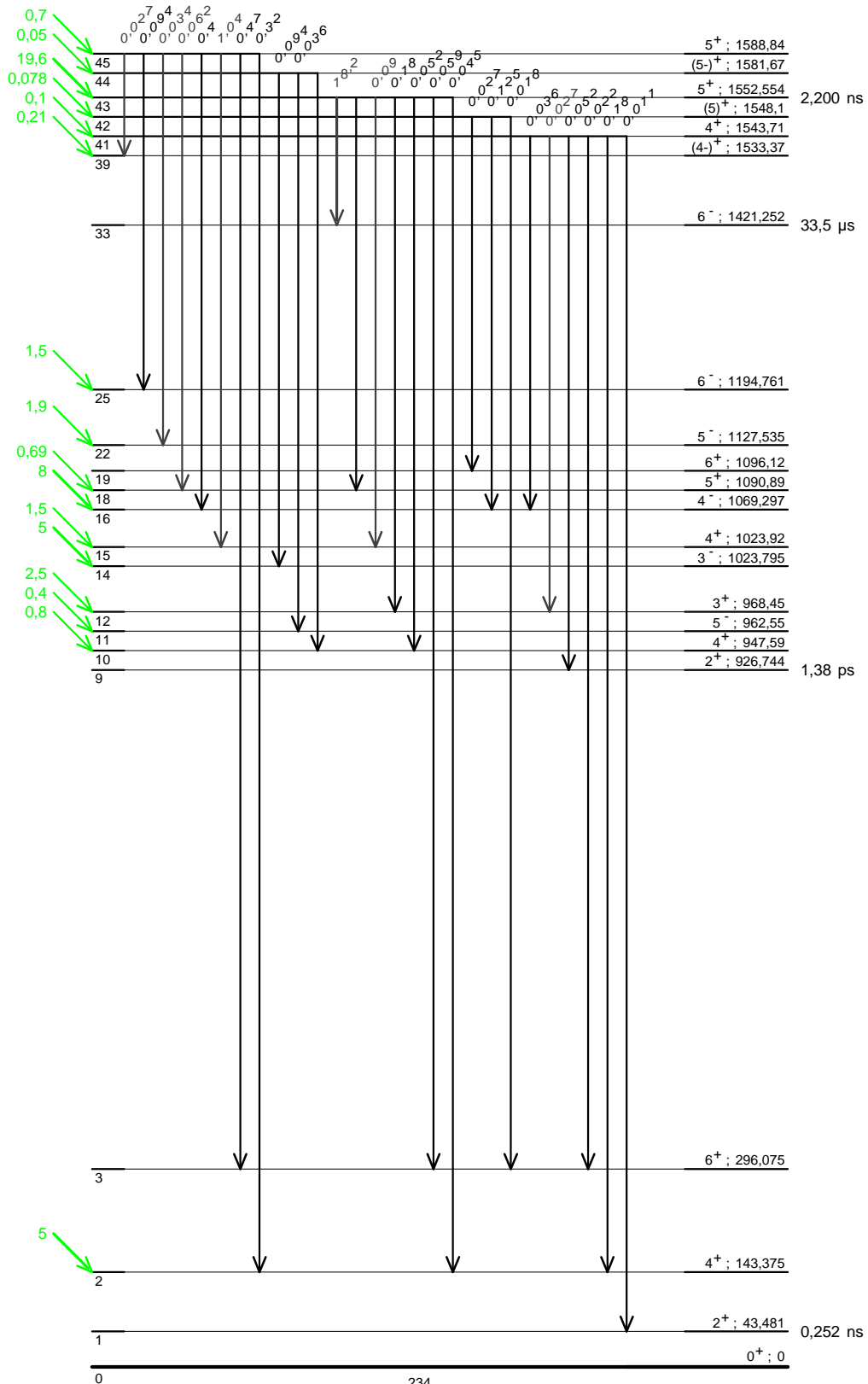


γ Emission intensities per 100 disintegrations

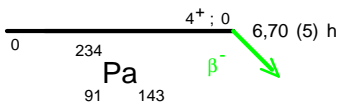




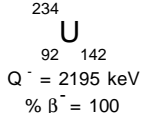
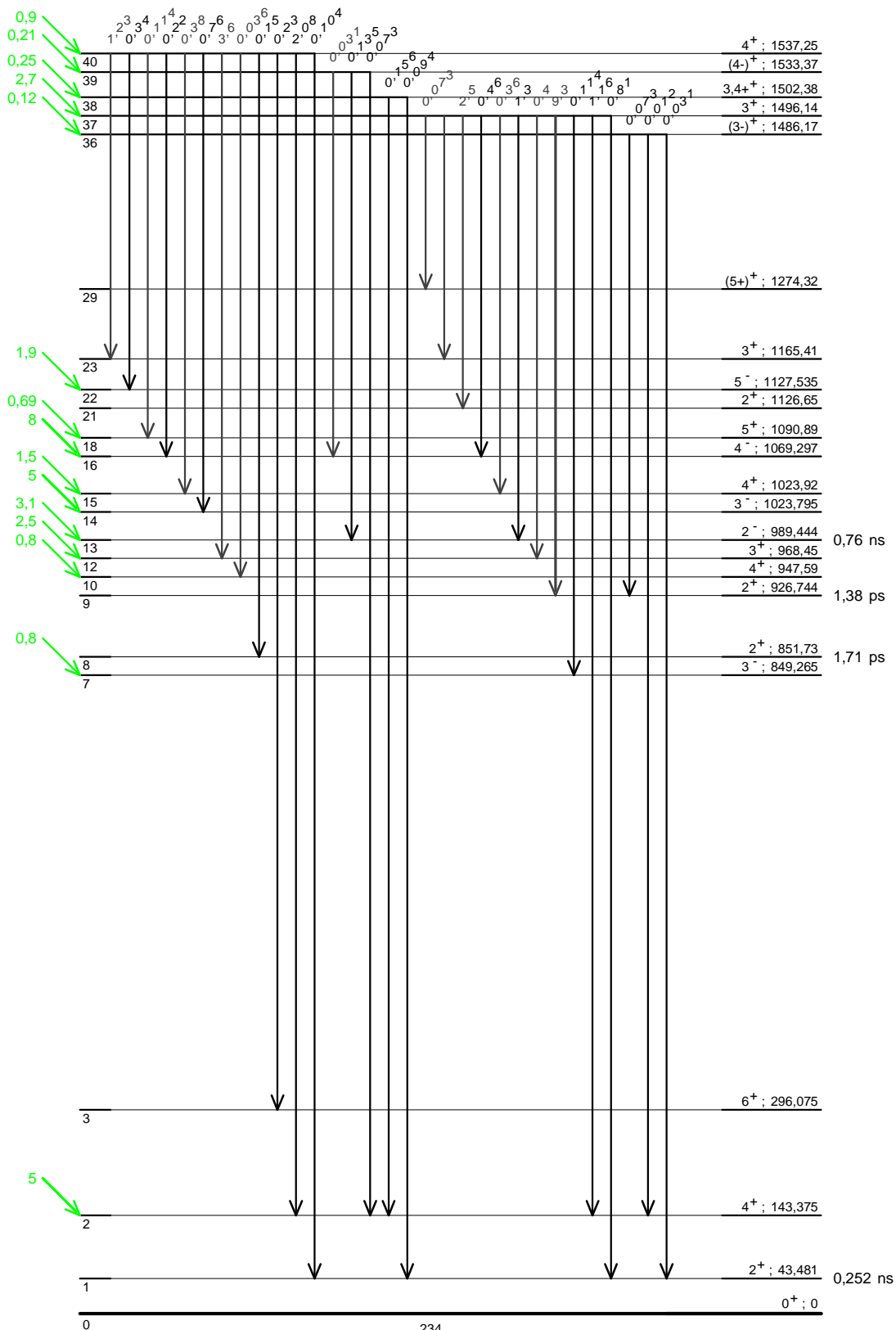
γ Emission intensities per 100 disintegrations

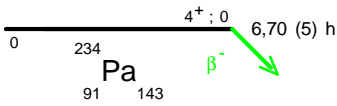


²³⁴U₁₄₂
Q⁻ = 2195 keV
% β⁻ = 100

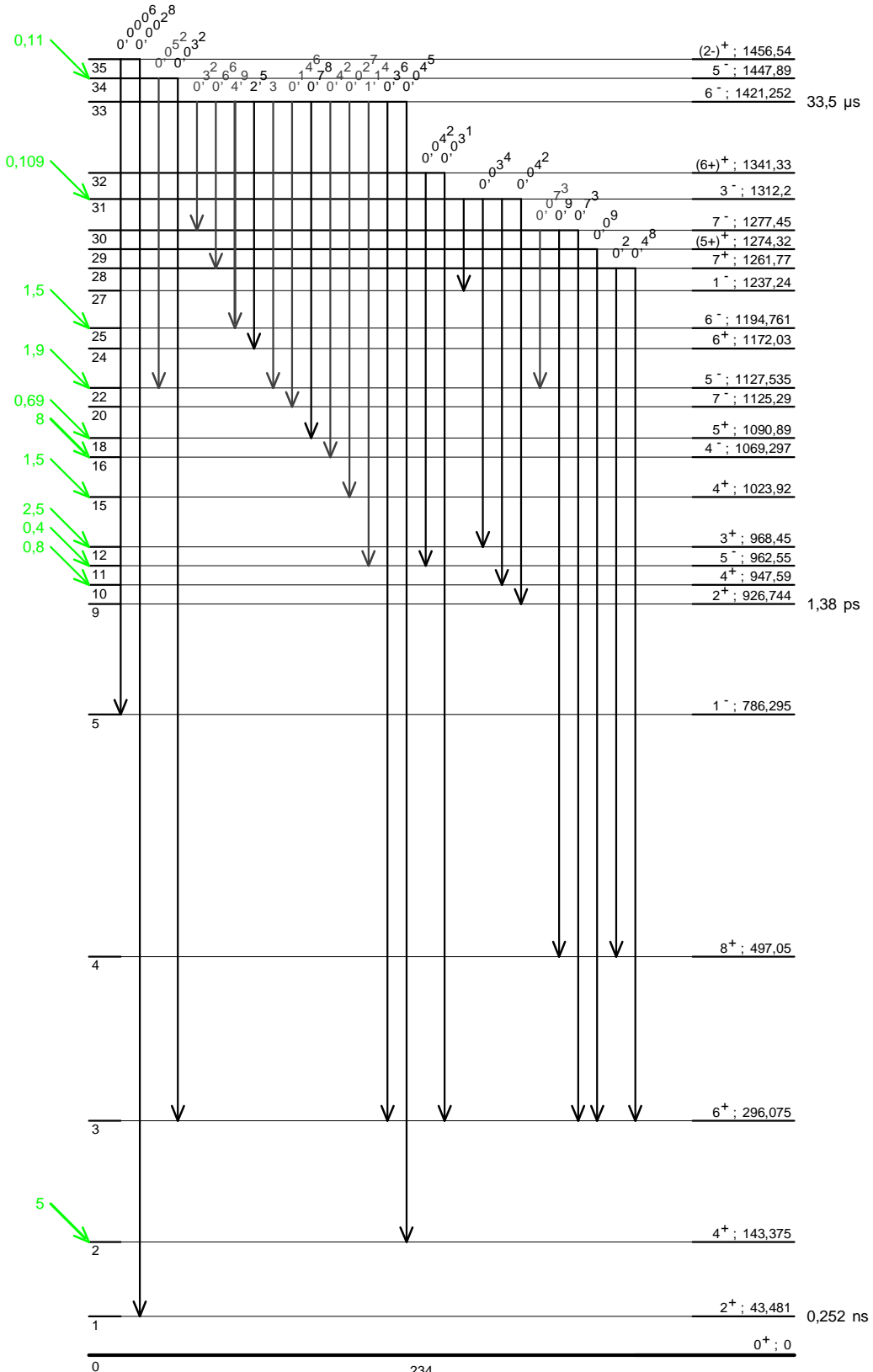


γ Emission intensities per 100 disintegrations

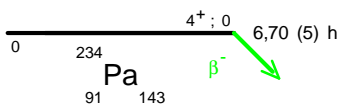




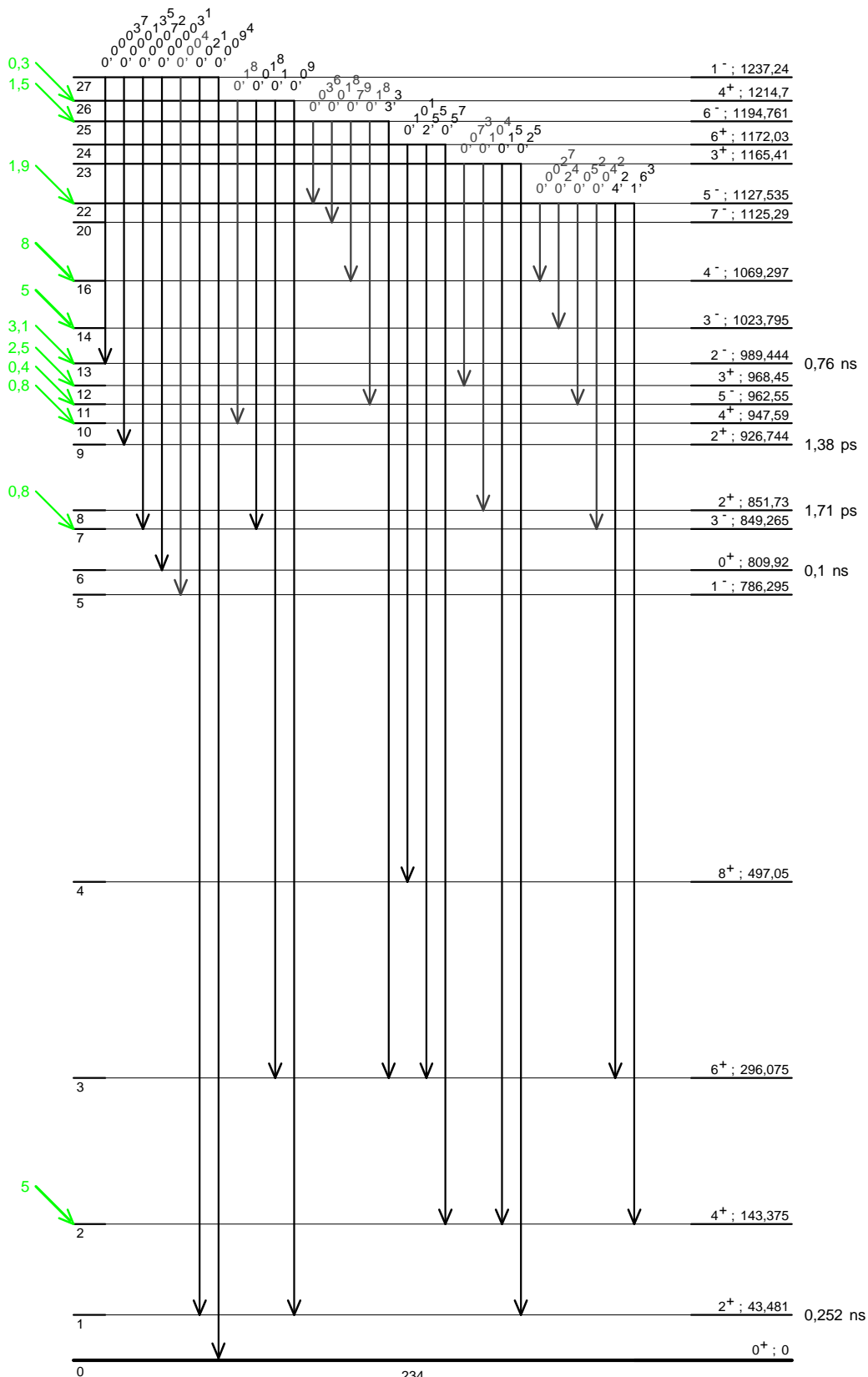
γ Emission intensities per 100 disintegrations



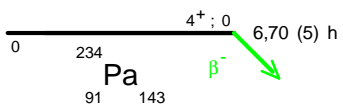
²³⁴U₉₂¹⁴²
 $Q^- = 2195$ keV
 $\% \beta^- = 100$



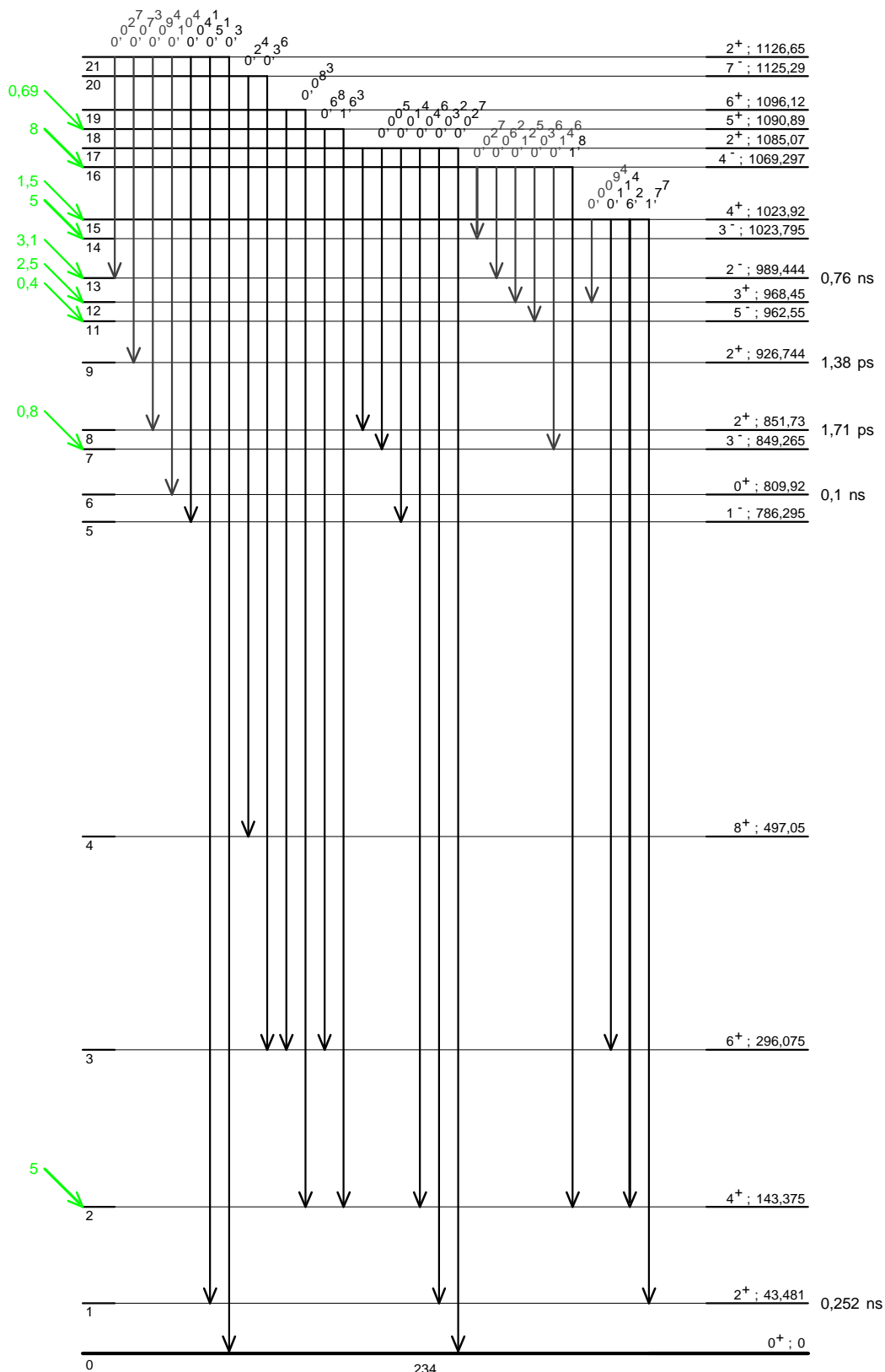
γ Emission intensities per 100 disintegrations



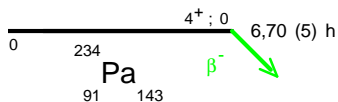
²³⁴U₁₄₂
Q⁻ = 2195 keV
% β⁻ = 100



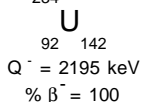
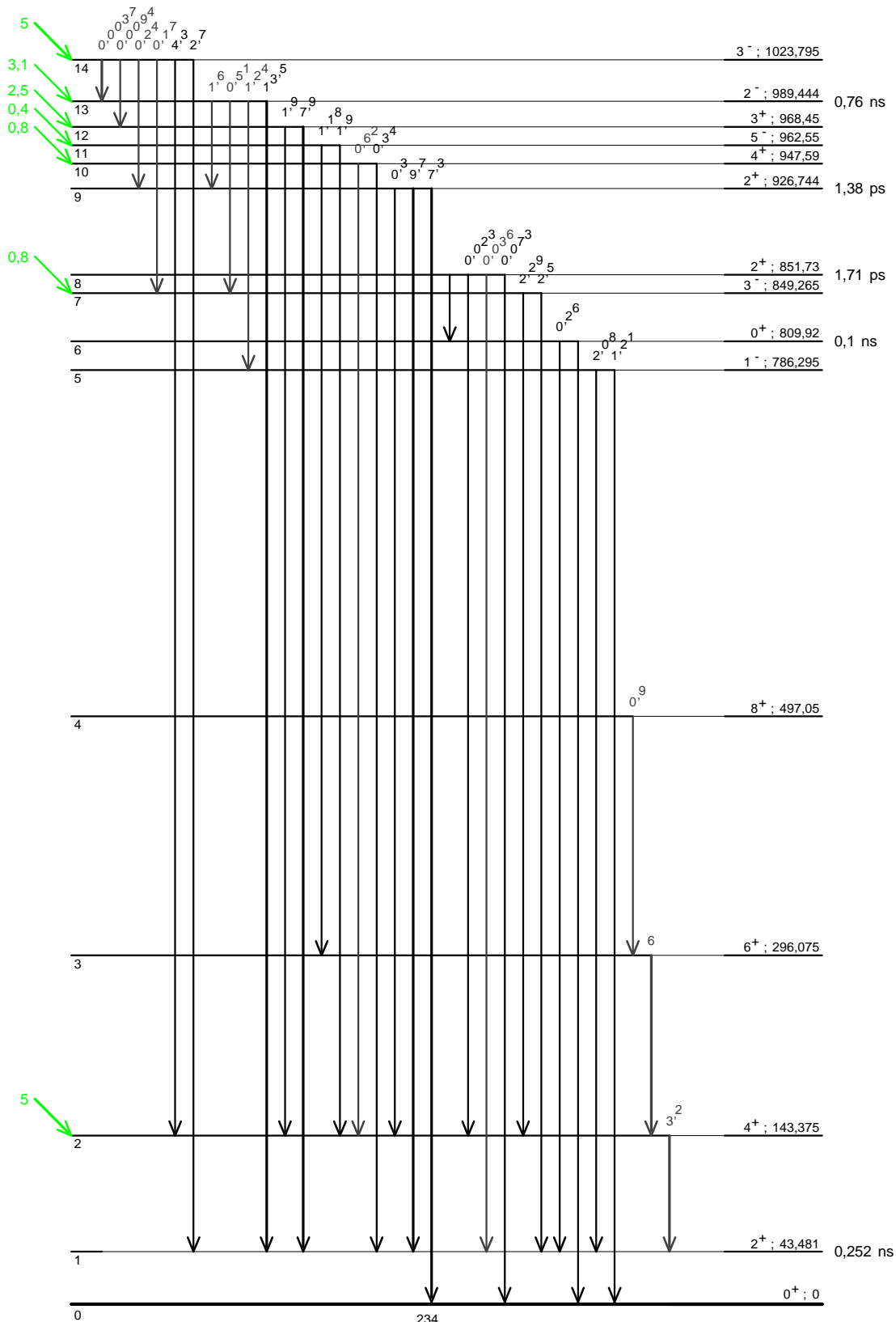
γ Emission intensities per 100 disintegrations

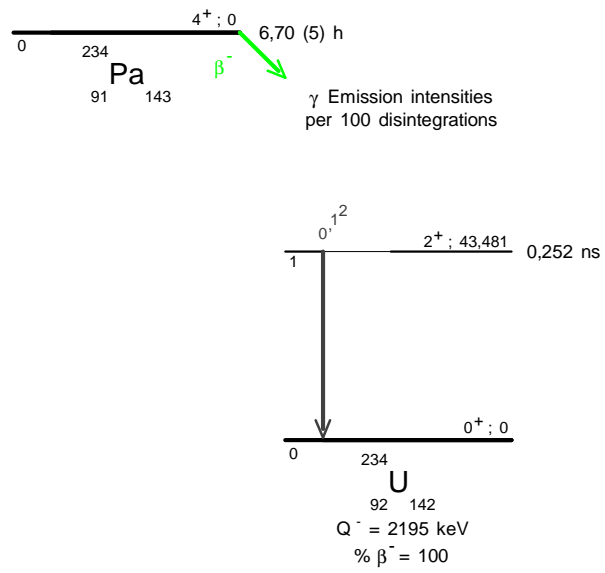


²³⁴U₉₂¹⁴²
Q⁻ = 2195 keV
% β⁻ = 100



γ Emission intensities per 100 disintegrations







1 Decay Scheme

Pa-234m disintegrates 99.85(1)% by beta minus emissions to levels in U-234 and 0.15(1)% through isomeric transition to the Pa-234 ground state.

Le protactinium metastable se désintègre par émissions bêta moins vers des niveaux excités de l'uranium 234 et par transition isomère vers le niveau fondamental du protactinium.

2 Nuclear Data

$T_{1/2}(^{234m}\text{Pa})$:	1,159	(11)	min
$T_{1/2}(^{234}\text{Pa})$:	6,70	(5)	h
$Q^-(^{234m}\text{Pa})$:	2269	(4)	keV + x keV (x < 10)
$Q^{IT}(^{234m}\text{Pa})$:	73,92	(2)	keV + x keV (x < 10)

2.1 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta_{0,30}^-$	299 (4)	0,00389 (22)		6,8
$\beta_{0,29}^-$	332 (4)	0,0108 (3)		6,6
$\beta_{0,28}^-$	358 (4)	0,0452 (8)		6
$\beta_{0,27}^-$	394 (4)	0,0258 (3)		6,4
$\beta_{0,26}^-$	406 (4)	0,00311 (19)		7,4
$\beta_{0,25}^-$	460 (4)	0,0146 (7)		6,9
$\beta_{0,24}^-$	473 (4)	0,0021 (3)		7,7
$\beta_{0,23}^-$	488 (4)	0,0357 (18)		6,6
$\beta_{0,22}^-$	575 (4)	0,0024 (3)		8
$\beta_{0,21}^-$	602 (4)	0,0061 (3)		7,6
$\beta_{0,20}^-$	667 (4)	0,00127 (23)		8,5
$\beta_{0,19}^-$	677 (4)	0,0249 (5)		7,2
$\beta_{0,18}^-$	698 (4)	0,00231 (19)		8,4
$\beta_{0,17}^-$	715 (4)	0,0320 (6)		7,2

	Energy keV	Probability × 100	Nature	lg <i>ft</i>
$\beta_{0,16}^-$	768 (4)	0,0131 (6)		7,7
$\beta_{0,14}^-$	834 (4)	0,0092 (11)		7,9
$\beta_{0,13}^-$	1032 (4)	0,0121 (11)		8,2
$\beta_{0,12}^-$	1095 (4)	0,0046 (3)		8,7
$\beta_{0,9}^-$	1224 (4)	1,006 (13)		6,5
$\beta_{0,4}^-$	1459 (4)	0,945 (12)		6,8
$\beta_{0,3}^-$	1483 (4)	0,049 (3)		8
$\beta_{0,0}^-$	2269 (4)	97,599 (24)	Allowed	5,5

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{2,1}$ (Pa)	< 10	0,15 (1)					
$\gamma_{6,4}$ (U)	41,82	0,0136 (7)					
$\gamma_{1,0}$ (U)	43,49 (2)	1,414 (26)	E2		520 (8)	143,7 (21)	713 (11)
$\gamma_{8,7}$ (U)	62,70 (1)	0,0019 (6)	E1		0,320 (5)	0,0791 (11)	0,426 (6)
$\gamma_{1,0}$ (Pa)	73,92 (2)	0,15 (1)	(M1+E2)		7,96 (25)	1,94 (7)	10,6 (4)
$\gamma_{2,1}$ (U)	99,86 (2)	0,0082 (7)	E2		9,77 (14)	2,71 (4)	13,42 (19)
$\gamma_{18,14}$ (U)	135,32 (8)	0,0000052 (6)	[E1]	0,190 (3)	0,0428 (6)	0,01043 (15)	0,247 (4)
$\gamma_{11,8}$ (U)	137,23 (5)	0,000059 (21)	[E1]	0,184 (3)	0,0413 (6)	0,01006 (15)	0,239 (4)
$\gamma_{8,5}$ (U)	140,1 (10)	<0,008	M1+E2	2,9 (22)	1,76 (25)	0,47 (9)	5,3 (18)
$\gamma_{20,14}$ (U)	166,5 (1)	0,000000273 (6)	[E1]	0,1179 (17)	0,0253 (4)	0,00613 (9)	0,1514 (22)
$\gamma_{12,8}$ (U)	185,0 (4)	0,00172 (15)					
$\gamma_{9,6}$ (U)	193,4 (8)	0,00133 (28)	[E2]	0,163 (3)	0,500 (12)	0,138 (4)	0,847 (18)
$\gamma_{14,13}$ (U)	197,91 (15)	0,000081 (39)	[M1,E2]	1,3 (12)	0,473 (22)	0,122 (4)	2,0 (12)
$\gamma_{11,7}$ (U)	199,9 (10)	0,0017 (8)	(E0+E2+M1)	1,3 (12)	0,473 (22)	0,122 (4)	1,9 (12)
$\gamma_{8,3}$ (U)	203,3 (8)	0,0029 (5)	M1+E2	0,8 (4)	0,420 (12)	0,1109 (23)	1,4 (4)
$\gamma_{23,18}$ (U)	209,9 (4)	0,00132 (15)					
$\gamma_{10,6}$ (U)	233,6 (2)	~ 0,00085					
$\gamma_{10,5}$ (U)	235,9 (3)	0,000096 (43)	[E1]	0,0532 (8)	0,01067 (16)	0,00258 (4)	0,0673 (10)
$\gamma_{9,4}$ (U)	236 (1)	0,074 (8)	E0				
$\gamma_{13,8}$ (U)	247,7 (8)	0,0019 (8)	[M1,E2]	0,7 (7)	0,22 (5)	0,056 (8)	1,0 (7)
$\gamma_{9,3}$ (U)	258,227 (3)	0,0778 (8)	(E1)	0,0434 (6)	0,00859 (12)	0,00207 (3)	0,0548 (8)
$\gamma_{11,6}$ (U)	275,5 (8)	0,00056 (22)	[M1,E2]	0,5 (5)	0,16 (4)	0,039 (8)	0,8 (6)
$\gamma_{10,3}$ (U)	299 (1)	0,00067 (14)	[E1]	0,0315 (5)	0,00608 (10)	0,001467 (24)	0,0395 (7)
$\gamma_{13,7}$ (U)	311 (1)	0,00054 (11)	[E1]	0,0289 (5)	0,00556 (9)	0,001339 (22)	0,0363 (6)
$\gamma_{11,4}$ (U)	316,7 (1)	0,00022 (6)	[E2]	0,0677 (10)	0,0674 (10)	0,0182 (3)	0,1597 (23)
$\gamma_{24,15}$ (U)	338,1 (8)	0,00113 (23)					
$\gamma_{11,3}$ (U)	340,2 (1)	0,000074 (22)	[E1]	0,0239 (4)	0,00453 (7)	0,001090 (16)	0,0298 (5)
$\gamma_{28,17}$ (U)	357,5 (10)	0,00080 (17)					
$\gamma_{24,14}$ (U)	362,8 (10)	0,00069 (15)					
$\gamma_{13,5}$ (U)	387,6 (8)	0,000512 (44)	[E2]	0,0463 (7)	0,0321 (5)	0,00858 (14)	0,0899 (14)
$\gamma_{12,3}$ (U)	387,6 (8)	0,00097 (15)					
$\gamma_{13,4}$ (U)	427,4 (2)	0,000020 (5)	[E1]	0,01488 (21)	0,00274 (4)	0,000657 (10)	0,0185 (3)
$\gamma_{14,8}$ (U)	445,91 (10)	0,000037 (9)	[M1,E2]	0,15 (12)	0,036 (16)	0,009 (4)	0,20 (14)
$\gamma_{13,3}$ (U)	450,98 (10)	0,00385 (16)	M1+E2	0,187 (3)	0,0400 (6)	0,00979 (14)	0,241 (4)
$\gamma_{28,15}$ (U)	453,58 (10)	0,00282 (16)	[M1]	0,258 (4)	0,0495 (7)	0,01193 (17)	0,324 (5)
$\gamma_{22,13}$ (U)	456,7 (10)	0,00095 (20)	[M1]	0,253 (4)	0,0485 (8)	0,01171 (18)	0,318 (5)

	Energy keV	P _{γ+ce} × 100	Multipolarity	α _K	α _L	α _M	α _T
γ _{17,10} (U)	468,43 (10)	0,00206 (12)					
γ _{28,14} (U)	475,74 (10)	0,00305 (17)	[M1]	0,227 (4)	0,0434 (6)	0,01048 (15)	0,285 (4)
γ _{18,10} (U)	485,44 (7)	0,0000217 (28)	[M1,E2]	0,12 (10)	0,028 (13)	0,007 (3)	0,16 (11)
γ _{19,10} (U)	507,6 (10)	0,00158 (15)					
γ _{17,9} (U)	509,3 (8)	0,0022 (3)					
γ _{20,10} (U)	516,74 (6)	0,000015 (2)	(M1)	0,182 (3)	0,0347 (5)	0,00837 (12)	0,228 (4)
γ _{18,9} (U)	526,16 (10)	0,0000110 (12)	[M1]	0,1732 (25)	0,0331 (5)	0,00797 (12)	0,217 (3)
γ _{23,13} (U)	544,14 (10)	0,00349 (15)					
γ _{20,9} (U)	557,41 (6)	0,0000098 (13)	(M1)	0,1485 (21)	0,0283 (4)	0,00682 (10)	0,186 (3)
γ _{25,13} (U)	572,2 (10)	0,00102 (20)	[M1]	0,1384 (21)	0,0264 (4)	0,00636 (10)	0,173 (3)
γ _{18,8} (U)	581,37 (10)	0,000081 (9)	[E1]	0,00815 (12)	0,001445 (21)	0,000345 (5)	0,01006 (14)
γ _{14,4} (U)	624,8 (10)	0,000117 (12)	[E1]	0,00712 (11)	0,001252 (18)	0,000299 (5)	0,00877 (13)
γ _{14,3} (U)	649,2 (10)	0,000064 (9)	[M1,E2]	0,06 (4)	0,012 (7)	0,0031 (15)	0,08 (5)
γ _{16,6} (U)	649,2 (10)	0,0010 (3)					
γ _{23,11} (U)	655,5 (10)	0,00139 (15)					
γ _{15,3} (U)	671 (1)	0,0004 (1)	[M1,E2]	0,05 (4)	0,011 (6)	0,0028 (14)	0,07 (5)
γ _{28,13} (U)	674,1 (10)	0,00071 (14)	[M1]	0,0894 (13)	0,01695 (25)	0,00408 (6)	0,1118 (17)
γ _{25,11} (U)	683,7 (10)	0,00058 (12)	[E1]	0,00603 (9)	0,001050 (15)	0,000250 (4)	0,00741 (11)
γ _{16,4} (U)	691,3 (3)	0,00898 (19)					
γ _{23,10} (U)	695,8 (10)	0,00164 (14)					
γ _{29,13} (U)	699,28 (10)	0,0058 (3)					
γ _{17,6} (U)	702,26 (10)	0,00721 (16)					
γ _{5,2} (U)	706,20 (12)	0,0052 (6)	[E1]	0,00568 (8)	0,000987 (14)	0,000235 (4)	0,00698 (10)
γ _{6,2} (U)	708,5 (10)	<0,00072	[E2]	0,01537 (22)	0,00489 (7)	0,001247 (19)	0,0219 (4)
γ _{18,6} (U)	719,29 (7)	0,0000271 (24)	[M1+E2]	0,05 (3)	0,009 (5)	0,0023 (12)	0,06 (4)
γ _{30,13} (U)	732,8 (10)	0,00130 (15)					
γ _{19,6} (U)	740,40 (8)	0,0118 (3)					
γ _{3,1} (U)	743,115 (5)	0,0946 (30)	E1	0,00518 (8)	0,000895 (13)	0,000213 (3)	0,00636 (9)
γ _{20,6} (U)	750,42 (6)	0,0000184 (22)	(M1)	0,0672 (10)	0,01272 (18)	0,00306 (5)	0,0841 (12)
γ _{18,4} (U)	760,84 (15)	0,0000046 (10)	[M1]	0,0648 (9)	0,01226 (18)	0,00295 (5)	0,0811 (12)
γ _{4,1} (U)	766,708 (20)	0,3290 (41)	(E2)	0,01336 (19)	0,00396 (6)	0,001004 (14)	0,0187 (3)
γ _{19,4} (U)	782,05 (10)	0,00782 (18)					
γ _{7,2} (U)	783,7 (1)	0,000040 (7)	[E2]	0,01285 (18)	0,00374 (6)	0,000946 (14)	0,0179 (3)
γ _{3,0} (U)	786,573 (22)	0,0539 (7)	E1+M2	0,00467 (7)	0,000804 (12)	0,000191 (3)	0,00573 (8)
γ _{20,4} (U)	792,25 (5)	0,0000106 (14)	[M1]	0,0582 (9)	0,01100 (16)	0,00265 (4)	0,0728 (11)
γ _{5,1} (U)	806,05 (10)	0,0062 (8)	[E1]	0,00447 (7)	0,000768 (11)	0,000183 (3)	0,00549 (8)
γ _{6,1} (U)	808,52 (10)	0,00281 (17)					
γ _{4,0} (U)	810,3 (7)	0,72	E0	0,00447 (7)	0,000768 (11)	0,000183 (3)	0,00549 (8)
γ _{21,5} (U)	818,6 (5)	0,0010 (3)					
γ _{28,10} (U)	825,9 (2)	0,0014 (4)					
γ _{22,5} (U)	844,5 (8)	0,00109 (23)					
γ _{6,0} (U)	852,0 (1)	0,00707 (15)	[E2]	0,01109 (16)	0,00302 (5)	0,000760 (11)	0,01514 (22)
γ _{28,9} (U)	867,2 (10)	0,00116 (16)					
γ _{21,3} (U)	880,93 (4)	0,00392 (5)					
γ _{7,1} (U)	883,65 (3)	0,00386 (5)	E2	0,01040 (15)	0,00276 (4)	0,000692 (10)	0,01409 (20)
γ _{28,8} (U)	922,13 (10)	0,01275 (20)					
γ _{7,0} (U)	927,05 (10)	0,00127 (13)	(E2)	0,00956 (14)	0,00245 (4)	0,000613 (9)	0,01284 (18)
γ _{26,7} (U)	936,75 (100)	0,00102 (17)					
γ _{10,2} (U)	942,39 (10)	0,00253 (9)	[E2]	0,00929 (13)	0,00236 (4)	0,000589 (9)	0,01244 (18)
γ _{8,1} (U)	946,362 (16)	0,01064 (14)	(E1)	0,00337 (5)	0,000571 (8)	0,0001355 (19)	0,00412 (6)
γ _{25,5} (U)	960,4 (10)	0,0009 (3)					
γ _{23,3} (U)	996,5 (20)	0,0059 (17)					
γ _{9,1} (U)	1001,441 (18)	0,856 (8)	E2	0,00835 (12)	0,00204 (3)	0,000507 (8)	0,01107 (16)
γ _{10,1} (U)	1042,1 (1)	0,00122 (8)	[E2,M1]	0,018 (11)	0,0036 (18)	0,0009 (4)	0,023 (13)
γ _{28,6} (U)	1059,9 (8)	0,00111 (22)					
γ _{28,5} (U)	1062,46 (10)	0,00224 (9)					
γ _{11,1} (U)	1082,5 (10)	0,00094 (20)	(M1)	0,0255 (4)	0,00478 (7)	0,001151 (17)	0,0318 (5)
γ _{10,0} (U)	1084,84 (10)	0,00081 (40)	[E2]	0,00726 (11)	0,001694 (24)	0,000419 (6)	0,00952 (14)
γ _{30,5} (U)	1121,2 (8)	0,00173 (15)					

	Energy keV	$P_{\gamma+ce}$ $\times 100$	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{28,3}(\text{U})$	1125,54 (10)	0,00347 (9)					
$\gamma_{11,0}(\text{U})$	1125,54 (10)	0,00039 (9)	[E2]	0,00681 (10)	0,001558 (22)	0,000385 (6)	0,00888 (13)
$\gamma_{12,0}(\text{U})$	1174,8 (10)	0,00192 (19)					
$\gamma_{13,1}(\text{U})$	1194,51 (3)	0,01363 (18)	E1	0,00226 (4)	0,000377 (6)	0,0000892 (13)	0,00277 (4)
$\gamma_{13,0}(\text{U})$	1237,93 (10)	0,00529 (11)	E1	0,00213 (3)	0,000354 (5)	0,0000838 (12)	0,00262 (4)
$\gamma_{14,1}(\text{U})$	1393,5 (9)	0,0029 (11)	E1	0,001743 (25)	0,000288 (4)	0,0000682 (10)	0,00221 (4)
$\gamma_{15,1}(\text{U})$	1414,87 (10)	0,00229 (8)	[E1]	0,001700 (24)	0,000281 (4)	0,0000664 (10)	0,00217 (3)
$\gamma_{14,0}(\text{U})$	1435,05 (10)	0,00975 (16)	E1	0,001660 (24)	0,000274 (4)	0,0000648 (9)	0,00213 (3)
$\gamma_{16,1}(\text{U})$	1459,6 (15)	0,0019 (5)					
$\gamma_{16,0}(\text{U})$	1501,8 (20)	0,0013					
$\gamma_{17,1}(\text{U})$	1511,29 (10)	0,01308 (19)					
$\gamma_{18,1}(\text{U})$	1528,42 (10)	0,00237 (8)	M1+E2	0,007 (4)	0,0014 (6)	0,00033 (14)	0,009 (4)
$\gamma_{19,1}(\text{U})$	1551,4 (10)	0,00137 (15)					
$\gamma_{17,0}(\text{U})$	1554,52 (10)	0,00826 (14)					
$\gamma_{20,1}(\text{U})$	1559,7 (10)	0,00074 (9)	M1	0,00971 (14)	0,00181 (3)	0,000434 (7)	0,01228 (18)
$\gamma_{18,0}(\text{U})$	1571,93 (10)	0,00111 (8)	M1	0,00951 (14)	0,001769 (25)	0,000425 (6)	0,01204 (17)
$\gamma_{19,0}(\text{U})$	1594,8 (1)	0,00235 (12)					
$\gamma_{20,0}(\text{U})$	1603,1 (15)	0,00048 (22)	(M1)	0,00902 (13)	0,001679 (24)	0,000403 (6)	0,01146 (17)
$\gamma_{21,0}(\text{U})$	1668,9 (10)	0,00118 (6)					
$\gamma_{22,0}(\text{U})$	1695,4 (10)	0,00038 (2)					
$\gamma_{23,1}(\text{U})$	1739,36 (10)	0,0214 (3)					
$\gamma_{25,1}(\text{U})$	1767,14 (10)	0,0084 (6)					
$\gamma_{24,0}(\text{U})$	1798,0 (9)	0,00031 (5)					
$\gamma_{25,0}(\text{U})$	1810,77 (10)	0,00376 (7)					
$\gamma_{26,1}(\text{U})$	1821,58 (10)	0,00089 (5)					
$\gamma_{27,1}(\text{U})$	1833,13 (10)	0,01759 (23)					
$\gamma_{26,0}(\text{U})$	1864,81 (10)	0,00120 (5)					
$\gamma_{28,1}(\text{U})$	1869,6 (1)	0,00932 (12)					
$\gamma_{27,0}(\text{U})$	1876,8 (1)	0,00819 (14)					
$\gamma_{29,1}(\text{U})$	1895,55 (11)	0,00218 (6)					
$\gamma_{28,0}(\text{U})$	1913,20 (11)	0,00628 (9)					
$\gamma_{30,1}(\text{U})$	1928,5 (10)	0,00045 (4)					
$\gamma_{29,0}(\text{U})$	1939,01 (13)	0,00285 (5)					
$\gamma_{30,0}(\text{U})$	1972,4 (8)	0,00041 (4)					

3 Atomic Data

3.1 U

ω_K	:	0,970	(4)
$\bar{\omega}_L$:	0,500	(19)
n_{KL}	:	0,794	(5)

3.1.1 X Radiations

	Energy keV	Relative probability
X_K		
$K\alpha_2$	94,666	62,47
$K\alpha_1$	98,44	100
$K\beta_3$	110,421	}
$K\beta_1$	111,298	}
$K\beta_5''$	111,964	}
		36,08
$K\beta_2$	114,407	}
$K\beta_4$	115,012	}
$KO_{2,3}$	115,377	}
X_L		
$L\ell$	11,6185	
$L\alpha$	13,4382 – 13,6146	
$L\eta$	15,399	
$L\beta$	15,7268 – 18,2061	
$L\gamma$	19,5072 – 20,7141	

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	71,776 – 80,954	100
KLX	88,153 – 98,429	59,6
KXY	104,51 – 115,59	8,88
Auger L	5,9 – 21,6	

4 Electron Emissions

		Energy keV	Electrons per 100 disint.
e _{AL}	(U)	5,9 - 21,6	0,856 (19)
e _{AK}	(U)		0,0203 (3)
	KLL	71,776 - 80,954	}
	KLX	88,153 - 98,429	}
	KXY	104,51 - 115,59	}
e _{AL}	(Pa)	5,9 - 20,9	0,048 (4)
e _{AK}	(Pa)		
ec _{1,0 L}	(U)	21,73 - 26,32	1,030 (19)
ec _{1,0 M}	(U)	37,94 - 39,94	0,285 (5)
ec _{1,0 N}	(U)	42,05 - 43,11	0,0770 (14)
ec _{1,0 L}	(Pa)	52,82 - 57,19	0,103 (8)
ec _{1,0 M}	(Pa)	68,56 - 70,48	0,025 (2)
ec _{4,0 T}	(U)	694,4 - 789,0	0,72
$\beta_{0,30}^-$	max:	299 (4)	0,00389 (22)
$\beta_{0,30}^-$	avg:	83,0 (13)	
$\beta_{0,29}^-$	max:	332 (4)	0,0108 (3)
$\beta_{0,29}^-$	avg:	93,0 (13)	
$\beta_{0,28}^-$	max:	358 (4)	0,0452 (8)
$\beta_{0,28}^-$	avg:	101,0 (13)	
$\beta_{0,27}^-$	max:	394 (4)	0,0258 (3)
$\beta_{0,27}^-$	avg:	112,3 (13)	
$\beta_{0,26}^-$	max:	406 (4)	0,00311 (19)
$\beta_{0,26}^-$	avg:	116,0 (13)	
$\beta_{0,25}^-$	max:	460 (4)	0,0146 (7)
$\beta_{0,25}^-$	avg:	133,3 (13)	
$\beta_{0,24}^-$	max:	473 (4)	0,0021 (3)
$\beta_{0,24}^-$	avg:	137,4 (14)	
$\beta_{0,23}^-$	max:	488 (4)	0,0357 (18)
$\beta_{0,23}^-$	avg:	142,3 (14)	
$\beta_{0,22}^-$	max:	575 (4)	0,0024 (3)
$\beta_{0,22}^-$	avg:	171,2 (14)	
$\beta_{0,21}^-$	max:	602 (4)	0,0061 (3)
$\beta_{0,21}^-$	avg:	180,1 (14)	
$\beta_{0,20}^-$	max:	667 (4)	0,00127 (23)
$\beta_{0,20}^-$	avg:	202,5 (14)	
$\beta_{0,19}^-$	max:	677 (4)	0,0249 (5)
$\beta_{0,19}^-$	avg:	205,8 (14)	
$\beta_{0,18}^-$	max:	698 (4)	0,00231 (19)

		Energy keV	Electrons per 100 disint.
$\beta_{0,18}^-$	avg:	213,3 (14)	
$\beta_{0,17}^-$	max:	715 (4)	0,0320 (6)
$\beta_{0,17}^-$	avg:	219,2 (14)	
$\beta_{0,16}^-$	max:	768 (4)	0,0131 (6)
$\beta_{0,16}^-$	avg:	237,6 (15)	
$\beta_{0,14}^-$	max:	834 (4)	0,0092 (11)
$\beta_{0,14}^-$	avg:	261,1 (15)	
$\beta_{0,13}^-$	max:	1032 (4)	0,0121 (11)
$\beta_{0,13}^-$	avg:	333,1 (15)	
$\beta_{0,12}^-$	max:	1095 (4)	0,0046 (3)
$\beta_{0,12}^-$	avg:	356,7 (15)	
$\beta_{0,9}^-$	max:	1224 (4)	1,006 (13)
$\beta_{0,9}^-$	avg:	405,6 (16)	
$\beta_{0,4}^-$	max:	1459 (4)	0,945 (12)
$\beta_{0,4}^-$	avg:	496,0 (16)	
$\beta_{0,3}^-$	max:	1483 (4)	0,049 (3)
$\beta_{0,3}^-$	avg:	505,3 (16)	
$\beta_{0,0}^-$	max:	2269 (4)	97,599 (24)
$\beta_{0,0}^-$	avg:	820,5 (17)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV	Photons per 100 disint.	
XL	(U)	11,6185 — 20,7141	0,856 (19)	
XK α_2	(U)	94,666	0,1973 (25)	} K α
XK α_1	(U)	98,44	0,316 (4)	}
XK β_3	(U)	110,421	}	
XK β_1	(U)	111,298	}	K' β_1
XK β_5''	(U)	111,964	}	
XK β_2	(U)	114,407	}	
XK β_4	(U)	115,012	}	K' β_2
XKO $_{2,3}$	(U)	115,377	}	
XL	(Pa)	11,3676 — 20,1126	0,046 (4)	

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}(\text{U})$	43,49 (2)	0,00198 (2)
$\gamma_{8,7}(\text{U})$	62,70 (1)	0,0013 (4)
$\gamma_{1,0}(\text{Pa})$	73,92 (2)	0,0129 (9)
$\gamma_{2,1}(\text{U})$	99,86 (2)	0,00057 (5)
$\gamma_{18,14}(\text{U})$	135,32 (8)	0,0000042 (5)
$\gamma_{11,8}(\text{U})$	137,23 (5)	0,000048 (17)
$\gamma_{8,5}(\text{U})$	140,1 (10)	<0,00127
$\gamma_{20,14}(\text{U})$	166,5 (1)	0,000000237 (5)
$\gamma_{12,8}(\text{U})$	185,0 (4)	0,00172 (15)
$\gamma_{9,6}(\text{U})$	193,4 (8)	0,00072 (15)
$\gamma_{14,13}(\text{U})$	197,91 (15)	0,000027 (7)
$\gamma_{11,7}(\text{U})$	199,9 (10)	0,00058 (12)
$\gamma_{8,3}(\text{U})$	203,3 (8)	0,00119 (9)
$\gamma_{23,18}(\text{U})$	209,9 (4)	0,00132 (15)
$\gamma_{10,5}(\text{U})$	235,9 (3)	0,00009 (4)
$\gamma_{(-1,1)}(\text{U})$	243,5 (8)	0,00050 (9)
$\gamma_{13,8}(\text{U})$	247,7 (8)	0,00097 (22)
$\gamma_{9,3}(\text{U})$	258,227 (3)	0,0738 (8)
$\gamma_{11,6}(\text{U})$	275,5 (8)	0,00031 (6)
$\gamma_{10,3}(\text{U})$	299 (1)	0,00064 (13)
$\gamma_{13,7}(\text{U})$	311 (1)	0,00052 (11)
$\gamma_{11,4}(\text{U})$	316,7 (1)	0,00019 (5)
$\gamma_{24,15}(\text{U})$	338,1 (8)	0,00113 (23)
$\gamma_{11,3}(\text{U})$	340,2 (1)	0,000072 (21)
$\gamma_{28,17}(\text{U})$	357,5 (10)	0,00080 (17)
$\gamma_{24,14}(\text{U})$	362,8 (10)	0,00069 (15)
$\gamma_{12,3}(\text{U})$	387,6 (8)	0,00097 (15)
$\gamma_{13,5}(\text{U})$	387,6 (8)	0,00047 (4)
$\gamma_{13,4}(\text{U})$	427,4 (2)	0,000020 (5)
$\gamma_{14,8}(\text{U})$	445,91 (10)	0,000031 (7)
$\gamma_{13,3}(\text{U})$	450,98 (10)	0,00310 (13)
$\gamma_{28,15}(\text{U})$	453,58 (10)	0,00213 (12)
$\gamma_{22,13}(\text{U})$	456,7 (10)	0,00072 (15)
$\gamma_{17,10}(\text{U})$	468,43 (10)	0,00206 (12)
$\gamma_{28,14}(\text{U})$	475,74 (10)	0,00237 (13)
$\gamma_{18,10}(\text{U})$	485,44 (7)	0,0000187 (17)
$\gamma_{19,10}(\text{U})$	507,5 (10)	0,00158 (15)
$\gamma_{17,9}(\text{U})$	509,2 (8)	0,0022 (3)
$\gamma_{20,10}(\text{U})$	516,60 (6)	0,0000122 (16)
$\gamma_{18,9}(\text{U})$	526,02 (10)	0,000009 (1)
$\gamma_{23,13}(\text{U})$	543,98 (10)	0,00349 (15)
$\gamma_{20,9}(\text{U})$	557,24 (6)	0,0000083 (11)
$\gamma_{(-1,2)}(\text{U})$	557,3 (10)	0,00072 (17)
$\gamma_{25,13}(\text{U})$	572 (1)	0,00087 (17)
$\gamma_{18,8}(\text{U})$	581,19 (10)	0,000080 (9)

	Energy keV	Photons per 100 disint.
$\gamma_{14,4}(\text{U})$	624,6 (10)	0,000116 (12)
$\gamma_{(-1,3)}(\text{U})$	647,7 (8)	0,00158 (15)
$\gamma_{14,3}(\text{U})$	649 (1)	0,000059 (8)
$\gamma_{16,6}(\text{U})$	649 (1)	0,0010 (3)
$\gamma_{23,11}(\text{U})$	655,3 (10)	0,00139 (15)
$\gamma_{15,3}(\text{U})$	670,8 (10)	0,00037 (9)
$\gamma_{28,13}(\text{U})$	673,9 (10)	0,00064 (13)
$\gamma_{25,11}(\text{U})$	683,4 (10)	0,00058 (12)
$\gamma_{16,4}(\text{U})$	691,0 (3)	0,00898 (19)
$\gamma_{23,10}(\text{U})$	695,5 (10)	0,00164 (14)
$\gamma_{29,13}(\text{U})$	699,02 (10)	0,0058 (3)
$\gamma_{17,6}(\text{U})$	702,0 (1)	0,00721 (16)
$\gamma_{5,2}(\text{U})$	705,94 (12)	0,0052 (6)
$\gamma_{6,2}(\text{U})$	708,2 (10)	<0,0007
$\gamma_{18,6}(\text{U})$	719,01 (7)	0,0000256 (20)
$\gamma_{30,13}(\text{U})$	732,5 (10)	0,00130 (15)
$\gamma_{19,6}(\text{U})$	740,10 (8)	0,0118 (3)
$\gamma_{3,1}(\text{U})$	742,813 (5)	0,094 (3)
$\gamma_{20,6}(\text{U})$	750,12 (6)	0,000017 (2)
$\gamma_{(-1,4)}(\text{U})$	760,3 (10)	0,00158 (15)
$\gamma_{18,4}(\text{U})$	760,53 (15)	0,0000043 (9)
$\gamma_{4,1}(\text{U})$	766,361 (20)	0,323 (4)
$\gamma_{19,4}(\text{U})$	781,75 (10)	0,00782 (18)
$\gamma_{7,2}(\text{U})$	783,4 (1)	0,000039 (7)
$\gamma_{3,0}(\text{U})$	786,272 (22)	0,0536 (7)
$\gamma_{20,4}(\text{U})$	791,94 (5)	0,0000099 (13)
$\gamma_{5,1}(\text{U})$	805,75 (10)	0,0062 (8)
$\gamma_{6,1}(\text{U})$	808,2 (1)	0,00281 (17)
$\gamma_{21,5}(\text{U})$	818,2 (5)	0,0010 (3)
$\gamma_{28,10}(\text{U})$	825,5 (2)	0,0014 (4)
$\gamma_{22,5}(\text{U})$	844,1 (8)	0,00109 (23)
$\gamma_{6,0}(\text{U})$	851,6 (1)	0,00696 (15)
$\gamma_{28,9}(\text{U})$	866,8 (10)	0,00116 (16)
$\gamma_{21,3}(\text{U})$	880,52 (4)	0,00392 (5)
$\gamma_{7,1}(\text{U})$	883,24 (3)	0,00381 (5)
$\gamma_{(-1,5)}(\text{U})$	887,29 (100)	0,00708 (14)
$\gamma_{28,8}(\text{U})$	921,72 (10)	0,01275 (20)
$\gamma_{7,0}(\text{U})$	926,61 (10)	0,00125 (13)
$\gamma_{26,7}(\text{U})$	936,3 (10)	0,00102 (17)
$\gamma_{10,2}(\text{U})$	941,96 (10)	0,00250 (9)
$\gamma_{8,1}(\text{U})$	945,961 (16)	0,01060 (14)
$\gamma_{25,5}(\text{U})$	960 (1)	0,0009 (3)
$\gamma_{23,3}(\text{U})$	996,1 (20)	0,0059 (17)
$\gamma_{9,1}(\text{U})$	1001,026 (18)	0,847 (8)
$\gamma_{10,1}(\text{U})$	1041,7 (1)	0,00119 (8)
$\gamma_{28,6}(\text{U})$	1059,4 (8)	0,00111 (22)
$\gamma_{28,5}(\text{U})$	1061,86 (10)	0,00224 (9)

	Energy keV	Photons per 100 disint.
$\gamma_{11,1}(\text{U})$	1081,9 (10)	0,00091 (19)
$\gamma_{10,0}(\text{U})$	1084,25 (10)	0,0008 (4)
$\gamma_{30,5}(\text{U})$	1120,6 (8)	0,00173 (15)
$\gamma_{28,3}(\text{U})$	1124,93 (10)	0,00347 (9)
$\gamma_{11,0}(\text{U})$	1124,93 (10)	0,00039 (9)
$\gamma_{12,0}(\text{U})$	1174,2 (10)	0,00192 (19)
$\gamma_{13,1}(\text{U})$	1193,77 (3)	0,01359 (18)
$\gamma_{(-1,6)}(\text{U})$	1220,37 (10)	0,00091 (9)
$\gamma_{13,0}(\text{U})$	1237,28 (10)	0,00528 (11)
$\gamma_{(-1,7)}(\text{U})$	1353,0 (15)	0,0015 (5)
$\gamma_{14,1}(\text{U})$	1392,6 (9)	0,0029 (11)
$\gamma_{15,1}(\text{U})$	1413,89 (10)	0,00229 (8)
$\gamma_{14,0}(\text{U})$	1434,16 (10)	0,00973 (16)
$\gamma_{16,1}(\text{U})$	1458,5 (15)	0,0019 (5)
$\gamma_{16,0}(\text{U})$	1501 (2)	0,0013
$\gamma_{17,1}(\text{U})$	1510,22 (10)	0,01308 (19)
$\gamma_{18,1}(\text{U})$	1527,28 (10)	0,00235 (8)
$\gamma_{19,1}(\text{U})$	1550,1 (10)	0,00137 (15)
$\gamma_{17,0}(\text{U})$	1553,77 (10)	0,00826 (14)
$\gamma_{20,1}(\text{U})$	1558,4 (10)	0,00073 (9)
$\gamma_{18,0}(\text{U})$	1570,67 (10)	0,00110 (8)
$\gamma_{19,0}(\text{U})$	1593,5 (6)	0,00235 (12)
$\gamma_{20,0}(\text{U})$	1601,8 (15)	0,00047 (22)
$\gamma_{21,0}(\text{U})$	1667,6 (10)	0,00118 (6)
$\gamma_{22,0}(\text{U})$	1694,1 (10)	0,00038 (2)
$\gamma_{(-1,8)}(\text{U})$	1720,5 (15)	0,00033 (15)
$\gamma_{(-1,9)}(\text{U})$	1732,2 (15)	0,0019 (3)
$\gamma_{23,1}(\text{U})$	1737,77 (10)	0,0214 (3)
$\gamma_{(-1,10)}(\text{U})$	1759,81 (10)	0,00146 (5)
$\gamma_{25,1}(\text{U})$	1765,44 (10)	0,0084 (6)
$\gamma_{24,0}(\text{U})$	1796,3 (9)	0,00031 (5)
$\gamma_{25,0}(\text{U})$	1809,05 (10)	0,00376 (7)
$\gamma_{26,1}(\text{U})$	1819,69 (10)	0,00089 (5)
$\gamma_{27,1}(\text{U})$	1831,37 (10)	0,01759 (23)
$\gamma_{26,0}(\text{U})$	1863,09 (10)	0,00120 (5)
$\gamma_{28,1}(\text{U})$	1867,7 (1)	0,00932 (12)
$\gamma_{27,0}(\text{U})$	1874,9 (1)	0,00819 (14)
$\gamma_{29,1}(\text{U})$	1893,51 (11)	0,00218 (6)
$\gamma_{28,0}(\text{U})$	1911,20 (11)	0,00628 (9)
$\gamma_{30,1}(\text{U})$	1926,5 (10)	0,00045 (4)
$\gamma_{29,0}(\text{U})$	1937,01 (13)	0,00285 (5)
$\gamma_{30,0}(\text{U})$	1970,3 (8)	0,00041 (4)
$\gamma_{(-1,11)}(\text{U})$	2022,24 (12)	0,000186 (3)
$\gamma_{(-1,12)}(\text{U})$	2041,23 (13)	0,00011 (1)
$\gamma_{(-1,13)}(\text{U})$	2065,80 (13)	0,00007
$\gamma_{(-1,14)}(\text{U})$	2093,19 (38)	0,00002
$\gamma_{(-1,15)}(\text{U})$	2102,14 (15)	0,00006

	Energy keV	Photons per 100 disint.
$\gamma_{(-1,16)}(\text{U})$	2136,69 (14)	0,00007

6 Main Production Modes

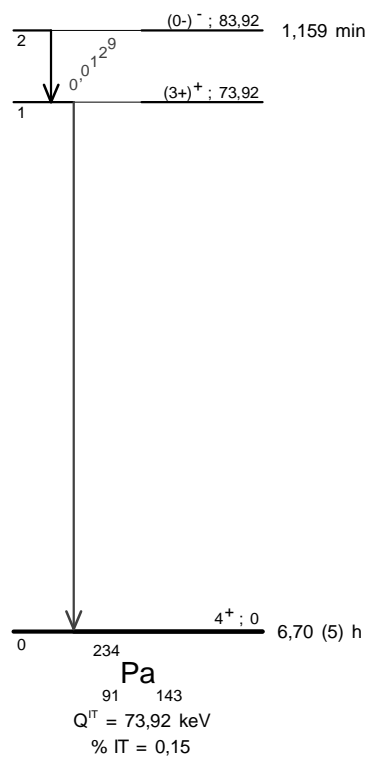
U – 238 natural decay chain member

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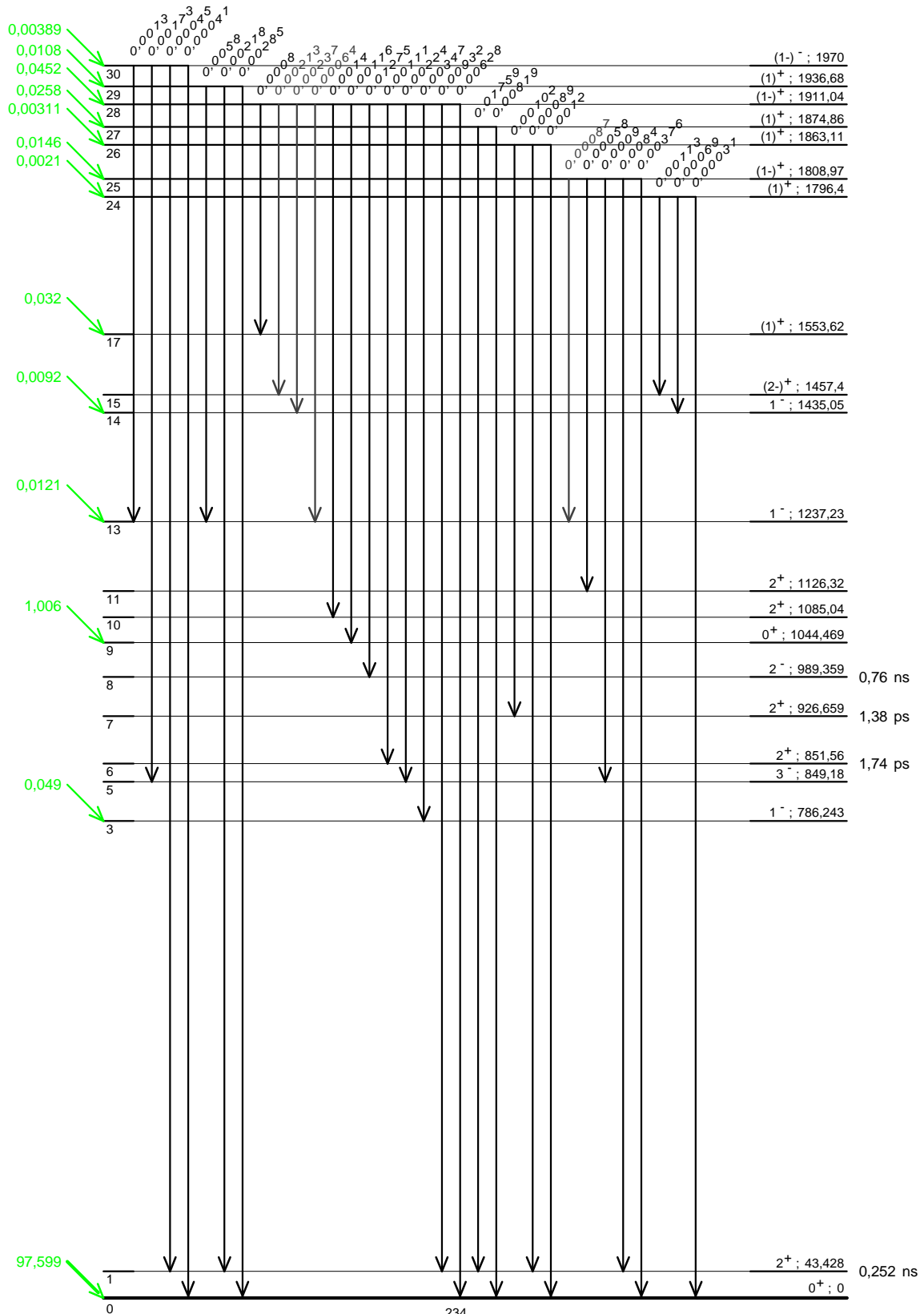
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γ Emission intensities
per 100 disintegrations



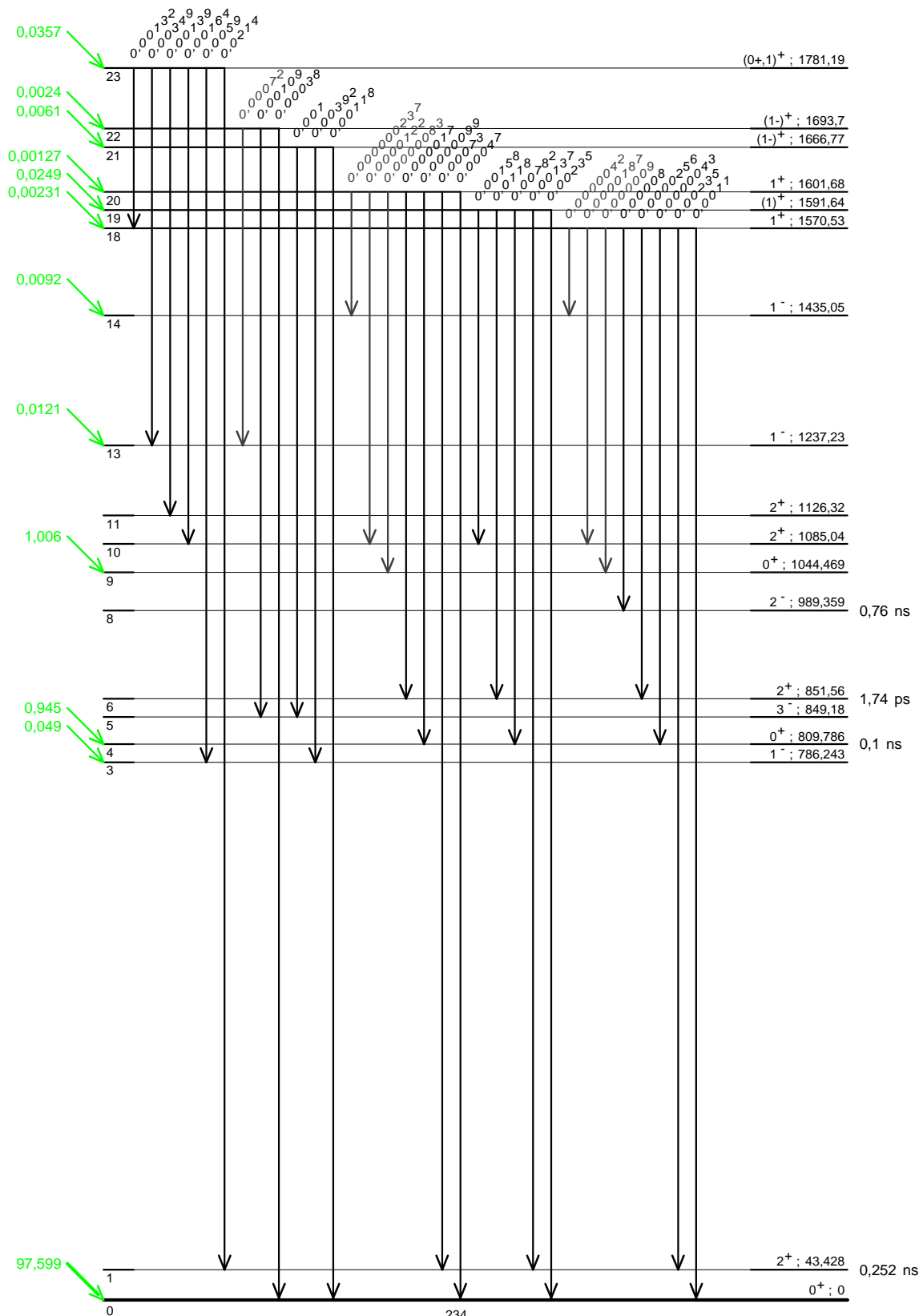
0 ^{234m}Pa ⁹¹ ¹⁴³ (0⁻)⁺; 0 1,159 (11) min β⁻

γ Emission intensities per 100 disintegrations

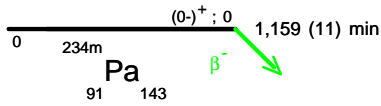


^{234m}Pa (0⁻)⁺; 0
 1,159 (11) min
 β⁻

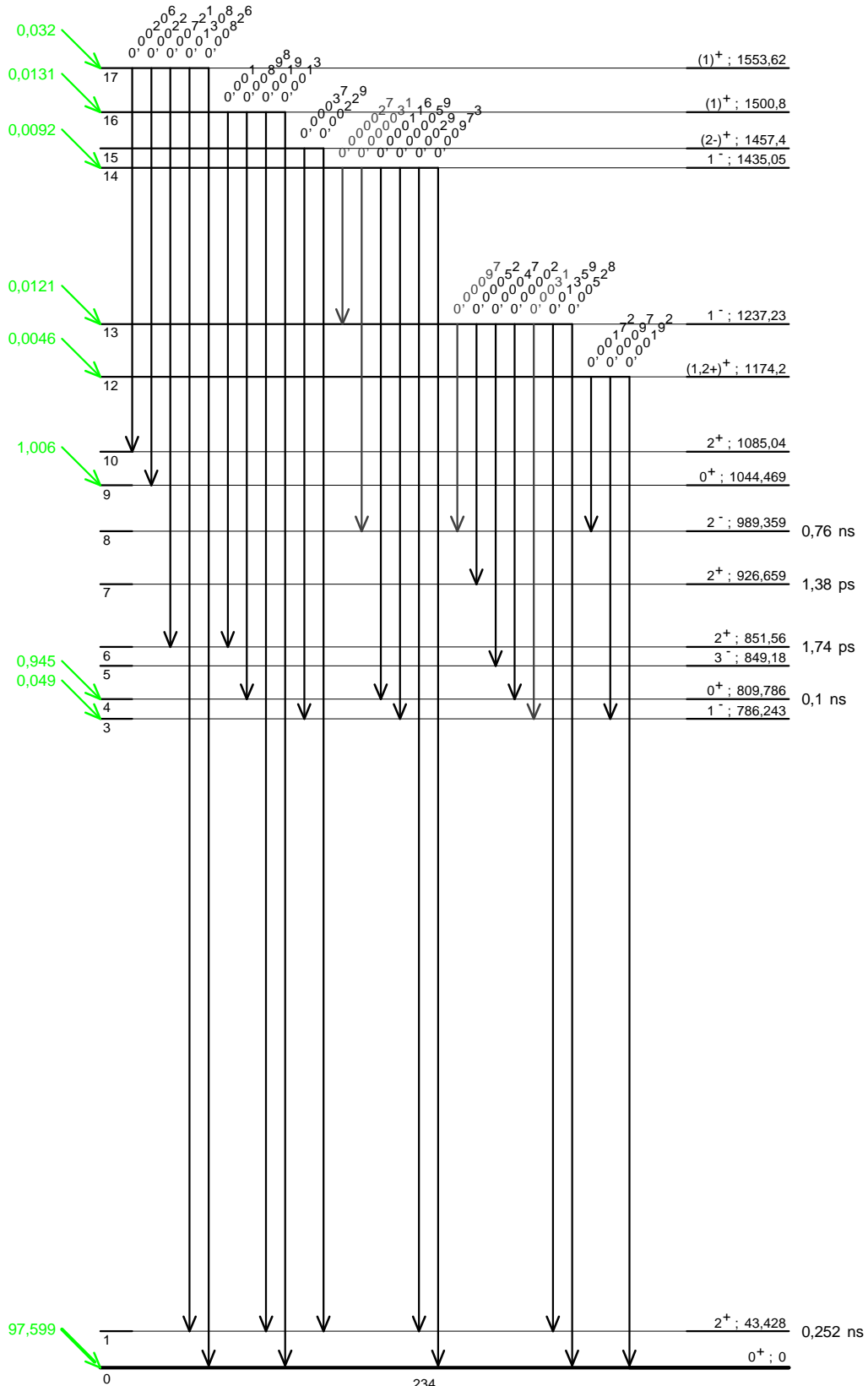
γ Emission intensities per 100 disintegrations



²³⁴U
 92 142
 Q⁻ = 2269 keV
 % β⁻ = 99,85



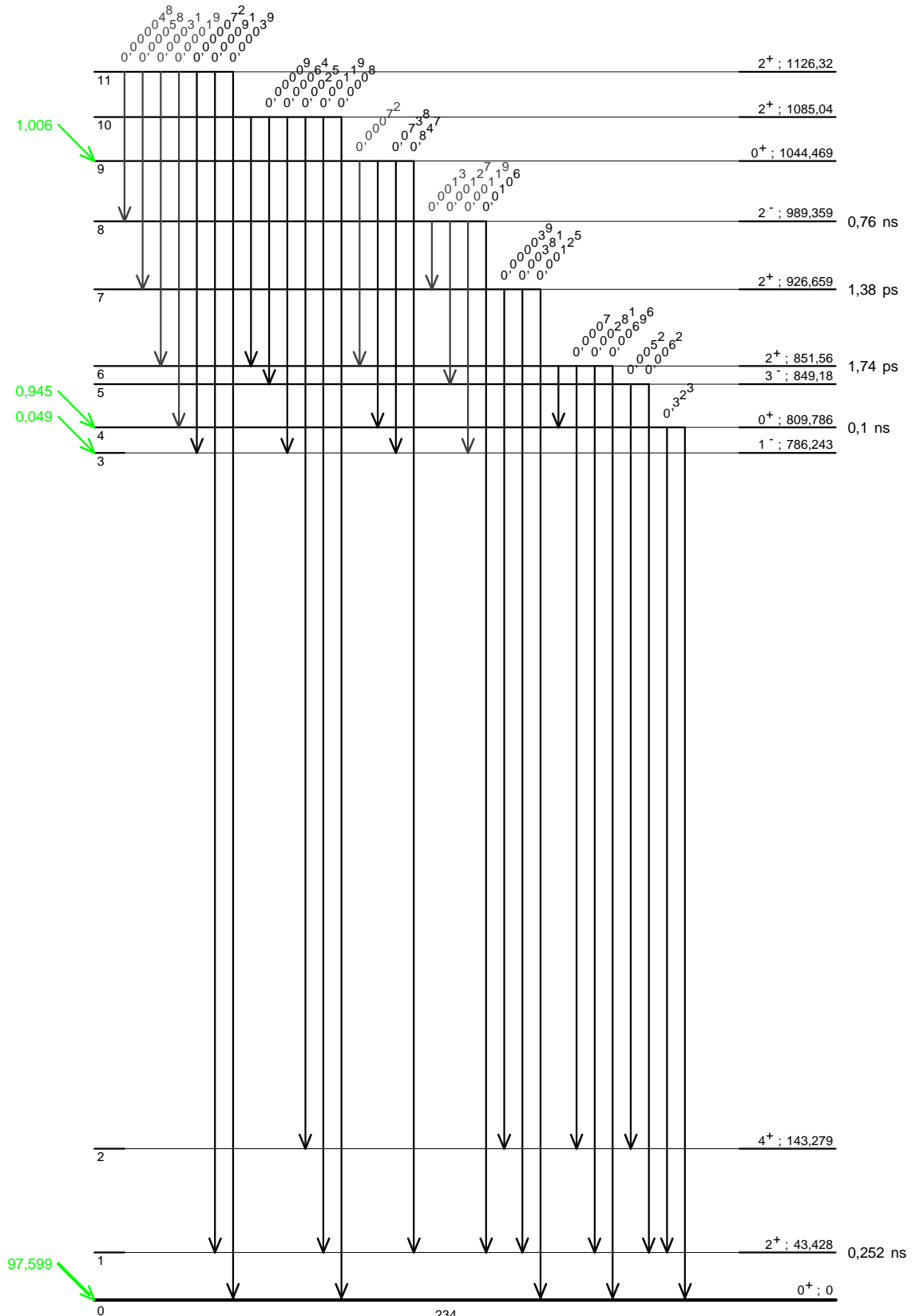
γ Emission intensities per 100 disintegrations



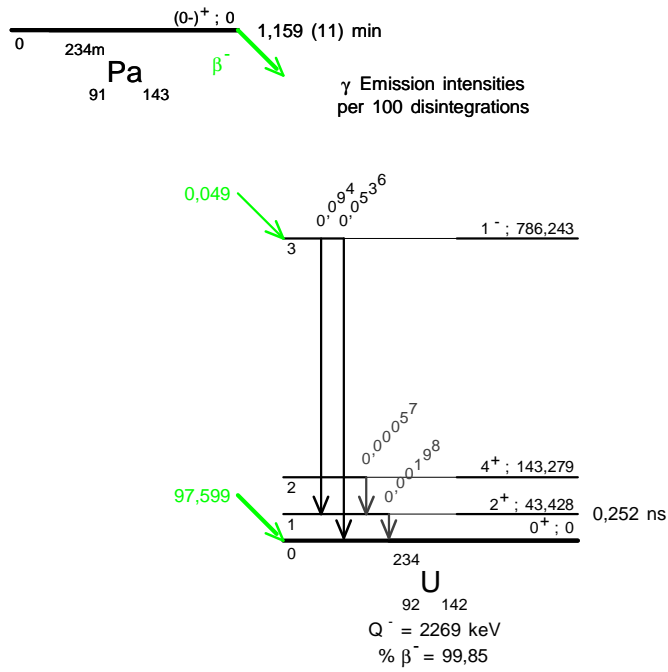
²³⁴U
 92 142
 Q⁻ = 2269 keV
 % β^- = 99,85

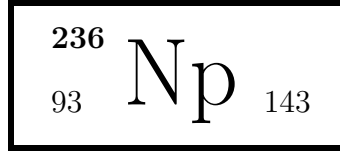
^{234m}₉₁Pa (0⁻); 0
 1,159 (11) min
 β⁻

γ Emission intensities per 100 disintegrations



²³⁴₉₂U
 Q⁻ = 2269 keV
 % β⁻ = 99,85





1 Decay Scheme

Np-236 decays 87,8 (6) % by electron capture to U-236, 12,0 (6) % by beta minus emission to Pu-236 and 0,16 (6)% by alpha emission to Pa-232.

Le neptunium 236 se désintègre majoritairement (87,8 %) par capture électronique vers l'uranium 236 et par transition bêta moins (12 %) vers le plutonium 236. Une faible branche par transition alpha vers le protactinium 232 est possible.

2 Nuclear Data

$T_{1/2}(^{236}\text{Np})$:	1,55	(8)	10^5	a
$T_{1/2}(^{236}\text{U})$:	23,42	(4)	10^6	a
$T_{1/2}(^{236}\text{Pu})$:	2,87	(1)		a
$T_{1/2}(^{232}\text{Pa})$:	1,31	(2)		d
$Q^-(^{236}\text{Np})$:	480	(50)		keV
$Q^+(^{236}\text{Np})$:	930	(50)		keV
$Q^\alpha(^{236}\text{Np})$:	5010	(50)		keV

2.1 β^- Transitions

	Energy keV	Probability $\times 100$	Nature	lg ft
$\beta_{0,3}^-$	174 (50)	11,8 (12)	1st forbidden	14,5
$\beta_{0,2}^-$	333 (50)	< 1,6	1st forbidden unique	> 16

2.2 Electron Capture Transitions

	Energy keV	Probability $\times 100$	Nature	lg ft	P_K	P_L	P_M
$\epsilon_{0,6}$	82 (50)	$\sim 0,096$	allowed	14,6		0,6	0,4

	Energy keV	Probability × 100	Nature	lg <i>ft</i>	<i>P_K</i>	<i>P_L</i>	<i>P_M</i>
ε _{0,3}	620 (50)	87,8 (43)	1st forbidden	14,1	0,726 (8)	0,201 (5)	0,073 (2)
ε _{0,2}	781 (50)	< 4,4	1st forbidden unique	> 15,9	0,74	0,19	0,07

2.3 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	<i>P_{γ+ce}</i> × 100	Multipolarity	<i>α_K</i>	<i>α_L</i>	<i>α_M</i>	<i>α_T</i>
γ _{1,0} (Pu)	44,63 (10)	11,9 (7)	E2		538 (11)	150 (3)	741 (15)
γ _{1,0} (U)	45,244 (2)	87,8 (6)	E2		429 (9)	118,6 (24)	589 (12)
γ _{5,4} (U)	56,6 (5)	~ 0,08	(E2)		145 (7)	40,1 (19)	199 (10)
γ _{2,1} (Pu)	102,82 (2)	12,0 (6)	E2		10,06 (20)	2,82 (6)	13,87 (28)
γ _{6,5} (U)	104,1 (10)	~ 0,096	E2		8,1 (4)	2,23 (11)	11,1 (6)
γ _{2,1} (U)	104,233 (5)	87,8 (6)	E2		8,00 (16)	2,22 (5)	10,99 (22)
γ _{3,2} (Pu)	158,35 (2)	11,8 (12)	E2	0,193 (4)	1,41 (3)	0,394 (8)	2,14 (4)
γ _{3,2} (U)	160,308 (3)	87,8 (43)	E2	0,208 (4)	1,13 (2)	0,313 (7)	1,76 (4)
γ _{4,2} (U)	538,1 (1)	~ 0,0008	E3	0,0622 (13)	0,0587 (12)	0,0160 (3)	0,143 (3)
γ _{5,2} (U)	594,5 (3)	~ 0,008					
γ _{4,1} (U)	642,34 (5)	~ 0,068	E1+(M2+E3)	0,112 (10)	0,031 (3)	0,0080 (8)	0,15 (2)
γ _{4,0} (U)	687,59 (4)	~ 0,021	E1+(M2+E3)	0,219 (12)	0,068 (6)	0,018 (2)	0,31 (2)

3 Atomic Data

3.1 U

ω_K	:	0,970	(4)
$\bar{\omega}_L$:	0,500	(19)
n_{KL}	:	0,794	(5)

3.1.1 X Radiations

	Energy keV	Relative probability
X_K		
$K\alpha_2$	94,666	62,47
$K\alpha_1$	98,44	100
$K\beta_3$	110,421	}
$K\beta_1$	111,298	}
$K\beta_5''$	111,964	}
		36,08
$K\beta_2$	114,407	}
$K\beta_4$	115,012	}
$KO_{2,3}$	115,377	}
		12,34
X_L		
$L\ell$	11,619	
$L\alpha$	13,438 – 13,615	
$L\eta$	15,399	
$L\beta$	15,727 – 18,206	
$L\gamma$	19,507 – 20,714	

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	71,78 – 80,95	100
KLX	88,15 – 98,43	59,6
KXY	104,51 – 115,59	8,88
Auger L		
	6,07 – 21,68	

3.2 Pu

$$\begin{aligned}\omega_K &: 0,971 \quad (4) \\ \bar{\omega}_L &: 0,521 \quad (20) \\ n_{KL} &: 0,790 \quad (5)\end{aligned}$$

3.2.1 X Radiations

	Energy keV	Relative probability		
X _K	K α_2	99,525		
	K α_1	103,734	63,17 100	
	K β_3	116,244	}	
	K β_1	117,228		
	K β_5''	117,918		36,7
	K β_2	120,54	}	
	K β_4	120,969		12,74
	KO _{2,3}	121,543		
	X _L	L ℓ	12,1246	
		L α	14,083 – 14,279	
L η		16,334		
L β		16,499 – 18,543		
L γ		20,708 – 21,984		

3.2.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	75,26 – 85,36	100
KLX	92,61 – 103,73	60,6
KXY	109,93 – 121,78	9,18
Auger L	6,19 – 23,10	

4 Electron Emissions

		Energy keV	Electrons per 100 disint.
e _{AL}	(U)	6,07 - 21,68	128,8 (19)
e _{AK}	(U)		2,1 (3)
	KLL	71,78 - 80,95	}
	KLX	88,15 - 98,43	}
	KXY	104,51 - 115,59	}
e _{AL}	(Pu)	6,19 - 23,10	10,7 (3)
e _{AK}	(Pu)		0,021 (4)
	KLL	75,26 - 85,36	}
	KLX	92,61 - 103,73	}
	KXY	109,93 - 121,78	}
ec _{1,0} L	(Pu)	21,53 - 26,57	8,7 (5)
ec _{1,0} L	(U)	23,486 - 28,076	63,9 (19)
ec _{3,2} K	(Pu)	36,56 (2)	0,73 (8)
ec _{1,0} M	(Pu)	38,70 - 40,86	2,42 (14)
ec _{1,0} M	(U)	39,696 - 41,690	17,7 (5)
ec _{3,2} K	(U)	44,706 (3)	6,6 (3)
ec _{2,1} L	(Pu)	79,72 - 84,76	8,1 (6)
ec _{2,1} L	(U)	82,475 - 87,065	58,6 (16)
ec _{2,1} M	(Pu)	96,89 - 99,04	2,28 (18)
ec _{2,1} M	(U)	98,685 - 100,680	16,25 (47)
ec _{3,2} L	(Pu)	135,25 - 140,29	5,4 (6)
ec _{3,2} L	(U)	138,55 - 143,14	36,0 (18)
ec _{3,2} M	(Pu)	152,42 - 154,57	1,50 (16)
ec _{3,2} M	(U)	154,76 - 156,76	10,0 (5)
$\beta_{0,3}^-$	max:	174 (50)	11,8 (12)
$\beta_{0,3}^-$	avg:	46 (15)	
$\beta_{0,2}^-$	max:	333 (50)	< 1,6
$\beta_{0,2}^-$	avg:	92 (16)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(U)	11,619 — 20,714		117,5 (30)	
XK α_2	(U)	94,666		20,2 (3)	} K α
XK α_1	(U)	98,44		32,4 (5)	}
XK β_3	(U)	110,421	}		
XK β_1	(U)	111,298	}	11,69 (25)	K' β_1
XK β_5''	(U)	111,964	}		
XK β_2	(U)	114,407	}		
XK β_4	(U)	115,012	}	4,00 (11)	K' β_2
XK $O_{2,3}$	(U)	115,377	}		
XL	(Pu)	12,1246 — 21,984		12,1 (4)	
XK α_2	(Pu)	99,525		0,212 (23)	} K α
XK α_1	(Pu)	103,734		0,33 (4)	}
XK β_3	(Pu)	116,244	}		
XK β_1	(Pu)	117,228	}	0,123 (14)	K' β_1
XK β_5''	(Pu)	117,918	}		
XK β_2	(Pu)	120,54	}		
XK β_4	(Pu)	120,969	}	0,043 (5)	K' β_2
XK $O_{2,3}$	(Pu)	121,543	}		

5.2 Gamma Emissions

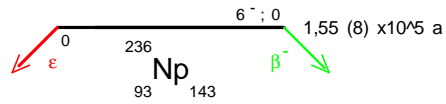
	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$ (Pu)	44,63 (10)	0,0161 (9)
$\gamma_{1,0}$ (U)	45,244 (2)	0,149 (3)
$\gamma_{5,4}$ (U)	56,6 (5)	~ 0,0004
$\gamma_{2,1}$ (Pu)	102,82 (2)	0,81 (6)
$\gamma_{6,5}$ (U)	104,1 (10)	~ 0,008
$\gamma_{2,1}$ (U)	104,234 (6)	7,32 (13)
$\gamma_{3,2}$ (Pu)	158,35 (3)	3,8 (4)
$\gamma_{3,2}$ (U)	160,307 (3)	31,8 (15)
$\gamma_{4,2}$ (U)	538,1 (1)	~ 0,0007
$\gamma_{5,2}$ (U)	594,5 (3)	~ 0,008
$\gamma_{4,1}$ (U)	642,34 (5)	~ 0,059
$\gamma_{4,0}$ (U)	687,60 (5)	~ 0,016

6 Main Production Modes

- U – $^{235}(\text{d,n})\text{Np} - 236$
- U – $^{235}(\alpha,\text{p}2\text{n})\text{Np} - 236$

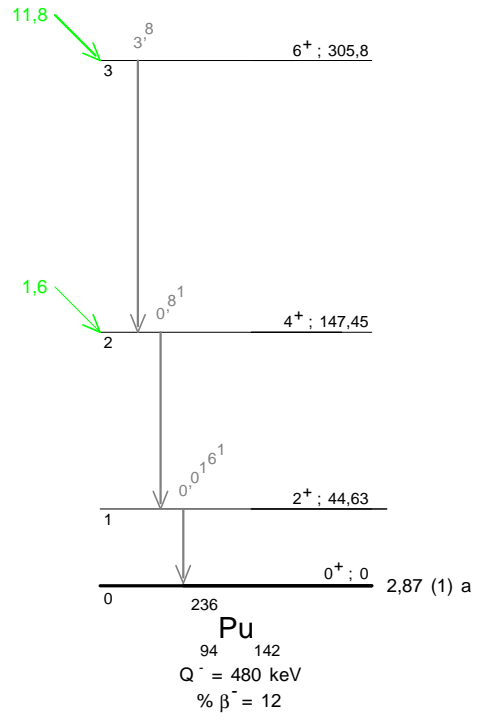
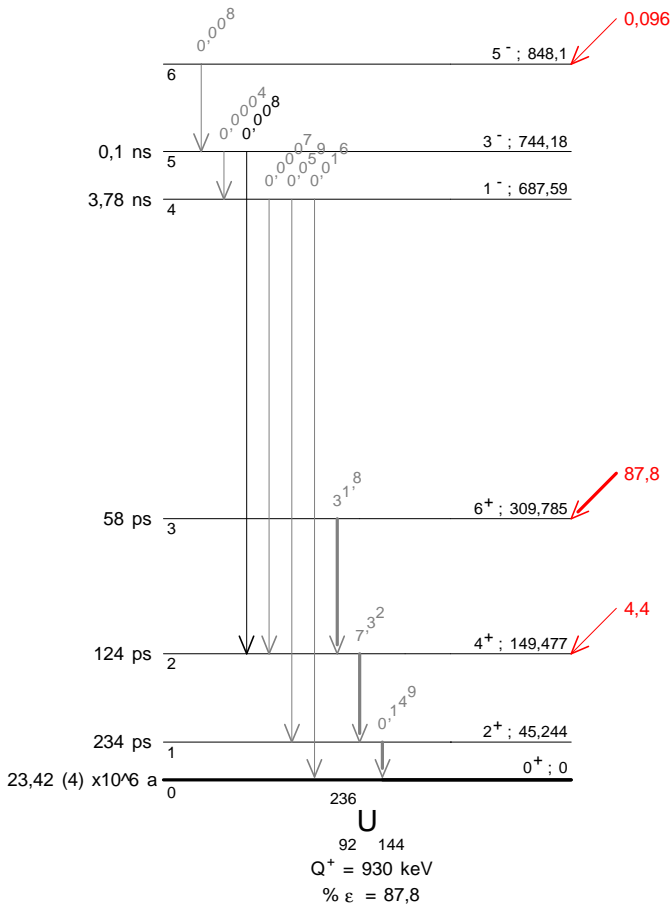
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γ Emission intensities per 100 disintegrations

γ Emission intensities per 100 disintegrations





1 Decay Scheme

Np-237 disintegrates by alpha transitions to the ground state and excited states of Pa-233.

Le neptunium 237 se désintègre par émission alpha vers les niveaux excités et le niveau fondamental de protactinium 233.

2 Nuclear Data

$T_{1/2}(^{237}\text{Np})$:	2,144	(7)	10^6	a
$T_{1/2}(^{233}\text{Pa})$:	26,98	(2)	d	
$Q^\alpha(^{237}\text{Np})$:	4958,3	(12)	keV	

2.1 α Transitions

	Energy keV	Probability $\times 100$	F
$\alpha_{0,20}$	4592,4 (12)	0,038 (4)	65
$\alpha_{-1,1}$	4629 (3)	0,011 (3)	84000
$\alpha_{0,18}$	4654,7 (12)	0,048 (23)	139
$\alpha_{0,17}$	4657,8 (12)	0,393 (23)	19,1
$\alpha_{0,16}$	4678,6 (12)	0,373 (9)	27
$\alpha_{0,15}$	4701,2 (13)	0,032 (8)	46000
$\alpha_{0,14}$	4720,4 (12)	6,43 (3)	3,14
$\alpha_{0,13}$	4745,9 (12)	3,46 (3)	8,9
$\alpha_{0,12}$	4756,7 (12)	0,38 (2)	
$\alpha_{0,11}$	4779,2 (13)	0,535 (10)	99
$\alpha_{0,10}$	4789,1 (12)}		> 56
$\alpha_{0,9}$	4795,0 (12)}	1,174 (13)	> 51
$\alpha_{0,8}$	4826,1 (16)	0,019	5932
$\alpha_{0,7}$	4849,3 (12)	9,5 (3)	17,9
$\alpha_{0,6}$	4854,7 (12)	23,0 (3)	7,8
$\alpha_{0,4}$	4871,8 (12)	47,64 (6)	5
$\alpha_{0,3}$	4887,8 (12)	2,02 (2)	152

	Energy keV	Probability × 100	F
$\alpha_{0,2}$	4901,2 (12)	2,430 (17)	156
$\alpha_{0,1}$	4951,6 (12)	0,51 (3)	1570
$\alpha_{0,0}$	4958,3 (12)	2,41 (3)	387

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{7,6}$ (Pa)	5,18						
$\gamma_{1,0}$ (Pa)	6,65 (5)		(M1)			2280 (60)	3080 (90)
$\gamma_{5,4}$ (Pa)	8,22 (5)	≈ 9					
$\gamma_{6,5}$ (Pa)	9						
$\gamma_{13,12}$ (Pa)	10,7						
$\gamma_{6,4}$ (Pa)	17,40 (5)		M1+E2				
$\gamma_{(-1,1)}$ (Pa)	21,5						
$\gamma_{7,4}$ (Pa)	22,6						
$\gamma_{8,7}$ (Pa)	24,14 (10)						
$\gamma_{(-1,2)}$ (Pa)	27,7						
$\gamma_{4,2}$ (Pa)	29,374 (20)	58,2 (26)	E1		2,29 (5)	0,585 (12)	3,07 (6)
$\gamma_{(-1,3)}$ (Pa)	29,6						
$\gamma_{12,10}$ (Pa)	32,46						
$\gamma_{14,12}$ (Pa)	36,32 (2)	0,50 (14)	M1 + 1,20 % E2		74 (15)	18 (4)	99 (20)
$\gamma_{13,10}$ (Pa)	43,2						
$\gamma_{6,2}$ (Pa)	46,53 (6)	0,209 (8)	[E1]		0,687 (14)	0,171 (4)	0,914 (18)
$\gamma_{19,15}$ (Pa)	48,96 (10)						
$\gamma_{9,7}$ (Pa)	54,4 (1)						
$\gamma_{2,0}$ (Pa)	57,104 (20)	67,4 (40)	E2		128 (3)	35,3 (7)	176 (4)
$\gamma_{17,14}$ (Pa)	62,59 (10)	0,4 (3)	[M1 + 50 % E2]		50 (40)	13 (10)	60 (50)
$\gamma_{3,1}$ (Pa)	63,9 (1)	1,10 (5)	(E2)		74,7 (15)	20,6 (4)	102,3 (20)
$\gamma_{3,0}$ (Pa)	70,49 (10)	0,42 (28)	[M1 + 50 % E2]		28 (19)	7,5 (54)	38 (26)
$\gamma_{10,5}$ (Pa)	74,54 (10)	0,13 (3)	[M1]		7,42 (15)	1,79 (4)	9,84 (20)
$\gamma_{4,0}$ (Pa)	86,477 (10)	29,8 (10)	E1		1,13 (5)	0,22 (6)	1,43 (8)
$\gamma_{5,1}$ (Pa)	87,99 (3)	0,167 (4)	[E1]		0,128 (3)	0,0312 (6)	0,169 (4)
$\gamma_{5,0}$ (Pa)	94,64 (5)	0,75 (8)	E1		0,1054 (21)	0,0257 (5)	0,140 (3)
$\gamma_{9,2}$ (Pa)	106,15 (25)	0,523 (31)	[E2]		6,78 (14)	1,87 (4)	9,28 (19)
$\gamma_{13,6}$ (Pa)	108,7	0,32 (4)	M1 + 4,62 % E2		2,7 (5)	0,65 (13)	3,5 (6)
$\gamma_{11,3}$ (Pa)	109,1 (1)						
$\gamma_{12,4}$ (Pa)	115,40 (35)	0,0029 (14)	[M1+E2]	5 (6)	3,3 (13)	0,9 (4)	10 (4)
$\gamma_{13,5}$ (Pa)	117,702 (20)	2,26 (12)	M1 + 8,26 % E2	9,3 (5)	2,16 (12)	0,53 (4)	12,2 (6)
$\gamma_{12,3}$ (Pa)	131,101 (25)	0,106 (6)	E1	0,202 (4)	0,0451 (9)	0,01094 (22)	0,262 (5)
$\gamma_{14,6}$ (Pa)	134,285 (20)	0,62 (9)	[M1+E2]	6,1 (10)	1,5 (3)	0,37 (8)	8,0 (11)
$\gamma_{18,9}$ (Pa)	139,9 (1)	0,00560 (49)	[E1]	0,174 (3)	0,0381 (8)	0,00925 (19)	0,225 (5)
$\gamma_{13,3}$ (Pa)	141,74 (10)						
$\gamma_{14,5}$ (Pa)	143,249 (20)	3,3 (3)	M1 + 7,76 % E2	5,38 (12)	1,171 (24)	0,287 (6)	6,94 (14)
$\gamma_{14,4}$ (Pa)	151,414 (20)	1,39 (14)	M1 + 32,89 % E2	3,4 (5)	1,09 (4)	0,277 (14)	4,9 (6)
$\gamma_{20,13}$ (Pa)	153,37 (10)	0,021 (6)	[E2]	0,226 (5)	1,267 (3)	0,349 (7)	1,96 (4)
$\gamma_{15,6}$ (Pa)	153,37						
$\gamma_{13,2}$ (Pa)	155,239 (20)	0,103 (9)	E1	0,1368 (27)	0,0292 (6)	0,00708 (14)	0,176 (4)
$\gamma_{15,5}$ (Pa)	162,41						
$\gamma_{10,1}$ (Pa)	162,41 (8)	0,0382 (12)	[E1]	0,1232 (25)	0,0260 (5)	0,00630 (13)	0,158 (3)
$\gamma_{10,0}$ (Pa)	169,156 (20)	0,0768 (4)	[E1]	0,1120 (22)	0,0235 (5)	0,00568 (11)	0,143 (3)
$\gamma_{15,4}$ (Pa)	170,59						
$\gamma_{16,7}$ (Pa)	170,59 (6)	0,100 (22)	[M1 + 13,79 % E2]	3,1 (5)	0,70 (7)	0,17 (1)	4,0 (5)
$\gamma_{16,6}$ (Pa)	176,12 (6)	0,070 (16)	[M1 + 13,79 % E2]	2,8 (4)	0,63 (7)	0,16 (1)	3,7 (5)

	Energy keV	$P_{\gamma+ce}$ $\times 100$	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{14,2}$ (Pa)	180,794 (19)	0,0180 (11)	[E1]	0,0960 (19)	0,0199 (4)	0,0048 (1)	0,1223 (25)
$\gamma_{15,3}$ (Pa)	186,86						
$\gamma_{20,11}$ (Pa)	186,86 (35)	0,003 (3)	[E1]	0,0889 (19)	0,0183 (4)	0,00442 (9)	0,1131 (23)
$\gamma_{17,7}$ (Pa)	191,46 (5)	0,074 (9)	[M1 + 13,79 % E2]	2,2 (3)	0,49 (5)	0,12 (1)	2,9 (4)
$\gamma_{16,4}$ (Pa)	193,26 (5)	0,167 (18)	[M1 + 13,79 % E2]	2,2 (3)	0,48 (5)	0,12 (1)	2,8 (4)
$\gamma_{18,7}$ (Pa)	194,67 (20)						
$\gamma_{12,1}$ (Pa)	194,95 (3)	0,192 (22)	E1	0,0806 (16)	0,0164 (4)	0,00397 (8)	0,1024 (21)
$\gamma_{17,6}$ (Pa)	196,86 (5)	0,078 (6)	[M1 + 13,79 % E2]	2,1 (3)	0,45 (5)	0,11 (1)	2,7 (3)
$\gamma_{18,6}$ (Pa)	199,95 (6)	0,020 (3)	[M1]	2,27 (5)	0,436 (9)	0,105 (2)	2,85 (6)
$\gamma_{15,2}$ (Pa)	199,95						
$\gamma_{12,0}$ (Pa)	201,62 (5)	0,0429 (10)	E1	0,0746 (15)	0,0151 (3)	0,00365 (7)	0,0946 (19)
$\gamma_{20,9}$ (Pa)	202,9 (2)	0,0052 (21)	[E1]	0,0735 (50)	0,0149 (3)	0,00360 (7)	0,0932 (19)
$\gamma_{16,3}$ (Pa)	209,19 (5)	0,0163 (16)	[E1]	0,0686 (14)	0,0138 (3)	0,00333 (7)	0,0868 (17)
$\gamma_{13,0}$ (Pa)	212,29 (5)	0,184 (11)	E1	0,0663 (13)	0,0133 (3)	0,00321 (7)	0,0839 (17)
$\gamma_{17,4}$ (Pa)	214,01 (5)	0,115 (13)	[M1 + 13,79 % E2]	1,64 (23)	0,35 (1)	0,09 (1)	2,1 (3)
$\gamma_{19,4}$ (Pa)	219,8						
$\gamma_{16,2}$ (Pa)	222,6 (2)						
$\gamma_{17,3}$ (Pa)	229,94 (5)	0,015 (3)	[E1]	0,0552 (11)	0,0110 (2)	0,00264 (5)	0,0697 (14)
$\gamma_{14,0}$ (Pa)	237,86 (2)	0,0610 (6)	[E1]	0,0511 (10)	0,01010 (15)	0,00243 (5)	0,0645 (13)
$\gamma_{19,2}$ (Pa)	248,95 (10)	0,012 (3)	[M1 + 13,79 % E2]	1,08 (15)	0,22 (1)	0,055 (6)	1,37 (16)
$\gamma_{15,1}$ (Pa)	250,58						
$\gamma_{15,0}$ (Pa)	257,09						
$\gamma_{20,7}$ (Pa)	257,09 (20)	0,048 (24)	[M1]	1,125 (23)	0,215 (4)	0,0518 (11)	1,41 (3)
$\gamma_{20,6}$ (Pa)	262,44 (20)	0,01120 (49)	[M1]	1,063 (21)	0,203 (4)	0,0489 (10)	1,33 (3)
$\gamma_{20,4}$ (Pa)	279,65 (20)	0,01320 (49)	[E2]	0,0847 (17)	0,100 (2)	0,0272 (6)	0,222 (5)
$\gamma_{(-1,4)}$ (Pa)	288,3						

3 Atomic Data

3.1 Pa

ω_K	:	0,970 (4)
$\bar{\omega}_L$:	0,488 (18)
n_{KL}	:	0,795 (5)

3.1.1 X Radiations

	Energy keV	Relative probability	
X_K	$K\alpha_2$	92,288	
	$K\alpha_1$	95,869	
	$K\beta_3$	107,595	}
	$K\beta_1$	108,422	}
	$K\beta_5''$	109,072	}
			35,84
	$K\beta_2$	111,405	}
	$K\beta_4$	111,87	}
	$KO_{2,3}$	112,38	}
			12,15

	Energy keV	Relative probability
X _L		
L ℓ	11,368	
L α	13,122 – 13,289	
L η	14,949	
L β	15,358 – 17,666	
L γ	18,94 – 20,113	

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	70,08 – 78,82	100
KLX	85,99 – 95,86	59,2
KXY	101,87 – 112,59	8,76
Auger L	5,90 – 21,01	

4 α Emissions

	Energy keV	Probability $\times 100$
$\alpha_{0,20}$	4515,1 (19)	0,038 (4)
$\alpha_{-1,1}$	4550,5 (22)	0,011 (3)
$\alpha_{0,18}$	4573 (3)	0,048 (23)
$\alpha_{0,17}$	4578,6 (14)	0,393 (23)
$\alpha_{0,16}$	4599,1 (18)	0,373 (9)
$\alpha_{0,15}$	4619,7 (21)	0,032 (8)
$\alpha_{0,14}$	4640 (1)	6,43 (3)
$\alpha_{0,13}$	4665,0 (9)	3,46 (3)
$\alpha_{0,12}$	4676,4	0,38 (2)
$\alpha_{0,11}$	4698,2 (8)	0,535 (10)
$\alpha_{0,10}$	4708,3 (20)}	
$\alpha_{0,9}$	4712,3 (20)}	1,174 (13)
$\alpha_{0,8}$	4741,3 (20)	0,019
$\alpha_{0,7}$	4766,5 (8)	9,5 (3)
$\alpha_{0,6}$	4771,4 (8)	23,0 (3)
$\alpha_{0,4}$	4788,0 (9)	47,64 (6)
$\alpha_{0,3}$	4803,5 (10)	2,02 (2)
$\alpha_{0,2}$	4816,8 (10)	2,430 (17)
$\alpha_{0,1}$	4866,4 (14)	0,51 (3)
$\alpha_{0,0}$	4872,7 (14)	2,41 (3)

5 Electron Emissions

		Energy keV	Electrons per 100 disint.
e _{AL}	(Pa)	5,90 - 21,01	47,1 (20)
e _{AK}	(Pa)		0,167 (24)
	KLL	70,08 - 78,82	}
	KLX	85,99 - 95,86	}
	KXY	101,87 - 112,59	}
ec _{13,5 K}	(Pa)	5,11 (2)	1,59 (9)
ec _{4,2 L}	(Pa)	8,269 - 12,641	32,7 (15)
ec _{14,12 L}	(Pa)	15,22 - 19,59	0,37 (11)
ec _{4,2 M}	(Pa)	24,013 - 25,932	8,4 (4)
ec _{6,2 L}	(Pa)	25,42 - 29,80	0,075 (3)
ec _{14,5 K}	(Pa)	30,65 (2)	2,26 (22)
ec _{14,12 M}	(Pa)	30,96 - 32,88	0,090 (27)
ec _{2,0 L}	(Pa)	35,999 - 40,371	48,9 (29)
ec _{14,4 K}	(Pa)	38,82 (2)	0,80 (12)
ec _{17,14 L}	(Pa)	41,48 - 45,86	0,3 (2)
ec _{3,1 L}	(Pa)	42,8 - 47,2	0,80 (4)
ec _{3,0 L}	(Pa)	49,38 - 53,76	0,3 (2)
ec _{2,0 M}	(Pa)	51,743 - 53,662	13,4 (8)
ec _{17,14 M}	(Pa)	57,23 - 59,15	0,08 (6)
ec _{3,1 M}	(Pa)	58,5 - 60,5	0,220 (9)
ec _{3,0 M}	(Pa)	65,13 - 67,05	0,08 (6)
ec _{4,0 L}	(Pa)	65,372 - 69,744	13,9 (6)
ec _{5,0 L}	(Pa)	73,54 - 77,91	0,070 (7)
ec _{4,0 M}	(Pa)	81,116 - 83,035	2,7 (7)
ec _{13,5 L}	(Pa)	96,597 - 100,969	0,369 (22)
ec _{13,5 M}	(Pa)	112,341 - 114,260	0,091 (7)
ec _{14,5 L}	(Pa)	122,144 - 126,516	0,49 (5)
ec _{14,4 L}	(Pa)	130,309 - 134,681	0,257 (10)
ec _{14,5 M}	(Pa)	137,888 - 139,807	0,121 (12)
ec _{14,4 M}	(Pa)	146,053 - 147,972	0,0654 (34)

6 Photon Emissions

6.1 X-Ray Emissions

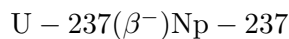
		Energy keV		Photons per 100 disint.	
XL	(Pa)	11,368 — 20,113		59,7 (32)	
XK α_2	(Pa)	92,288		1,813 (20)	} K α
XK α_1	(Pa)	95,869		2,906 (20)	}
XK β_3	(Pa)	107,595	}		
XK β_1	(Pa)	108,422	}	1,06 (10)	K' β_1
XK β_5''	(Pa)	109,072	}		
XK β_2	(Pa)	111,405	}		
XK β_4	(Pa)	111,87	}	0,380 (9)	K' β_2
XKO $_{2,3}$	(Pa)	112,38	}		

6.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{7,6}$ (Pa)	5,18	0,220 (5)
$\gamma_{5,4}$ (Pa)	8,22 (5)	0,12 (5)
$\gamma_{(-1,1)}$ (Pa)	21,5	0,352 (13)
$\gamma_{(-1,2)}$ (Pa)	27,7	0,84 (7)
$\gamma_{4,2}$ (Pa)	29,374 (20)	14,3 (6)
$\gamma_{14,12}$ (Pa)	36,32 (2)	0,005 (1)
$\gamma_{6,2}$ (Pa)	46,53 (6)	0,109 (4)
$\gamma_{2,0}$ (Pa)	57,104 (20)	0,381 (21)
$\gamma_{17,14}$ (Pa)	62,59 (10)	0,006 (2)
$\gamma_{3,1}$ (Pa)	63,9 (1)	0,0107 (4)
$\gamma_{3,0}$ (Pa)	70,49 (10)	0,0107 (4)
$\gamma_{10,5}$ (Pa)	74,54 (10)	0,012 (3)
$\gamma_{4,0}$ (Pa)	86,477 (10)	12,26 (12)
$\gamma_{5,1}$ (Pa)	87,99 (3)	0,143 (3)
$\gamma_{5,0}$ (Pa)	94,64 (5)	0,66 (7)
$\gamma_{9,2}$ (Pa)	106,15 (25)	0,0509 (29)
$\gamma_{13,6}$ (Pa)	108,7	0,071 (3)
$\gamma_{12,4}$ (Pa)	115,40 (35)	0,0026 (8)
$\gamma_{13,5}$ (Pa)	117,702 (20)	0,171 (4)
$\gamma_{12,3}$ (Pa)	131,101 (25)	0,084 (5)
$\gamma_{14,6}$ (Pa)	134,285 (20)	0,069 (5)
$\gamma_{18,9}$ (Pa)	139,9 (1)	0,0046 (4)
$\gamma_{14,5}$ (Pa)	143,249 (20)	0,42 (4)
$\gamma_{14,4}$ (Pa)	151,414 (20)	0,234 (2)

	Energy keV	Photons per 100 disint.
$\gamma_{20,13}$ (Pa)	153,37 (10)	0,007 (2)
$\gamma_{13,2}$ (Pa)	155,239 (20)	0,088 (8)
$\gamma_{10,1}$ (Pa)	162,41 (8)	0,033 (1)
$\gamma_{10,0}$ (Pa)	169,156 (20)	0,0672 (3)
$\gamma_{16,7}$ (Pa)	170,59 (6)	0,020 (4)
$\gamma_{16,6}$ (Pa)	176,12 (6)	0,015 (3)
$\gamma_{14,2}$ (Pa)	180,81 (10)	0,016 (1)
$\gamma_{20,11}$ (Pa)	186,86 (35)	0,003 (3)
$\gamma_{17,7}$ (Pa)	191,46 (5)	0,019 (1)
$\gamma_{16,4}$ (Pa)	193,26 (5)	0,044 (1)
$\gamma_{18,7}$ (Pa)	194,67 (20)	0,033 (1)
$\gamma_{12,1}$ (Pa)	194,95 (3)	0,174 (20)
$\gamma_{17,6}$ (Pa)	196,86 (5)	0,0210 (1)
$\gamma_{18,6}$ (Pa)	199,95 (6)	0,0053 (8)
$\gamma_{12,0}$ (Pa)	201,62 (5)	0,0392 (9)
$\gamma_{20,9}$ (Pa)	202,9 (2)	0,0048 (19)
$\gamma_{16,3}$ (Pa)	209,19 (5)	0,0150 (15)
$\gamma_{13,0}$ (Pa)	212,29 (5)	0,17 (1)
$\gamma_{17,4}$ (Pa)	214,01 (5)	0,037 (2)
$\gamma_{16,2}$ (Pa)	222,6 (2)	0,002 (2)
$\gamma_{17,3}$ (Pa)	229,94 (5)	0,014 (3)
$\gamma_{14,0}$ (Pa)	237,86 (2)	0,0573 (6)
$\gamma_{19,2}$ (Pa)	248,95 (10)	0,005 (1)
$\gamma_{20,7}$ (Pa)	257,09 (20)	0,02 (1)
$\gamma_{20,6}$ (Pa)	262,44 (20)	0,0048 (2)
$\gamma_{20,4}$ (Pa)	279,65 (20)	0,0108 (4)
$\gamma_{(-1,4)}$ (Pa)	288,3	0,0162 (5)

7 Main Production Modes

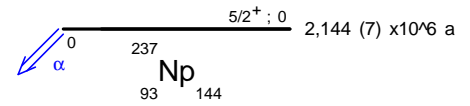


8 References

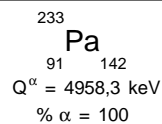
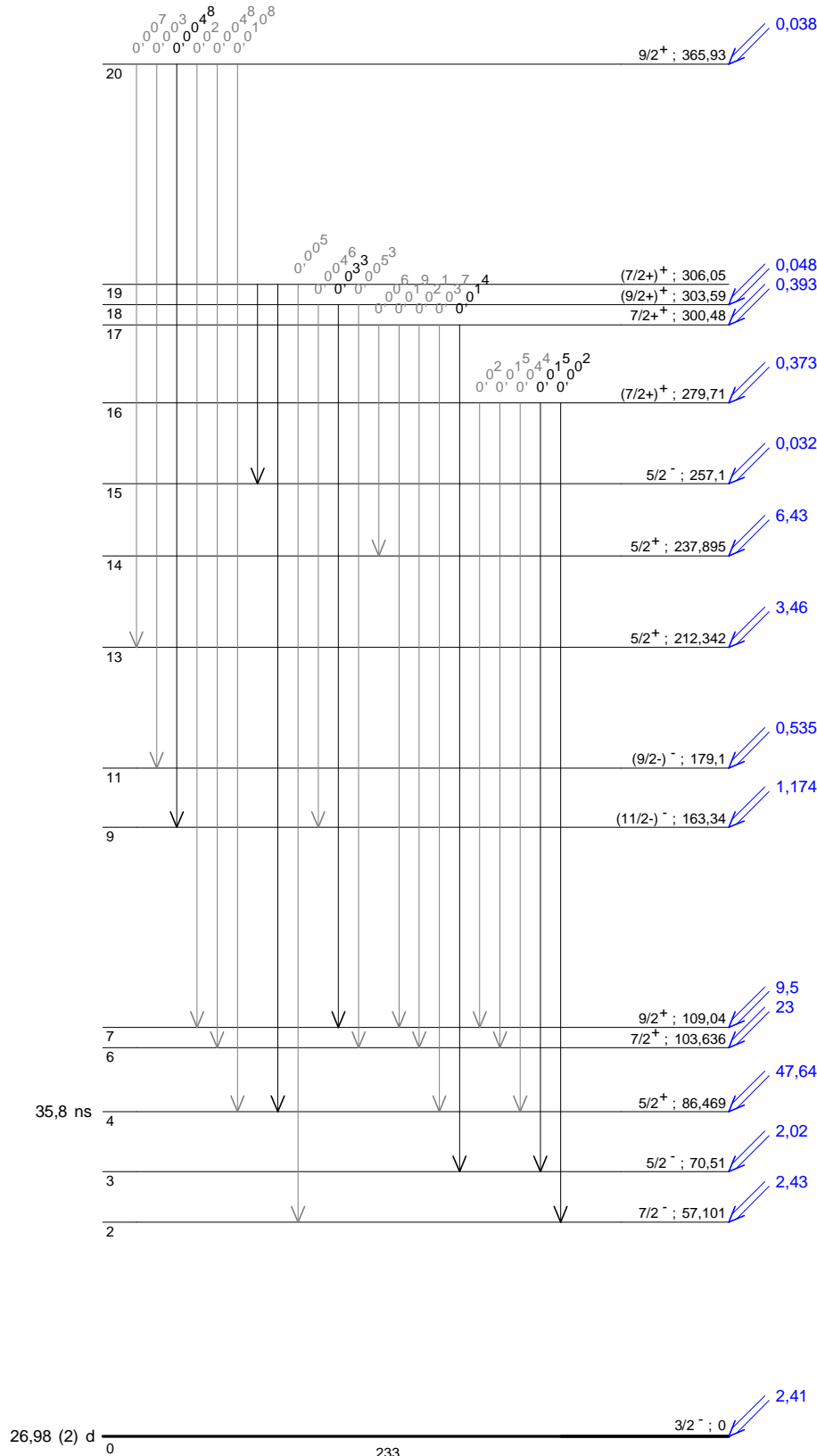
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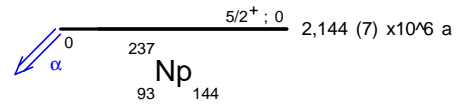
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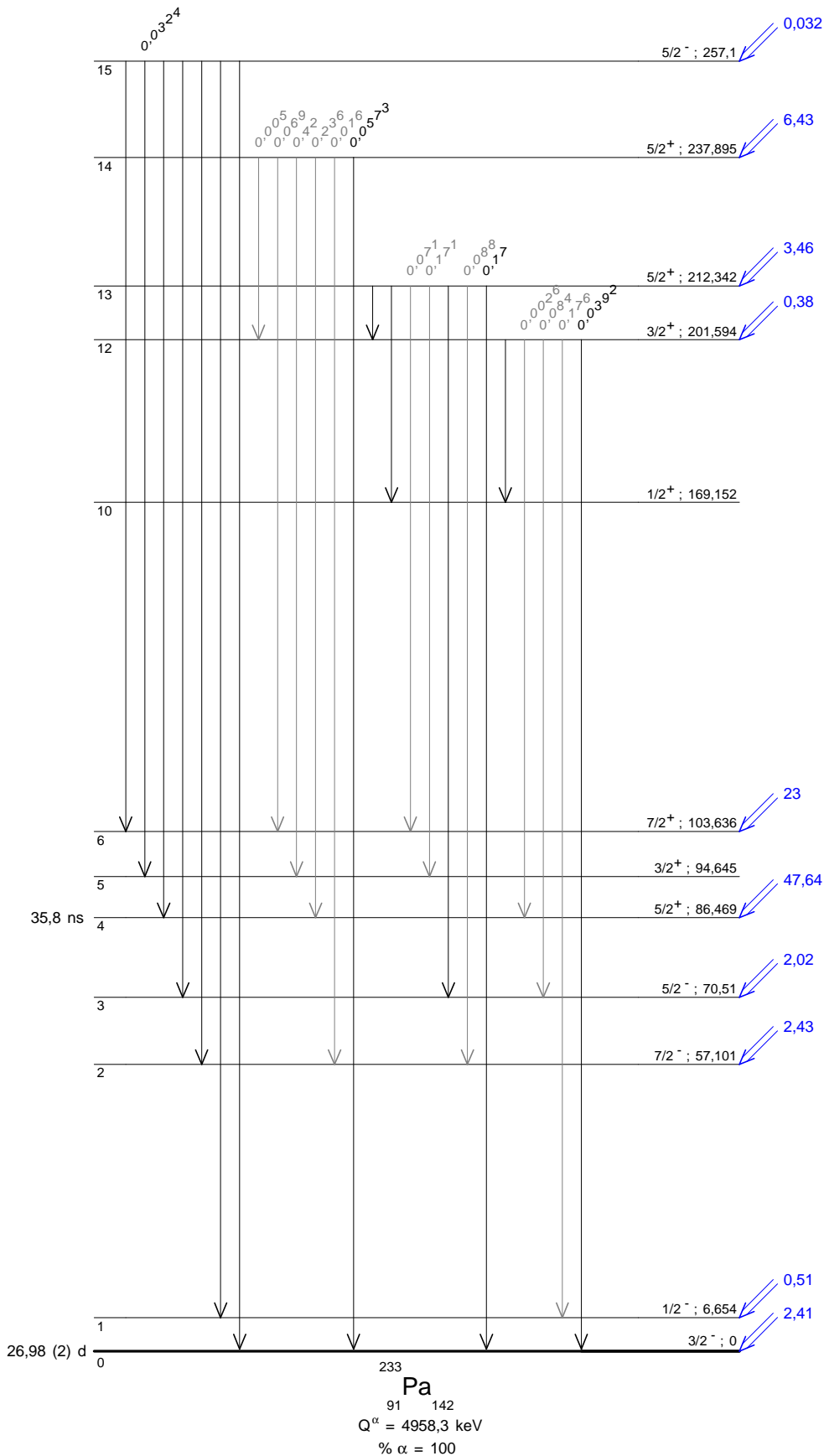


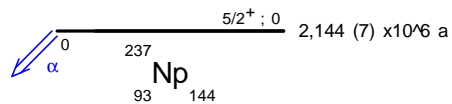
γ Emission intensities per 100 disintegrations



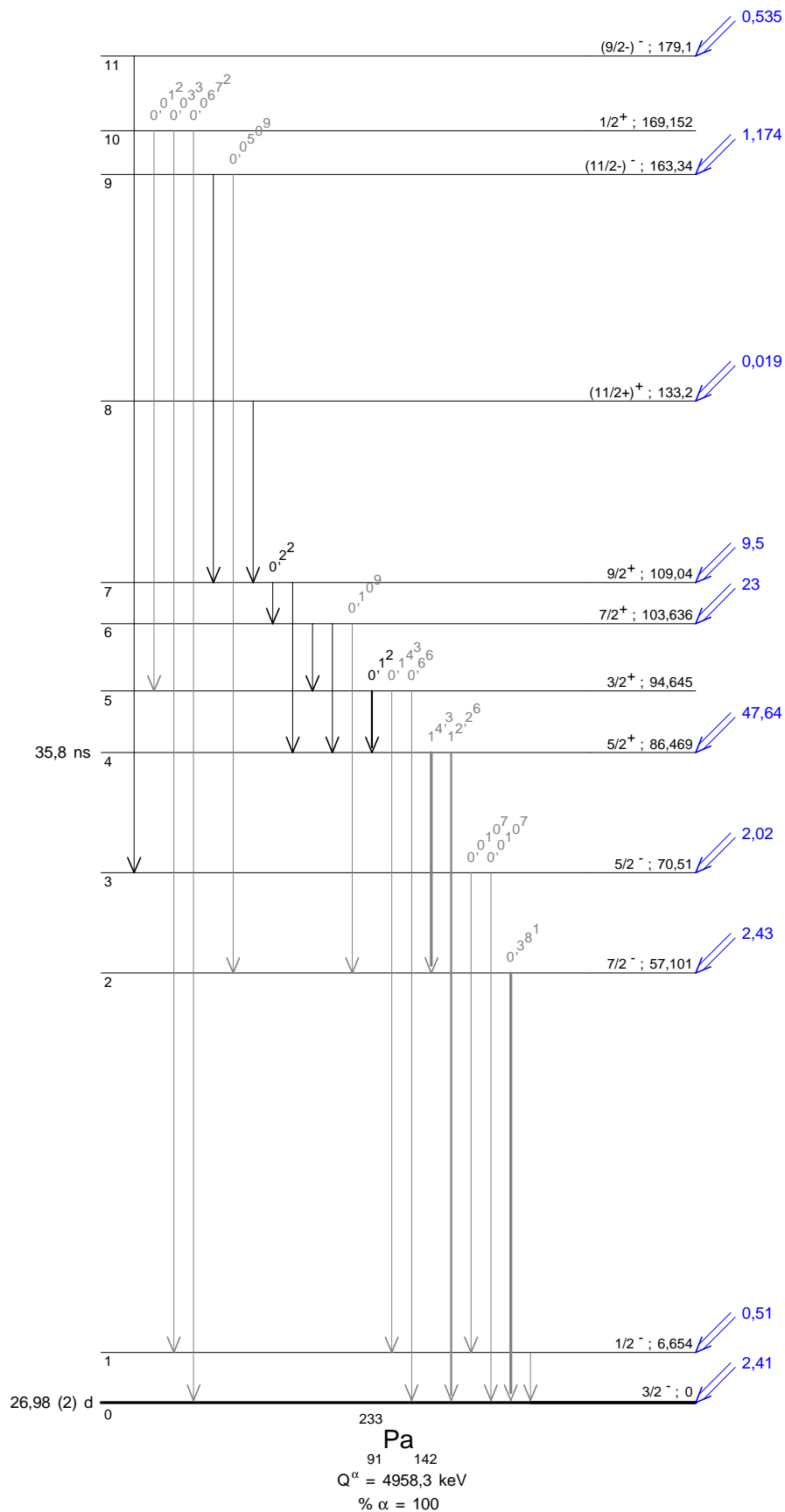


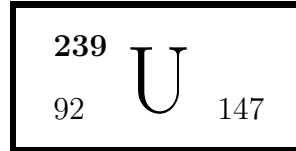
γ Emission intensities per 100 disintegrations





γ Emission intensities per 100 disintegrations





1 Decay Scheme

U-239 disintegrates by beta minus emission to levels in Np-239.

L'uranium 239 se désintègre par émission bêta vers des niveaux excités du neptunium 239.

2 Nuclear Data

$T_{1/2}({}^{239}\text{U})$:	23,46	(5)	min
$T_{1/2}({}^{239}\text{Np})$:	2,356	(3)	d
$Q^{-}({}^{239}\text{U})$:	1261,5	(16)	keV

2.1 β^{-} Transitions

	Energy keV	Probability $\times 100$	Nature	lg ft
$\beta_{0,32}^{-}$	164,5 (16)	0,0060 (5)		
$\beta_{0,31}^{-}$	212,3 (16)	0,0059 (4)		
$\beta_{0,30}^{-}$	221,1 (16)	0,0077 (4)		
$\beta_{0,29}^{-}$	247,9 (16)	0,0074 (4)		
$\beta_{0,28}^{-}$	269,3 (16)	0,0262 (9)		
$\beta_{0,27}^{-}$	295,0 (16)	0,0008 (2)		
$\beta_{0,26}^{-}$	297,3 (16)	0,211 (3)		
$\beta_{0,25}^{-}$	302,3 (16)	0,0284 (7)	1 st Forbidden	
$\beta_{0,24}^{-}$	398,1 (16)	0,0005 (2)		
$\beta_{0,23}^{-}$	412,0 (16)	0,0264 (4)	1 st Forbidden	
$\beta_{0,22}^{-}$	417,4 (16)	0,215 (3)		
$\beta_{0,21}^{-}$	442,2 (16)	0,228 (3)		
$\beta_{0,18}^{-}$	566,3 (16)	0,0118 (11)		
$\beta_{0,17}^{-}$	599,2 (16)	0,261 (6)	1 st Forbidden	7,35
$\beta_{0,15}^{-}$	697,6 (16)	0,0247 (7)		
$\beta_{0,14}^{-}$	731,2 (16)	0,0029 (4)		
$\beta_{0,13}^{-}$	743,5 (16)	0,063 (2)		

	Energy keV	Probability × 100	Nature	lg <i>ft</i>
$\beta_{0,12}^-$	787,1 (16)	0,0033 (4)		
$\beta_{0,4}^-$	1143,9 (16)	2,2 (4)	1st Forbidden	7,4
$\beta_{0,3}^-$	1186,5 (16)	72,8 (19)	1st Forbidden	5,91
$\beta_{0,1}^-$	1230,4 (16)	9,4 (15)	Allowed	6,83
$\beta_{0,0}^-$	1261,5 (16)	14,4 (22)	Allowed	6,7

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{1,0}(\text{Np})$	31,1310 (12)	19,0 (14)	M1+E2		195 (10)	50 (3)	263 (13)
$\gamma_{4,3}(\text{Np})$	43,1	2,0 (4)	M1+E2		114 (13)	30 (4)	154 (18)
$\gamma_{3,1}(\text{Np})$	43,533 (1)	9,3 (6)	E1		0,856 (17)	0,215 (4)	1,14 (3)
$\gamma_{(-1,1)}(\text{Np})$	46,6	0,009 (4)					
$\gamma_{6,4}(\text{Np})$	55,37 (5)	0,0076 (25)	M1+E2		63 (20)	17 (6)	90 (30)
$\gamma_{2,0}(\text{Np})$	71,210 (2)	0,141 (4)	E2		52,3 (10)	14,6 (3)	71,9 (14)
$\gamma_{3,0}(\text{Np})$	74,664 (1)	65,8 (17)	E1		0,207 (4)	0,0512 (10)	0,276 (6)
$\gamma_{4,1}(\text{Np})$	86,72 (7)	0,065 (6)	E1		0,140 (3)	0,0344 (7)	0,186 (4)
$\gamma_{15,11}(\text{Np})$	111,0 (2)	0,0202 (5)					
$\gamma_{4,0}(\text{Np})$	117,727 (20)	0,123 (10)	E1		0,0632 (13)	0,0155 (3)	0,0841 (17)
$\gamma_{(-1,2)}(\text{Np})$	134,71 (13)	0,0019 (3)					
$\gamma_{(-1,3)}(\text{Np})$	142,5 (1)	0,0045 (6)					
$\gamma_{7,2}(\text{Np})$	170,15 (5)	0,031 (1)					
$\gamma_{(-1,4)}(\text{Np})$	174,07 (6)	0,0097 (3)					
$\gamma_{8,3}(\text{Np})$	186,15 (4)	0,10 (5)	[M1+E2]	1,7 (16)	0,645 (13)	0,167 (14)	2,6 (16)
$\gamma_{10,8}(\text{Np})$	187,28 (8)	0,020 (9)	[M1+E2]	1,7 (16)	0,631 (13)	0,164 (14)	2,6 (16)
$\gamma_{9,7}(\text{Np})$	197,28 (12)	0,0024 (3)					
$\gamma_{24,17}(\text{Np})$	201,18 (6)	0,0005 (2)					
$\gamma_{(-1,5)}(\text{Np})$	220,52 (4)	0,0282 (7)					
$\gamma_{(-1,6)}(\text{Np})$	236,28 (14)	0,00092 (18)					
$\gamma_{21,16}(\text{Np})$	239,86 (5)	0,00087 (23)					
$\gamma_{21,15}(\text{Np})$	255,37 (5)	0,0011 (2)					
$\gamma_{30,19}(\text{Np})$	258,44 (6)	0,00073 (18)					
$\gamma_{8,0}(\text{Np})$	260,80 (2)	0,00310 (21)	[E1]	0,0434 (9)	0,0087 (2)	0,00211 (4)	0,0549 (11)
$\gamma_{(-1,7)}(\text{Np})$	262,89 (19)	0,0008 (3)					
$\gamma_{(-1,8)}(\text{Np})$	265,44 (17)	0,0009 (3)					
$\gamma_{28,18}(\text{Np})$	296,93 (13)	0,0024 (8)	[M1+E2]	0,5 (4)	0,13 (4)	0,034 (9)	0,7 (5)
$\gamma_{25,17}(\text{Np})$	296,93 (13)		[M1+E2]	0,5 (4)	0,13 (4)	0,034 (9)	0,7 (5)
$\gamma_{26,17}(\text{Np})$	301,95 (3)	0,0018 (7)	[M1+E2]	0,5 (4)	0,13 (4)	0,032 (9)	0,6 (5)
$\gamma_{32,20}(\text{Np})$	312,05 (3)	0,0006					
$\gamma_{22,13}(\text{Np})$	326,21 (7)	0,0044 (2)					
$\gamma_{(-1,9)}(\text{Np})$	330,14 (14)	0,00069 (13)					
$\gamma_{(-1,10)}(\text{Np})$	332,06 (14)	0,0012 (2)					
$\gamma_{30,18}(\text{Np})$	345,13 (8)	0,0039 (2)					
$\gamma_{(-1,11)}(\text{Np})$	348,23 (18)	0,0007 (3)					
$\gamma_{(-1,12)}(\text{Np})$	351,33 (15)	0,0007 (2)					
$\gamma_{(-1,13)}(\text{Np})$	361,83 (8)	0,0044 (3)					
$\gamma_{10,3}(\text{Np})$	373,51 (4)	0,034 (10)	[M1+E2]	0,26 (22)	0,07 (3)	0,017 (6)	0,35 (22)
$\gamma_{11,3}(\text{Np})$	378,06 (6)	0,0101 (4)					
$\gamma_{11,2}(\text{Np})$	381,27 (16)	0,0006 (2)					

	Energy keV	P _{γ+ce} × 100	Multipolarity	α _K	α _L	α _M	α _T
γ _(-1,14) (Np)	393,01 (18)	0,0006 (2)					
γ _{25,15} (Np)	395,19 (11)	0,0021 (2)					
γ _{12,3} (Np)	399,13 (13)	0,0016 (3)					
γ _(-1,15) (Np)	400,55 (15)	0,0009 (2)					
γ _(-1,16) (Np)	404,84 (18)	0,0009 (3)					
γ _{32,17} (Np)	434,71 (4)	0,00122 (20)	(E1)	0,0148 (3)	0,00276 (5)	0,00066 (1)	0,0184 (4)
γ _(-1,17) (Np)	445,81 (12)	0,0011 (2)					
γ _{10,0} (Np)	448,18 (2)	0,00920 (31)	[E1]	0,0139 (3)	0,00258 (5)	0,00062 (1)	0,0173 (4)
γ _(-1,18) (Np)	452,17 (12)	0,0016 (2)					
γ _{14,3} (Np)	455,63 (6)	0,0008 (3)					
γ _{12,0} (Np)	474,36 (6)	0,0017 (2)					
γ _(-1,19) (Np)	478,13 (19)	0,00055 (23)					
γ _(-1,20) (Np)	479,55 (14)	0,0010 (2)					
γ _{13,1} (Np)	486,87 (3)	0,0627 (14)	[E1]	0,0118 (3)	0,00217 (5)	0,00052 (1)	0,0147 (4)
γ _(-1,21) (Np)	490,33 (13)	0,0007 (1)					
γ _{15,2} (Np)	492,76 (7)	0,0050 (2)					
γ _{14,1} (Np)	499,1 (1)	0,0021 (2)					
γ _(-1,22) (Np)	502,12 (17)	0,0006 (2)					
γ _{16,3} (Np)	504,76 (8)	0,00545 (31)	[E2]	0,0293 (6)	0,0143 (3)	0,0038 (1)	0,0488 (10)
γ _(-1,23) (Np)	506,80 (14)	0,0010 (2)					
γ _{13,0} (Np)	518,00 (2)	0,00456 (30)	[E1]	0,01050 (15)	0,00190 (4)	0,00046 (1)	0,01300 (19)
γ _{18,6} (Np)	522,12 (10)	0,00274 (33)	[M1+E2]	0,11 (9)	0,025 (13)	0,006 (3)	0,14 (10)
γ _{15,1} (Np)	532,86 (10)	0,0023 (2)					
γ _(-1,24) (Np)	541,32 (10)	0,0029 (3)					
γ _{17,4} (Np)	544,48 (9)	0,0041 (5)	[M1+E2]	0,10 (8)	0,022 (11)	0,005 (3)	0,13 (9)
γ _{16,1} (Np)	547,99 (12)	0,00202 (30)	[E1]	0,00941 (19)	0,00170 (4)	0,00041 (1)	0,01170 (24)
γ _(-1,25) (Np)	558,46 (17)	0,0006 (2)					
γ _{29,11} (Np)	560,63 (7)	0,0058 (3)					
γ _{15,0} (Np)	563,89 (4)	0,0004 (2)					
γ _(-1,26) (Np)	567,88 (18)	0,0004 (1)					
γ _(-1,27) (Np)	575,27 (5)	0,0131 (4)					
γ _(-1,28) (Np)	577,15 (14)	0,0014 (3)					
γ _(-1,29) (Np)	585,49 (14)	0,0012 (2)					
γ _{17,3} (Np)	587,62 (2)	0,0214 (15)	[M1+E2]	0,08 (6)	0,018 (9)	0,004 (2)	0,11 (7)
γ _{23,8} (Np)	588,70 (8)	0,0055 (3)					
γ _(-1,30) (Np)	591,82 (19)	0,0009 (4)					
γ _(-1,31) (Np)	599,13 (15)	0,0007 (2)					
γ _(-1,32) (Np)	602,79 (8)	0,0048 (3)					
γ _(-1,33) (Np)	604,85 (6)	0,00096 (27)					
γ _{23,7} (Np)	607,96 (15)	0,0013 (3)					
γ _(-1,34) (Np)	614,53 (17)	0,0006 (2)					
γ _(-1,35) (Np)	618,03 (16)	0,0007 (2)					
γ _{18,2} (Np)	624,11 (7)	0,00626 (30)	[E1]	0,00737 (15)	0,00131 (3)	0,00031 (1)	0,0091 (2)
γ _(-1,36) (Np)	629,00 (11)	0,0027 (3)					
γ _{17,1} (Np)	631,10 (3)	0,0676 (20)	[E1]	0,0072 (2)	0,00128 (3)	0,00031 (1)	0,00892 (17)
γ _{32,11} (Np)	644,253 (30)	0,0019 (4)					
γ _{21,6} (Np)	646,26 (10)	0,0029 (3)					
γ _(-1,37) (Np)	649,79 (19)	0,0009 (4)					
γ _{17,0} (Np)	662,28 (2)	0,171 (5)	[E1]	0,00660 (13)	0,001170 (17)	0,00028 (1)	0,00815 (16)
γ _{18,1} (Np)	664,17 (9)	0,00544 (40)	[E1]	0,00657 (13)	0,001160 (17)	0,00028 (1)	0,00811 (16)
γ _(-1,38) (Np)	668,76 (18)	0,00055 (18)					
γ _(-1,39) (Np)	670,88 (20)	0,0006 (3)					
γ _(-1,40) (Np)	691,01 (6)	0,0074 (3)					
γ _(-1,41) (Np)	692,61 (13)	0,0016 (3)					
γ _{18,0} (Np)	695,23 (2)	0,00363 (30)	[E1]	0,00604 (13)	0,001060 (15)	0,00025 (1)	0,00745 (15)
γ _(-1,42) (Np)	701,21 (10)	0,0024 (2)					
γ _{26,8} (Np)	703,63 (10)	0,00235 (20)	[E2]	0,0162 (3)	0,00537 (11)	0,00138 (3)	0,0234 (5)
γ _{19,3} (Np)	707,38 (9)	0,0022 (2)					
γ _{20,3} (Np)	710,35 (15)	0,003					

	Energy keV	P _{γ+ce} × 100	Multipolarity	α _K	α _L	α _M	α _T
γ _(-1,43) (Np)	714,22 (9)	0,0030 (3)					
γ _{26,7} (Np)	722,85 (4)	0,0276 (7)	[E2]	0,0155 (3)	0,00499 (10)	0,001060 (18)	0,0222 (4)
γ _{23,5} (Np)	727,52 (10)	0,0026 (3)					
γ _(-1,44) (Np)	730,95 (6)	0,0090 (3)					
γ _(-1,45) (Np)	746,06 (11)	0,0043 (5)					
γ _{21,2} (Np)	748,09 (3)	0,0890 (4)					
γ _{29,8} (Np)	752,84 (8)	0,0013 (3)					
γ _(-1,46) (Np)	764,04 (11)	0,0026 (3)					
γ _(-1,47) (Np)	768,15 (11)	0,0020 (2)					
γ _(-1,48) (Np)	769,52 (17)	0,0004 (1)					
γ _{22,2} (Np)	772,94 (9)	0,0029 (2)					
γ _{23,3} (Np)	774,77 (4)	0,015 (4)					
γ _{30,8} (Np)	779,57 (14)	0,0006 (1)					
γ _{21,1} (Np)	788,19 (7)	0,0049 (2)					
γ _{26,6} (Np)	791,13 (5)	0,0075 (2)					
γ _(-1,49) (Np)	795,13 (15)	0,0008 (2)					
γ _{22,1} (Np)	812,89 (3)	0,0685 (3)					
γ _{21,0} (Np)	819,26 (3)	0,129 (3)					
γ _(-1,50) (Np)	829,59 (17)	0,00046 (13)					
γ _(-1,51) (Np)	831,89 (9)	0,0021 (2)					
γ _{25,4} (Np)	841,45 (4)	0,0025 (4)					
γ _{22,0} (Np)	844,10 (3)	0,139 (3)					
γ _{26,4} (Np)	846,39 (4)	0,0324 (13)	[M1+E2]	0,032 (21)	0,007 (4)	0,0016 (8)	0,04 (3)
γ _{23,0} (Np)	849,44 (9)	0,0020 (2)					
γ _(-1,52) (Np)	862,56 (18)	0,0004 (1)					
γ _{30,6} (Np)	867,11 (11)	0,00076 (8)					
γ _{28,5} (Np)	869,57 (9)	0,0016 (1)					
γ _{28,4} (Np)	874,43 (3)	0,00343 (22)	[M1+E2]	0,030 (19)	0,006 (4)	0,0015 (8)	0,038 (23)
γ _{25,3} (Np)	884,45 (5)	0,0086 (2)					
γ _{25,2} (Np)	887,97 (3)	0,0023 (2)					
γ _{26,3} (Np)	889,49 (4)	0,0217 (7)	[M1+E2]	0,029 (18)	0,006 (3)	0,0014 (7)	0,036 (22)
γ _{27,2} (Np)	895,15 (15)	0,0008 (2)					
γ _(-1,53) (Np)	913,68 (9)	0,0019 (1)					
γ _{28,3} (Np)	917,40 (8)	0,00279 (12)	[M1+E2]	0,026 (17)	0,005 (3)	0,0013 (7)	0,034 (22)
γ _{28,2} (Np)	920,95 (8)	0,00261 (10)	[E1]	0,00366 (6)	0,00063 (1)	0,00015 (1)	0,00450 (9)
γ _{30,4} (Np)	922,83 (13)	0,0006 (1)					
γ _{25,1} (Np)	928,05 (3)	0,0051 (2)					
γ _{31,4} (Np)	931,51 (5)	0,00547 (33)	[M1+E2]	0,026 (16)	0,005 (3)	0,0013 (7)	0,032 (19)
γ _{26,1} (Np)	933,09 (3)	0,0263 (6)	[E1]	0,00358 (7)	0,00061 (1)	0,00015 (1)	0,00439 (9)
γ _{29,3} (Np)	938,98 (8)	0,00031 (8)					
γ _(-1,54) (Np)	948,88 (19)	0,00024 (10)					
γ _{25,0} (Np)	959,18 (3)	0,0078 (3)					
γ _{28,1} (Np)	960,99 (5)	0,01054 (30)	[E1]	0,00340 (7)	0,00058 (1)	0,00014 (1)	0,00417 (9)
γ _{26,0} (Np)	964,23 (2)	0,0909 (20)	[E1]	0,00338 (7)	0,00058 (1)	0,00014 (1)	0,00415 (8)
γ _(-1,55) (Np)	970,07 (14)	0,0009 (2)					
γ _{31,3} (Np)	974,58 (4)	0,00040 (8)	[E2]	0,00917 (18)	0,00234 (5)	0,00059 (1)	0,0123 (5)
γ _(-1,56) (Np)	988,51 (14)	0,00044 (9)					
γ _{28,0} (Np)	992,16 (2)	0,00281 (10)	[E1]	0,00322 (7)	0,00055 (1)	0,00013 (1)	0,00395 (8)
γ _(-1,57) (Np)	1002,40 (13)	0,00049 (9)					
γ _(-1,58) (Np)	1005,27 (13)	0,0006 (1)					
γ _(-1,59) (Np)	1009,38 (18)	0,0003 (1)					
γ _{30,0} (Np)	1040,37 (4)	0,0011 (1)					
γ _{32,1} (Np)	1065,76 (12)	0,00060 (8)	[M1+E2]	0,018 (11)	0,004 (2)	0,0009 (4)	0,023 (13)
γ _{32,0} (Np)	1096,99 (3)	0,00164 (10)	[M1+E2]	0,017 (11)	0,003 (2)	0,0008 (4)	0,022 (13)
γ _(-1,60) (Np)	1101,99 (16)	0,00031 (1)					

3 Atomic Data

3.1 Np

ω_K	:	0,971	(4)
$\bar{\omega}_L$:	0,511	(20)
$\bar{\omega}_M$:	0,0528	
n_{KL}	:	0,791	(5)
\bar{n}_{LM}	:	1,163	

3.1.1 X Radiations

	Energy keV	Relative probability
X _K		
K α_2	97,069	62,82
K α_1	101,059	100
K β_3	113,303	}
K β_1	114,234	}
K β_5''	114,912	}
		36,21
K β_2	117,463	}
K β_4	117,876	}
KO _{2,3}	118,429	}
		12,47
X _L		
L ℓ	11,871	
L α	13,671 – 13,946	
L η	15,861	
L β	16,109 – 17,992	
L γ	20,784 – 21,491	

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	73,501 – 83,134	100
KLX	90,358 – 101,054	60,2
KXY	107,19 – 118,66	9,06
Auger L	6,04 – 13,12	

4 Electron Emissions

		Energy keV	Electrons per 100 disint.
e _{AL}	(Np)	6,04 - 13,12	14,7 (7)
e _{AK}	(Np)		0,0091 (13)
	KLL	73,501 - 83,134	}
	KLX	90,358 - 101,054	}
	KXY	107,19 - 118,66	}
ec _{1,0 L}	(Np)	8,704 - 13,520	14,0 (11)
ec _{4,3 L}	(Np)	20,7 - 25,5	1,48 (28)
ec _{3,1 L}	(Np)	21,106 - 25,920	3,72 (25)
ec _{1,0 M}	(Np)	25,392 - 27,467	3,6 (3)
ec _{1,0 N}	(Np)	29,630 - 30,728	0,99 (8)
ec _{6,4 L}	(Np)	32,94 - 37,76	0,0053 (17)
ec _{4,3 M}	(Np)	37,4 - 39,4	0,39 (8)
ec _{3,1 M}	(Np)	37,794 - 39,869	0,94 (6)
ec _{4,3 N}	(Np)	41,6 - 42,7	0,10 (13)
ec _{3,1 N}	(Np)	42,032 - 43,130	0,248 (16)
ec _{2,0 L}	(Np)	48,78 - 53,60	0,115 (21)
ec _{6,4 M}	(Np)	49,63 - 51,71	0,0014 (5)
ec _{3,0 L}	(Np)	52,237 - 57,050	10,7 (3)
ec _{4,1 L}	(Np)	64,29 - 69,11	0,0077 (7)
ec _{2,0 M}	(Np)	65,47 - 67,55	0,032 (3)
ec _{8,3 K}	(Np)	67,48 (4)	0,049 (46)
ec _{10,8 K}	(Np)	68,61 (8)	0,010 (9)
ec _{3,0 M}	(Np)	68,925 - 71,000	2,64 (8)
ec _{2,0 N}	(Np)	69,71 - 70,81	0,0088 (16)
ec _{3,0 N}	(Np)	73,163 - 74,261	0,704 (21)
ec _{4,1 M}	(Np)	80,98 - 83,06	0,00189 (18)
ec _{4,0 L}	(Np)	95,30 - 100,12	0,0071 (6)
ec _{4,0 M}	(Np)	111,988 - 114,063	0,00175 (14)
ec _{8,3 L}	(Np)	163,72 - 168,54	0,0186 (6)
ec _{10,8 L}	(Np)	164,85 - 169,67	0,00353 (20)
ec _{8,3 M}	(Np)	180,41 - 182,49	0,00481 (42)
ec _{8,3 N}	(Np)	184,65 - 185,75	0,00132 (9)
ec _{10,3 K}	(Np)	254,84 (4)	0,007 (6)
ec _{10,3 L}	(Np)	351,08 - 355,90	0,0018 (9)
ec _{17,3 K}	(Np)	468,95 (2)	0,0015 (12)
ec _{17,0 K}	(Np)	543,61 (2)	0,001122 (40)
ec _{26,4 K}	(Np)	727,72 (4)	0,0010 (7)
$\beta_{0,32}^-$	max:	164,5 (16)	0,0060 (5)
$\beta_{0,32}^-$	avg:	43,7 (5)	
$\beta_{0,31}^-$	max:	212,3 (16)	0,0059 (4)
$\beta_{0,31}^-$	avg:	57,3 (5)	
$\beta_{0,30}^-$	max:	221,1 (16)	0,0077 (4)

		Energy keV	Electrons per 100 disint.
$\beta_{0,30}^-$	avg:	59,9 (5)	
$\beta_{0,29}^-$	max:	247,9 (16)	0,0074 (4)
$\beta_{0,29}^-$	avg:	67,6 (5)	
$\beta_{0,28}^-$	max:	269,3 (16)	0,0262 (9)
$\beta_{0,28}^-$	avg:	74,0 (5)	
$\beta_{0,27}^-$	max:	295,0 (16)	0,0008 (2)
$\beta_{0,27}^-$	avg:	81,7 (5)	
$\beta_{0,26}^-$	max:	297,3 (16)	0,211 (3)
$\beta_{0,26}^-$	avg:	82,4 (5)	
$\beta_{0,25}^-$	max:	302,3 (16)	0,0284 (7)
$\beta_{0,25}^-$	avg:	83,9 (5)	
$\beta_{0,24}^-$	max:	398,1 (16)	0,0005 (2)
$\beta_{0,24}^-$	avg:	113,4 (5)	
$\beta_{0,23}^-$	max:	412,0 (16)	0,0264 (4)
$\beta_{0,23}^-$	avg:	117,8 (5)	
$\beta_{0,22}^-$	max:	417,4 (16)	0,215 (3)
$\beta_{0,22}^-$	avg:	119,6 (5)	
$\beta_{0,21}^-$	max:	442,2 (16)	0,228 (3)
$\beta_{0,21}^-$	avg:	127,4 (5)	
$\beta_{0,18}^-$	max:	566,3 (16)	0,0118 (11)
$\beta_{0,18}^-$	avg:	168,0 (5)	
$\beta_{0,17}^-$	max:	599,2 (16)	0,261 (6)
$\beta_{0,17}^-$	avg:	179,0 (5)	
$\beta_{0,15}^-$	max:	697,6 (16)	0,0247 (7)
$\beta_{0,15}^-$	avg:	212,6 (5)	
$\beta_{0,14}^-$	max:	731,2 (16)	0,0029 (4)
$\beta_{0,14}^-$	avg:	224,3 (5)	
$\beta_{0,13}^-$	max:	743,5 (16)	0,063 (2)
$\beta_{0,13}^-$	avg:	228,6 (5)	
$\beta_{0,12}^-$	max:	787,1 (16)	0,0033 (4)
$\beta_{0,12}^-$	avg:	244,0 (5)	
$\beta_{0,4}^-$	max:	1143,9 (16)	2,2 (4)
$\beta_{0,4}^-$	avg:	374,0 (5)	
$\beta_{0,3}^-$	max:	1186,5 (16)	72,8 (19)
$\beta_{0,3}^-$	avg:	390,4 (5)	
$\beta_{0,1}^-$	max:	1230,4 (16)	9,4 (15)
$\beta_{0,1}^-$	avg:	406,8 (5)	
$\beta_{0,0}^-$	max:	1261,5 (16)	14,4 (22)
$\beta_{0,0}^-$	avg:	418,6 (5)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV	Photons per 100 disint.	
XL	(Np)	11,871 — 21,491	16,1 (5)	
XK α_2	(Np)	97,069	0,091 (3)	} K α
XK α_1	(Np)	101,059	0,144 (5)	
XK β_3	(Np)	113,303	}	K' β_1
XK β_1	(Np)	114,234	}	
XK β_5''	(Np)	114,912	}	
XK β_2	(Np)	117,463	}	K' β_2
XK β_4	(Np)	117,876	}	
XKO $_{2,3}$	(Np)	118,429	}	

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$ (Np)	31,1310 (12)	0,072 (4)
$\gamma_{4,3}$ (Np)	43,06 (2)	0,013 (2)
$\gamma_{3,1}$ (Np)	43,533 (1)	4,35 (28)
$\gamma_{(-1,1)}$ (Np)	46,6	0,009 (4)
$\gamma_{6,4}$ (Np)	55,37 (5)	0,0000836 (20)
$\gamma_{2,0}$ (Np)	71,210 (2)	0,00193 (4)
$\gamma_{3,0}$ (Np)	74,664 (1)	51,6 (13)
$\gamma_{4,1}$ (Np)	86,72 (7)	0,055 (5)
$\gamma_{15,11}$ (Np)	111,0 (2)	0,0202 (5)
$\gamma_{4,0}$ (Np)	117,727 (20)	0,113 (9)
$\gamma_{(-1,2)}$ (Np)	134,71 (13)	0,0019 (3)
$\gamma_{(-1,3)}$ (Np)	142,5 (1)	0,0045 (6)
$\gamma_{7,2}$ (Np)	170,15 (5)	0,031 (1)
$\gamma_{(-1,4)}$ (Np)	174,07 (6)	0,0097 (3)
$\gamma_{8,3}$ (Np)	186,15 (4)	0,0288 (7)
$\gamma_{10,8}$ (Np)	187,28 (8)	0,0056 (3)
$\gamma_{9,7}$ (Np)	197,28 (12)	0,0024 (3)
$\gamma_{24,17}$ (Np)	201,18 (6)	0,0005 (2)
$\gamma_{(-1,5)}$ (Np)	220,52 (4)	0,0282 (7)
$\gamma_{(-1,6)}$ (Np)	236,28 (14)	0,00092 (18)
$\gamma_{21,16}$ (Np)	239,86 (5)	0,00087 (23)
$\gamma_{21,15}$ (Np)	255,37 (5)	0,0011 (2)

	Energy keV	Photons per 100 disint.
$\gamma_{30,19}(\text{Np})$	258,44 (6)	0,00073 (18)
$\gamma_{8,0}(\text{Np})$	260,80 (2)	0,0031 (2)
$\gamma_{(-1,7)}(\text{Np})$	262,89 (19)	0,0008 (3)
$\gamma_{(-1,8)}(\text{Np})$	265,44 (17)	0,0009 (3)
$\gamma_{28,18}(\text{Np})$	296,93 (13)	0,0014 (2)
$\gamma_{26,17}(\text{Np})$	301,95 (3)	0,0011 (3)
$\gamma_{32,20}(\text{Np})$	312,05 (3)	0,0006
$\gamma_{22,13}(\text{Np})$	326,21 (7)	0,0044 (2)
$\gamma_{(-1,9)}(\text{Np})$	330,14 (14)	0,00069 (13)
$\gamma_{(-1,10)}(\text{Np})$	332,06 (14)	0,0012 (2)
$\gamma_{30,18}(\text{Np})$	345,13 (8)	0,0039 (2)
$\gamma_{(-1,11)}(\text{Np})$	348,23 (18)	0,0007 (3)
$\gamma_{(-1,12)}(\text{Np})$	351,33 (15)	0,0007 (2)
$\gamma_{(-1,13)}(\text{Np})$	361,83 (8)	0,0044 (3)
$\gamma_{10,3}(\text{Np})$	373,51 (4)	0,025 (6)
$\gamma_{11,3}(\text{Np})$	378,06 (6)	0,0101 (4)
$\gamma_{11,2}(\text{Np})$	381,27 (16)	0,0006 (2)
$\gamma_{(-1,14)}(\text{Np})$	393,01 (18)	0,0006 (2)
$\gamma_{25,15}(\text{Np})$	395,19 (11)	0,0021 (2)
$\gamma_{12,3}(\text{Np})$	399,13 (13)	0,0016 (3)
$\gamma_{(-1,15)}(\text{Np})$	400,55 (15)	0,0009 (2)
$\gamma_{(-1,16)}(\text{Np})$	404,84 (18)	0,0009 (3)
$\gamma_{32,17}(\text{Np})$	434,71 (4)	0,0012 (2)
$\gamma_{(-1,17)}(\text{Np})$	445,81 (12)	0,0011 (2)
$\gamma_{10,0}(\text{Np})$	448,18 (2)	0,0090 (3)
$\gamma_{(-1,18)}(\text{Np})$	452,17 (12)	0,0016 (2)
$\gamma_{14,3}(\text{Np})$	455,63 (6)	0,0008 (3)
$\gamma_{12,0}(\text{Np})$	474,36 (6)	0,0017 (2)
$\gamma_{(-1,19)}(\text{Np})$	478,13 (19)	0,00055 (23)
$\gamma_{(-1,20)}(\text{Np})$	479,55 (14)	0,0010 (2)
$\gamma_{13,1}(\text{Np})$	486,87 (3)	0,0618 (14)
$\gamma_{(-1,21)}(\text{Np})$	490,33 (13)	0,0007 (1)
$\gamma_{15,2}(\text{Np})$	492,76 (7)	0,0050 (2)
$\gamma_{14,1}(\text{Np})$	499,1 (1)	0,0021 (2)
$\gamma_{(-1,22)}(\text{Np})$	502,12 (17)	0,0006 (2)
$\gamma_{16,3}(\text{Np})$	504,76 (8)	0,0052 (3)
$\gamma_{(-1,23)}(\text{Np})$	506,80 (14)	0,0010 (2)
$\gamma_{13,0}(\text{Np})$	518,00 (2)	0,0045 (3)
$\gamma_{18,6}(\text{Np})$	522,12 (10)	0,0024 (2)
$\gamma_{15,1}(\text{Np})$	532,86 (10)	0,0023 (2)
$\gamma_{(-1,24)}(\text{Np})$	541,32 (10)	0,0029 (3)
$\gamma_{17,4}(\text{Np})$	544,48 (9)	0,0036 (3)
$\gamma_{16,1}(\text{Np})$	547,99 (12)	0,0020 (3)
$\gamma_{(-1,25)}(\text{Np})$	558,46 (17)	0,0006 (2)
$\gamma_{29,11}(\text{Np})$	560,63 (7)	0,0058 (3)
$\gamma_{15,0}(\text{Np})$	563,89 (4)	0,0004 (2)
$\gamma_{(-1,26)}(\text{Np})$	567,88 (18)	0,0004 (1)

	Energy keV	Photons per 100 disint.
$\gamma_{(-1,27)}(\text{Np})$	575,27 (5)	0,0131 (4)
$\gamma_{(-1,28)}(\text{Np})$	577,15 (14)	0,0014 (3)
$\gamma_{(-1,29)}(\text{Np})$	585,49 (14)	0,0012 (2)
$\gamma_{17,3}(\text{Np})$	587,62 (2)	0,0193 (5)
$\gamma_{23,8}(\text{Np})$	588,70 (8)	0,0055 (3)
$\gamma_{(-1,30)}(\text{Np})$	591,82 (19)	0,0009 (4)
$\gamma_{(-1,31)}(\text{Np})$	599,13 (15)	0,0007 (2)
$\gamma_{(-1,32)}(\text{Np})$	602,79 (8)	0,0048 (3)
$\gamma_{(-1,33)}(\text{Np})$	604,85 (6)	0,00096 (27)
$\gamma_{23,7}(\text{Np})$	607,96 (15)	0,0013 (3)
$\gamma_{(-1,34)}(\text{Np})$	614,53 (17)	0,0006 (2)
$\gamma_{(-1,35)}(\text{Np})$	618,03 (16)	0,0007 (2)
$\gamma_{18,2}(\text{Np})$	624,11 (7)	0,0062 (3)
$\gamma_{(-1,36)}(\text{Np})$	629,00 (11)	0,0027 (3)
$\gamma_{17,1}(\text{Np})$	631,10 (3)	0,067 (2)
$\gamma_{32,11}(\text{Np})$	644,253 (30)	0,0019 (4)
$\gamma_{21,6}(\text{Np})$	646,26 (10)	0,0029 (3)
$\gamma_{(-1,37)}(\text{Np})$	649,79 (19)	0,0009 (4)
$\gamma_{17,0}(\text{Np})$	662,28 (2)	0,170 (5)
$\gamma_{18,1}(\text{Np})$	664,17 (9)	0,0054 (4)
$\gamma_{(-1,38)}(\text{Np})$	668,76 (18)	0,00055 (18)
$\gamma_{(-1,39)}(\text{Np})$	670,88 (20)	0,0006 (3)
$\gamma_{(-1,40)}(\text{Np})$	691,01 (6)	0,0074 (3)
$\gamma_{(-1,41)}(\text{Np})$	692,61 (13)	0,0016 (3)
$\gamma_{18,0}(\text{Np})$	695,23 (2)	0,0036 (3)
$\gamma_{(-1,42)}(\text{Np})$	701,21 (10)	0,0024 (2)
$\gamma_{26,8}(\text{Np})$	703,63 (10)	0,0023 (2)
$\gamma_{19,3}(\text{Np})$	707,38 (9)	0,0022 (2)
$\gamma_{20,3}(\text{Np})$	710,35 (15)	0,003
$\gamma_{(-1,43)}(\text{Np})$	714,22 (9)	0,0030 (3)
$\gamma_{26,7}(\text{Np})$	722,85 (4)	0,0270 (7)
$\gamma_{23,5}(\text{Np})$	727,52 (10)	0,0026 (3)
$\gamma_{(-1,44)}(\text{Np})$	730,95 (6)	0,0090 (3)
$\gamma_{(-1,45)}(\text{Np})$	746,06 (11)	0,0043 (5)
$\gamma_{21,2}(\text{Np})$	748,09 (3)	0,0890 (4)
$\gamma_{29,8}(\text{Np})$	752,84 (8)	0,0013 (3)
$\gamma_{(-1,46)}(\text{Np})$	764,04 (11)	0,0026 (3)
$\gamma_{(-1,47)}(\text{Np})$	768,15 (11)	0,0020 (2)
$\gamma_{(-1,48)}(\text{Np})$	769,52 (17)	0,0004 (1)
$\gamma_{22,2}(\text{Np})$	772,94 (9)	0,0029 (2)
$\gamma_{23,3}(\text{Np})$	774,77 (4)	0,015 (4)
$\gamma_{30,8}(\text{Np})$	779,57 (14)	0,0006 (1)
$\gamma_{21,1}(\text{Np})$	788,19 (7)	0,0049 (2)
$\gamma_{26,6}(\text{Np})$	791,13 (5)	0,0075 (2)
$\gamma_{(-1,49)}(\text{Np})$	795,13 (15)	0,0008 (2)
$\gamma_{22,1}(\text{Np})$	812,89 (3)	0,0685 (3)
$\gamma_{21,0}(\text{Np})$	819,26 (3)	0,129 (3)

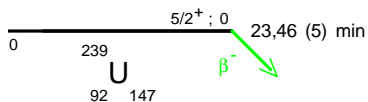
	Energy keV	Photons per 100 disint.
$\gamma_{(-1,50)}(\text{Np})$	829,59 (17)	0,00046 (13)
$\gamma_{(-1,51)}(\text{Np})$	831,89 (9)	0,0021 (2)
$\gamma_{25,4}(\text{Np})$	841,45 (4)	0,0025 (4)
$\gamma_{22,0}(\text{Np})$	844,10 (3)	0,139 (3)
$\gamma_{26,4}(\text{Np})$	846,39 (4)	0,0312 (8)
$\gamma_{23,0}(\text{Np})$	849,44 (9)	0,0020 (2)
$\gamma_{(-1,52)}(\text{Np})$	862,56 (18)	0,0004 (1)
$\gamma_{30,6}(\text{Np})$	867,11 (11)	0,00076 (8)
$\gamma_{28,5}(\text{Np})$	869,57 (9)	0,0016 (1)
$\gamma_{28,4}(\text{Np})$	874,43 (3)	0,0033 (2)
$\gamma_{25,3}(\text{Np})$	884,45 (5)	0,0086 (2)
$\gamma_{25,2}(\text{Np})$	887,97 (3)	0,0023 (2)
$\gamma_{26,3}(\text{Np})$	889,49 (4)	0,0209 (5)
$\gamma_{27,2}(\text{Np})$	895,15 (15)	0,0008 (2)
$\gamma_{(-1,53)}(\text{Np})$	913,68 (9)	0,0019 (1)
$\gamma_{28,3}(\text{Np})$	917,40 (8)	0,0027 (1)
$\gamma_{28,2}(\text{Np})$	920,95 (8)	0,0026 (1)
$\gamma_{30,4}(\text{Np})$	922,83 (13)	0,0006 (1)
$\gamma_{25,1}(\text{Np})$	928,05 (3)	0,0051 (2)
$\gamma_{31,4}(\text{Np})$	931,51 (5)	0,0053 (3)
$\gamma_{26,1}(\text{Np})$	933,09 (3)	0,0262 (6)
$\gamma_{29,3}(\text{Np})$	938,98 (8)	0,00031 (8)
$\gamma_{(-1,54)}(\text{Np})$	948,88 (19)	0,00024 (10)
$\gamma_{25,0}(\text{Np})$	959,18 (3)	0,0078 (3)
$\gamma_{28,1}(\text{Np})$	960,99 (5)	0,0105 (3)
$\gamma_{26,0}(\text{Np})$	964,23 (2)	0,0905 (20)
$\gamma_{(-1,55)}(\text{Np})$	970,07 (14)	0,0009 (2)
$\gamma_{31,3}(\text{Np})$	974,58 (4)	0,00040 (8)
$\gamma_{(-1,56)}(\text{Np})$	988,51 (14)	0,00044 (9)
$\gamma_{28,0}(\text{Np})$	992,16 (2)	0,0028 (1)
$\gamma_{(-1,57)}(\text{Np})$	1002,40 (13)	0,00049 (9)
$\gamma_{(-1,58)}(\text{Np})$	1005,27 (13)	0,0006 (1)
$\gamma_{(-1,59)}(\text{Np})$	1009,38 (18)	0,0003 (1)
$\gamma_{30,0}(\text{Np})$	1040,37 (4)	0,0011 (1)
$\gamma_{32,1}(\text{Np})$	1065,76 (12)	0,00059 (8)
$\gamma_{32,0}(\text{Np})$	1096,99 (3)	0,0016 (1)
$\gamma_{(-1,60)}(\text{Np})$	1101,99 (16)	0,00031 (1)

6 Main Production Modes

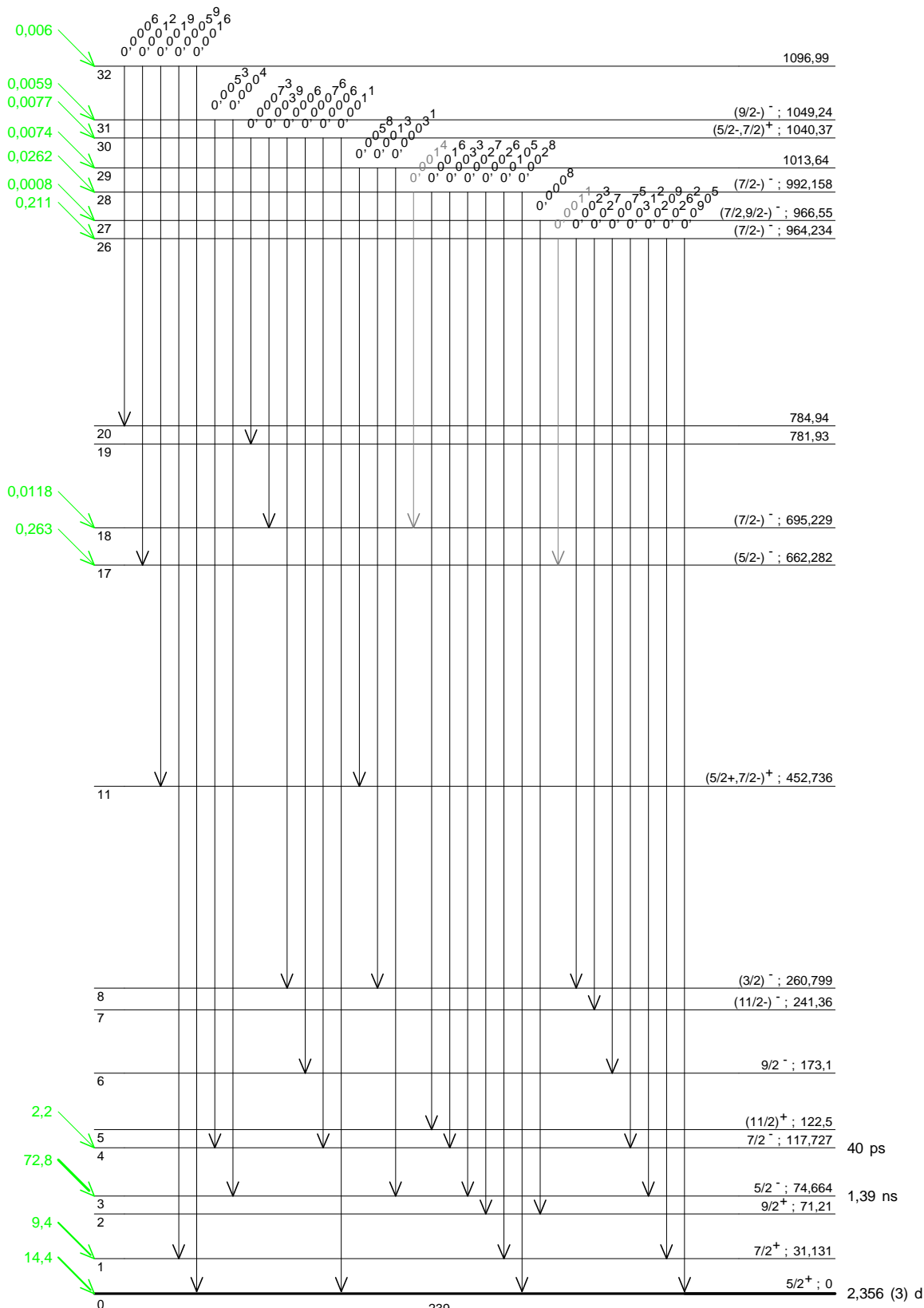
$$\left\{ \begin{array}{l} \text{U} - 238(\text{n},\gamma)\text{U} - 239 \\ \text{Possible impurities : U} - 238 \end{array} \right.$$

7 References

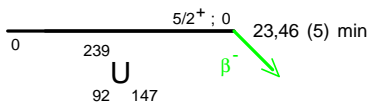
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(Theoretical ICC)



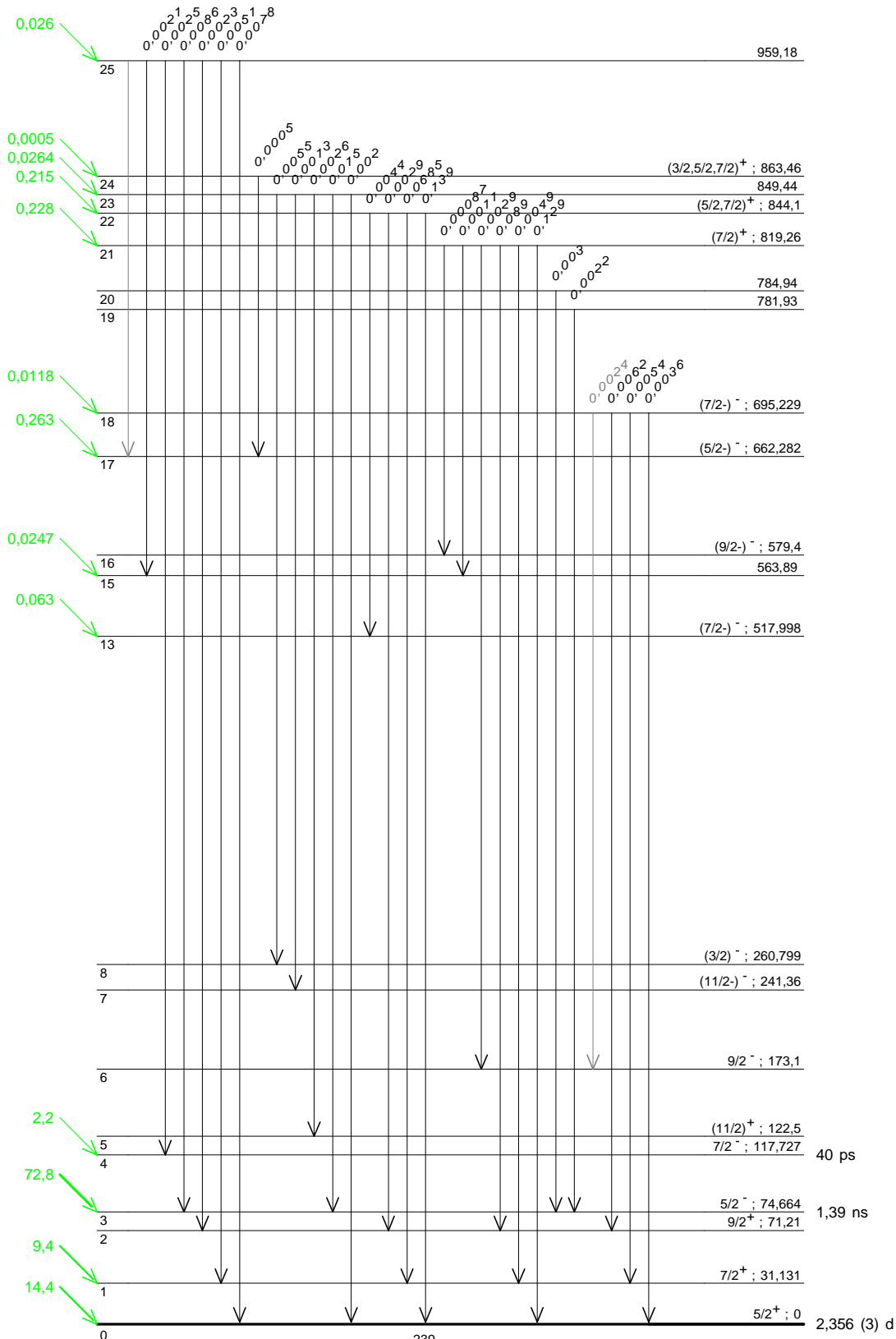
γ Emission intensities per 100 disintegrations



²³⁹Np
_{93 146}
 $Q^- = 1261,5$ keV
 $\% \beta^- = 100$



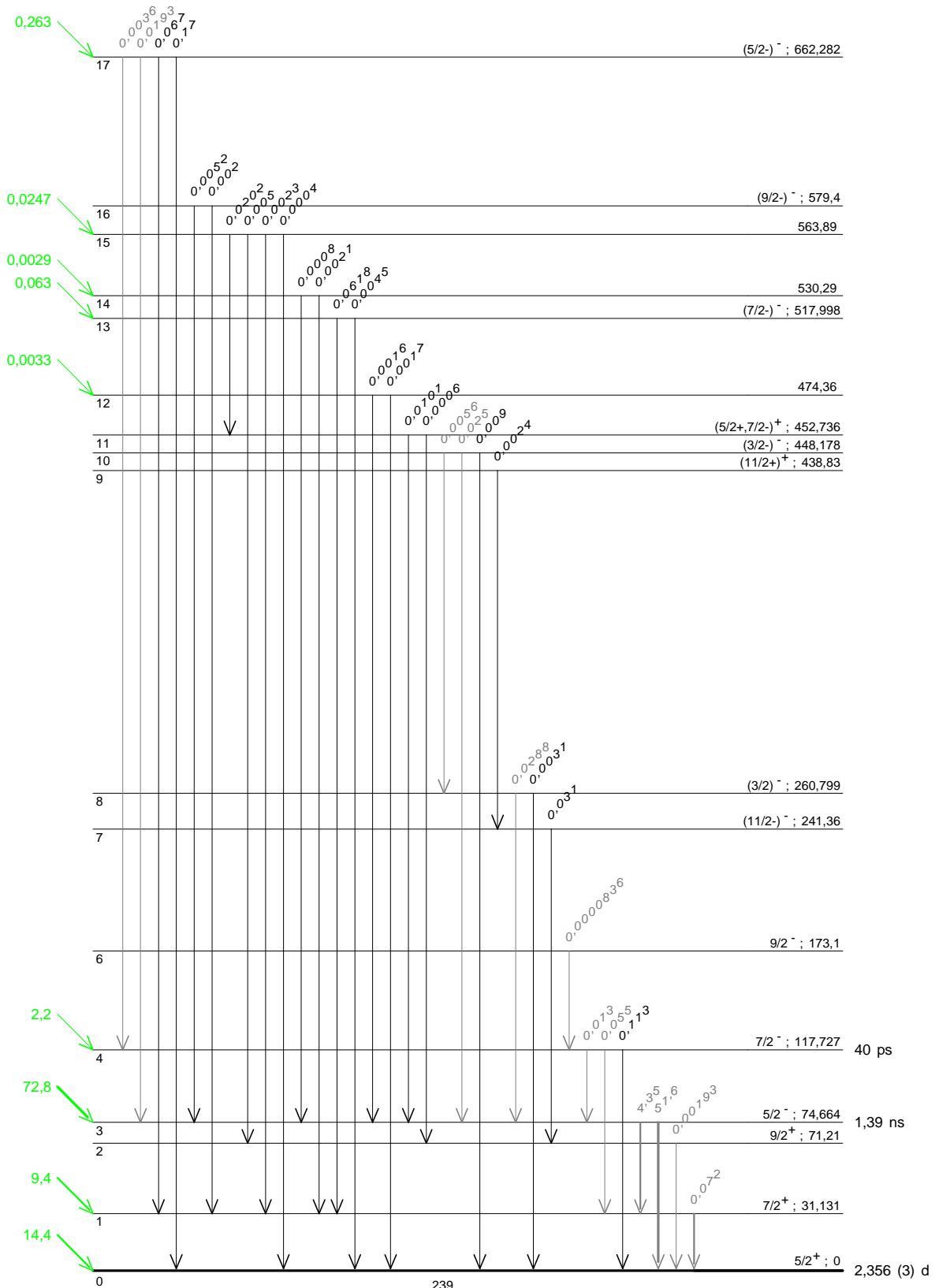
γ Emission intensities per 100 disintegrations



²³⁹Np ₉₃ 146
 $Q^- = 1261,5$ keV
 $\% \beta^- = 100$

²³⁹U _{92 147} 5/2⁺; 0 23,46 (5) min
β⁻

γ Emission intensities per 100 disintegrations



²³⁹Np _{93 146}
Q⁻ = 1261,5 keV
% β⁻ = 100



1 Decay Scheme

Am-242m undergoes 99.54% IT decay directly to the ground state of Am-242, along with a small alpha-decay branch of 0.46% to various nuclear levels of Np-238. A small spontaneous fission branch of $1.5(6) \times 10^{-8}\%$ has been determined by Caldwell *et al.* (1967), compared with an upper limit of only $4.8 \times 10^{-9}\%$ quoted by Zelenkov *et al.* (1986).

L'américium 242 métastable se désintègre principalement (99,54 %) par transition isomérique vers l'américium 242. Un faible branchement par transition alpha peuple des niveaux excités du neptunium 238.

2 Nuclear Data

$T_{1/2}({}^{242m}\text{Am})$: 143	(2)	a
$T_{1/2}({}^{242}\text{Am})$: 16,01	(2)	h
$T_{1/2}({}^{238}\text{Np})$: 2,102	(5)	d
$Q^\alpha({}^{242m}\text{Am})$: 5637,10	(25)	keV
$Q^{IT}({}^{242m}\text{Am})$: 48,60	(5)	keV

2.1 α Transitions

	Energy keV	Probability $\times 100$	F
$\alpha_{0,68}$	5059 (3)	0,000009 (5)	2400
$\alpha_{0,64}$	5111,8 (15)	0,00009 (5)	540
$\alpha_{0,59}$	5153 (3)	0,0012 (3)	81
$\alpha_{0,57}$	5168,0 (12)	0,00014 (5)	840
$\alpha_{0,56}$	5177,5 (7)	0,0009 (3)	146
$\alpha_{0,48}$	5229,51 (26)	0,0258 (11)	11,2
$\alpha_{0,47}$	5239,8 (15)	0,00009 (5)	3600
$\alpha_{0,42}$	5260,40 (26)	0,00009 (5)	4900
$\alpha_{0,41}$	5262,4 (10)	0,00009 (5)	5000
$\alpha_{0,36}$	5294,67 (25)	0,409 (9)	1,8
$\alpha_{0,35}$	5303,1 (7)	0,00014 (5)	6000
$\alpha_{0,28}$	5336,36 (25)	0,0018 (5)	730

	Energy keV	Probability × 100	F
$\alpha_{0,27}$	5336,42 (26)	0,0018 (5)	730
$\alpha_{0,25}$	5337,87 (26)	0,00009 (5)	14800
$\alpha_{0,23}$	5340,07 (25)	0,00009 (5)	15300
$\alpha_{0,20}$	5361,58 (25)	0,0046 (5)	414
$\alpha_{0,14}$	5404,27 (25)	0,0028 (5)	1250
$\alpha_{0,11}$	5421,58 (25)	0,0007 (5)	6400
$\alpha_{0,9}$	5457,95 (25)	0,0051 (9)	1430
$\alpha_{0,6}$	5501,06 (25)	0,0046 (9)	2820
$\alpha_{0,3}$	5550,43 (25)	0,00064 (18)	39000
$\alpha_{0,1}$	5610,67 (25)	0,000014 (14)	4000000

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{3,2}(\text{Np})$	24,34 (1)	0,021 (3)	M1+E2		242 (4)	59,6 (9)	322 (5)
$\gamma_{1,0}(\text{Np})$	26,427 (2)	< 0,24	M1+E2		252 (4)	63,7 (9)	338 (5)
$\gamma_{11,10}(\text{Np})$	32,64 (1)	0,0026 (4)	M1+E2		102,6 (15)	25,0 (4)	136,4 (20)
$\gamma_{9,6}(\text{Np})$	43,11 (1)	0,0040 (9)	M1+E2		46,1 (7)	11,25 (16)	61,3 (9)
$\gamma_{19,11}(\text{Np})$	43,33 (1)	0,00112 (18)	M1+E2		93,5 (14)	24,6 (4)	126,7 (18)
$\gamma_{10,6}(\text{Np})$	46,833 (3)	0,00037 (7)	M1+E2		36,7 (6)	8,97 (13)	48,8 (7)
$\gamma_{1,0}(\text{Am})$	48,60 (5)	99,54 (1)	E4		333000 (5000)	266000 (5000)	704000 (8000)
$\gamma_{6,3}(\text{Np})$	49,371 (3)	0,244 (8)	E1		0,615 (9)	0,1536 (22)	0,821 (12)
$\gamma_{14,9}(\text{Np})$	53,67 (1)	0,097 (13)	M1+E2		34,2 (5)	8,73 (13)	46,0 (7)
$\gamma_{30,19}(\text{Np})$	53,85 (2)	0,00011 (6)	M1+E2		27,8 (4)	6,93 (10)	37,2 (6)
$\gamma_{9,5}(\text{Np})$	57,51 (1)	0,0015 (4)	E1		0,412 (6)	0,1023 (15)	0,549 (8)
$\gamma_{3,1}(\text{Np})$	60,247 (3)	0,132 (12)	M1+E2		17,34 (25)	4,23 (6)	23,1 (4)
$\gamma_{36,20}(\text{Np})$	66,92 (1)	0,0205 (6)	E1		0,277 (4)	0,0684 (10)	0,368 (6)
$\gamma_{28,14}(\text{Np})$	67,92 (2)	0,100 (8)	M1+E2		17,7 (19)	4,6 (6)	24 (3)
$\gamma_{6,2}(\text{Np})$	73,72 (1)	0,0101 (7)	E1		0,214 (3)	0,0529 (8)	0,285 (4)
$\gamma_{19,10}(\text{Np})$	75,98 (1)	0,00052 (8)	E2		38,4 (6)	10,70 (15)	52,8 (8)
$\gamma_{11,6}(\text{Np})$	79,48 (1)	0,0033 (8)	M1+E2		19 (3)	5,2 (8)	26 (4)
$\gamma_{27,11}(\text{Np})$	85,16 (7)	0,020 (7)	M1+E2		14,3 (18)	3,9 (6)	19 (3)
$\gamma_{3,0}(\text{Np})$	86,674 (2)	0,205 (7)	M1+E2		5,98 (9)	1,459 (21)	7,95 (12)
$\gamma_{(-1,1)}(\text{Np})$	89,60 (5)	0,0013 (3)					
$\gamma_{9,3}(\text{Np})$	92,48 (1)	0,00324 (35)	E1		0,1184 (17)	0,0291 (4)	0,1574 (22)
$\gamma_{11,5}(\text{Np})$	93,88 (1)	0,0042 (5)	E1		0,1138 (16)	0,0280 (4)	0,1513 (22)
$\gamma_{14,6}(\text{Np})$	96,78 (1)	0,0059 (10)	E2		12,28 (18)	3,42 (5)	16,90 (24)
$\gamma_{30,11}(\text{Np})$	97,18 (2)	0,00013 (7)	E2		12,05 (17)	3,36 (5)	16,58 (24)
$\gamma_{36,14}(\text{Np})$	109,61 (1)	≤ 0,14	M1+E2		4,9 (5)	1,32 (14)	6,7 (7)
$\gamma_{6,1}(\text{Np})$	109,618 (3)	≤ 0,02	E1		0,0760 (11)	0,0186 (3)	0,1010 (15)
$\gamma_{14,5}(\text{Np})$	111,18 (1)	0,0027 (5)	E1		0,0733 (11)	0,0180 (3)	0,0974 (14)
$\gamma_{19,6}(\text{Np})$	122,81 (1)	0,00039 (18)	M1+E2	5,4 (12)	3,11 (22)	0,83 (7)	9,6 (9)
$\gamma_{36,11}(\text{Np})$	126,92 (1)	0,0008 (4)	E2	0,196 (3)	3,51 (5)	0,979 (14)	5,03 (7)
$\gamma_{23,8}(\text{Np})$	131,50 (5)	0,00034 (8)	E1	0,205 (3)	0,0475 (7)	0,01161 (17)	0,268 (4)
$\gamma_{28,8}(\text{Np})$	135,21 (2)	0,0085 (5)	E1	0,192 (3)	0,0443 (7)	0,01081 (16)	0,251 (4)
$\gamma_{6,0}(\text{Np})$	136,045 (2)	0,0118 (3)	E1	0,190 (3)	0,0436 (6)	0,01064 (15)	0,247 (4)
$\gamma_{28,7}(\text{Np})$	139,05 (3)	≤ 0,00014	E1	0,180 (3)	0,0412 (6)	0,01006 (15)	0,235 (4)
$\gamma_{8,1}(\text{Np})$	139,11 (2)	≤ 0,00049	E2	0,211 (3)	2,32 (4)	0,646 (9)	3,40 (5)
$\gamma_{30,7}(\text{Np})$	151,01 (3)	0,000099 (22)	E1	0,1495 (21)	0,0334 (5)	0,00814 (12)	0,194 (3)

	Energy keV	$P_{\gamma+ce}$ $\times 100$	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{19,4}$ (Np)	152,70 (2)	$\leq 0,00082$	E1	0,1458 (21)	0,0325 (5)	0,00791 (11)	0,189 (3)
$\gamma_{9,1}$ (Np)	152,73 (1)	$\leq 0,00082$	E1	0,1457 (21)	0,0324 (5)	0,00791 (11)	0,189 (3)
$\gamma_{11,2}$ (Np)	153,19 (1)	0,00037 (4)	E1	0,1447 (21)	0,0322 (5)	0,00785 (11)	0,187 (3)
$\gamma_{20,5}$ (Np)	153,87 (1)	0,0266 (8)	M1+E2	5,53 (8)	1,123 (16)	0,273 (4)	7,02 (10)
$\gamma_{10,1}$ (Np)	156,451 (3)	0,00032 (5)	E1	0,1379 (20)	0,0305 (5)	0,00744 (11)	0,1784 (25)
$\gamma_{(-1,2)}$ (Np)	160,61 (2)	0,0004 (2)					
$\gamma_{34,8}$ (Np)	163,1 (5)	$\leq 0,079$	M1+E2	2,5 (5)	1,04 (3)	0,273 (11)	3,9 (5)
$\gamma_{36,9}$ (Np)	163,29 (1)	$\leq 0,079$	M1+E2	2,5 (5)	1,04 (3)	0,272 (11)	3,9 (5)
$\gamma_{(-1,3)}$ (Np)	165,97 (15)	0,000046 (23)					
$\gamma_{45,13}$ (Np)	170,7 (8)	0,00280 (22)	M1+E2	2,2 (5)	0,882 (23)	0,230 (9)	3,4 (5)
$\gamma_{48,14}$ (Np)	174,76 (6)	0,00720 (16)	M1+E2	2,1 (5)	0,809 (17)	0,211 (7)	3,1 (4)
$\gamma_{30,6}$ (Np)	176,66 (2)	0,00006 (3)	E2	0,181 (3)	0,804 (12)	0,223 (4)	1,285 (18)
$\gamma_{10,0}$ (Np)	182,878 (2)	0,00103 (4)	E1	0,0965 (14)	0,0206 (3)	0,00502 (7)	0,1238 (18)
$\gamma_{11,1}$ (Np)	189,10 (1)	0,00030 (5)	E1	0,0894 (13)	0,0190 (3)	0,00462 (7)	0,1146 (16)
$\gamma_{23,4}$ (Np)	190,88 (5)	0,00012 (3)	E1	0,0875 (13)	0,0185 (3)	0,00451 (7)	0,1121 (16)
$\gamma_{28,4}$ (Np)	194,59 (2)	0,00157 (5)	E1	0,0837 (12)	0,01768 (25)	0,00430 (6)	0,1072 (15)
$\gamma_{19,2}$ (Np)	196,52 (1)	0,00011 (5)	E1	0,0819 (12)	0,01725 (25)	0,00419 (6)	0,1048 (15)
$\gamma_{36,6}$ (Np)	206,39 (1)	0,0027 (3)	E2	0,1454 (21)	0,412 (6)	0,1138 (16)	0,711 (10)
$\gamma_{20,2}$ (Np)	213,19 (1)	0,00015 (5)	M1+E2	1,19 (24)	0,401 (11)	0,1032 (17)	1,73 (25)
$\gamma_{11,0}$ (Np)	215,522 (4)	0,00064 (10)	E1	0,0664 (10)	0,01376 (20)	0,00334 (5)	0,0847 (12)
$\gamma_{19,1}$ (Np)	232,43 (1)	0,00060 (3)	E1	0,0560 (8)	0,01145 (16)	0,00278 (4)	0,0712 (10)
$\gamma_{(-1,4)}$ (Np)	233,69 (10)	0,00013 (3)					
$\gamma_{25,2}$ (Np)	236,90 (6)	0,00010 (5)	M1+E2	0,89 (18)	0,280 (12)	0,0717 (21)	1,27 (19)
$\gamma_{27,2}$ (Np)	238,35 (7)	0,000017 (9)	E1	0,0530 (8)	0,01078 (16)	0,00261 (4)	0,0673 (10)
$\gamma_{17,0}$ (Np)	250,33 (3)	$\leq 0,0012$	(M1+E2)	0,77 (15)	0,233 (12)	0,0595 (21)	1,08 (16)
$\gamma_{30,2}$ (Np)	250,37 (2)	$\leq 0,0006$	E1	0,0475 (7)	0,00958 (14)	0,00232 (4)	0,0602 (9)
$\gamma_{42,4}$ (Np)	270,55 (7)	0,000030 (9)	E1	0,0400 (6)	0,00798 (12)	0,00193 (3)	0,0506 (7)
$\gamma_{25,1}$ (Np)	272,80 (6)	0,000069 (15)	M1+E2	0,61 (12)	0,176 (11)	0,0448 (21)	0,85 (13)
$\gamma_{36,2}$ (Np)	280,11 (1)	0,000063 (7)	E1	0,0371 (6)	0,00735 (11)	0,00178 (3)	0,0468 (7)
$\gamma_{25,0}$ (Np)	299,23 (6)	0,000046 (23)	M1+E2	0,48 (9)	0,131 (9)	0,0332 (19)	0,65 (10)

3 Atomic Data

3.1 Np

$$\begin{aligned}\omega_K &: 0,971 \quad (4) \\ \bar{\omega}_L &: 0,511 \quad (20) \\ n_{KL} &: 0,791 \quad (5)\end{aligned}$$

3.1.1 X Radiations

	Energy keV	Relative probability
X _K		
Kα ₂	97,069	63,3
Kα ₁	101,059	100
Kβ ₃	113,303	}
Kβ ₁	114,234	}
Kβ ₅ ''	114,912	}
		36,7
Kβ ₂	117,463	}
Kβ ₄	117,876	}
KO _{2,3}	118,429	}
		12,3
X _L		
Lℓ	11,871	
Lα	13,761 – 13,946	
Lη	15,861	
Lβ	16,109 – 17,992	
Lγ	20,784 – 21,491	

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	73,501 – 83,134	100
KLX	90,358 – 101,054	63,6
KXY	107,19 – 118,66	9,09
Auger L	6,036 – 13,516	

4 α Emissions

	Energy keV	Probability $\times 100$
$\alpha_{0,68}$	4975 (3)	0,000009 (5)
$\alpha_{0,64}$	5027,3 (15)	0,00009 (5)
$\alpha_{0,59}$	5068 (3)	0,0012 (3)
$\alpha_{0,57}$	5082,6 (12)	0,00014 (5)
$\alpha_{0,56}$	5091,9 (7)	0,0009 (3)
$\alpha_{0,48}$	5143,07 (26)	0,0258 (11)
$\alpha_{0,47}$	5153,2 (15)	0,00009 (5)
$\alpha_{0,42}$	5173,45 (26)	0,00009 (5)
$\alpha_{0,41}$	5175,4 (10)	0,00009 (5)
$\alpha_{0,36}$	5207,15 (25)	0,409 (9)
$\alpha_{0,35}$	5215,4 (7)	0,00014 (5)
$\alpha_{0,28}$	5248,15 (25)	0,0018 (5)
$\alpha_{0,27}$	5248,21 (26)	0,0018 (5)
$\alpha_{0,25}$	5249,64 (26)	0,00009 (5)
$\alpha_{0,23}$	5251,80 (25)	0,00009 (5)
$\alpha_{0,20}$	5272,96 (25)	0,0046 (5)
$\alpha_{0,14}$	5314,95 (25)	0,0028 (5)
$\alpha_{0,11}$	5331,97 (25)	0,0007 (5)
$\alpha_{0,9}$	5367,73 (25)	0,0051 (9)
$\alpha_{0,6}$	5410,13 (25)	0,0046 (9)
$\alpha_{0,3}$	5458,68 (25)	0,00064 (18)
$\alpha_{0,1}$	5517,93 (25)	0,000014 (14)

5 Electron Emissions

		Energy keV	Electrons per 100 disint.
e _{AL}	(Am)	7,143 - 15,146	22,1 (11)
e _{AL}	(Np)	6,036 - 13,516	0,35 (4)
e _{AK}	(Np)		0,0019 (7)
	KLL	73,501 - 83,134	}
	KLX	90,358 - 101,054	}
	KXY	107,19 - 118,66	}
ec _{1,0 L}	(Am)	24,79 - 30,10	47,1 (10)
ec _{1,0 M}	(Am)	42,47 - 44,78	37,6 (9)
ec _{1,0 N}	(Am)	47,0 - 48,2	11,9 (3)

6 Photon Emissions

6.1 X-Ray Emissions

		Energy keV	Photons per 100 disint.	
XL	(Am)	12,377 — 22,836	25,0 (11)	
XL	(Np)	11,871 — 21,491	0,37 (4)	
XK α_2	(Np)	97,069	0,019 (9)	} K α
XK α_1	(Np)	101,059	0,030 (14)	
XK β_3	(Np)	113,303	}	} K' β_1
XK β_1	(Np)	114,234	}	
XK β_5''	(Np)	114,912	}	
XK β_2	(Np)	117,463	}	} K' β_2
XK β_4	(Np)	117,876	}	
XKO _{2,3}	(Np)	118,429	}	

6.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{3,2}$ (Np)	24,34 (1)	0,000064 (9)
$\gamma_{1,0}$ (Np)	26,427 (2)	< 0,000708
$\gamma_{11,10}$ (Np)	32,64 (1)	0,000019 (3)
$\gamma_{9,6}$ (Np)	43,11 (1)	0,000064 (14)
$\gamma_{19,11}$ (Np)	43,33 (1)	0,0000087 (14)
$\gamma_{10,6}$ (Np)	46,833 (3)	0,0000074 (14)
$\gamma_{1,0}$ (Am)	48,60 (5)	0,0001414 (22)
$\gamma_{6,3}$ (Np)	49,371 (3)	0,134 (4)
$\gamma_{14,9}$ (Np)	53,67 (1)	0,0021 (3)
$\gamma_{30,19}$ (Np)	53,85 (2)	0,0000028 (14)
$\gamma_{9,5}$ (Np)	57,51 (1)	0,00097 (23)
$\gamma_{3,1}$ (Np)	60,247 (3)	0,0055 (5)
$\gamma_{36,20}$ (Np)	66,92 (1)	0,0150 (5)
$\gamma_{28,14}$ (Np)	67,92 (2)	0,0040 (3)
$\gamma_{6,2}$ (Np)	73,72 (1)	0,0079 (6)
$\gamma_{19,10}$ (Np)	75,98 (1)	0,0000097 (14)
$\gamma_{11,6}$ (Np)	79,48 (1)	0,000124 (23)
$\gamma_{27,11}$ (Np)	85,16 (7)	0,0010 (3)
$\gamma_{3,0}$ (Np)	86,674 (2)	0,0229 (7)
$\gamma_{(-1,1)}$ (Np)	89,60 (5)	0,0013 (3)
$\gamma_{9,3}$ (Np)	92,48 (1)	0,0028 (3)
$\gamma_{11,5}$ (Np)	93,88 (1)	0,0036 (4)
$\gamma_{14,6}$ (Np)	96,78 (1)	0,00033 (6)

	Energy keV	Photons per 100 disint.
$\gamma_{30,11}$ (Np)	97,18 (2)	0,000007 (4)
$\gamma_{36,14}$ (Np)	109,61 (1)	$\leq 0,0184$
$\gamma_{6,1}$ (Np)	109,618 (3)	$\leq 0,0184$
$\gamma_{14,5}$ (Np)	111,18 (1)	0,0025 (4)
$\gamma_{19,6}$ (Np)	122,81 (1)	0,00004 (2)
$\gamma_{36,11}$ (Np)	126,92 (1)	0,00013 (7)
$\gamma_{23,8}$ (Np)	131,50 (5)	0,00027 (6)
$\gamma_{28,8}$ (Np)	135,21 (2)	0,0068 (4)
$\gamma_{6,0}$ (Np)	136,045 (2)	0,0094 (3)
$\gamma_{28,7}$ (Np)	139,05 (3)	$\leq 0,00011$
$\gamma_{8,1}$ (Np)	139,11 (2)	$\leq 0,00011$
$\gamma_{30,7}$ (Np)	151,01 (3)	0,000083 (18)
$\gamma_{19,4}$ (Np)	152,70 (2)	$\leq 0,00069$
$\gamma_{9,1}$ (Np)	152,73 (1)	$\leq 0,00069$
$\gamma_{11,2}$ (Np)	153,19 (1)	0,00031 (4)
$\gamma_{20,5}$ (Np)	153,87 (1)	0,00332 (10)
$\gamma_{10,1}$ (Np)	156,451 (3)	0,00027 (5)
$\gamma_{(-1,2)}$ (Np)	160,61 (2)	0,00041 (18)
$\gamma_{34,8}$ (Np)	163,1 (5)	$\leq 0,0161$
$\gamma_{36,9}$ (Np)	163,29 (1)	$\leq 0,0161$
$\gamma_{(-1,3)}$ (Np)	165,97 (15)	0,000046 (23)
$\gamma_{45,13}$ (Np)	170,7 (8)	0,00063 (5)
$\gamma_{48,14}$ (Np)	174,76 (6)	0,00017 (4)
$\gamma_{30,6}$ (Np)	176,66 (2)	0,000028 (14)
$\gamma_{10,0}$ (Np)	182,878 (2)	0,00092 (3)
$\gamma_{11,1}$ (Np)	189,10 (1)	0,00027 (5)
$\gamma_{23,4}$ (Np)	190,88 (5)	0,000106 (24)
$\gamma_{28,4}$ (Np)	194,59 (2)	0,00142 (5)
$\gamma_{19,2}$ (Np)	196,52 (1)	0,00010 (5)
$\gamma_{36,6}$ (Np)	206,39 (1)	0,00156 (18)
$\gamma_{20,2}$ (Np)	213,19 (1)	0,000055 (18)
$\gamma_{11,0}$ (Np)	215,522 (4)	0,00059 (10)
$\gamma_{19,1}$ (Np)	232,43 (1)	0,00056 (3)
$\gamma_{(-1,4)}$ (Np)	233,69 (10)	0,00013 (3)
$\gamma_{25,2}$ (Np)	236,90 (6)	0,000046 (23)
$\gamma_{27,2}$ (Np)	238,35 (7)	0,000016 (8)
$\gamma_{17,0}$ (Np)	250,33 (3)	$\leq 0,00056$
$\gamma_{30,2}$ (Np)	250,37 (2)	$\leq 0,00056$
$\gamma_{42,4}$ (Np)	270,55 (7)	0,000029 (8)
$\gamma_{25,1}$ (Np)	272,80 (6)	0,000037 (8)
$\gamma_{36,2}$ (Np)	280,11 (1)	0,000060 (6)
$\gamma_{25,0}$ (Np)	299,23 (6)	0,000028 (14)

7 Main Production Modes

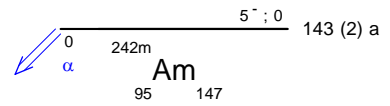
Am – 241(n, γ)Am – 242m

U – 238(n, γ), beta decay and (n, γ)

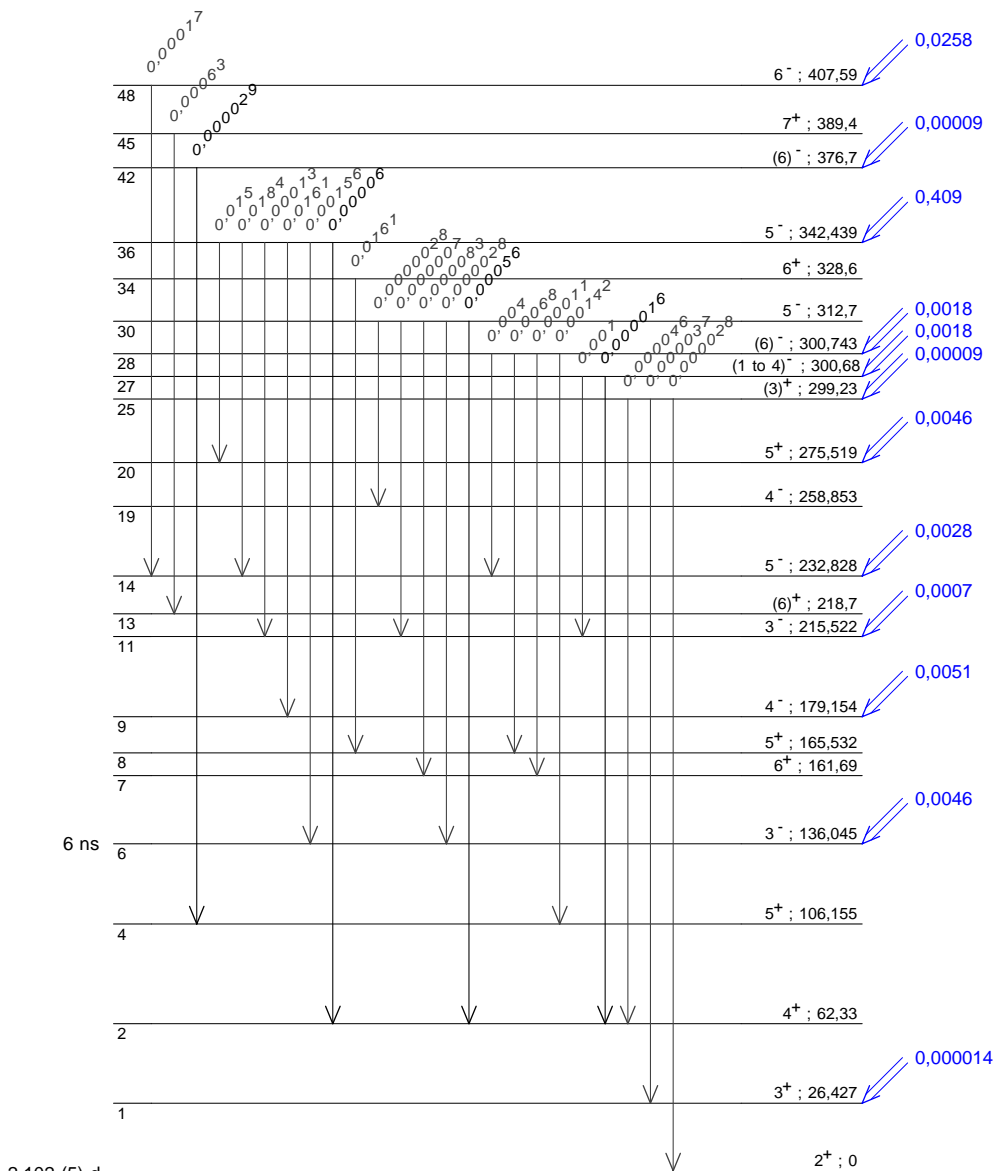
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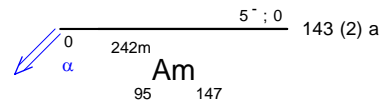




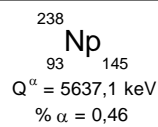
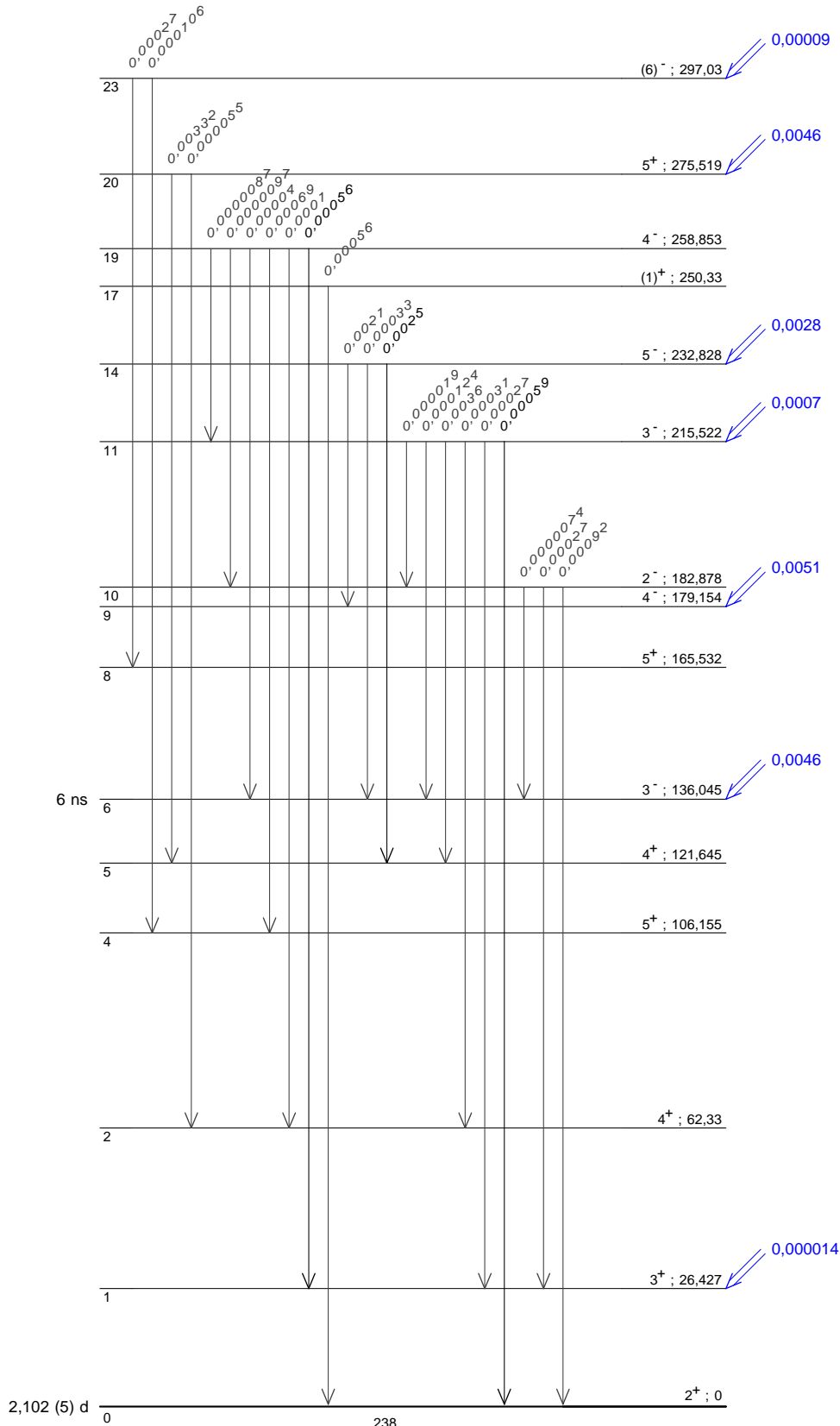
γ Emission intensities per 100 disintegrations

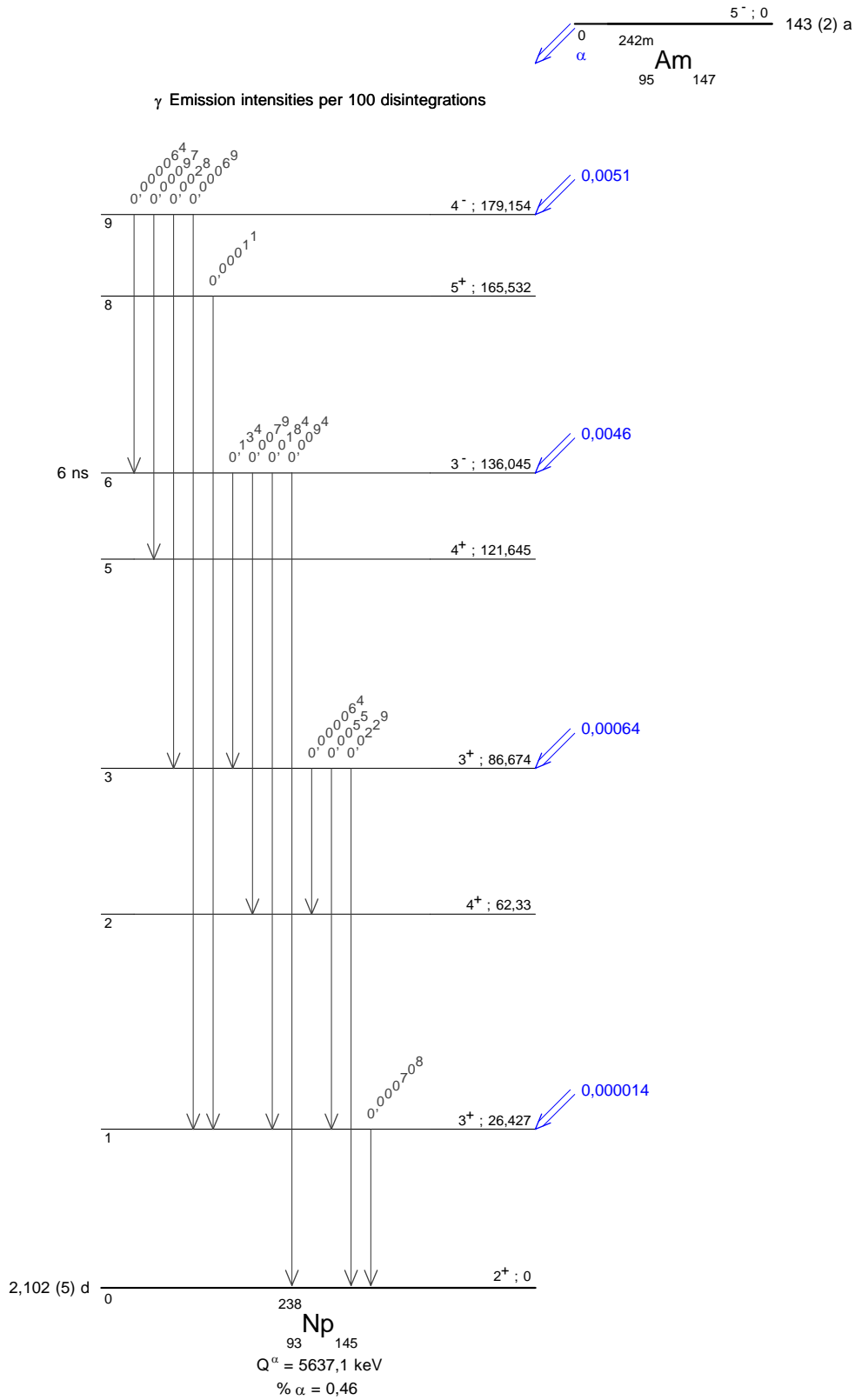


²³⁸Np
93 145
Q^α = 5637,1 keV
% α = 0,46



γ Emission intensities per 100 disintegrations





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