Monographie BIPM-5

Table of Radionuclides
(Vol. 4 – A = 133 to 252)

M.-M. Bé, V. Chisté, C. Dulieu
E. Browne
V. Chechev, N. Kuzmenko
F. Kondev
A. Luca
M. Galán
A. Pearce
X. Huang

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France

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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 *Comité Consultatif des Rayonnements Ionisants* (CCRI), previously known as the *Comité Consultatif pour les Etalons de Mesure des Rayonnements Ionisants* (CCEMRI). 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 hoped 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 fifty-five 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 four 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 ^{125}Sb and ^{153}Sm while Volume 4 contains the data for a further thirty-one radionuclides with re-evaluation for ^{226}Ra. The data have been collated and evaluated by an international working group (Decay Data Evaluation Project) led by the 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.

The work involved in evaluating nuclear data is on-going and the recommended values are updated on the LNHB website at http://www.nucleide.org/DDEP_WG/DDEPdata.htm.
The publication of further volumes of Monographie 5 is envisaged as and when necessary to add new radionuclide data or re-evaluations in a 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.

K. Carneiro
President of the CCRI

A.J. Wallard
Director of the BIPM

Monographie BIPM-5 – Table of Radionuclides, Volume 4

Marie-Martine BÉ, Vanessa CHISTÉ, Christophe DULIEU, Laboratoire National Henri Becquerel (LNHB), France ;
Edgardo BROWNE, Lawrence Berkeley National Laboratory (LBNL), USA ;
Valery CHECHEV, Nikolay KUZMENKO, Khlopin Radium Institute (KRI), Russia ;
Filip G. KONDEV, Argonne National Laboratory (ANL), USA ;
Aurelian LUCA, Horia Hulubei National Institute of Physics and Nuclear Engineering (IFIN-HH), Romania ;
Mónica GALÁN, Laboratorio de Metrología de Radiaciones Ionizantes (CIEMAT), Spain ;
Andrew PEARCE, National Physical Laboratory (NPL), United Kingdom ;
Xiaolong HUANG, China Institute of Atomic Energy (CIAE), China.

"TABLE DE RADIONUCLÉIDES"

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

^{133}I, ^{133}Xe, ^{133}Xe^{m}, ^{135}Xe^{m}, ^{139}Ce, ^{206}Tl, ^{210}Tl, ^{210}Pb, ^{210}Bi, ^{210}Po, ^{213}Po, ^{214}Pb, ^{214}Bi, ^{214}Po, ^{217}Rn, ^{218}Po, ^{218}At, ^{218}Rn, ^{221}Fr, ^{222}Rn, ^{226}Ra, ^{227}Ac, ^{232}U, ^{236}U, ^{237}Np, ^{238}Np, ^{239}U, ^{239}Np, ^{239}Pu, ^{241}Pu, ^{246}Cm, ^{252}Cf.

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:

^{133}I, ^{133}Xe, ^{133}Xe^{m}, ^{135}Xe^{m}, ^{139}Ce, ^{206}Tl, ^{210}Tl, ^{210}Pb, ^{210}Bi, ^{210}Po, ^{213}Po, ^{214}Pb, ^{214}Bi, ^{214}Po, ^{217}Rn, ^{218}Po, ^{218}At, ^{218}Rn, ^{221}Fr, ^{222}Rn, ^{226}Ra, ^{227}Ac, ^{232}U, ^{236}U, ^{237}Np, ^{238}Np, ^{239}U, ^{239}Np, ^{239}Pu, ^{241}Pu, ^{246}Cm, ^{252}Cf.

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:

^{133}I, ^{133}Xe, ^{133}Xe^{m}, ^{135}Xe^{m}, ^{139}Ce, ^{206}Tl, ^{210}Tl, ^{210}Pb, ^{210}Bi, ^{210}Po, ^{213}Po, ^{214}Pb, ^{214}Bi, ^{214}Po, ^{217}Rn, ^{218}Po, ^{218}At, ^{218}Rn, ^{221}Fr, ^{222}Rn, ^{226}Ra, ^{227}Ac, ^{232}U, ^{236}U, ^{237}Np, ^{238}Np, ^{239}U, ^{239}Np, ^{239}Pu, ^{241}Pu, ^{246}Cm, ^{252}Cf.

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:

^{133}I, ^{133}Xe, ^{133}Xe^{m}, ^{135}Xe^{m}, ^{139}Ce, ^{206}Tl, ^{210}Tl, ^{210}Pb, ^{210}Bi, ^{210}Po, ^{213}Po, ^{214}Pb, ^{214}Bi, ^{214}Po, ^{217}Rn, ^{218}Po, ^{218}At, ^{218}Rn, ^{221}Fr, ^{222}Rn, ^{226}Ra, ^{227}Ac, ^{232}U, ^{236}U, ^{237}Np, ^{238}Np, ^{239}U, ^{239}Np, ^{239}Pu, ^{241}Pu, ^{246}Cm, ^{252}Cf.

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 volúmen agrupa la evaluación de los radionucleidos siguientes :

^{133}I, ^{133}Xe, ^{133}Xe^{m}, ^{135}Xe^{m}, ^{139}Ce, ^{206}Tl, ^{210}Tl, ^{210}Pb, ^{210}Bi, ^{210}Po, ^{213}Po, ^{214}Pb, ^{214}Bi, ^{214}Po, ^{217}Rn, ^{218}Po, ^{218}At, ^{218}Rn, ^{221}Fr, ^{222}Rn, ^{226}Ra, ^{227}Ac, ^{232}U, ^{236}U, ^{237}Np, ^{238}Np, ^{239}U, ^{239}Np, ^{239}Pu, ^{241}Pu, ^{246}Cm, ^{252}Cf.

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

Marie-Martine BÉ, Vanessa CHISTÉ, Christophe DULIEU, Laboratoire National Henri Becquerel (LNHB), France ;
Edgardo BROWNE, Lawrence Berkeley National Laboratory (LBNL), USA ;
Valery CHECHEV, Nikolay KUZMENKO, Khlopin Radium Institute (KRI), Russia ;
Filip G. KONDEV, Argonne National Laboratory (ANL), USA ;
Aurelian LUCA, Horia Hulubei National Institute of Physics and Nuclear Engineering (IFIN-HH), Romania ;
Mónica GALÁN, Laboratorio de Metrología de Radiaciones Ionizantes (CIEMAT), Spain ;
Andrew PEARCE, National Physical Laboratory (NPL), United Kingdom ;
Xiaolong HUANG, China Institute of Atomic Energy (CIAE), China.

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 trois volumes de la *Monographie* BIPM-5 [99Be, 04Be, 06Be]. 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 quatrième de la *Monographie* 5 [04Be] 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 :
$U(y) = k \times u_c(y)$ où *k* 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 ± 0,011 et
9,2 (11) 9,2 ± 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 énième 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 $T_{1/2}$ <= 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.

AVERTISSEMENT

Ce document a été imprimé en 2008, 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://www1.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 three volumes of evaluations have already been published as *Monographie* BIPM-5 [04Be, 06Be].
Moreover, LNHB developed a software (NUCLEIDE) 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 fourth in the series of the *Monographie* 5 published under the BIPM auspices.

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 :
$U(y) = k \times u_c(y)$ where *k* is the coverage factor.
For this publication the expanded uncertainty is computed with $k = 1$.

The value of the uncertainty, in parentheses, applies to the least significant digits, i.e. :
9.230 (11) means 9.230 ± 0.011 and
9.2 (11) 9.2 ± 1.1

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 $T_{1/2}$ <= 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 = 365.242 198 days = 31 556 926 seconds

- 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.

NOTICE

This report was printed in 2008, new evaluations and updated issues will be available on:
http://www.nucleide.org/NucData.htm
http://www1.bipm.org/fr/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 drei Bände der *Monographie* BIPM-5 [99Be, 04Be, 06Be] 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 vierte Ausgabe der *Monographie* BIPM-5 [04Be].

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:

$U(y) = k \times u_c(y)$ wo k der Erweiterungsfaktor ist.

Für die vorliegende Veröffentlichung ist die erweitere Unsicherheit mit $k = 1$ berechnet.
Die Werte der Unsicherheit beziehen sich auf die letzten Stellen, d. h.:

9,230 (11) bedeutet 9,230 ± 0,011 und
9,2 (11) bedeutet 9,2 ± 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 a = 365,242 198 d = 31 556 926 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 2008 erstellt. Alle späteren Fassungen oder neueren Evaluationen können vom Leser unter

http://www.nucleide.org/NucData.htm
http://www1.bipm.org/fr/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* BIPM-5 [04Be, 06Be].
В дополнение в LNHB была развита 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 Radionucleides, 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 рассмотрений.

Настоящий том представляет собой четвёртый выпуск *Monographie* BIPM-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 = 365,242 198 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 2008 г. Новые оценки и обновленные результаты можно найти на сайте:
http://www.nucleide.org/NucData.htm
http://www1.bipm.org/fr/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].

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 menús 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 *Khoplin 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, $\boldsymbol{u_c}$, 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 $\boldsymbol{U}$:
$\boldsymbol{U}(y) = k \times \boldsymbol{u}_c(y)$ donde k 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 :
9,230 (11) significa 9,230 ± 0,011 y
9,2 (11) significa 9,2 ± 1,1

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 2008. Para obtener todas las nuevas evaluaciones actualizadas ulteriormente, el lector deberá referirse a los documentos disponibles en :

http://www.nucleide.org/NucData.htm
http://www1.bipm.org/fr/publications/monographie-ri-5.html

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[06Be] **Monographie BIPM-5 – Table of Radionuclides, Volume 3**
Marie-Martine BÉ, Vanessa CHISTÉ, Christophe DULIEU, (LNHB), France ; Edgardo BROWNE, Coral BAGLIN, (LBNL), USA ; Valery CHECHEV, Nikolay KUZMENKO, (KRI), Russia ; Richard HELMER, (INEEL), USA ; Filip KONDEV, (ANL), USA ; T. Desmond MACMAHON, (NPL), U.K. ; Kyung Beom LEE, (KRISS), South Korea.
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AUTEURS POUR CORRESPONDANCE

AUTHOR’S MAIL ADDRESSES

ADRESSEN DER AUTOREN

AUTORES PARA CORRESPONDENCIA

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.

Dr. Marie-Martine Bé
CEA/LNHB- 602
91191 Gif-sur-Yvette, CEDEX, France
Tel: 33-1-69-08-46-41
Fax: 33-1-69-08-26-19
E-mail: mmbe@cea.fr

Dr. Edgardo Browne
Lawrence Berkeley National Laboratory
MS 88RO192, Berkeley, California 94720, USA
Tel: (510) 486-7647
Fax: (510) 486-5757
E-mail: ebrowne@lbl.gov

Dr. Valery P. Chechev
V.G. Khlopin Radium Institute
28, 2nd Murinsky Ave., 194021 St. Petersburg, Russia
Tel: 007 (812) 2473706
Fax: 007 (812) 2478095
E-mail: chechev@atom.nw.ru

Dr. Vanessa Chisté
CEA/LNHB
91191 Gif-sur-Yvette, CEDEX, France
Tel: 33-1-69-08-63-07
Fax: 33-1-69-08-26-19
E-mail: vanessa.chiste@cea.fr

Dr. Filip G. Kondev
Applied Physics and Nuclear Data,
Nuclear Engineering Division
Argonne National Laboratory
9700 South Cass Ave. Argonne, IL 60439, USA
Tel: 1-(630) 252-4484
Fax: 1-(630) 252-5287
E-mail: kondev@anl.gov

Dr. Mónica Galán
CIEMAT, Laboratorio de Metrologia de Radiaciones Ionizantes
Avenida de la Complutense, 22
28040 Madrid, Spain
E-mail: monica.galan@ciemat.es

Dr. Andrew Pearce
National Physical Laboratory
Teddington,
Middlesex, TW11 OLM, United Kingdom
E-mail: Andy.Pearce@npl.co.uk

Dr. Aurelian Luca
IFIN-HH/Radionuclide Metrology Laboratory
407 Atomistilor street
PO Box MG-6
077125 Mahurele, Ilfov County, Romania
E-mail : aluca@ifin.nipne.ro

Dr. Xialong Huang
China Nuclear Data center
PO Box 275 (41)
Beijing, China
E-mail : huang@ciae.ac.cn

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(Volumes 1 to 4 - All nuclides sorted by increasing atomic mass)

* : updated evaluations

133	I	
53		80

1 Decay Scheme

I-133 disintegrates by beta minus emission to excited levels in Xe-133.
L' iode 133 se désexcite par émission beta moins vers les niveaux excités du xénon 133.

2 Nuclear Data

$T_{1/2}(^{133}I)$	:	20,87	(8)	h
$T_{1/2}(^{133}Xe)$	:	5,2474	(5)	d
$Q^{-}(^{133}I)$	:	1757	(4)	keV

2.1 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,13}$	167 (4)	0,414 (15)	Allowed	6,18
$\beta^-_{0,12}$	371 (4)	1,25 (4)	Allowed	6,81
$\beta^-_{0,11}$	407 (4)	0,397 (12)	Allowed	7,44
$\beta^-_{0,10}$	459 (4)	3,75 (7)	Allowed	6,64
$\beta^-_{0,9}$	521 (4)	3,12 (6)	Allowed	6,91
$\beta^-_{0,8}$	706 (4)	0,58 (5)	Allowed	8,09
$\beta^-_{0,7}$	846 (4)	0,026 (18)	(1st) Forbidden	9,7
$\beta^-_{0,6}$	882 (4)	4,16 (13)	allowed	7,59
$\beta^-_{0,5}$	1013 (4)	1,81 (6)	Unique (th) Forbidden	8,17
$\beta^-_{0,3}$	1227 (4)	83,42 (21)	Allowed	6,81
$\beta^-_{0,1}$	1524 (4)	1,07 (6)	1st Forbidden Unique	9,92

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{4,3}$(Xe)	150,382 (9)	0,029 (6)					
$\gamma_{(-1,1)}$(Xe)	167,97 (6)	0,078 (17)					
$\gamma_{13,12}$(Xe)	203,787 (31)	0,00432 (8)					
$\gamma_{1,0}$(Xe)	233,219 (15)	2,88 (2)	M4	6,24 (9)	2,035 (29)	0,453 (6)	8,84 (12)
$\gamma_{10,8}$(Xe)	245,837 (18)	0,035 (9)					
$\gamma_{2,0}$(Xe)	262,70 (6)	0,377 (13)	M1+E2	0,0497 (7)	0,00641 (9)	0,001300 (18)	0,0577 (8)
$\gamma_{3,2}$(Xe)	267,17 (6)	0,117 (7)					
$\gamma_{6,3}$(Xe)	345,459 (6)	0,104 (18)					
$\gamma_{9,6}$(Xe)	361,118 (7)	0,11 (4)					
$\gamma_{8,4}$(Xe)	372,143 (19)	0,009 (6)					
$\gamma_{7,3}$(Xe)	381,578 (30)	0,045 (5)					
$\gamma_{10,7}$(Xe)	386,784 (30)	0,059 (5)					
$\gamma_{4,2}$(Xe)	417,55 (6)	0,155 (10)	M1+E2	0,0139 (10)	0,001921 (27)	0,000392 (6)	0,0163 (11)
$\gamma_{10,6}$(Xe)	422,903 (7)	0,314 (10)	M1+E2	0,0128 (13)	0,00185 (3)	0,000379 (6)	0,0151 (13)
$\gamma_{11,7}$(Xe)	438,930 (34)	0,040 (5)					
$\gamma_{5,1}$(Xe)	510,531 (22)	1,81 (6)					
$\gamma_{12,6}$(Xe)	510,822 (9)	0,004 (5)					
$\gamma_{8,3}$(Xe)	522,525 (17)	0,04 (5)					
$\gamma_{3,0}$(Xe)	529,872 (3)	87,0 (2)	M1+E2	0,00691 (13)	0,000956 (14)	0,0001948 (29)	0,00810 (14)
$\gamma_{13,8}$(Xe)	537,543 (34)	0,035 (7)					
$\gamma_{10,5}$(Xe)	554,484 (17)	0,0004 (5)					
$\gamma_{9,4}$(Xe)	556,195 (10)	0,020 (3)					
$\gamma_{(-1,2)}$(Xe)	567,1 (4)	0,003 (3)					
$\gamma_{10,4}$(Xe)	617,98 (1)	0,542 (15)	M1+E2	0,0050 (7)	0,00066 (6)	0,000134 (12)	0,0059 (8)
$\gamma_{7,2}$(Xe)	648,75 (7)	0,056 (13)	M1	0,00510 (7)	0,000639 (9)	0,0001292 (18)	0,00590 (8)
$\gamma_{11,4}$(Xe)	670,126 (19)	0,042 (6)					
$\gamma_{13,7}$(Xe)	678,490 (42)	0,022 (7)					
$\gamma_{4,0}$(Xe)	680,254 (9)	0,648 (19)	M1	0,00460 (6)	0,000570 (8)	0,0001152 (16)	0,00527 (7)
$\gamma_{9,3}$(Xe)	706,577 (6)	1,496 (40)	M1+E2	0,0036 (6)	0,00047 (5)	0,000095 (10)	0,0042 (6)
$\gamma_{10,3}$(Xe)	768,362 (6)	0,459 (15)	M1+E2	0,00318 (22)	0,000402 (22)	0,000081 (4)	0,00368 (24)
$\gamma_{8,2}$(Xe)	789,70 (6)	0,050 (4)					
$\gamma_{11,3}$(Xe)	820,508 (17)	0,154 (6)	M1+E2	0,0026 (3)	0,00033 (3)	0,000068 (6)	0,0031 (4)
$\gamma_{12,3}$(Xe)	856,281 (9)	1,233 (40)	M1+E2	0,00202 (3)	0,000263 (4)	0,0000533 (8)	0,00235 (3)
$\gamma_{6,0}$(Xe)	875,331 (5)	4,48 (12)	E2+M3	0,001876 (26)	0,000245 (3)	0,0000496 (7)	0,00218 (3)
$\gamma_{13,4}$(Xe)	909,686 (31)	0,213 (9)	M1+E2	0,00222 (4)	0,000277 (5)	0,0000559 (9)	0,00257 (4)
$\gamma_{7,0}$(Xe)	911,45 (3)	0,046 (6)					
$\gamma_{(-1,3)}$(Xe)	1018,1 (5)	0,0060 (26)					
$\gamma_{10,2}$(Xe)	1035,53 (6)	0,0086 (18)					
$\gamma_{8,0}$(Xe)	1052,397 (17)	0,551 (16)					
$\gamma_{13,3}$(Xe)	1060,068 (30)	0,137 (7)	M1+E2	0,00143 (20)	0,000179 (22)	0,000036 (4)	0,00165 (23)
$\gamma_{11,2}$(Xe)	1087,68 (6)	0,0121 (18)					
$\gamma_{9,0}$(Xe)	1236,449 (5)	1,49 (4)					
$\gamma_{10,0}$(Xe)	1298,234 (5)	2,33 (7)	M1+E2	0,000822 (12)	0,0001026 (15)	0,00002070 (29)	0,000972 (14)
$\gamma_{13,2}$(Xe)	1327,24 (7)	0,00022 (22)					
$\gamma_{11,0}$(Xe)	1350,380 (17)	0,148 (5)	M1+E2	0,00085 (10)	0,000104 (12)	0,0000211 (23)	0,00101 (12)
$\gamma_{12,0}$(Xe)	1386,153 (8)	0,0086 (26)	[E2]				
$\gamma_{13,0}$(Xe)	1589,94 (3)	0,0029 (4)					

3 Atomic Data

3.1 Xe

ω_K	:	0,888	(5)
$\bar{\omega}_L$	:	0,097	(5)
n_{KL}	:	0,902	(4)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	29,459		53,98
	$K\alpha_1$	29,779		100
	$K\beta_3$	33,562	}	
	$K\beta_1$	33,625	}	
	$K\beta_5''$	33,881	}	28,99
	$K\beta_2$	34,415	}	
	$K\beta_4$	34,496	}	6,84
	$KO_{2,3}$	34,552	}	
X_L				
	$L\ell$	3,6378		
	$L\alpha$	4,0977 – 4,1103		
	$L\eta$	3,9576		
	$L\beta$	4,4176 – 4,7758		
	$L\gamma$	4,895 – 5,296		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	23,512 – 24,842	100
KLX	27,897 – 29,770	46,5
KXY	32,27 – 34,54	5,41
Auger L	2,4 – 5,2	

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Xe)	2,4 - 5,2		0,677 (4)
e_{AK}	(Xe)			0,072 (4)
	KLL	23,512 - 24,842	}	
	KLX	27,897 - 29,770	}	
	KXY	32,27 - 34,54	}	
$ec_{1,0\ T}$	(Xe)	198,655 - 233,207		2,59 (6)
$ec_{1,0\ K}$	(Xe)	198,655 (15)		1,828 (41)
$ec_{1,0\ L}$	(Xe)	227,766 - 228,437		0,596 (13)
$ec_{1,0\ M}$	(Xe)	232,070 - 232,542		0,1327 (29)
$ec_{3,0\ K}$	(Xe)	495,331 (3)		0,596 (11)
$ec_{3,0\ L}$	(Xe)	524,419 - 525,090		0,083 (12)
$\beta^-_{0,13}$	max:	167 (4)		0,414 (15)
$\beta^-_{0,13}$	avg:	45,1 (12)		
$\beta^-_{0,12}$	max:	371 (4)		1,25 (4)
$\beta^-_{0,12}$	avg:	108,8 (14)		
$\beta^-_{0,11}$	max:	407 (4)		0,397 (12)
$\beta^-_{0,11}$	avg:	120,8 (14)		
$\beta^-_{0,10}$	max:	459 (4)		3,75 (7)
$\beta^-_{0,10}$	avg:	138,7 (14)		
$\beta^-_{0,9}$	max:	521 (4)		3,12 (6)
$\beta^-_{0,9}$	avg:	160,4 (15)		
$\beta^-_{0,8}$	max:	706 (4)		0,58 (5)
$\beta^-_{0,8}$	avg:	228,4 (16)		
$\beta^-_{0,7}$	max:	846 (4)		0,026 (18)
$\beta^-_{0,7}$	avg:	283,1 (16)		
$\beta^-_{0,6}$	max:	882 (4)		4,16 (13)
$\beta^-_{0,6}$	avg:	297,4 (16)		
$\beta^-_{0,5}$	max:	1013 (4)		1,81 (6)
$\beta^-_{0,5}$	avg:	350,5 (17)		
$\beta^-_{0,3}$	max:	1227 (4)		83,42 (21)
$\beta^-_{0,3}$	avg:	439,4 (17)		
$\beta^-_{0,1}$	max:	1524 (4)		1,07 (6)
$\beta^-_{0,1}$	avg:	572,0 (17)		

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Xe)	3,6378 — 5,296		0,0724 (14)	
$XK\alpha_2$	(Xe)	29,459		0,163 (4)	} $K\alpha$
$XK\alpha_1$	(Xe)	29,779		0,303 (6)	}
$XK\beta_3$	(Xe)	33,562	}		
$XK\beta_1$	(Xe)	33,625	}	0,0877 (19)	$K'\beta_1$
$XK\beta_5''$	(Xe)	33,881	}		
$XK\beta_2$	(Xe)	34,415	}		
$XK\beta_4$	(Xe)	34,496	}	0,0207 (7)	$K'\beta_2$
$XKO_{2,3}$	(Xe)	34,552	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{4,3}$(Xe)	150,382 (9)	0,029 (6)
$\gamma_{(-1,1)}$(Xe)	167,97 (6)	0,078 (17)
$\gamma_{13,12}$(Xe)	203,787 (31)	0,00432 (8)
$\gamma_{1,0}$(Xe)	233,219 (15)	0,293 (4)
$\gamma_{10,8}$(Xe)	245,837 (18)	0,035 (9)
$\gamma_{2,0}$(Xe)	262,70 (6)	0,356 (12)
$\gamma_{3,2}$(Xe)	267,17 (6)	0,117 (7)
$\gamma_{6,3}$(Xe)	345,459 (6)	0,104 (18)
$\gamma_{9,6}$(Xe)	361,118 (7)	0,11 (4)
$\gamma_{8,4}$(Xe)	372,143 (19)	0,009 (6)
$\gamma_{7,3}$(Xe)	381,578 (30)	0,045 (5)
$\gamma_{10,7}$(Xe)	386,784 (30)	0,059 (5)
$\gamma_{4,2}$(Xe)	417,55 (6)	0,153 (10)
$\gamma_{10,6}$(Xe)	422,903 (7)	0,309 (10)
$\gamma_{11,7}$(Xe)	438,930 (34)	0,040 (5)
$\gamma_{5,1}$(Xe)	510,530 (22)	1,81 (6)
$\gamma_{12,6}$(Xe)	510,821 (9)	0,004 (5)
$\gamma_{8,3}$(Xe)	522,524 (17)	0,04 (5)
$\gamma_{3,0}$(Xe)	529,8709 (30)	86,3 (2)
$\gamma_{13,8}$(Xe)	537,542 (34)	0,035 (7)
$\gamma_{10,5}$(Xe)	554,483 (17)	0,0004 (5)
$\gamma_{9,4}$(Xe)	556,194 (10)	0,020 (3)
$\gamma_{(-1,2)}$(Xe)	567,1 (4)	0,003 (3)
$\gamma_{10,4}$(Xe)	617,978 (10)	0,539 (15)
$\gamma_{7,2}$(Xe)	648,75 (7)	0,056 (13)

	Energy keV	Photons per 100 disint.
$\gamma_{11,4}$(Xe)	670,124 (19)	0,042 (6)
$\gamma_{13,7}$(Xe)	678,488 (42)	0,022 (7)
$\gamma_{4,0}$(Xe)	680,252 (9)	0,645 (19)
$\gamma_{9,3}$(Xe)	706,575 (6)	1,49 (4)
$\gamma_{10,3}$(Xe)	768,360 (6)	0,457 (15)
$\gamma_{8,2}$(Xe)	789,69 (6)	0,050 (4)
$\gamma_{11,3}$(Xe)	820,505 (17)	0,154 (6)
$\gamma_{12,3}$(Xe)	856,278 (9)	1,23 (4)
$\gamma_{6,0}$(Xe)	875,328 (5)	4,47 (12)
$\gamma_{13,4}$(Xe)	909,683 (31)	0,212 (9)
$\gamma_{7,0}$(Xe)	911,447 (30)	0,046 (6)
$\gamma_{(-1,3)}$(Xe)	1018,1 (5)	0,0060 (26)
$\gamma_{10,2}$(Xe)	1035,53 (6)	0,0086 (18)
$\gamma_{8,0}$(Xe)	1052,393 (17)	0,551 (16)
$\gamma_{13,3}$(Xe)	1060,063	0,137 (7)
$\gamma_{11,2}$(Xe)	1087,67 (6)	0,0121 (18)
$\gamma_{9,0}$(Xe)	1236,443 (5)	1,49 (4)
$\gamma_{10,0}$(Xe)	1298,227 (5)	2,33 (7)
$\gamma_{13,2}$(Xe)	1327,23 (7)	0,00022 (22)
$\gamma_{11,0}$(Xe)	1350,373 (17)	0,148 (5)
$\gamma_{12,0}$(Xe)	1386,145 (8)	0,0086 (26)
$\gamma_{13,0}$(Xe)	1589,93 (3)	0,0029 (4)

6 Main Production Modes

$\mathrm{Te}-133(\beta^-)\ \mathrm{I}-133$

Fissionproduct
Possible impurities : I – 131, I – 132, I – 134, I – 135

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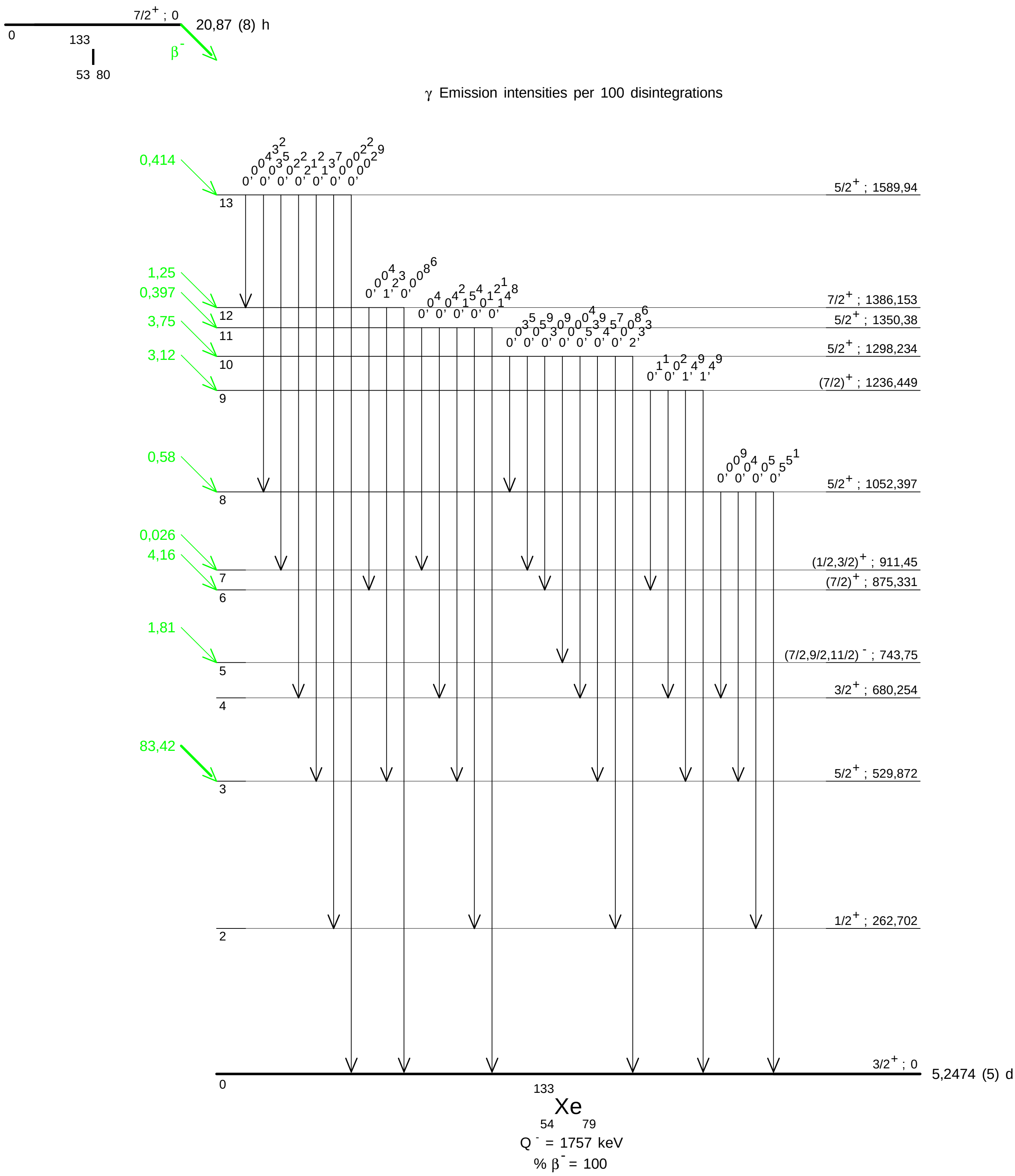

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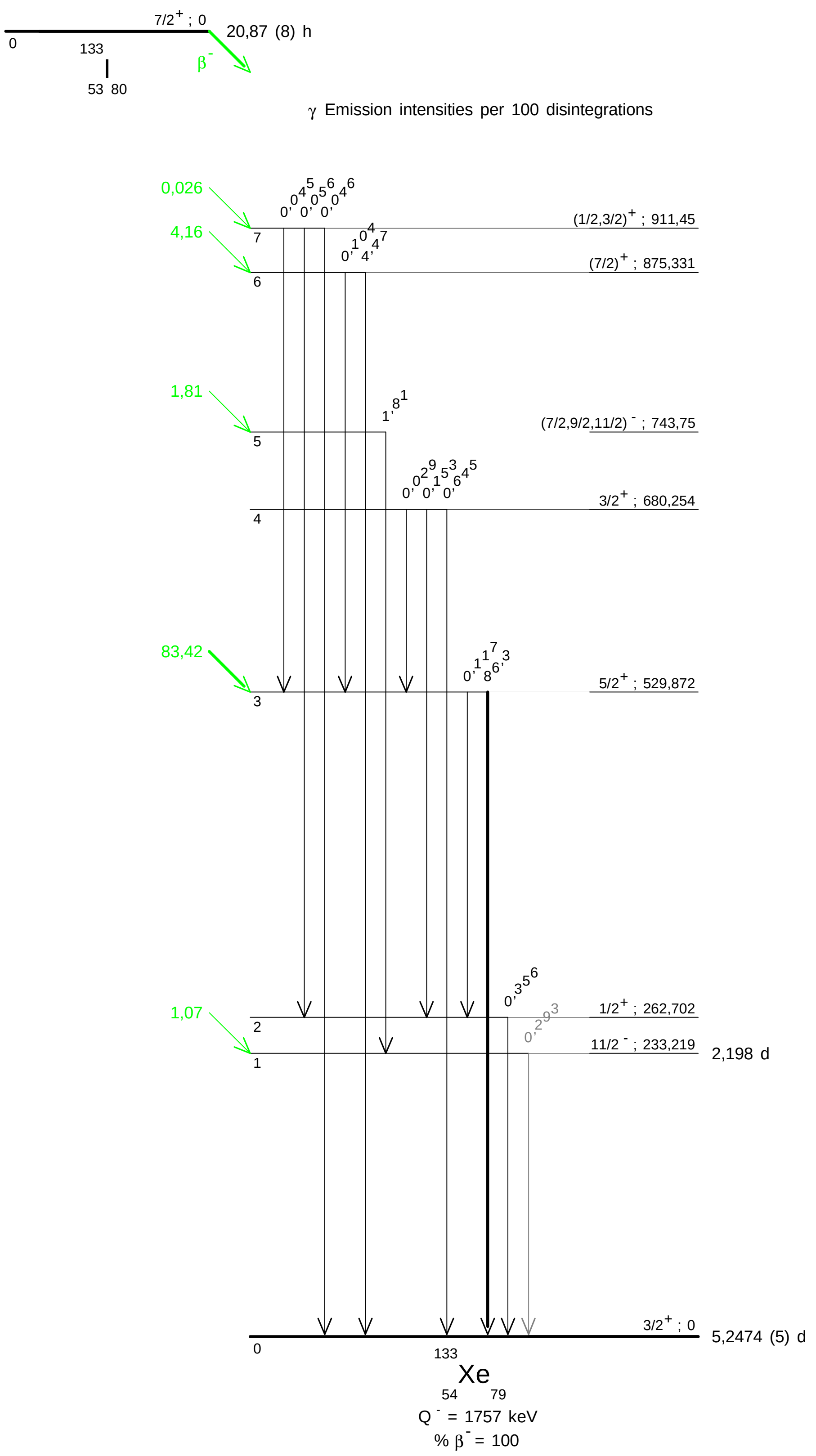

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$^{133}_{54}Xe_{79}$

1 Decay Scheme

Xe-133 disintegrates by beta minus emission to the excited levels of Cs-133.
Le xénon 133 se désintègre vers des niveaux excités du césium 133.

2 Nuclear Data

$T_{1/2}(^{133}Xe)$	:	5,2474	(5)	d
$Q^-(^{133}Xe)$	:	427,4	(24)	keV

2.1 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,3}$	43,6 (24)	0,0092 (9)	Allowed	6,84
$\beta^-_{0,2}$	266,8 (24)	0,87 (8)	Allowed	7,31
$\beta^-_{0,1}$	346,4 (24)	99,12 (8)	Allowed	5,62

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{2,1}$(Cs)	79,6142 (12)	0,78 (8)	M1+1,54%E2	1,495 (21)	0,217 (6)	0,0447 (12)	1,768 (26)
$\gamma_{1,0}$(Cs)	80,9979 (11)	99,8 (12)	M1+E2	1,429 (20)	0,214 (3)	0,0442 (6)	1,698 (24)
$\gamma_{2,0}$(Cs)	160,6120 (16)	0,088 (10)	M1+E2	0,234 (4)	0,0471 (13)	0,0099 (3)	0,294 (5)
$\gamma_{3,2}$(Cs)	223,2368 (13)	0,00019 (7)	M1+E2	0,0836 (12)	0,01103 (16)	0,00226 (3)	0,0975 (14)
$\gamma_{3,1}$(Cs)	302,8508 (5)	0,0061 (8)	M1+0,05%E2	0,0373 (5)	0,00484 (7)	0,000988 (14)	0,0434 (6)
$\gamma_{3,0}$(Cs)	383,8485 (12)	0,0029 (4)	E2	0,01684 (24)	0,00269 (4)	0,000559 (8)	0,0202 (3)

3 Atomic Data

3.1 Cs

ω_K	:	0,894	(4)
$\bar{\omega}_L$	:	0,104	(5)
n_{KL}	:	0,895	(4)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	30,6254		54,13
	$K\alpha_1$	30,9731		100
	$K\beta_3$	34,9197	}	
	$K\beta_1$	34,9873	}	
	$K\beta_5''$	35,252	}	29,22
	$K\beta_2$	35,822	}	
	$K\beta_4$	35,907	}	7,13
	$KO_{2,3}$	35,972	}	
X_L				
	$L\ell$	3,795		
	$L\alpha$	4,273 – 4,287		
	$L\eta$	4,142		
	$L\beta$	4,62 – 4,988		
	$L\gamma$	5,131 – 5,553		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	24,411 – 25,804	100
KLX	28,991 – 30,961	47,2
KXY	33,55 – 35,96	5,56
Auger L	2,5 – 5,6	

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Cs)	2,5 - 5,6		49,9 (3)
e_{AK}	(Cs)			5,65 (24)
	KLL	24,411 - 25,804	}	
	KLX	28,991 - 30,961	}	
	KXY	33,55 - 35,96	}	
$ec_{2,1\ K}$	(Cs)	43,6295 (19)		0,419 (45)
$ec_{1,0\ T}$	(Cs)	45,0133 - 80,9865		62,8 (10)
$ec_{1,0\ K}$	(Cs)	45,0133 (11)		52,9 (9)
$ec_{2,1\ L}$	(Cs)	73,8998 - 74,6022		0,061 (7)
$ec_{1,0\ L}$	(Cs)	75,2836 - 75,9860		7,92 (13)
$ec_{1,0\ M}$	(Cs)	79,7808 - 80,2724		1,635 (26)
$ec_{1,0\ N}$	(Cs)	80,7671 - 80,9214		0,3441 (46)
$\beta^-_{0,3}$	max:	43,6 (24)		0,0092 (9)
$\beta^-_{0,3}$	avg:	11,1 (7)		
$\beta^-_{0,2}$	max:	266,8 (24)		0,87 (8)
$\beta^-_{0,2}$	avg:	75,2 (8)		
$\beta^-_{0,1}$	max:	346,4 (24)		99,12 (8)
$\beta^-_{0,1}$	avg:	100,6 (8)		

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Cs)	3,795 — 5,553		5,79 (11)	
XKα_2	(Cs)	30,6254		13,54 (24)	} Kα
XKα_1	(Cs)	30,9731		25,0 (5)	}
XKβ_3	(Cs)	34,9197	}		
XKβ_1	(Cs)	34,9873	}	7,31 (15)	K$'\beta_1$
XKβ''_5	(Cs)	35,252	}		
XKβ_2	(Cs)	35,822	}		
XKβ_4	(Cs)	35,907	}	1,78 (6)	K$'\beta_2$
XKO$_{2,3}$	(Cs)	35,972	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{2,1}$(Cs)	79,6142 (12)	0,28 (3)
$\gamma_{1,0}$(Cs)	80,9979 (11)	37,0 (3)
$\gamma_{2,0}$(Cs)	160,6120 (16)	0,068 (8)
$\gamma_{3,2}$(Cs)	223,2368 (13)	0,00017 (6)
$\gamma_{3,1}$(Cs)	302,8508 (5)	0,0058 (8)
$\gamma_{3,0}$(Cs)	383,8485 (12)	0,0028 (4)

6 Main Production Modes

Fission product()
Possible impurities : Xe – 129, Xe – 131, Xe – 135

Te – 130(α,n)Xe – 133
Possible impurities : Xe – 125, Xe – 127, Xe – 135

Xe – 132(n,γ)Xe – 133 σ : 0,4 barns
Cs – 133(n,p)Xe – 133
Possible impurities : Xe – 135, Xe – 137

Ba – 136(n,α)Xe – 133
Possible impurities : Xe – 135, Xe – 137

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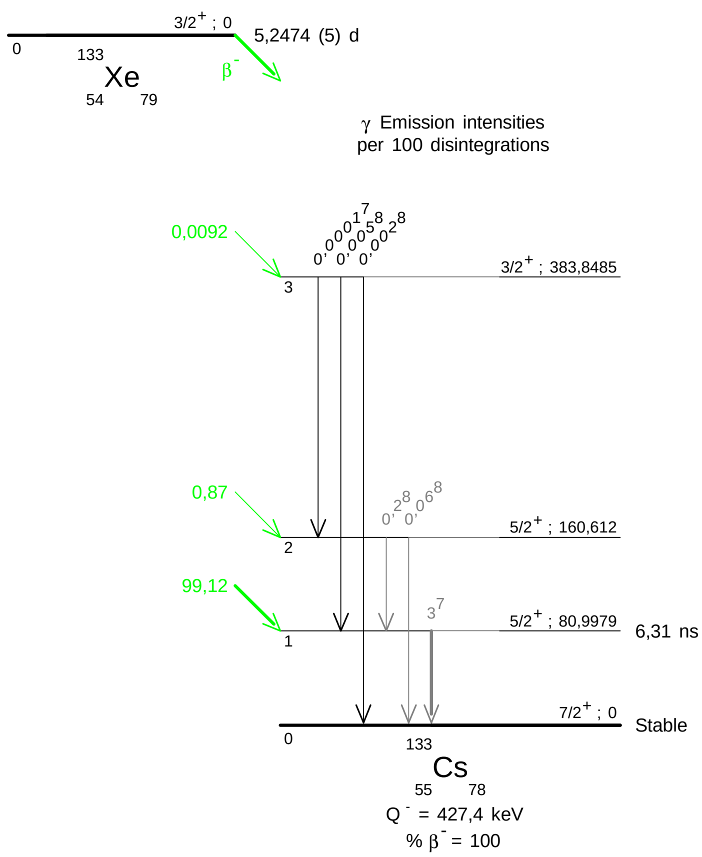

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133 Xe **m**
54 Xe 79

1 Decay Scheme

Xe-133m disintegrates by a strong converted gamma transition to the ground state of Xe-133.
Le Xénon 133 métastable se déexcite selon une transition gamma fortement convertie.

2 Nuclear Data

$T_{1/2}(^{133}Xe^{m})$	:	2,198	(13)	d
$T_{1/2}(^{133}Xe)$	:	5,256	(9)	d

2.1 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{1,0}$(Xe)	233,219 (15)	100	M4	6,25 (9)	2,04 (3)	0,453 (7)	8,84 (13)

3 Atomic Data

3.1 Xe

ω_K	:	0,888	(5)
$\bar{\omega}_L$	:	0,097	(5)
n_{KL}	:	0,902	(4)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	29,459		53,98
	$K\alpha_1$	29,779		100
	$K\beta_3$	33,562	}	
	$K\beta_1$	33,625	}	
	$K\beta_5''$	33,881	}	28,99
	$K\beta_2$	34,415	}	
	$K\beta_4$	34,496	}	6,84
	$KO_{2,3}$	34,552	}	
X_L				
	$L\ell$	3,638		
	$L\alpha$	4,098 – 4,11		
	$L\eta$	3,958		
	$L\beta$	4,418 – 4,776		
	$L\gamma$	4,895 – 5,296		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	23,512 – 24,842	100
KLX	27,897 – 29,770	46,5
KXY	32,27 – 34,54	5,41
Auger L	2,4 – 5,2	

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Xe)	2,4 - 5,2		70,4 (10)
e_{AK}	(Xe)			7,1 (4)
	KLL	23,512 - 24,842	}	
	KLX	27,897 - 29,770	}	
	KXY	32,27 - 34,54	}	
$ec_{1,0\ K}$	(Xe)	198,655 (15)		63,5 (12)
$ec_{1,0\ L}$	(Xe)	227,766 - 228,437		20,73 (40)
$ec_{1,0\ M}$	(Xe)	232,070 - 232,542		4,60 (8)
$ec_{1,0\ N}$	(Xe)	233,006 - 233,152		0,943 (18)

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Xe)	3,638 — 5,296		7,6 (4)	
$XK\alpha_2$	(Xe)	29,459		16,0 (4)	} $K\alpha$
$XK\alpha_1$	(Xe)	29,779		29,7 (6)	}
$XK\beta_3$	(Xe)	33,562	}		
$XK\beta_1$	(Xe)	33,625	}	8,61 (20)	$K'\beta_1$
$XK\beta_5''$	(Xe)	33,881	}		
$XK\beta_2$	(Xe)	34,415	}		
$XK\beta_4$	(Xe)	34,496	}	2,03 (7)	$K'\beta_2$
$XKO_{2,3}$	(Xe)	34,552	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Xe)	233,219 (15)	10,16 (13)

6 Main Production Modes

$\begin{cases} \text{Fission product} \\ \text{Possible impurities : } Xe-127,\ Xe-131m,\ Xe-131,\ Xe-133,\ Xe-135 \end{cases}$

$\begin{cases} Xe-132(n,\gamma)Xe-133m \quad \sigma : 0{,}05\ (1)\ \text{barns} \\ \text{Possible impurities : } Xe-125,\ Xe-129m,\ Xe-133,\ Xe-135,\ Xe-135m,\ Xe-137 \end{cases}$

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$^{135}_{54}Xe^{m}_{81}$

1 Decay Scheme

Xe-135 metastable mainly disintegrates by isomeric transition to Xe-135. A weak beta minus transition to Cs-135 has been observed.
Le xénon 135 metastable se déexcite vers le niveau fondamental de xénon 135 principalement. Une faible transition bêta moins vers le césium 135 a été observée.

2 Nuclear Data

$T_{1/2}(^{135}Xe^{m})$	:	15,30	(3)	min
$T_{1/2}(^{135}Cs)$	:	2300000	(300000)	a
$T_{1/2}(^{135}Xe)$	:	9,14	(2)	h
$Q^{-}(^{135}Xe^{m})$	:	1692	(4)	keV

2.1 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,4}$	334 (4)	0,00016		8,7
$\beta^-_{0,3}$	500 (4)	0,000032		9,9
$\beta^-_{0,2}$	559 (4)	0,00024		9,2
$\beta^-_{0,1}$	905,1 (40)	0,0036 (18)	1st Forbidden	8,7

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{1,0}$(Xe)	526,570 (5)	96,996 (2)	M4	0,1908 (27)	0,0364 (5)	0,0077 (1)	0,237 (3)
$\gamma_{1,0}$(Cs)	786,91	0,0036 (18)	E2				
$\gamma_{2,0}$(Cs)	1133	0,00024					

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{3,0}$(Cs)	1192	0,000032					
$\gamma_{4,0}$(Cs)	1358	0,00016	E1				

3 Atomic Data

3.1 Xe

ω_K : 0,888 (5)
$\bar{\omega}_L$: 0,097 (5)
n_{KL} : 0,902 (4)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	29,459		53,98
	$K\alpha_1$	29,779		100
	$K\beta_3$	33,562	}	
	$K\beta_1$	33,625	}	
	$K\beta_5''$	33,881	}	28,99
	$K\beta_2$	34,415	}	
	$K\beta_4$	34,496	}	6,84
	$KO_{2,3}$	34,552	}	
X_L				
	$L\ell$	3,6378		
	$L\alpha$	4,0977 – 4,1103		
	$L\eta$	3,9576		
	$L\beta$	4,4176 – 4,7758		
	$L\gamma$	4,895 – 5,2960		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	23,512 – 24,842	100
KLX	27,897 – 29,770	46,5
KXY	32,27 – 34,54	5,41
Auger L	2,5 – 5,3	

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Xe)	2,5 - 5,3		15,21 (9)
e_{AK}	(Xe)			1,73 (8)
	KLL	23,512 - 24,842	}	
	KLX	27,897 - 29,770	}	
	KXY	32,27 - 34,54	}	
$ec_{1,0\ T}$	(Xe)	492,006 - 526,560		19,16 (25)
$ec_{1,0\ K}$	(Xe)	492,006 (5)		15,42 (22)
$ec_{1,0\ L}$	(Xe)	521,12 - 521,79		2,943 (41)
$ec_{1,0\ M}$	(Xe)	525,42 - 525,89		0,622 (8)
$ec_{1,0\ N}$	(Xe)	526,36 - 526,50		0,1283 (18)
$\beta^-_{0,4}$	max:	334 (4)		0,00016
$\beta^-_{0,4}$	avg:	96,4 (13)		
$\beta^-_{0,3}$	max:	500 (4)		0,000032
$\beta^-_{0,3}$	avg:	152,8 (15)		
$\beta^-_{0,2}$	max:	559 (4)		0,00024
$\beta^-_{0,2}$	avg:	173,9 (15)		
$\beta^-_{0,1}$	max:	905,1 (40)		0,0036 (18)
$\beta^-_{0,1}$	avg:	306 (17)		

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Xe)	3,6378 — 5,2960		1,637 (30)	
$XK\alpha_2$	(Xe)	29,459		3,90 (7)	} $K\alpha$
$XK\alpha_1$	(Xe)	29,779		7,22 (12)	}
$XK\beta_3$	(Xe)	33,562	}		
$XK\beta_1$	(Xe)	33,625	}	2,09 (4)	$K'\beta_1$
$XK\beta_5''$	(Xe)	33,881	}		
$XK\beta_2$	(Xe)	34,415	}		
$XK\beta_4$	(Xe)	34,496	}	0,494 (14)	$K'\beta_2$
$XKO_{2,3}$	(Xe)	34,552	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Xe)	526,570 (5)	80,84 (20)
$\gamma_{1,0}$(Cs)	786,89	0,0036 (18)
$\gamma_{2,0}$(Cs)	1133	0,00024
$\gamma_{3,0}$(Cs)	1192	0,000032
$\gamma_{4,0}$(Cs)	1358	0,00016

6 Main Production Modes

Xe – 136(n,2n)Xe – 135m
Possible impurities : Xe – 135, Xe – 134, Xe – 133, Xe – 133m, Xe – 131

Xe – 134(n,γ)Xe – 135m
Possible impurities : Xe – 135, Xe – 134, Xe – 133, Xe – 133m, Xe – 131

Ba – 138(n,α)Xe – 135m
Possible impurities : Xe – 135, Xe – 134, Xe – 133, Xe – 133m, Xe – 131

Xe – 136(d,t)Xe – 135m
Possible impurities : Xe – 135, Xe – 134, Xe – 133, Xe – 133m, Xe – 131

Fission product ()
Possible impurities : Xe – 135, Xe – 134, Xe – 133, Xe – 133m, Xe – 131

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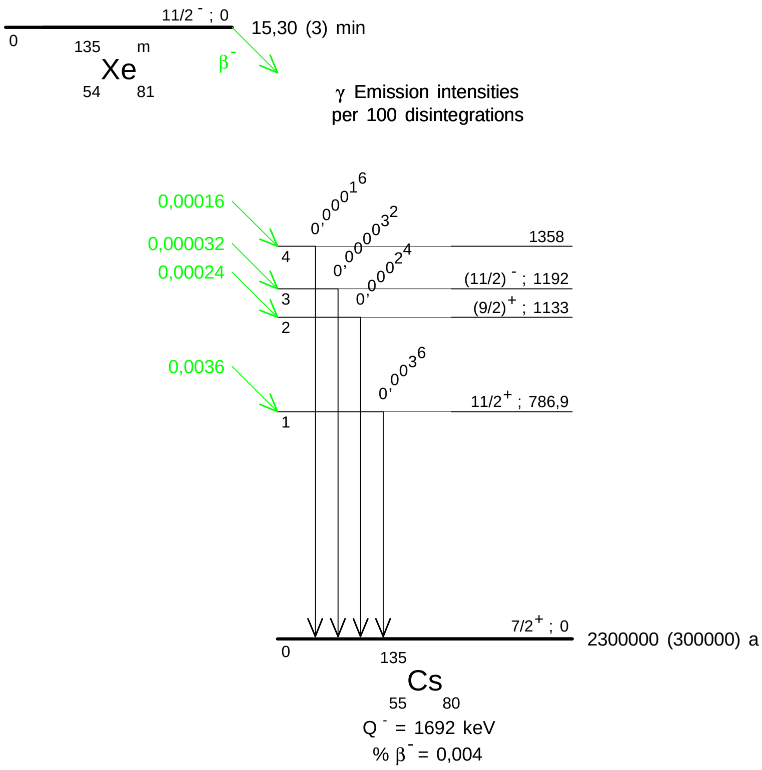
11/2 - ; 0
15,30 (3) min
0
135 m
Xe
54 81
β-
γ Emission intensities
per 100 disintegrations
0,00016
0,000032
0,00024
0,0036
0,00016
0,000032
0,00024
0,0036
4
3
2
1
1358
(11/2) - ; 1192
(9/2)+ ; 1133
11/2+ ; 786,9
7/2+ ; 0
2300000 (300000) a
0
135
Cs
55 80
Q - = 1692 keV
% β- = 0,004

$^{139}_{58}$Ce $_{81}$

1 Decay Scheme

Ce-139 disintegrates by electron capture to La-139.
If asymmetric uncertainties are used, the probability of capture to the 165 keV level is 99,9973 (+27-53) and that to the ground state is less than 0,008%.
Le cérium 139 se désintègre par capture électronique vers le lanthane 139. La probabilité de capture vers le niveau fondamental est inférieure à 0,008 %.

2 Nuclear Data

$T_{1/2}$(^{139}Ce)	:	137,641	(20)	d
Q^{+}(^{139}Ce)	:	270	(3)	keV

2.1 Electron Capture Transitions

	Energy keV	Probability × 100	Nature	lg ft	P_K	P_L	P_M
$\epsilon_{0,1}$	104,1 (30)	99,9973 (27)	Allowed	5,42	0,716 (7)	0,217 (5)	0,0669 (18)
$\epsilon_{0,0}$	270 (3)	0,008	2nd Forbidden	10,6			

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{1,0}$(La)	165,8576 (11)	100,00 (4)	M1	0,2146 (10)	0,0288 (6)	0,0060 (2)	0,2516 (7)

3 Atomic Data

3.1 La

ω_K	:	0,905	(4)
$\bar{\omega}_L$	:	0,117	(5)
n_{KL}	:	0,882	(4)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	33,0344		54,44
	$K\alpha_1$	33,4421		100
	$K\beta_3$	37,7206	}	
	$K\beta_1$	37,8015	}	
	$K\beta_5''$	38,084	}	29,78
	$K\beta_2$	38,7303	}	
	$K\beta_4$	38,828	}	7,53
	$KO_{2,3}$	38,91	}	
X_L				
	$L\ell$	4,117		
	$L\alpha$	4,634 – 4,65		
	$L\eta$	4,525		
	$L\beta$	5,041 – 5,381		
	$L\gamma$	5,62 – 6,072		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	26,240 – 27,795	100
KLX	31,231 – 33,428	48,3
KXY	36,2 – 38,9	5,84
Auger L	2,7 – 6,2	

4 Electron Emissions

		Energy keV	Electrons per 100 disint.
e_{AL}	(La)	2,7 - 6,2	90,1 (6)
e_{AK}	(La)		8,4 (4)
	KLL	26,240 - 27,795	}
	KLX	31,231 - 33,428	}
	KXY	36,2 - 38,9	}
$ec_{1,0\ T}$	(La)	126,933 - 165,843	20,10 (6)
$ec_{1,0\ K}$	(La)	126,9330 (11)	17,15 (8)
$ec_{1,0\ L}$	(La)	159,591 - 160,375	2,30 (5)
$ec_{1,0\ M}$	(La)	164,496 - 165,026	0,479 (16)

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(La)	4,117 — 6,072		12,19 (18)	
$XK\alpha_2$	(La)	33,0344		22,80 (24)	} $K\alpha$
$XK\alpha_1$	(La)	33,4421		41,9 (4)	}
$XK\beta_3$	(La)	37,7206	}		
$XK\beta_1$	(La)	37,8015	}	12,47 (18)	$K'\beta_1$
$XK\beta_5''$	(La)	38,084	}		
$XK\beta_2$	(La)	38,7303	}		
$XK\beta_4$	(La)	38,828	}	3,16 (8)	$K'\beta_2$
$XKO_{2,3}$	(La)	38,91	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(La)	165,8575 (11)	79,90 (4)

6 Main Production Modes

Ce – 138(n,γ)Ce – 139m   σ : 0,015 (5) barns
Ce – 139m(I.T.,)Ce – 139
Possible impurities : T1/2 = 56 s

Ce – 138(n,γ)Ce – 139   σ : 1,1 (3) barns
Possible impurities : Ce – 141

La – 139(d,2n)Ce – 139
Possible impurities : none

La – 139(p,n)Ce – 139m

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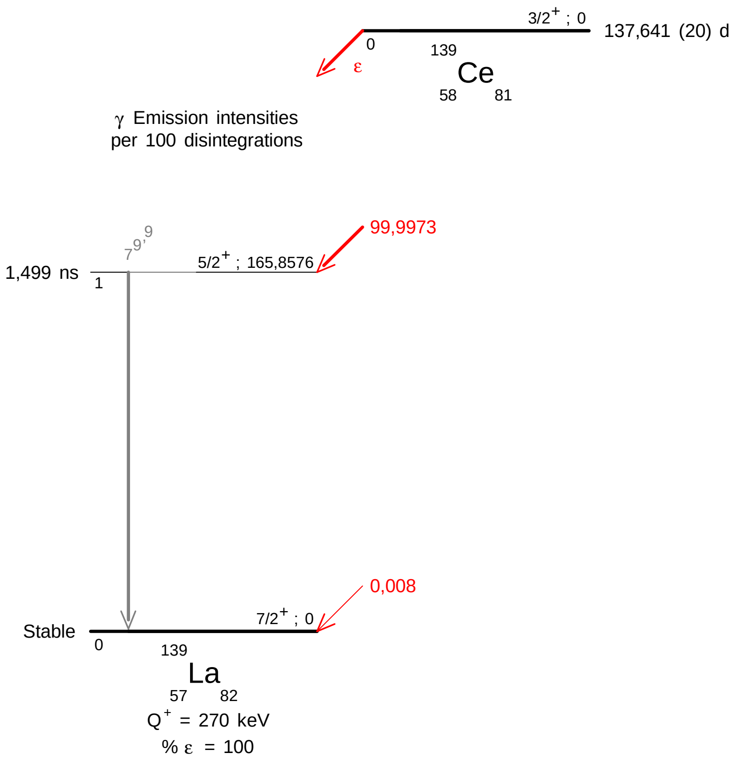

LNHB, INEEL / M.M. Bé, R.G. Helmer

206 Tl
81 Tl 125

1 Decay Scheme

Tl-206 disintegrates 100% by beta minus emissions to the ground state level of Pb-206 mainly.
Le thallium 206 se désintègre par émissions beta moins essentiellement vers le niveau fondamental de plomb 206.

2 Nuclear Data

$T_{1/2}$(^{206}Tl) : 4,202 (11) min
Q^-(^{206}Tl) : 1532,4 (6) keV

2.1 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,2}$	366,0 (8)	0,110 (14)	1st Forbidden	6
$\beta^-_{0,1}$	729,3 (6)	0,0051 (3)	Unique 1st Forbidden	8,6
$\beta^-_{0,0}$	1532,4 (6)	99,885 (14)	1st Forbidden	5,2

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{2,1}$(Pb)	363,3 (5)	0,00015 (15)	E2	0,0414 (12)	0,0187 (6)	0,00476 (14)	0,0663 (20)
$\gamma_{1,0}$(Pb)	803,06 (3)	0,0051 (3)	E2	0,00801 (24)	0,00174 (5)	0,000419 (13)	0,01030 (31)
$\gamma_{2,0}$(Pb)	1166,4	0,110 (14)	E0				

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		59,5
	$K\alpha_1$	74,97		100
	$K\beta_3$	84,451	}	
	$K\beta_1$	84,937	}	
	$K\beta_5''$	85,47	}	34,18
	$K\beta_2$	87,238	}	
	$K\beta_4$	87,58	}	10,32
	$KO_{2,3}$	87,911	}	
X_L				
	$L\ell$	9,19		
	$L\alpha$	10,449 – 10,551		
	$L\eta$	11,349		
	$L\beta$	12,144 – 12,795		
	$L\gamma$	14,308 – 15,217		

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	5,2 – 15,7	

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Pb)	5,2 - 15,7		
e_{AK}	(Pb)			0,0034 (6)
	KLL	56,028 - 61,669	}	
	KLX	68,181 - 74,969	}	
	KXY	80,3 - 88,0	}	
$ec_{2,0\ K}$	(Pb)	1078,4		0,093 (11)
$ec_{2,0\ L}$	(Pb)	1150,54 - 1151,20		0,017 (3)
$\beta^-_{0,2}$	max:	366,0	(8)	0,110 (14)
$\beta^-_{0,2}$	avg:	104,52	(25)	
$\beta^-_{0,1}$	max:	729,3	(6)	0,0051 (3)
$\beta^-_{0,1}$	avg:	232,39	(21)	
$\beta^-_{0,0}$	max:	1532,4	(6)	99,885 (14)
$\beta^-_{0,0}$	avg:	538,86	(25)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Pb)	9,190 — 15,217		0,035 (4)	
$XK\alpha_2$	(Pb)	72,8049		0,026 (3)	} $K\alpha$
$XK\alpha_1$	(Pb)	74,97		0,044 (5)	}
$XK\beta_3$	(Pb)	84,451	}		
$XK\beta_1$	(Pb)	84,937	}	0,0150 (17)	$K'\beta_1$
$XK\beta''_5$	(Pb)	85,47	}		
$XK\beta_2$	(Pb)	87,238	}		
$XK\beta_4$	(Pb)	87,58	}	0,0045 (6)	$K'\beta_2$
$XKO_{2,3}$	(Pb)	87,911	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{2,1}$(Pb)	363,3 (5)	0,00014 (14)
$\gamma_{1,0}$(Pb)	803,06 (3)	0,0050 (3)

6 Main Production Modes

Tl – 205(n,γ)Tl – 206 σ : 0,10 (3) barns

Bi – 210 α – decay

Tl – 205(d,p)Tl – 206

Pb – 207(t,α)Tl – 206

Pb – 208(d,α)Tl – 206

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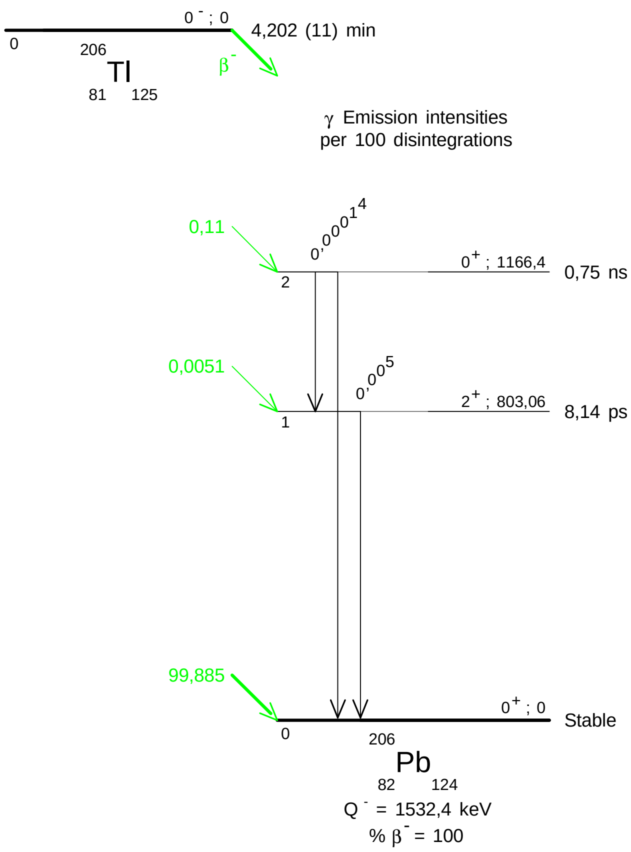

ANL / F.G. Kondev

210 Tl
81 Tl 129

1 Decay Scheme

Tl-210 disintegrates by beta minus emission to excited levels in Pb-210. A weak delayed neutron emission has been observed.
Le thallium 210 se désintègre par émission bêta moins vers des niveaux excités de plomb 210. Une émission de neutrons retardés de faible intensité a été mise en évidence.

2 Nuclear Data

$T_{1/2}(^{210}\mathrm{Tl})$	:	1,30	(3)	min
$T_{1/2}(^{210}\mathrm{Pb})$	:	22,23	(12)	a
$Q^{-}(^{210}\mathrm{Tl})$	:	5482	(12)	keV

2.1 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,11}$	1380 (12)	∼ 2		6,2
$\beta^-_{0,10}$	1603 (12)	∼ 7		5,9
$\beta^-_{0,9}$	1860 (12)	∼ 24		5,6
$\beta^-_{0,8}$	2024 (12)	∼ 10	Allowed	6,1
$\beta^-_{0,7}$	2413 (12)	∼ 10	2 Forbidden unique	6,4
$\beta^-_{0,3}$	4290 (12)	∼ 31	Allowed	6,9
$\beta^-_{0,2}$	4386 (12)	∼ 13	Allowed	7,3

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{(-1,1)}$(Pb)	83 (30)	30 (6)	[E2]		∼ 10	∼ 3	∼ 14

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{3,2}$(Pb)	97 (30)	40 (20)	M1 + E2	∼ 4	∼ 3	∼ 0,8	∼ 9
$\gamma_{2,1}$(Pb)	296 (3)	89 (11)	E2	0,0671 (19)	0,0399 (17)	0,0103 (5)	0,120 (5)
$\gamma_{(-1,2)}$(Pb)	356 (10)	5,0 (25)	[M1]	0,221 (18)	0,038 (3)	0,0088 (8)	0,270 (22)
$\gamma_{(-1,3)}$(Pb)	382 (10)	3,7 (24)	[M1]	0,183 (14)	0,0310 (24)	0,0073 (6)	0,223 (17)
$\gamma_{11,9}$(Pb)	480 (36)	2 (1)					
$\gamma_{(-1,4)}$(Pb)	670 (20)	2 (1)					
$\gamma_{1,0}$(Pb)	799,6 (3)	100	E2	0,00811 (24)	0,001764 (50)	0,000425 (13)	0,01042 (31)
$\gamma_{7,5}$(Pb)	860 (30)	6,9 (20)					
$\gamma_{(-1,5)}$(Pb)	910 (30)	3 (2)					
$\gamma_{4,1}$(Pb)	1070 (20)	11,9 (49)	[E1]	0,00185 (6)	0,000281 (8)	0,000065 (2)	0,00222 (7)
$\gamma_{5,2}$(Pb)	1110 (20)	6,9 (20)					
$\gamma_{9,6}$(Pb)	1210 (20)	16,8 (40)					
$\gamma_{6,2}$(Pb)	1310 (20)	20,8 (49)					
$\gamma_{5,1}$(Pb)	1410 (20)	4,9 (20)					
$\gamma_{(-1,6)}$(Pb)	1490 (20)	2 (1)					
$\gamma_{(-1,7)}$(Pb)	1540 (30)	2 (1)					
$\gamma_{8,4}$(Pb)	1590 (30)	2 (1)					
$\gamma_{(-1,8)}$(Pb)	1650 (30)	2 (1)					
$\gamma_{10,4}$(Pb)	2010 (30)	6,9 (20)					
$\gamma_{(-1,9)}$(Pb)	2090 (30)	4,9 (20)					
$\gamma_{7,1}$(Pb)	2280 (12)	3 (2)					
$\gamma_{8,2}$(Pb)	2360 (30)	7,9 (30)					
$\gamma_{9,3}$(Pb)	2430 (30)	8,9 (30)					

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				
	$K\alpha_2$	72,805		59,5
	$K\alpha_1$	74,97		100
	$K\beta_3$	84,451	}	
	$K\beta_1$	84,937	}	
	$K\beta_5''$	85,47	}	34,2
	$K\beta_2$	87,238	}	
	$K\beta_4$	87,58	}	10,3
	$KO_{2,3}$	87,911	}	

		Energy keV	Relative probability
X_L			
	$L\ell$	9,186	
	$L\alpha$	10,449 – 10,551	
	$L\eta$	11,349	
	$L\beta$	12,144 – 13,376	
	$L\gamma$	14,308 – 15,217	

4 Electron Emissions

		Energy keV			Electrons per 100 disint.
$ec_{3,2\ K}$	(Pb)	~ 9			~ 16
$ec_{-1,1\ L}$	(Pb)	67,1392	-	69,9648	~ 20
$ec_{-1,1\ M}$	(Pb)	79,1493	-	80,5160	~ 6
$ec_{3,2\ L}$	(Pb)	81,1392	-	83,9648	~ 12
$ec_{3,2\ M}$	(Pb)	93,1493	-	94,5160	~ 3,2
$ec_{2,1\ K}$	(Pb)	208		(3)	5,3 (7)
$ec_{-1,2\ K}$	(Pb)	268		(10)	0,88 (45)
$ec_{2,1\ L}$	(Pb)	280,1392	-	282,9648	3,15 (42)
$ec_{2,1\ M}$	(Pb)	292,1493	-	293,5160	0,81 (11)
$ec_{-1,3\ K}$	(Pb)	294		(10)	0,55 (37)
$ec_{2,1\ N}$	(Pb)	295,1064	-	295,8637	0,205 (27)
$ec_{-1,2\ L}$	(Pb)	340,1392	-	342,9648	0,15 (8)
$ec_{-1,2\ M}$	(Pb)	352,1493	-	353,5160	0,035 (18)
$ec_{-1,3\ L}$	(Pb)	366,1392	-	368,9648	0,09 (6)
$ec_{-1,3\ M}$	(Pb)	378,1493	-	379,5160	0,022 (15)
$ec_{1,0\ K}$	(Pb)	711,6		(3)	0,803 (12)
$ec_{1,0\ L}$	(Pb)	783,7	-	786,6	0,1746 (25)
$ec_{1,0\ M}$	(Pb)	795,7	-	797,1	0,0421 (6)
$ec_{1,0\ N}$	(Pb)	798,7	-	799,5	0,01066 (16)
$ec_{4,1\ K}$	(Pb)	982		(20)	0,022 (9)
$\beta^-_{0,11}$	max:	1380		(12)	~ 2
$\beta^-_{0,11}$	avg:	477		(13)	
$\beta^-_{0,10}$	max:	1603		(12)	~ 7
$\beta^-_{0,10}$	avg:	568		(14)	
$\beta^-_{0,9}$	max:	1860		(12)	~ 24
$\beta^-_{0,9}$	avg:	674		(10)	
$\beta^-_{0,8}$	max:	2024		(12)	~ 10
$\beta^-_{0,8}$	avg:	743		(10)	
$\beta^-_{0,7}$	max:	2413		(12)	~ 10
$\beta^-_{0,7}$	avg:	907		(7)	
$\beta^-_{0,3}$	max:	4290		(12)	~ 31
$\beta^-_{0,3}$	avg:	1721		(11)	

		Energy keV		Electrons per 100 disint.
$\beta^-_{0,2}$	max:	4386	(12)	~ 13
$\beta^-_{0,2}$	avg:	1763	(5)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
$XK\alpha_2$	(Pb)	72,805		7 (4)	} $K\alpha$
$XK\alpha_1$	(Pb)	74,97		11 (6)	}
$XK\beta_3$	(Pb)	84,451	}		
$XK\beta_1$	(Pb)	84,937	}	3,8 (19)	$K'\beta_1$
$XK\beta_5''$	(Pb)	85,47	}		
$XK\beta_2$	(Pb)	87,238	}		
$XK\beta_4$	(Pb)	87,58	}	1,1 (6)	$K'\beta_2$
$XKO_{2,3}$	(Pb)	87,911	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{(-1,1)}$(Pb)	83 (30)	1,98 (40)
$\gamma_{3,2}$(Pb)	97 (30)	4 (2)
$\gamma_{2,1}$(Pb)	296 (3)	79 (10)
$\gamma_{(-1,2)}$(Pb)	356 (10)	4 (2)
$\gamma_{(-1,3)}$(Pb)	382 (10)	3 (2)
$\gamma_{11,9}$(Pb)	480 (36)	2 (1)
$\gamma_{(-1,4)}$(Pb)	670 (20)	2 (1)
$\gamma_{1,0}$(Pb)	799,6 (3)	98,969 (30)
$\gamma_{7,5}$(Pb)	860 (30)	6,9 (20)
$\gamma_{(-1,5)}$(Pb)	910 (30)	3 (2)
$\gamma_{4,1}$(Pb)	1070 (20)	11,9 (49)
$\gamma_{5,2}$(Pb)	1110 (20)	6,9 (20)
$\gamma_{9,6}$(Pb)	1210 (20)	16,8 (40)

	Energy keV	Photons per 100 disint.
$\gamma_{6,2}$(Pb)	1310 (20)	20,8 (49)
$\gamma_{5,1}$(Pb)	1410 (20)	4,9 (20)
$\gamma_{(-1,6)}$(Pb)	1490 (20)	2 (1)
$\gamma_{(-1,7)}$(Pb)	1540 (30)	2 (1)
$\gamma_{8,4}$(Pb)	1590 (30)	2 (1)
$\gamma_{(-1,8)}$(Pb)	1650 (30)	2 (1)
$\gamma_{10,4}$(Pb)	2010 (30)	6,9 (20)
$\gamma_{(-1,9)}$(Pb)	2090 (30)	4,9 (20)
$\gamma_{7,1}$(Pb)	2280 (12)	3 (2)
$\gamma_{8,2}$(Pb)	2360 (30)	7,9 (30)
$\gamma_{9,3}$(Pb)	2430 (30)	8,9 (30)

6 Main Production Modes

Ra – 226 decay chain.

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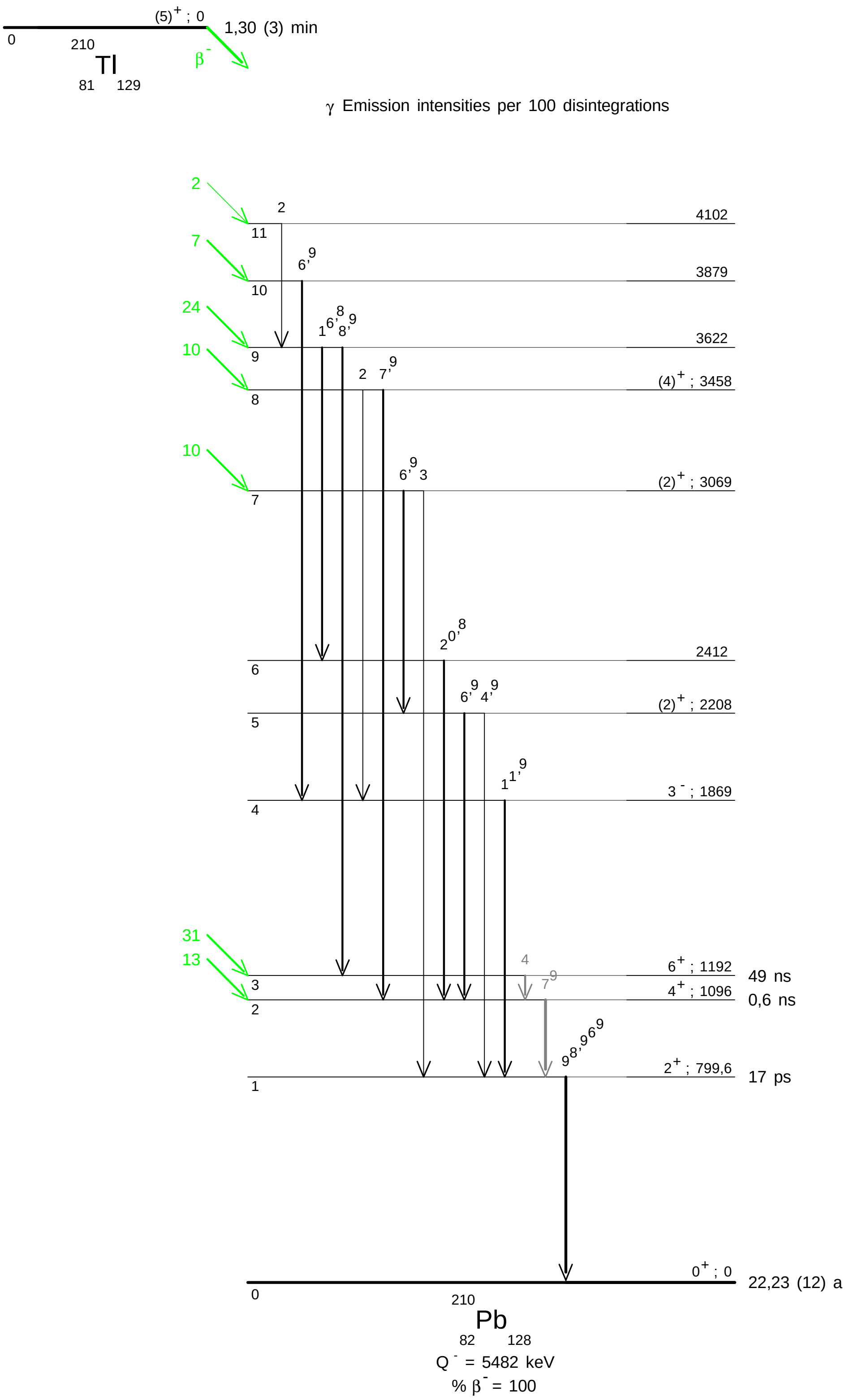

LNE-LNHB / V. Chisté, M.M. Bé

$^{210}_{82}\text{Pb}_{128}$

1 Decay Scheme

Pb-210 disintegrates by beta minus emission to the excited level and to the ground state level of Bi-210. A weak alpha transition to the Hg-206 ground state has been observed.
Le plomb 210 se désintègre par émission bêta moins vers le niveau excité et le niveau fondamental de bismuth 210. Une transition alpha de très faible intensité (1,9(4) E-6 %) vers le niveau fondamental de mercure 206 a été mise en évidence.

2 Nuclear Data

$T_{1/2}(^{210}\text{Pb})$	:	22,23	(12)	a
$T_{1/2}(^{210}\text{Bi})$	:	5,012	(5)	d
$T_{1/2}(^{206}\text{Hg})$	:	8,15	(10)	min
$Q^-(^{210}\text{Pb})$	:	63,5	(5)	keV
$Q^\alpha(^{210}\text{Pb})$	:	3792	(20)	keV

2.1 α Transitions

	Energy keV	Probability × 100	F
$\alpha_{0,0}$	3792 (20)	0,0000019 (4)	1

2.2 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,1}$	17,0 (5)	80,2 (13)	1st Forbidden	5,5
$\beta^-_{0,0}$	63,5 (5)	19,8 (13)	1st Forbidden	7,8

2.3 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_L	α_M	α_T
$\gamma_{1,0}$(Bi)	46,539 (1)	80,2 (13)	M1	13,64 (19)	3,21 (5)	17,86 (25)

3 Atomic Data

3.1 Bi

ω_K	:	0,964	(4)
$\bar{\omega}_L$	:	0,391	(16)
$\bar{\omega}_M$	:	0,0365	(20)
n_{KL}	:	0,809	(5)
$\bar{n}_{LM}$	:	1,29	(4)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	74,8157		59,77
	$K\alpha_1$	77,1088		100
	$K\beta_3$	86,835	}	
	$K\beta_1$	87,344	}	
	$K\beta_5''$	87,862	}	34,25
	$K\beta_2$	89,732	}	
	$K\beta_4$	90,074	}	10,48
	$KO_{2,3}$	90,421	}	
X_L				
	$L\ell$	9,4207		
	$L\alpha$	10,7308 – 10,8387		
	$L\eta$	11,7127		
	$L\beta$	12,4814 – 13,8066		
	$L\gamma$	14,7735 – 15,7084		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger L	5,3 – 10,7	

3.2 Hg

ω_K	:	0,962	(4)
$\bar{\omega}_L$	:	0,355	(14)
n_{KL}	:	0,813	(4)

3.2.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	68,895		58,99
	$K\alpha_1$	70,82		100
	$K\beta_3$	79,823	}	
	$K\beta_1$	80,254	}	
	$K\beta_5''$	80,762	}	33,94
	$K\beta_2$	82,435	}	
	$K\beta_4$	82,776	}	9,94
	$KO_{2,3}$	83,028	}	

4 α Emissions

	Energy keV	Probability × 100
$\alpha_{0,0}$	3720 (20)	0,0000019 (4)

5 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Bi)	5,3 - 10,7		36,0 (9)
e_{AK}	(Bi)			
$ec_{1,0\ L}$	(Bi)	30,152 - 33,120		58 (1)
$ec_{1,0\ M}$	(Bi)	42,540 - 43,959		13,65 (25)
$ec_{1,0\ N}$	(Bi)	45,601 - 46,382		3,50 (6)
$\beta^-_{0,1}$	max:	17,0	(5)	80,2 (13)
$\beta^-_{0,1}$	avg:	4,3	(1)	
$\beta^-_{0,0}$	max:	63,5	(5)	19,8 (13)
$\beta^-_{0,0}$	avg:	16,3	(1)	

6 Photon Emissions

6.1 X-Ray Emissions

		Energy keV	Photons per 100 disint.
XL	(Bi)	9,4207 — 15,7084	22,0 (5)

6.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Bi)	46,539 (1)	4,252 (40)

7 Main Production Modes

Ra – 226 decay chain()

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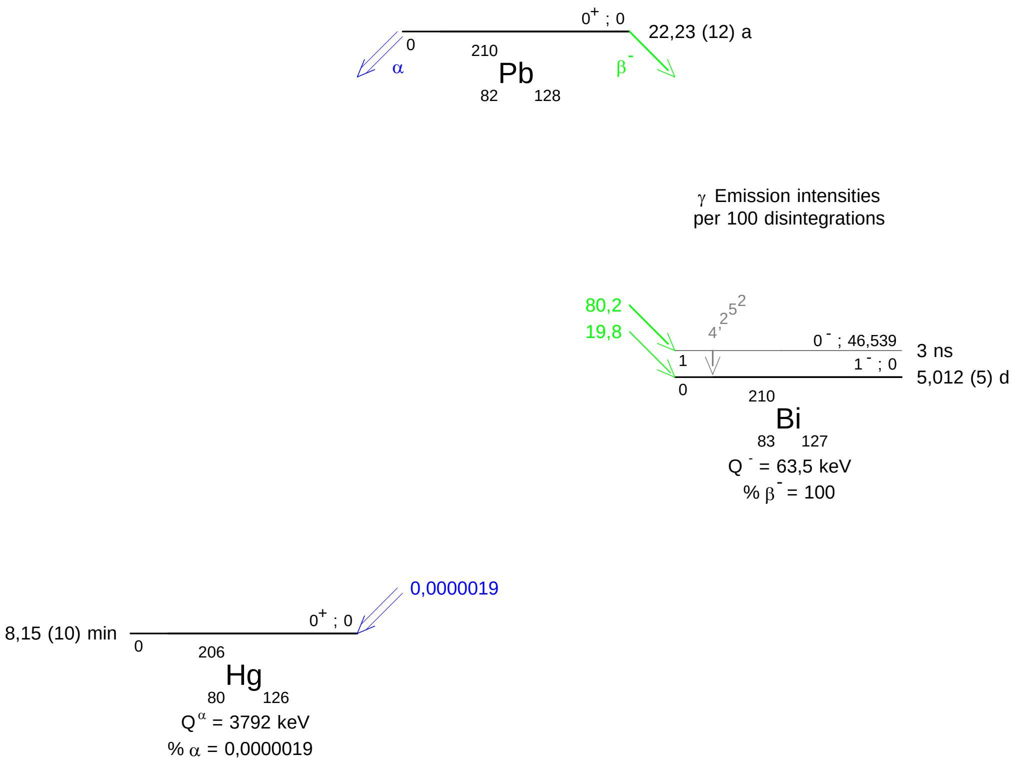
0+ ; 0
22,23 (12) a
0
210
Pb
82
128
α
β-
γ Emission intensities
per 100 disintegrations
80,2
19,8
0 - ; 46,539
3 ns
1
1 - ; 0
5,012 (5) d
0
210
Bi
83
127
Q - = 63,5 keV
% β- = 100
0,0000019
8,15 (10) min
0+ ; 0
0
206
Hg
80
126
Qα = 3792 keV
% α = 0,0000019

$^{210}_{83}$ Bi $_{127}$

1 Decay Scheme

Bi-210 mainly disintegrates by beta minus emission to the Po-210 fundamental level. Two weak alpha emissions to excited levels of Tl-206 have been pointed out.
Le bismuth 210 se désintègre principalement par émission bêta moins vers le niveau fondamental de polonium 210. Des transitions alpha de très faible intensité vers les niveaux excités de 304,8 keV et 265,7 keV de thalium 206 ont été mises en évidence.

2 Nuclear Data

$T_{1/2}(^{210}\text{Bi})$	:	5,012	(5)	d
$T_{1/2}(^{210}\text{Po})$	:	138,3763	(17)	d
$T_{1/2}(^{206}\text{Tl})$	:	4,202	(11)	min
$Q^{-}(^{210}\text{Bi})$	:	1162,1	(8)	keV
$Q^{\alpha}(^{210}\text{Bi})$	:	5042,7	(18)	keV

2.1 α Transitions

	Energy keV	Probability × 100	F
$\alpha_{0,2}$	4740 (4)	0,000084 (9)	49
$\alpha_{0,1}$	4778 (4)	0,000056 (6)	58

2.2 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,0}$	1162,1 (8)	99,99986 (2)	1st Forbidden	8

2.3 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{1,0}$(Tl)	265,832 (5)	0,000056 (6)	E2	0,0855 (12)	0,0561 (8)	0,01440 (21)	0,1603 (23)
$\gamma_{2,0}$(Tl)	304,896 (6)	0,000084 (9)	M1	0,307 (5)	0,0519 (8)	0,01210 (17)	0,375 (6)

3 Atomic Data

3.1 Tl

ω_K	:	0,967	(15)
$\bar{\omega}_L$	:	0,40	(4)
n_{KL}	:	0,81	(3)

4 α Emissions

	Energy keV	Probability × 100
$\alpha_{0,2}$	4650 (4)	0,000084 (9)
$\alpha_{0,1}$	4687 (4)	0,000056 (6)

5 Electron Emissions

		Energy keV	Electrons per 100 disint.
$\beta^-_{0,0}$	max:	1162,1 (8)	99,99986 (2)
$\beta^-_{0,0}$	avg:	389,2 (3)	

6 Photon Emissions

6.1 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Tl)	265,832 (5)	0,000048 (5)

	Energy keV	Photons per 100 disint.
$\gamma_{2,0}$(Tl)	304,896 (6)	0,000061 (7)

7 Main Production Modes

Ra – 226 decay chain
Possible impurities : Bi – 214

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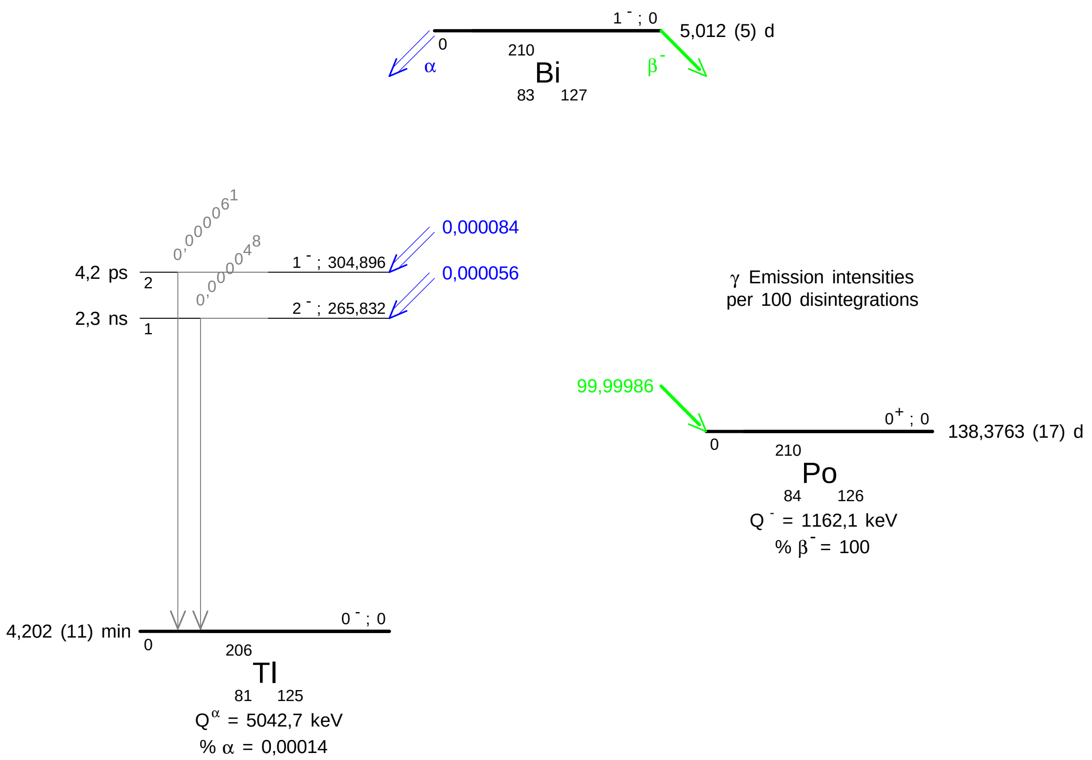
1 ⁻ ; 0
5,012 (5) d
0
210
Bi
83 127
α
β⁻
0,000061
0,000048
4,2 ps
2
1 ⁻ ; 304,896
0,000084
2,3 ns
1
2 ⁻ ; 265,832
0,000056
γ Emission intensities
per 100 disintegrations
99,99986
0⁺ ; 0
138,3763 (17) d
0
210
Po
84 126
Q⁻ = 1162,1 keV
% β⁻ = 100
4,202 (11) min
0
0 ⁻ ; 0
206
Tl
81 125
Qα = 5042,7 keV
% α = 0,00014

210 Po
84 Po 126

1 Decay Scheme

Po-210 disintegrates by alpha emission to the 803-keV excited level (0,00124 (4) %) and to the ground state level of Pb-206.
Le polonium 210 se désintègre par émission alpha principalement vers le niveau fondamental du plomb 206 ainsi que vers le niveau excité de 803 keV avec une intensité de 0,00124 (4)%.

2 Nuclear Data

$T_{1/2}$(^{210}Po)	:	138,3763	(17)	d
Q^{α}(^{210}Po)	:	5407,46	(7)	keV

2.1 α Transitions

	Energy keV	Probability × 100	F
$\alpha_{0,1}$	4604,36 (9)	0,00124 (4)	1,5
$\alpha_{0,0}$	5407,46 (7)	99,99876 (4)	1

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{1,0}$(Pb)	803,10 (5)	0,00124 (4)	E2	0,00804 (12)	0,001745 (25)	0,000420 (6)	0,01033 (15)

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				
	$K\alpha_2$	72,805		59,5
	$K\alpha_1$	74,97		100
	$K\beta_3$	84,451	}	
	$K\beta_1$	84,937	}	
	$K\beta_5''$	85,47	}	34,2
	$K\beta_2$	87,238	}	
	$K\beta_4$	87,58	}	10,3
	$KO_{2,3}$	87,911	}	
X_L				
	$L\ell$	9,186		
	$L\alpha$	10,449 – 10,551		
	$L\eta$	11,349		
	$L\beta$	12,144 – 13,377		
	$L\gamma$	14,308 – 15,217		

4 α Emissions

	Energy keV	Probability × 100
$\alpha_{0,1}$	4516,66 (9)	0,00124 (4)
$\alpha_{0,0}$	5304,33 (7)	99,99876 (4)

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Pb)	9,186 — 15,217		0,00000384 (10)	
$XK\alpha_2$	(Pb)	72,805		0,00000277 (10)	} $K\alpha$
$XK\alpha_1$	(Pb)	74,97		0,00000466 (17)	}
$XK\beta_3$	(Pb)	84,451	}		
$XK\beta_1$	(Pb)	84,937	}	0,00000159 (6)	$K'\beta_1$
$XK\beta_5''$	(Pb)	85,47	}		
$XK\beta_2$	(Pb)	87,238	}		
$XK\beta_4$	(Pb)	87,58	}	0,000000481 (20)	$K'\beta_2$
$XKO_{2,3}$	(Pb)	87,911	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Pb)	803,10 (5)	0,00123 (4)

6 Main Production Modes

Ra – 226 decay chain

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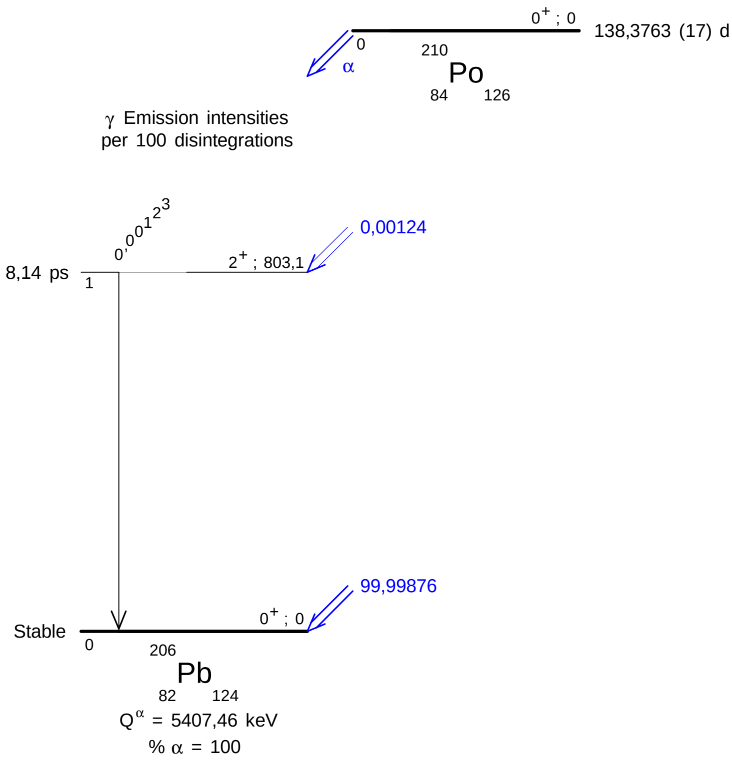
0+ ; 0
138,3763 (17) d
0
α
210
Po
84
126
γ Emission intensities
per 100 disintegrations
0,00124
8,14 ps
1
2+ ; 803,1
99,99876
Stable
0
0+ ; 0
206
Pb
82
124
Qα = 5407,46 keV
% α = 100

$^{213}_{84}\text{Po}_{129}$

1 Decay Scheme

Po-213 disintegrates 100% by alpha emissions to levels in Pb-209.
Le polonium 213 se désintègre principalement vers le niveau fondamental du plomb 209.

2 Nuclear Data

$T_{1/2}(^{213}\text{Po})$	:	3,70	(5)	10^{-6} s
$T_{1/2}(^{209}\text{Pb})$	:	3,253	(14)	h
$Q^{\alpha}(^{213}\text{Po})$	:	8536,1	(26)	keV

2.1 α Transitions

	Energy keV	Probability × 100	F
$\alpha_{0,1}$	7760 (10)	0,0050 (5)	185
$\alpha_{0,0}$	8536,2 (25)	99,9950 (5)	1,238

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{1,0}$(Pb)	778,8 (3)	0,0050 (5)	M1	0,0278 (4)	0,00462 (7)	0,001079 (16)	0,0339 (5)

3 α Emissions

	Energy keV	Probability × 100
$\alpha_{0,1}$	7614 (10)	0,0050 (5)
$\alpha_{0,0}$	8375,9 (25)	99,9950 (5)

4 Photon Emissions

4.1 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Pb)	778,8 (3)	0,0048 (5)

5 Main Production Modes

Daughter of Bi – 213

Descendant of Ac – 225

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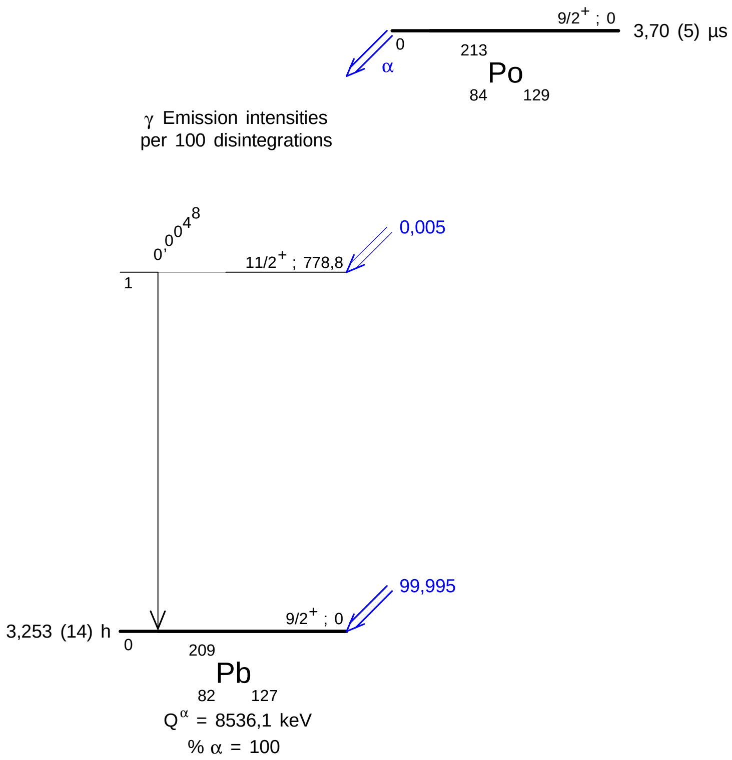

CNDC / Huang Xiaolong, Wang Baosong

$^{214}_{82}$Pb $_{132}$

1 Decay Scheme

Pb-214 disintegrates by beta minus emission to excited levels and to the ground state level of Bi-214.
Le plomb 214 se désintègre par émission bêta moins vers des niveaux excités et le niveau fondamental du bismuth 214.

2 Nuclear Data

$T_{1/2}(^{214}\text{Pb})$	:	26,8	(9)	min
$T_{1/2}(^{214}\text{Bi})$	:	19,9	(4)	min
$Q^-(^{214}\text{Pb})$	:	1019	(11)	keV

2.1 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,9}$	180 (11)	2,762 (22)	Allowed	4,5
$\beta^-_{0,8}$	222 (11)	0,0196 (27)	Allowed	6,9
$\beta^-_{0,7}$	485 (11)	1,047 (17)	1st Forbidden	6,2
$\beta^-_{0,5}$	667 (11)	46,52 (37)	1st Forbidden	5,1
$\beta^-_{0,4}$	729 (11)	41,09 (39)	1st Forbidden	5,2
$\beta^-_{0,0}$	1019 (11)	9,2 (7)	1st Forbidden	6,3

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{1,0}$(Bi)	53,2275 (21)	14,71 (42)	M1 + E2		9,80 (29)	2,32 (7)	12,88 (39)
$\gamma_{(-1,0)}$(Bi)	107,22 (9)	0,0068 (14)					
$\gamma_{(-1,1)}$(Bi)	137,45 (30)	0,045 (18)					
$\gamma_{(-1,2)}$(Bi)	141,3 (6)	0,027 (14)					

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{(-1,3)}$(Bi)	170,07 (6)	0,0146 (27)					
$\gamma_{3,2}$(Bi)	196,17 (10)	0,069 (9)					
$\gamma_{3,1}$(Bi)	205,642 (30)	0,0114 (23)					
$\gamma_{(-1,4)}$(Bi)	216,47 (7)	0,0100 (23)					
$\gamma_{4,1}$(Bi)	241,997 (3)	13,72 (20)	M1(+E2)	0,724 (22)	0,1250 (38)	0,0295 (9)	0,888 (27)
$\gamma_{3,0}$(Bi)	258,87 (3)	0,924 (13)	M1	0,601 (18)	0,1037 (31)	0,0244 (7)	0,737 (22)
$\gamma_{7,3}$(Bi)	274,80 (5)	0,504 (15)	M1 + E2	0,295 (9)	0,0731 (22)	0,0179 (5)	0,392 (12)
$\gamma_{4,0}$(Bi)	295,224 (2)	27,29 (26)	M1 + E2	0,390 (12)	0,0698 (21)	0,0165 (5)	0,482 (14)
$\gamma_{9,7}$(Bi)	305,26 (3)	0,0324 (22)	[E1]	0,0241 (7)	0,00413 (12)	0,000971 (29)	0,0295 (9)
$\gamma_{6,2}$(Bi)	314,32 (7)	0,077 (6)					
$\gamma_{6,1}$(Bi)	323,83 (4)	0,0287 (32)					
$\gamma_{5,0}$(Bi)	351,932 (2)	46,96 (37)	M1(+ E2)	0,260 (8)	0,0445 (13)	0,01049 (31)	0,319 (10)
$\gamma_{9,6}$(Bi)	462,00 (7)	0,213 (6)					
$\gamma_{7,1}$(Bi)	480,43 (2)	0,3838 (49)	M1(+E2)	0,1132 (34)	0,0192 (6)	0,00452 (14)	0,1384 (42)
$\gamma_{9,5}$(Bi)	487,09 (7)	0,438 (6)	(E1)	0,00871 (26)	0,001423 (43)	0,000333 (10)	0,01058 (32)
$\gamma_{7,0}$(Bi)	533,66 (2)	0,192 (10)	[M1,E2]	0,05 (3)	0,010 (4)	0,0023 (9)	0,06 (4)
$\gamma_{8,3}$(Bi)	538,41 (9)	0,0196 (27)					
$\gamma_{9,4}$(Bi)	543,81 (7)	0,050 (9)	E1 + M2	0,00696 (21)	0,001124 (34)	0,000262 (8)	0,00843 (25)
$\gamma_{9,3}$(Bi)	580,13 (3)	0,372 (6)	(E1)	0,00611 (18)	0,000981 (29)	0,000229 (7)	0,00740 (22)
$\gamma_{(-1,5)}$(Bi)	765,96 (9)	0,053 (8)					
$\gamma_{9,1}$(Bi)	785,96 (9)	1,068 (13)	E1	0,00341 (10)	0,000533 (16)	0,0001239 (37)	0,00410 (12)
$\gamma_{9,0}$(Bi)	839,00 (4)	0,589 (8)	(E1)	0,00302 (9)	0,000470 (14)	0,0001092 (33)	0,00363 (11)

3 Atomic Data

3.1 Bi

ω_K	:	0,964	(4)
$\bar{\omega}_L$	:	0,391	(16)
$\bar{\omega}_M$	:	0,031	(3)
n_{KL}	:	0,809	(5)
$\bar{n}_{LM}$	:	1,28	

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	74,8157		59,77
	$K\alpha_1$	77,1088		100
	$K\beta_3$	86,835	}	
	$K\beta_1$	87,344	}	
	$K\beta_5''$	87,862	}	34,25
	$K\beta_2$	89,732	}	
	$K\beta_4$	90,074	}	10,48
	$KO_{2,3}$	90,421	}	

		Energy keV	Relative probability
X_L			
	$L\ell$	9,42	
	$L\alpha$	10,45 – 10,55	
	$L\eta$	11,35	
	$L\beta$	12,13 – 13,38	
	$L\gamma$	14,31 – 16,36	

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	57,49 – 63,42	100
KLX	70,02 – 77,10	56,2
KXY	82,45 – 90,52	9,2
Auger L	5,3 – 16,4	

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Bi)	5,3 - 16,4		19,8 (3)
e_{AK}	(Bi)			0,80 (9)
	KLL	57,49 - 63,42	}	
	KLX	70,02 - 77,10	}	
	KXY	82,45 - 90,52	}	
$ec_{1,0\ L}$	(Bi)	36,8400 - 39,8089		10,39 (31)
$ec_{1,0\ M}$	(Bi)	49,2284 - 50,6479		2,46 (8)
$ec_{1,0\ N}$	(Bi)	52,2893 - 53,0704		0,641 (20)
$ec_{4,1\ K}$	(Bi)	151,471 (3)		5,26 (16)
$ec_{3,0\ K}$	(Bi)	168,34 (3)		0,32 (1)
$ec_{4,0\ K}$	(Bi)	204,698 (2)		7,22 (23)
$ec_{4,1\ L}$	(Bi)	225,610 - 228,578		0,908 (28)
$ec_{4,1\ M}$	(Bi)	237,998 - 239,417		0,214 (7)
$ec_{4,1\ N}$	(Bi)	241,059 - 241,840		0,0560 (17)
$ec_{3,0\ L}$	(Bi)	242,48 - 245,45		0,0551 (17)
$ec_{5,0\ K}$	(Bi)	261,406 (2)		9,26 (29)
$ec_{4,0\ L}$	(Bi)	278,836 - 281,805		1,291 (40)
$ec_{4,0\ M}$	(Bi)	291,225 - 292,644		0,305 (10)

		Energy keV		Electrons per 100 disint.
$ec_{4,0\ N}$	(Bi)	294,286 - 295,067		0,0797 (25)
$ec_{5,0\ L}$	(Bi)	335,544 - 338,513		1,584 (46)
$ec_{5,0\ M}$	(Bi)	347,933 - 349,352		0,373 (11)
$ec_{5,0\ N}$	(Bi)	350,994 - 351,775		0,0975 (29)
$\beta^-_{0,9}$	max:	180	(11)	2,762 (22)
$\beta^-_{0,9}$	avg:	50	(3)	
$\beta^-_{0,8}$	max:	222	(11)	0,0196 (27)
$\beta^-_{0,8}$	avg:	62	(3)	
$\beta^-_{0,7}$	max:	485	(11)	1,047 (17)
$\beta^-_{0,7}$	avg:	145	(4)	
$\beta^-_{0,5}$	max:	667	(11)	46,52 (37)
$\beta^-_{0,5}$	avg:	207	(4)	
$\beta^-_{0,4}$	max:	724	(11)	41,09 (39)
$\beta^-_{0,4}$	avg:	227	(4)	
$\beta^-_{0,0}$	max:	1019	(11)	9,2 (7)
$\beta^-_{0,0}$	avg:	337	(4)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Bi)	9,42 — 16,36		12,42 (22)	
$XK\alpha_2$	(Bi)	74,8157		6,26 (12)	} $K\alpha$
$XK\alpha_1$	(Bi)	77,1088		10,47 (20)	}
$XK\beta_3$	(Bi)	86,835	}		
$XK\beta_1$	(Bi)	87,344	}	3,59 (9)	$K'\beta_1$
$XK\beta_5''$	(Bi)	87,862	}		
$XK\beta_2$	(Bi)	89,732	}		
$XK\beta_4$	(Bi)	90,074	}	1,10 (4)	$K'\beta_2$
$XKO_{2,3}$	(Bi)	90,421	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Bi)	53,2275 (21)	1,060 (7)
$\gamma_{(-1,0)}$(Bi)	107,22 (9)	0,0068 (14)
$\gamma_{(-1,1)}$(Bi)	137,45 (30)	0,045 (18)
$\gamma_{(-1,2)}$(Bi)	141,3 (6)	0,027 (14)
$\gamma_{(-1,3)}$(Bi)	170,07 (6)	0,0146 (27)
$\gamma_{3,2}$(Bi)	196,20 (5)	0,069 (9)
$\gamma_{3,1}$(Bi)	205,68 (9)	0,0114 (23)
$\gamma_{(-1,4)}$(Bi)	216,47 (7)	0,0100 (23)
$\gamma_{4,1}$(Bi)	241,997 (3)	7,268 (22)
$\gamma_{3,0}$(Bi)	258,87 (3)	0,5318 (36)
$\gamma_{7,3}$(Bi)	274,80 (5)	0,362 (10)
$\gamma_{4,0}$(Bi)	295,224 (2)	18,414 (36)
$\gamma_{9,7}$(Bi)	305,26 (3)	0,0315 (21)
$\gamma_{6,2}$(Bi)	314,32 (7)	0,077 (6)
$\gamma_{6,1}$(Bi)	323,83 (4)	0,0287 (32)
$\gamma_{5,0}$(Bi)	351,932 (2)	35,60 (7)
$\gamma_{9,6}$(Bi)	462,00 (7)	0,213 (6)
$\gamma_{7,1}$(Bi)	480,43 (2)	0,3371 (41)
$\gamma_{9,5}$(Bi)	487,09 (7)	0,433 (6)
$\gamma_{7,0}$(Bi)	533,66 (2)	0,182 (6)
$\gamma_{8,3}$(Bi)	538,41 (8)	0,0196 (27)
$\gamma_{9,4}$(Bi)	543,81 (7)	0,050 (9)
$\gamma_{9,3}$(Bi)	580,13 (3)	0,369 (6)
$\gamma_{(-1,5)}$(Bi)	765,96 (9)	0,053 (8)
$\gamma_{9,1}$(Bi)	785,96 (9)	1,064 (13)
$\gamma_{9,0}$(Bi)	839,04 (9)	0,587 (8)

6 Main Production Modes

$$\begin{cases} \text{Ra} - 226 \text{ decay chain} \\ \text{Possible impurities : Pb} - 210 \end{cases}$$

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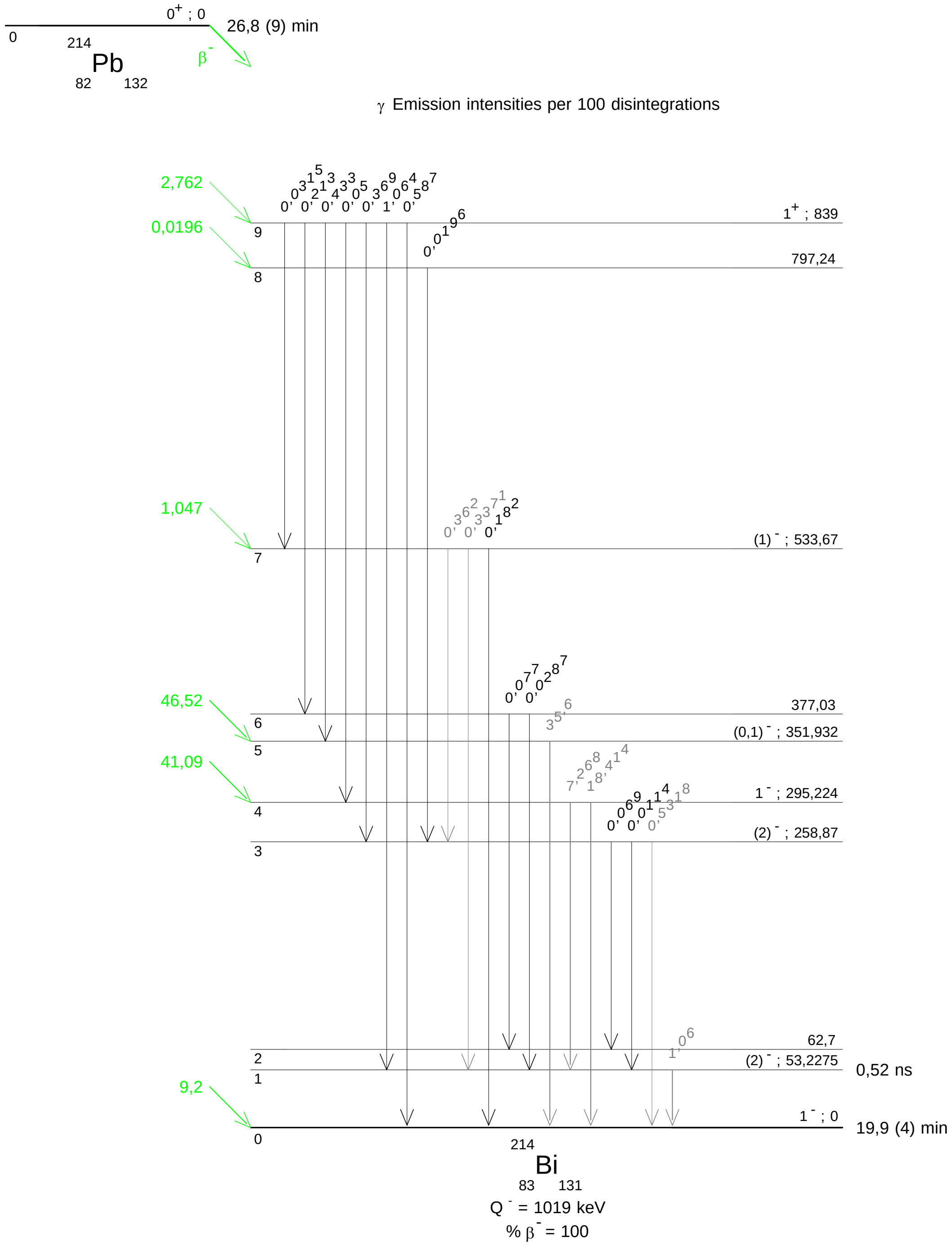
0+ ; 0
26,8 (9) min
214 Pb 82 132
β-
γ Emission intensities per 100 disintegrations
2,762
0,0196
1,047
46,52
41,09
9,2
1+ ; 839
797,24
(1)- ; 533,67
377,03
(0,1)- ; 351,932
1- ; 295,224
(2)- ; 258,87
62,7
(2)- ; 53,2275
0,52 ns
1- ; 0
19,9 (4) min
214 Bi 83 131
Q- = 1019 keV
% β- = 100

$^{214}_{83}\mathrm{Bi}_{131}$

1 Decay Scheme

Bi-214 disintegrates by beta minus emissions to the excited levels and to the ground state level of Po-214 (99,979 (13) %) and by alpha emission to the excited levels of Tl-210 (0,0210 (13) %). Some long range alpha emissions from the excited levels of Po-214 were pointed out with an intensity of 3,1 E-3 %.
Le bismuth 214 se désintègre par émission bêta moins vers des niveaux excités et le niveau fondamental de polonium 214 et par émission alpha vers les niveaux excités du thalium 210 (0,0210 (13) %). Des émissions alpha de long parcours provenant des niveaux excités de polonium 214 vers des niveaux du plomb 210, d'intensité de l'ordre de 3,1 E-3 %, ont été mises en évidence.

2 Nuclear Data

$T_{1/2}(^{214}\mathrm{Bi})$	:	19,9	(4)	min
$T_{1/2}(^{214}\mathrm{Po})$	:	162,3	(12)	10^{-6} s
$T_{1/2}(^{210}\mathrm{Tl})$	:	1,30	(3)	min
$T_{1/2}(^{210}\mathrm{Pb})$	:	22,23	(12)	a
$Q^{-}(^{214}\mathrm{Bi})$	:	3270	(11)	keV
$Q^{\alpha}(^{214}\mathrm{Bi})$	:	5621	(3)	keV

2.1 α Transitions

	Energy keV	Probability × 100	F
$\alpha_{0,5}$	5035 (3)	0,000052 (3)	45
$\alpha_{0,4}$	5119 (3)	0,000045 (3)	160
$\alpha_{0,3}$	5283 (3)	0,00013 (1)	450
$\alpha_{0,2}$	5373 (9)	0,00125 (7)	130
$\alpha_{0,1}$	5556 (3)	0,0116 (7)	130
$\alpha_{0,0}$	5621 (3)	0,0082 (5)	370
$^{*}\alpha_{1,0}$	8442 (6)	0,00012	
$^{*}\alpha_{6,1}$	8694 (6)	0,00006	
$^{*}\alpha_{2,0}$	9108 (6)	0,00002	

	Energy keV	Probability × 100	F
$^*\alpha_{4,0}$	9249 (6)	0,0022	
$^*\alpha_{6,0}$	9494 (6)	0,00005	
$^*\alpha_{7,0}$	9563 (8)	0,00002	
$^*\alpha_{10,0}$	9680 (6)	0,0001	
$^*\alpha_{14,0}$	9850 (8)	0,00004	
$^*\alpha_{17,0}$	9981 (6)	0,00012	
$^*\alpha_{21,0}$	10100 (6)	0,00007	
$^*\alpha_{24,0}$	10281 (6)	0,00014	
$^*\alpha_{26,0}$	10339 (8)	0,00002	
$^*\alpha_{32,0}$	10532 (6)	0,00008	
$^*\alpha_{38,0}$	10713 (10)	0,00002	

* Transitions α of long range.

2.2 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,80}$	86 (11)	0,0011 (5)		6,8
$\beta^-_{0,79}$	99 (11)	0,00014 (9)	1st Forbidden	7,8
$\beta^-_{0,77}$	110 (11)	0,00079 (12)		7,2
$\beta^-_{0,76}$	121 (11)	0,00019		8
$\beta^-_{0,75}$	127 (11)	0,00118 (9)		7,3
$\beta^-_{0,73}$	176 (11)	0,00037 (4)		8,2
$\beta^-_{0,72}$	188 (11)	0,0052 (7)		7,1
$\beta^-_{0,70}$	204 (11)	0,00141 (23)	1st Forbidden	7,8
$\beta^-_{0,69}$	216 (11)	0,030 (5)		6,6
$\beta^-_{0,65}$	256 (11)	0,0252 (24)		6,9
$\beta^-_{0,62}$	270 (11)	0,0160 (16)		7,1
$\beta^-_{0,61}$	284 (11)	0,032 (5)		6,9
$\beta^-_{0,60}$	291 (11)	0,0165 (6)		7,2
$\beta^-_{0,58}$	309 (11)	0,00036 (14)	1st Forbidden	9
$\beta^-_{0,57}$	329 (11)	0,041 (7)		7
$\beta^-_{0,56}$	336 (11)	0,00216 (32)		8,3
$\beta^-_{0,55}$	341 (11)	0,0025 (9)		8,3
$\beta^-_{0,54}$	348 (11)	0,0220 (9)		7,3
$\beta^-_{0,53}$	353 (11)	0,0014 (9)	1st Forbidden	8,6
$\beta^-_{0,52}$	373 (11)	0,0046 (5)	1st Forbidden	8,1
$\beta^-_{0,51}$	376 (11)	0,022 (3)		7,5
$\beta^-_{0,50}$	390 (11)	0,0115 (16)		7,8
$\beta^-_{0,49}$	400 (11)	0,0087 (4)	1st Forbidden	7,9

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,48}$	409 (11)	0,0146 (20)		7,6
$\beta^-_{0,47}$	443 (11)	0,00218 (17)		8,7
$\beta^-_{0,44}$	484 (11)	0,0248 (31)		7,8
$\beta^-_{0,43}$	500 (11)	0,038 (5)		7,6
$\beta^-_{0,42}$	541 (11)	0,525 (16)		6,6
$\beta^-_{0,41}$	551 (11)	0,247 (8)		6,9
$\beta^-_{0,39}$	571 (11)	0,026 (4)		8
$\beta^-_{0,40}$	573 (11)	0,0471 (23)	1st Forbidden	7,7
$\beta^-_{0,38}$	575 (11)	0,231 (15)	1st Forbidden	7
$\beta^-_{0,37}$	608 (11)	0,098 (9)		7,5
$\beta^-_{0,36}$	639 (11)	0,0223 (21)		8,2
$\beta^-_{0,35}$	665 (11)	0,058 (4)		7,7
$\beta^-_{0,34}$	710 (11)	0,00018 (9)	1st Forbidden	10,5
$\beta^-_{0,32}$	727 (11)	0,044 (7)	1st Forbidden	8,1
$\beta^-_{0,31}$	764 (11)	0,092 (9)	1st Forbidden	7,9
$\beta^-_{0,30}$	765 (11)	0,169 (10)	1st Forbidden	7,6
$\beta^-_{0,29}$	788 (11)	1,227 (27)		6,8
$\beta^-_{0,28}$	822 (11)	2,76 (6)	Allowed	6,5
$\beta^-_{0,27}$	847 (11)	0,0620 (49)		8,1
$\beta^-_{0,26}$	909 (11)	0,0030 (8)		9,6
$\beta^-_{0,25}$	922 (11)	0,0014 (9)		9,9
$\beta^-_{0,24}$	977 (11)	0,558 (8)	1st Forbidden	7,4
$\beta^-_{0,23}$	1004 (11)	0,187 (12)	1st Forbidden	8
$\beta^-_{0,21}$	1068 (11)	5,642 (43)	1st Forbidden	6,6
$\beta^-_{0,20}$	1077 (11)	0,851 (10)	1st Forbidden	7,4
$\beta^-_{0,19}$	1124 (11)	0,433 (22)	1st Forbidden	7,8
$\beta^-_{0,18}$	1151 (11)	4,339 (18)	1st Forbidden	6,8
$\beta^-_{0,17}$	1182 (11)	0,114 (6)		8,4
$\beta^-_{0,16}$	1253 (11)	2,449 (10)	1st Forbidden	7,2
$\beta^-_{0,15}$	1261 (11)	1,430 (9)	1st Forbidden	7,4
$\beta^-_{0,14}$	1275 (11)	1,171 (18)		7,5
$\beta^-_{0,13}$	1382 (11)	1,584 (10)	1st Forbidden	7,5
$\beta^-_{0,12}$	1423 (11)	8,147 (28)	1st Forbidden	6,9
$\beta^-_{0,11}$	1506 (11)	17,10 (8)	1st Forbidden	6,6
$\beta^-_{0,10}$	1529 (11)	0,116 (16)	1st Forbidden	8,8
$\beta^-_{0,9}$	1540 (11)	17,494 (36)	1st Forbidden	6,7
$\beta^-_{0,8}$	1557 (11)	0,170 (16)		8,7
$\beta^-_{0,7}$	1609 (11)	0,65 (6)	1st Forbidden	8,2
$\beta^-_{0,6}$	1727 (11)	3,12 (4)	1st Forbidden	7,6
$\beta^-_{0,5}$	1857 (11)	0,396 (46)	1st Forbidden	8,6
$\beta^-_{0,4}$	1894 (11)	7,45 (5)	1st Forbidden	7,4
$\beta^-_{0,1}$	2661 (11)	0,62 (20)	1st Forbidden	9
$\beta^-_{0,0}$	3270 (11)	19,67 (20)	1st Forbidden	7,9

2.3 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{1,0}$(Tl)	62,5 (10)	0,0116 (7)	(M1)				
$\gamma_{2,1}$(Tl)	191,1 (18)	0,00125 (7)					
$\gamma_{11,6}$(Po)	221 (1)	0,106 (31)	[M1,E2]	0,5 (5)	0,158 (10)	0,0394 (9)	0,8 (5)
$\gamma_{(-1,0)}$(Po)	230 (1)	0,0031 (11)		0,0474 (9)	0,00848 (15)	0,00200 (4)	0,0585 (11)
$\gamma_{16,11}$(Po)	252,80 (6)	0,0212 (33)	[M1]	0,658 (10)	0,1154 (17)	0,0272 (4)	0,809 (12)
$\gamma_{6,3}$(Po)	268,614 (26)	0,0168 (19)	[E1]	0,0329 (5)	0,00577 (9)	0,001359 (20)	0,0405 (6)
$\gamma_{29,22}$(Po)	273,80 (5)	0,120 (8)					
$\gamma_{42,28}$(Po)	280,95 (5)	0,062 (6)					
$\gamma_{(-1,1)}$(Po)	304,2 (2)	0,033 (6)		0,23 (17)	0,055 (14)	0,014 (3)	0,30 (19)
$\gamma_{14,7}$(Po)	333,350 (42)	0,0646 (41)	[E1]	0,0202 (3)	0,00345 (5)	0,000811 (12)	0,0247 (4)
$\gamma_{(-1,2)}$(Po)	334,78 (8)	0,033 (5)					
$\gamma_{11,5}$(Po)	349,009 (24)	0,164 (43)	[M1]	0,272 (4)	0,0475 (7)	0,01118 (16)	0,335 (5)
$\gamma_{11,4}$(Po)	386,823 (18)	0,343 (30)	[M1,E2]	0,12 (9)	0,027 (10)	0,0065 (20)	0,16 (10)
$\gamma_{18,9}$(Po)	388,94 (5)	0,493 (6)	(M1)	0,203 (3)	0,0353 (5)	0,00832 (12)	0,250 (4)
$\gamma_{29,17}$(Po)	394,05 (8)	0,0127 (18)					
$\gamma_{35,22}$(Po)	396,01 (8)	0,0259 (18)					
$\gamma_{2,1}$(Po)	405,74 (4)	0,180 (7)	[E2]	0,0344 (5)	0,01478 (21)	0,00377 (6)	0,0541 (8)
$\gamma_{28,14}$(Po)	452,92 (10)	0,034 (5)	[M1,E2]	0,08 (6)	0,017 (7)	0,0040 (15)	0,10 (7)
$\gamma_{9,3}$(Po)	454,850 (26)	0,292 (5)	[E1]	0,01028 (15)	0,001706 (24)	0,000399 (6)	0,01251 (18)
$\gamma_{21,10}$(Po)	461,15 (20)	0,067 (9)	[M1]	0,1289 (19)	0,0223 (4)	0,00525 (8)	0,1581 (23)
$\gamma_{12,4}$(Po)	469,756 (18)	0,145 (18)	[M1,E2]	0,07 (5)	0,015 (6)	0,0036 (14)	0,09 (6)
$\gamma_{21,9}$(Po)	474,52 (5)	0,100 (9)	[M1,E2]	0,07 (5)	0,015 (6)	0,0035 (14)	0,09 (6)
$\gamma_{38,22}$(Po)	485,92 (11)	0,021 (4)					
$\gamma_{29,14}$(Po)	487,95 (13)	0,028 (9)	[E1]	0,00889 (13)	0,001463 (21)	0,000342 (5)	0,01080 (16)
$\gamma_{39,21}$(Po)	494,2 (4)	0,011 (3)					
$\gamma_{31,15}$(Po)	496,90 (18)	0,0068 (18)					
$\gamma_{23,11}$(Po)	501,96 (15)	0,0181 (22)					
$\gamma_{42,22}$(Po)	519,90 (5)	0,0166 (17)					
$\gamma_{42,21}$(Po)	524,6 (2)	0,0169 (17)					
$\gamma_{6,2}$(Po)	528 (1)	0,0112 (13)	[E2]	0,0198 (3)	0,00633 (10)	0,001584 (24)	0,0282 (5)
$\gamma_{23,9}$(Po)	536,77 (4)	0,061 (8)					
$\gamma_{21,7}$(Po)	543,0 (2)	0,093 (23)	[M1,E2]	0,05 (4)	0,010 (5)	0,0024 (10)	0,06 (4)
$\gamma_{22,7}$(Po)	547,6 (3)	0,034 (3)					
$\gamma_{62,28}$(Po)	551,9 (8)	0,0055 (14)					
$\gamma_{12,3}$(Po)	572,76 (7)	0,072 (8)	[E1]	0,00643 (9)	0,001042 (15)	0,000243 (4)	0,00779 (11)
$\gamma_{15,5}$(Po)	595,32 (7)	0,0183 (17)	[M1,E2]	0,04 (3)	0,008 (4)	0,0019 (8)	0,05 (3)
$\gamma_{41,18}$(Po)	600,0 (5)	0,008 (4)					
$\gamma_{1,0}$(Po)	609,316 (7)	46,42 (19)	E2	0,01487 (21)	0,00416 (6)	0,001030 (15)	0,0204 (3)
$\gamma_{13,3}$(Po)	615,53 (10)	0,055 (7)	[E1]	0,00557 (8)	0,000898 (13)	0,000209 (3)	0,00674 (10)
$\gamma_{14,4}$(Po)	617,0 (2)	0,027 (5)	[E1]	0,00555 (8)	0,000894 (13)	0,000209 (3)	0,00672 (10)
$\gamma_{51,23}$(Po)	626,4 (6)	0,0041 (14)					
$\gamma_{(-1,3)}$(Po)	630,79 (7)	0,0166 (14)					
$\gamma_{15,4}$(Po)	633,14 (10)	0,057 (3)	[M1,E2]	0,035 (21)	0,007 (3)	0,0016 (7)	0,044 (25)
$\gamma_{29,12}$(Po)	634,72 (21)	0,0067 (24)	[M1,E2]	0,035 (21)	0,007 (3)	0,0016 (7)	0,043 (25)
$\gamma_{16,4}$(Po)	639,62 (10)	0,035 (5)	[E2]	0,01351 (19)	0,00363 (5)	0,000895 (13)	0,0183 (3)
$\gamma_{20,6}$(Po)	649,19 (7)	0,056 (7)	[M1,E2]	0,033 (20)	0,006 (3)	0,0015 (7)	0,041 (24)
$\gamma_{27,11}$(Po)	658,7 (2)	0,017 (4)					
$\gamma_{21,6}$(Po)	661,1 (2)	0,056 (4)	[M1,E2]	0,031 (19)	0,006 (3)	0,0014 (6)	0,039 (22)
$\gamma_{3,1}$(Po)	665,445 (23)	1,539 (7)	E1	0,00479 (7)	0,000767 (11)	0,000179 (3)	0,00579 (9)
$\gamma_{38,16}$(Po)	677,41 (15)	0,0055 (23)					
$\gamma_{28,11}$(Po)	683,22 (6)	0,084 (6)	[E1]	0,00456 (7)	0,000728 (11)	0,00016960 (24)	0,00551 (8)
$\gamma_{39,15}$(Po)	687,6 (3)	0,0066 (14)					
$\gamma_{27,9}$(Po)	693,3 (5)	0,0059 (15)					
$\gamma_{8,2}$(Po)	697,88 (20)	0,069 (4)	[M1,E2]	0,027 (16)	0,0051 (23)	0,0012 (6)	0,034 (19)
$\gamma_{38,14}$(Po)	699,82 (18)	0,016 (5)					
$\gamma_{18,5}$(Po)	703,11 (4)	0,504 (12)	[M1]	0,0424 (6)	0,00724 (11)	0,001702 (24)	0,0519 (8)
$\gamma_{28,10}$(Po)	704,9 (3)	0,051 (10)	[E1]	0,00429 (6)	0,000684 (10)	0,0001593 (23)	0,00519 (8)

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{41,15}$(Po)	708,8 (3)	0,0119 (20)					
$\gamma_{17,4}$(Po)	710,73 (10)	0,076 (4)					
$\gamma_{14,3}$(Po)	719,869 (37)	0,399 (10)	E2	0,01075 (15)	0,00264 (4)	0,000646 (9)	0,01424 (20)
$\gamma_{23,6}$(Po)	722,98 (12)	0,037 (7)					
$\gamma_{42,14}$(Po)	733,80 (15)	0,038 (3)					
$\gamma_{18,4}$(Po)	740,73 (18)	0,0440 (23)	[M1,E2]	0,024 (14)	0,0044 (20)	0,0010 (5)	0,029 (16)
$\gamma_{29,9}$(Po)	752,84 (3)	0,130 (8)	[M1,E2]	0,023 (13)	0,0042 (19)	0,0010 (5)	0,028 (16)
$\gamma_{4,1}$(Po)	768,359 (14)	4,969 (19)	M1 + E2	0,0122 (18)	0,0026 (3)	0,00063 (6)	0,0157 (21)
$\gamma_{28,7}$(Po)	786,1 (4)	0,31 (5)	[E1]	0,00350 (5)	0,000553 (8)	0,0001285 (18)	0,00422 (6)
$\gamma_{21,5}$(Po)	788,6 (5)	0,016 (5)	[M1]	0,0315 (5)	0,00536 (8)	0,001258 (18)	0,0385 (6)
$\gamma_{5,1}$(Po)	806,173 (20)	1,276 (6)	E2	0,00867 (13)	0,00197 (3)	0,000480 (7)	0,01127 (16)
$\gamma_{20,4}$(Po)	814,885 (10)	0,0399 (31)	[M1,E2]	0,019 (11)	0,0034 (15)	0,0008 (4)	0,023 (13)
$\gamma_{29,7}$(Po)	821,18 (3)	0,172 (10)	M1	0,0283 (4)	0,00482 (7)	0,001131 (16)	0,0346 (5)
$\gamma_{21,4}$(Po)	826,46 (20)	0,133 (11)	M1	0,0279 (4)	0,00474 (7)	0,001113 (16)	0,0341 (5)
$\gamma_{12,2}$(Po)	832,38 (11)	0,0354 (20)	[E2]	0,00816 (12)	0,00182 (4)	0,000442 (7)	0,01057 (15)
$\gamma_{38,12}$(Po)	847,16 (11)	0,016 (6)					
$\gamma_{19,3}$(Po)	873,02 (19)	0,019 (3)					
$\gamma_{24,5}$(Po)	878,03 (12)	0,0120 (28)	[M1,E2]	0,016 (9)	0,0028 (13)	0,0007 (3)	0,019 (10)
$\gamma_{28,6}$(Po)	904,29 (10)	0,066 (8)	[E1]	0,00271 (4)	0,000423 (6)	0,0000983 (14)	0,00326 (5)
$\gamma_{24,4}$(Po)	915,74 (15)	0,023 (5)	[M1,E2]	0,014 (8)	0,0025 (11)	0,0006 (3)	0,017 (9)
$\gamma_{20,3}$(Po)	917,8 (3)	0,005 (3)	[E1]	0,00263 (4)	0,000411 (6)	0,0000956 (14)	0,00317 (5)
$\gamma_{38,11}$(Po)	930,2 (2)	0,043 (8)					
$\gamma_{6,1}$(Po)	934,059 (16)	3,173 (11)	M1 + E2	0,0192 (8)	0,00327 (13)	0,00077 (3)	0,0234 (10)
$\gamma_{29,6}$(Po)	939,6 (5)	0,016 (4)	[M1,E2]	0,013 (7)	0,0024 (11)	0,00056 (24)	0,016 (8)
$\gamma_{35,7}$(Po)	943,34 (12)	0,017 (3)					
$\gamma_{37,8}$(Po)	949,8 (5)	0,0055 (23)					
$\gamma_{38,10}$(Po)	952,2 (8)	0,0059 (23)					
$\gamma_{30,6}$(Po)	961,61 (17)	0,0101 (14)					
$\gamma_{42,11}$(Po)	964,08 (3)	0,363 (12)					
$\gamma_{41,10}$(Po)	976,18 (12)	0,0151 (21)					
$\gamma_{23,3}$(Po)	991,49 (19)	0,011 (3)	[M1,E2]	0,012 (6)	0,0021 (9)	0,00049 (21)	0,014 (7)
$\gamma_{48,12}$(Po)	1013,8 (2)	0,0087 (19)					
$\gamma_{44,11}$(Po)	1021,0 (5)	0,016 (3)					
$\gamma_{28,5}$(Po)	1032,37 (8)	0,061 (4)	[E1]	0,00213 (3)	0,000331 (5)	0,0000768 (11)	0,00257 (4)
$\gamma_{39,7}$(Po)	1038,0 (3)	0,0086 (15)					
$\gamma_{27,4}$(Po)	1045,6 (2)	0,023 (3)					
$\gamma_{7,1}$(Po)	1051,964 (31)	0,328 (8)	[M1,E2]	0,010 (5)	0,0018 (8)	0,00042 (17)	0,012 (6)
$\gamma_{42,7}$(Po)	1067,2 (3)	0,024 (7)					
$\gamma_{28,4}$(Po)	1069,96 (8)	0,272 (10)	[E1]	0,00200 (3)	0,000310 (5)	0,0000719 (10)	0,00241 (4)
$\gamma_{8,1}$(Po)	1103,61 (20)	0,107 (15)	[M1,E2]	0,009 (5)	0,0016 (7)	0,00037 (15)	0,011 (5)
$\gamma_{29,4}$(Po)	1104,79 (19)	0,074 (14)	[M1,E2]	0,009 (5)	0,0016 (7)	0,00037 (15)	0,011 (5)
$\gamma_{37,6}$(Po)	1118,9 (5)	0,010 (4)					
$\gamma_{9,1}$(Po)	1120,295 (15)	15,14 (3)	M1 + E2	0,01246 (19)	0,00210 (3)	0,000494 (8)	0,01522 (23)
$\gamma_{31,4}$(Po)	1130,29 (19)	0,036 (3)					
$\gamma_{10,1}$(Po)	1133,664 (31)	0,255 (8)	[E2]	0,00462 (7)	0,000888 (13)	0,000212 (3)	0,00578 (8)
$\gamma_{11,1}$(Po)	1155,182 (16)	1,657 (7)	M1+E2	0,0110 (3)	0,00187 (5)	0,000438 (11)	0,0135 (4)
$\gamma_{32,4}$(Po)	1167,3 (2)	0,0123 (17)					
$\gamma_{28,3}$(Po)	1172,98 (10)	0,055 (7)	[E2]	0,00434 (6)	0,000824 (12)	0,000196 (3)	0,00542 (8)
$\gamma_{29,3}$(Po)	1207,70 (3)	0,455 (12)	[E1]	0,001622 (23)	0,000249 (4)	0,0000577 (8)	0,00196 (3)
$\gamma_{(-1,4)}$(Po)	1226,7 (3)	0,018 (8)					
$\gamma_{30,3}$(Po)	1230,6 (4)	0,007 (5)					
$\gamma_{12,1}$(Po)	1238,115 (12)	5,901 (14)	M1 + E2	0,00983 (14)	0,001651 (24)	0,000387 (6)	0,01200 (17)
$\gamma_{13,1}$(Po)	1280,97 (2)	1,451 (6)	M1	0,00901 (13)	0,001513 (22)	0,000355 (5)	0,01101 (16)
$\gamma_{37,4}$(Po)	1284 (1)	0,013 (6)					
$\gamma_{41,5}$(Po)	1303,76 (8)	0,105 (5)					
$\gamma_{38,4}$(Po)	1316,96 (15)	0,077 (7)					
$\gamma_{35,3}$(Po)	1330,0 (2)	0,0120 (14)					
$\gamma_{41,4}$(Po)	1341,49 (16)	0,0214 (27)					
$\gamma_{42,4}$(Po)	1351 (1)	0,0042 (11)					

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{65,7}$(Po)	1353,4 (8)	0,0036 (9)					
$\gamma_{4,0}$(Po)	1377,675 (12)	3,984 (11)	E2	0,00324 (5)	0,000585 (9)	0,0001385 (20)	0,00404 (6)
$\gamma_{14,1}$(Po)	1385,314 (31)	0,796 (5)	[E1]	0,001281 (18)	0,000196 (3)	0,0000453 (7)	0,001631 (23)
$\gamma_{43,4}$(Po)	1392,5 (4)	0,0087 (19)					
$\gamma_{15,1}$(Po)	1401,494 (41)	1,337 (7)	(M1 + E2)	0,0043 (7)	0,00074 (11)	0,00017 (3)	0,0053 (9)
$\gamma_{16,1}$(Po)	1407,98 (4)	2,398 (8)	(E2)	0,00312 (5)	0,000559 (8)	0,0001323 (19)	0,00389 (6)
$\gamma_{38,3}$(Po)	1419,7 (3)	0,0055 (10)					
$\gamma_{65,6}$(Po)	1470,9 (3)	0,0094 (13)					
$\gamma_{17,1}$(Po)	1479,15 (14)	0,051 (4)					
$\gamma_{18,1}$(Po)	1509,236 (15)	2,144 (10)	M1+E2	0,00591 (9)	0,000988 (14)	0,000232 (4)	0,00732 (11)
$\gamma_{51,4}$(Po)	1515,5 (3)	0,0072 (21)					
$\gamma_{19,1}$(Po)	1538,46 (6)	0,401 (22)					
$\gamma_{6,0}$(Po)	1543,375 (14)	0,303 (13)	[E2]	0,00265 (4)	0,000463 (7)	0,0001093 (16)	0,00333 (5)
$\gamma_{20,1}$(Po)	1583,244 (40)	0,712 (5)	M1 +E2	0,00513 (14)	0,000858 (23)	0,000201 (6)	0,00642 (18)
$\gamma_{21,1}$(Po)	1594,81 (8)	0,276 (15)	[M1]	0,00514 (8)	0,000859 (12)	0,000201 (3)	0,00644 (9)
$\gamma_{22,1}$(Po)	1599,31 (6)	0,322 (15)					
$\gamma_{65,4}$(Po)	1636,3 (2)	0,0111 (16)					
$\gamma_{23,1}$(Po)	1657,00 (19)	0,047 (5)					
$\gamma_{7,0}$(Po)	1661,28 (6)	1,051 (9)	E2	0,00232 (4)	0,000399 (6)	0,0000940 (14)	0,00296 (5)
$\gamma_{57,3}$(Po)	1665,8 (2)	0,015 (6)					
$\gamma_{24,1}$(Po)	1683,99 (4)	0,217 (3)					
$\gamma_{61,3}$(Po)	1711,0 (8)	0,023 (5)					
$\gamma_{9,0}$(Po)	1729,611 (13)	2,852 (10)	E2	0,00216 (3)	0,000368 (6)	0,0000866 (13)	0,00278 (4)
$\gamma_{26,1}$(Po)	1751,4 (8)	0,0009 (5)					
$\gamma_{11,0}$(Po)	1764,498 (14)	15,39 (5)	M1	0,00397 (6)	0,000661 (10)	0,0001548 (22)	0,00511 (8)
$\gamma_{27,1}$(Po)	1813,73 (14)	0,0108 (9)					
$\gamma_{28,1}$(Po)	1838,36 (5)	0,343 (10)					
$\gamma_{12,0}$(Po)	1847,431 (25)	2,025 (12)					
$\gamma_{29,1}$(Po)	1873,16 (6)	0,212 (8)					
$\gamma_{13,0}$(Po)	1890,29 (15)	0,078 (4)					
$\gamma_{30,1}$(Po)	1895,92 (14)	0,146 (8)					
$\gamma_{31,1}$(Po)	1898,7 (4)	0,049 (8)					
$\gamma_{32,1}$(Po)	1935,6 (2)	0,032 (7)					
$\gamma_{35,1}$(Po)	1994,6 (6)	0,0024 (5)					
$\gamma_{15,0}$(Po)	2010,81 (12)	0,0434 (17)					
$\gamma_{36,1}$(Po)	2021,6 (2)	0,0214 (21)					
$\gamma_{37,1}$(Po)	2052,95 (12)	0,069 (4)					
$\gamma_{38,1}$(Po)	2085,1 (2)	0,0082 (5)					
$\gamma_{40,1}$(Po)	2089,7 (2)	0,0443 (22)					
$\gamma_{41,1}$(Po)	2109,94 (12)	0,084 (3)					
$\gamma_{18,0}$(Po)	2118,552 (30)	1,162 (5)	M1	0,00248 (4)	0,000412 (6)	0,0000964 (14)	0,00356 (5)
$\gamma_{19,0}$(Po)	2147,9 (2)	0,0134 (13)					
$\gamma_{43,1}$(Po)	2160,4 (3)	0,007 (5)					
$\gamma_{44,1}$(Po)	2176,5 (2)	0,0033 (6)					
$\gamma_{20,0}$(Po)	2192,56 (16)	0,038 (3)					
$\gamma_{21,0}$(Po)	2204,21 (4)	4,929 (23)	M1	0,00224 (4)	0,000372 (6)	0,0000870 (13)	0,00333 (5)
$\gamma_{48,1}$(Po)	2251,6 (2)	0,0055 (5)					
$\gamma_{49,1}$(Po)	2260,3 (2)	0,0087 (4)					
$\gamma_{23,0}$(Po)	2266,52 (19)	0,0165 (8)					
$\gamma_{50,1}$(Po)	2270,9 (4)	0,0014 (3)					
$\gamma_{51,1}$(Po)	2284,3 (2)	0,0050 (4)					
$\gamma_{52,1}$(Po)	2287,65 (23)	0,0046 (5)					
$\gamma_{24,0}$(Po)	2293,40 (12)	0,306 (4)					
$\gamma_{53,1}$(Po)	2310,2 (3)	0,0014 (9)					
$\gamma_{54,1}$(Po)	2312,4 (2)	0,0086 (8)					
$\gamma_{55,1}$(Po)	2319,3 (3)	0,0014 (9)					
$\gamma_{56,1}$(Po)	2325,0 (3)	0,0017 (3)					
$\gamma_{57,1}$(Po)	2331,3 (2)	0,026 (4)					
$\gamma_{25,0}$(Po)	2348,3 (13)	0,0014 (9)					

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{58,1}$(Po)	2353,5 (7)	0,00036 (14)					
$\gamma_{26,0}$(Po)	2361,00 (19)	0,0021 (6)					
$\gamma_{60,1}$(Po)	2369,0 (4)	0,0028 (4)					
$\gamma_{61,1}$(Po)	2376,9 (2)	0,0086 (8)					
$\gamma_{62,1}$(Po)	2390,8 (2)	0,00156 (14)					
$\gamma_{65,1}$(Po)	2405,1 (5)	0,0011 (7)					
$\gamma_{27,0}$(Po)	2423,27 (13)	0,0048 (6)					
$\gamma_{69,1}$(Po)	2444,7 (8)	0,008 (4)					
$\gamma_{28,0}$(Po)	2447,86 (10)	1,550 (7)	E1	0,000503 (7)	0,0000751 (11)	0,00001735 (25)	0,001424 (20)
$\gamma_{70,1}$(Po)	2459,0 (8)	0,00141 (23)					
$\gamma_{29,0}$(Po)	2482,8 (4)	0,00096 (18)					
$\gamma_{30,0}$(Po)	2505,4 (2)	0,0056 (6)					
$\gamma_{77,1}$(Po)	2550,7 (7)	0,00032 (9)					
$\gamma_{34,0}$(Po)	2562,0 (6)	0,00018 (9)					
$\gamma_{79,1}$(Po)	2564,0 (6)	0,00014 (9)					
$\gamma_{35,0}$(Po)	2604,6 (5)	0,00036 (9)					
$\gamma_{36,0}$(Po)	2630,9 (3)	0,00086 (23)					
$\gamma_{37,0}$(Po)	2662,5 (10)	0,000200 (41)					
$\gamma_{38,0}$(Po)	2694,8 (2)	0,033 (3)					
$\gamma_{40,0}$(Po)	2699,4 (3)	0,00282 (23)					
$\gamma_{41,0}$(Po)	2719,3 (2)	0,00170 (17)					
$\gamma_{43,0}$(Po)	2769,9 (2)	0,0225 (8)					
$\gamma_{44,0}$(Po)	2785,9 (2)	0,0055 (5)					
$\gamma_{47,0}$(Po)	2827,0 (2)	0,00218 (17)					
$\gamma_{48,0}$(Po)	2861,1 (4)	0,00041 (13)					
$\gamma_{50,0}$(Po)	2880,3 (2)	0,0101 (16)					
$\gamma_{51,0}$(Po)	2893,6 (2)	0,0057 (5)					
$\gamma_{54,0}$(Po)	2921,9 (2)	0,0134 (5)					
$\gamma_{55,0}$(Po)	2928,6 (3)	0,00109 (9)					
$\gamma_{56,0}$(Po)	2934,6 (3)	0,00046 (12)					
$\gamma_{60,0}$(Po)	2978,9 (2)	0,0137 (4)					
$\gamma_{62,0}$(Po)	3000,0 (2)	0,0089 (7)					
$\gamma_{69,0}$(Po)	3053,9 (2)	0,022 (3)					
$\gamma_{72,0}$(Po)	3081,7 (3)	0,0052 (7)					
$\gamma_{73,0}$(Po)	3094,0 (4)	0,00037 (4)					
$\gamma_{75,0}$(Po)	3142,6 (4)	0,00118 (9)					
$\gamma_{76,0}$(Po)	3149,0 (5)	0,00019					
$\gamma_{77,0}$(Po)	3160,6 (6)	0,00047 (8)					
$\gamma_{80,0}$(Po)	3183,6 (4)	0,0011 (5)					

3 Atomic Data

3.1 Po

ω_K	:	0,97	(2)
$\bar{\omega}_L$	:	0,43	(4)
$\bar{\omega}_M$	:	0,0328	
n_{KL}	:	0,805	(40)
$\bar{n}_{LM}$	:	1,267	

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	76,8641		59,7
	$K\alpha_1$	79,2912		100
	$K\beta_3$	89,2579	}	
	$K\beta_1$	89,8098	}	
	$K\beta_5''$	90,3073	}	34,4
	$K\beta_5'$	90,4215	}	
	$K\beta_2$	92,32	}	
	$K\beta_4$	92,6199	}	10,8
	$KO_{2,3}$	92,983	}	
X_L				
	$L\ell$	9,66		
	$L\alpha$	11,016 – 11,13		
	$L\eta$	12,085		
	$L\beta$	12,824 – 14,248		
	$L\gamma$	15,251 – 16,21		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	58,97 – 65,20	100
KLX	71,93 – 76,60	56,5
KXY	84,72 – 93,04	9,27
Auger L	5,4 – 16,8	

3.2 Pb

ω_K	:	0,968	(13)
$\bar{\omega}_L$	:	0,40	(4)
n_{KL}	:	0,806	(40)

4 α Emissions

	Energy keV	Probability × 100
$\alpha_{0,5}$	4941 (3)	0,000052 (3)
$\alpha_{0,4}$	5023 (3)	0,000045 (3)
$\alpha_{0,3}$	5184 (3)	0,00013 (1)
$\alpha_{0,2}$	5273 (9)	0,00125 (7)
$\alpha_{0,1}$	5452 (3)	0,0116 (7)
$\alpha_{0,0}$	5516 (3)	0,0082 (5)
$^*\alpha_{1,0}$	8287 (6)	0,00012
$^*\alpha_{6,1}$	8430 (6)	0,00006
$^*\alpha_{2,0}$	8950 (6)	0,00002
$^*\alpha_{4,0}$	9080 (6)	0,0022
$^*\alpha_{6,0}$	9320 (6)	0,00005
$^*\alpha_{7,0}$	9378 (8)	0,00002
$^*\alpha_{10,0}$	9500 (6)	0,0001
$^*\alpha_{14,0}$	9670 (8)	0,00004
$^*\alpha_{17,0}$	9802 (6)	0,00012
$^*\alpha_{21,0}$	9907 (6)	0,00007
$^*\alpha_{24,0}$	10082 (6)	0,00014
$^*\alpha_{26,0}$	10150 (8)	0,00002
$^*\alpha_{32,0}$	10332 (6)	0,00008
$^*\alpha_{38,0}$	10505 (10)	0,00002

* α of long range.

5 Electron Emissions

		Energy keV			Electrons per 100 disint.
e_{AL}	(Po)	5,4	- 16,8		0,934 (16)
e_{AK}	(Po)				0,053 (7)
	KLL	58,97	- 65,20	}	
	KLX	71,93	- 76,60	}	
	KXY	84,72	- 93,04	}	
$ec_{18,9\ K}$	(Po)	295,84	(5)		0,0800 (16)
$ec_{1,0\ K}$	(Po)	516,216	(7)		0,676 (10)
$ec_{1,0\ L}$	(Po)	592,388	- 595,510		0,1892 (28)
$ec_{4,1\ K}$	(Po)	675,259	(14)		0,060 (9)
$ec_{6,1\ K}$	(Po)	840,959	(16)		0,0595 (25)
$ec_{9,1\ K}$	(Po)	1027,195	(15)		0,1858 (29)
$ec_{12,1\ K}$	(Po)	1145,015	(12)		0,0573 (8)
$ec_{11,0\ K}$	(Po)	1671,398	(14)		0,0608 (9)
$\beta^-_{0,80}$	max:	86	(11)		0,0011 (5)
$\beta^-_{0,80}$	avg:	23	(3)		
$\beta^-_{0,79}$	max:	97	(11)		0,00014 (9)
$\beta^-_{0,79}$	avg:	26	(3)		
$\beta^-_{0,77}$	max:	110	(11)		0,00079 (12)
$\beta^-_{0,77}$	avg:	29	(3)		
$\beta^-_{0,76}$	max:	121	(11)		0,00019
$\beta^-_{0,76}$	avg:	32	(3)		
$\beta^-_{0,75}$	max:	127	(11)		0,00118 (9)
$\beta^-_{0,75}$	avg:	34	(3)		
$\beta^-_{0,73}$	max:	176	(11)		0,00037 (4)
$\beta^-_{0,73}$	avg:	48	(3)		
$\beta^-_{0,72}$	max:	188	(11)		0,0052 (7)
$\beta^-_{0,72}$	avg:	51	(3)		
$\beta^-_{0,70}$	max:	202	(11)		0,00141 (23)
$\beta^-_{0,70}$	avg:	55	(3)		
$\beta^-_{0,69}$	max:	216	(11)		0,030 (5)
$\beta^-_{0,69}$	avg:	59	(3)		
$\beta^-_{0,65}$	max:	256	(11)		0,0252 (24)
$\beta^-_{0,65}$	avg:	71	(3)		
$\beta^-_{0,62}$	max:	270	(11)		0,0160 (16)
$\beta^-_{0,62}$	avg:	75	(3)		
$\beta^-_{0,61}$	max:	284	(11)		0,032 (5)
$\beta^-_{0,61}$	avg:	80	(3)		
$\beta^-_{0,60}$	max:	291	(11)		0,0165 (6)
$\beta^-_{0,60}$	avg:	82	(3)		

		Energy keV		Electrons per 100 disint.
$\beta^-_{0,58}$	max:	307	(11)	0,00036 (14)
$\beta^-_{0,58}$	avg:	87	(3)	
$\beta^-_{0,57}$	max:	329	(11)	0,041 (7)
$\beta^-_{0,57}$	avg:	93	(3)	
$\beta^-_{0,56}$	max:	336	(11)	0,00216 (32)
$\beta^-_{0,56}$	avg:	95	(3)	
$\beta^-_{0,55}$	max:	341	(11)	0,0025 (9)
$\beta^-_{0,55}$	avg:	97	(3)	
$\beta^-_{0,54}$	max:	348	(11)	0,0220 (9)
$\beta^-_{0,54}$	avg:	99	(3)	
$\beta^-_{0,53}$	max:	350	(11)	0,0014 (9)
$\beta^-_{0,53}$	avg:	100	(3)	
$\beta^-_{0,52}$	max:	373	(11)	0,0046 (5)
$\beta^-_{0,52}$	avg:	107	(3)	
$\beta^-_{0,51}$	max:	376	(11)	0,022 (3)
$\beta^-_{0,51}$	avg:	108	(3)	
$\beta^-_{0,50}$	max:	390	(11)	0,0115 (16)
$\beta^-_{0,50}$	avg:	113	(3)	
$\beta^-_{0,49}$	max:	400	(11)	0,0087 (4)
$\beta^-_{0,49}$	avg:	116	(3)	
$\beta^-_{0,48}$	max:	409	(11)	0,0146 (20)
$\beta^-_{0,48}$	avg:	119	(4)	
$\beta^-_{0,47}$	max:	443	(11)	0,00218 (17)
$\beta^-_{0,47}$	avg:	130	(4)	
$\beta^-_{0,44}$	max:	484	(11)	0,0248 (31)
$\beta^-_{0,44}$	avg:	143	(4)	
$\beta^-_{0,43}$	max:	500	(11)	0,038 (5)
$\beta^-_{0,43}$	avg:	149	(4)	
$\beta^-_{0,42}$	max:	541	(11)	0,525 (16)
$\beta^-_{0,42}$	avg:	162	(4)	
$\beta^-_{0,41}$	max:	551	(11)	0,247 (8)
$\beta^-_{0,41}$	avg:	166	(4)	
$\beta^-_{0,40}$	max:	571	(11)	0,0471 (23)
$\beta^-_{0,40}$	avg:	172	(4)	
$\beta^-_{0,39}$	max:	571	(11)	0,026 (4)
$\beta^-_{0,39}$	avg:	173	(4)	
$\beta^-_{0,38}$	max:	575	(11)	0,231 (15)
$\beta^-_{0,38}$	avg:	174	(4)	
$\beta^-_{0,37}$	max:	608	(11)	0,098 (9)
$\beta^-_{0,37}$	avg:	185	(4)	
$\beta^-_{0,36}$	max:	639	(11)	0,0223 (21)
$\beta^-_{0,36}$	avg:	196	(4)	

		Energy keV		Electrons per 100 disint.
$\beta^-_{0,35}$	max:	665	(11)	0,058 (4)
$\beta^-_{0,35}$	avg:	205	(4)	
$\beta^-_{0,34}$	max:	708	(11)	0,00018 (9)
$\beta^-_{0,34}$	avg:	220	(4)	
$\beta^-_{0,32}$	max:	725	(11)	0,044 (7)
$\beta^-_{0,32}$	avg:	226	(4)	
$\beta^-_{0,31}$	max:	762	(11)	0,092 (9)
$\beta^-_{0,31}$	avg:	240	(4)	
$\beta^-_{0,30}$	max:	765	(11)	0,169 (10)
$\beta^-_{0,30}$	avg:	241	(4)	
$\beta^-_{0,29}$	max:	788	(11)	1,227 (27)
$\beta^-_{0,29}$	avg:	249	(3)	
$\beta^-_{0,28}$	max:	822	(11)	2,76 (6)
$\beta^-_{0,28}$	avg:	262	(4)	
$\beta^-_{0,27}$	max:	847	(11)	0,0620 (49)
$\beta^-_{0,27}$	avg:	271	(4)	
$\beta^-_{0,26}$	max:	909	(11)	0,0030 (8)
$\beta^-_{0,26}$	avg:	294	(4)	
$\beta^-_{0,25}$	max:	922	(11)	0,0014 (9)
$\beta^-_{0,25}$	avg:	298	(4)	
$\beta^-_{0,24}$	max:	977	(11)	0,558 (8)
$\beta^-_{0,24}$	avg:	319	(4)	
$\beta^-_{0,23}$	max:	1004	(11)	0,187 (12)
$\beta^-_{0,23}$	avg:	329	(4)	
$\beta^-_{0,21}$	max:	1066	(11)	5,642 (43)
$\beta^-_{0,21}$	avg:	353	(4)	
$\beta^-_{0,20}$	max:	1077	(11)	0,851 (10)
$\beta^-_{0,20}$	avg:	357	(4)	
$\beta^-_{0,19}$	max:	1122	(11)	0,433 (22)
$\beta^-_{0,19}$	avg:	375	(4)	
$\beta^-_{0,18}$	max:	1151	(11)	4,339 (18)
$\beta^-_{0,18}$	avg:	386	(4)	
$\beta^-_{0,17}$	max:	1182	(11)	0,114 (6)
$\beta^-_{0,17}$	avg:	398	(4)	
$\beta^-_{0,16}$	max:	1253	(11)	2,449 (10)
$\beta^-_{0,16}$	avg:	425	(4)	
$\beta^-_{0,15}$	max:	1259	(11)	1,430 (9)
$\beta^-_{0,15}$	avg:	428	(4)	
$\beta^-_{0,14}$	max:	1275	(11)	1,171 (18)
$\beta^-_{0,14}$	avg:	434	(4)	
$\beta^-_{0,13}$	max:	1380	(11)	1,584 (10)
$\beta^-_{0,13}$	avg:	476	(4)	

		Energy keV		Electrons per 100 disint.
$\beta^-_{0,12}$	max:	1423	(11)	8,147 (28)
$\beta^-_{0,12}$	avg:	493	(4)	
$\beta^-_{0,11}$	max:	1506	(11)	17,10 (8)
$\beta^-_{0,11}$	avg:	526	(4)	
$\beta^-_{0,10}$	max:	1527	(11)	0,116 (16)
$\beta^-_{0,10}$	avg:	535	(4)	
$\beta^-_{0,9}$	max:	1540	(11)	17,494 (36)
$\beta^-_{0,9}$	avg:	540	(4)	
$\beta^-_{0,8}$	max:	1557	(11)	0,170 (16)
$\beta^-_{0,8}$	avg:	547	(4)	
$\beta^-_{0,7}$	max:	1609	(11)	0,65 (6)
$\beta^-_{0,7}$	avg:	568	(4)	
$\beta^-_{0,6}$	max:	1727	(11)	3,12 (4)
$\beta^-_{0,6}$	avg:	616	(5)	
$\beta^-_{0,5}$	max:	1855	(11)	0,396 (46)
$\beta^-_{0,5}$	avg:	669	(5)	
$\beta^-_{0,4}$	max:	1892	(11)	7,45 (5)
$\beta^-_{0,4}$	avg:	685	(5)	
$\beta^-_{0,1}$	max:	2661	(11)	0,62 (20)
$\beta^-_{0,1}$	avg:	1008	(5)	
$\beta^-_{0,0}$	max:	3270	(11)	19,67 (20)
$\beta^-_{0,0}$	avg:	1270	(5)	

6 Photon Emissions

6.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Po)	9,66 — 16,21		0,627 (15)	
$XK\alpha_2$	(Po)	76,8641		0,426 (13)	} $K\alpha$
$XK\alpha_1$	(Po)	79,2912		0,710 (22)	}
$XK\beta_3$	(Po)	89,2579	}		
$XK\beta_1$	(Po)	89,8098	}	0,244 (9)	$K'\beta_1$
$XK\beta_5''$	(Po)	90,3073	}		
$XK\beta_5'$	(Po)	90,4215	}		
$XK\beta_2$	(Po)	92,32	}		
$XK\beta_4$	(Po)	92,6199	}	0,0760 (29)	$K'\beta_2$
$XKO_{2,3}$	(Po)	92,983	}		

6.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Tl)	62,5 (10)	0,0116 (7)
$\gamma_{2,1}$(Tl)	191,1 (18)	0,00125 (7)
$\gamma_{11,6}$(Po)	221 (1)	0,059 (6)
$\gamma_{(-1,0)}$(Po)	230 (1)	0,0029 (10)
$\gamma_{16,11}$(Po)	252,80 (6)	0,0117 (18)
$\gamma_{6,3}$(Po)	268,8 (2)	0,0161 (18)
$\gamma_{29,22}$(Po)	273,80 (5)	0,120 (8)
$\gamma_{42,28}$(Po)	280,95 (5)	0,062 (6)
$\gamma_{(-1,1)}$(Po)	304,2 (2)	0,0255 (23)
$\gamma_{14,7}$(Po)	333,350 (42)	0,063 (4)
$\gamma_{(-1,2)}$(Po)	334,78 (8)	0,033 (5)
$\gamma_{11,5}$(Po)	348,92 (6)	0,123 (32)
$\gamma_{11,4}$(Po)	386,77 (5)	0,296 (5)
$\gamma_{18,9}$(Po)	388,88 (5)	0,394 (5)
$\gamma_{29,17}$(Po)	394,05 (8)	0,0127 (18)
$\gamma_{35,22}$(Po)	396,01 (8)	0,0259 (18)
$\gamma_{2,1}$(Po)	405,74 (3)	0,171 (7)
$\gamma_{28,14}$(Po)	452,92 (10)	0,031 (4)
$\gamma_{9,3}$(Po)	454,770 (12)	0,288 (5)
$\gamma_{21,10}$(Po)	461,0 (2)	0,058 (8)
$\gamma_{12,4}$(Po)	469,76 (7)	0,133 (15)
$\gamma_{21,9}$(Po)	474,41 (5)	0,092 (6)
$\gamma_{38,22}$(Po)	485,92 (11)	0,021 (4)

	Energy keV	Photons per 100 disint.
$\gamma_{29,14}$(Po)	487,95 (13)	0,028 (9)
$\gamma_{39,21}$(Po)	494,2 (4)	0,011 (3)
$\gamma_{31,15}$(Po)	496,90 (18)	0,0068 (18)
$\gamma_{23,11}$(Po)	501,96 (15)	0,0181 (22)
$\gamma_{42,22}$(Po)	519,90 (5)	0,0166 (17)
$\gamma_{42,21}$(Po)	524,6 (2)	0,0169 (17)
$\gamma_{6,2}$(Po)	528 (1)	0,0109 (13)
$\gamma_{23,9}$(Po)	536,77 (4)	0,061 (8)
$\gamma_{21,7}$(Po)	543,0 (2)	0,088 (21)
$\gamma_{22,7}$(Po)	547,6 (3)	0,034 (3)
$\gamma_{62,28}$(Po)	551,9 (8)	0,0055 (14)
$\gamma_{12,3}$(Po)	572,76 (7)	0,071 (8)
$\gamma_{15,5}$(Po)	595,23 (7)	0,0174 (15)
$\gamma_{41,18}$(Po)	600,0 (5)	0,008 (4)
$\gamma_{1,0}$(Po)	609,312 (7)	45,49 (19)
$\gamma_{13,3}$(Po)	615,73 (10)	0,055 (7)
$\gamma_{14,4}$(Po)	617,0 (2)	0,027 (5)
$\gamma_{51,23}$(Po)	626,4 (6)	0,0041 (14)
$\gamma_{(-1,3)}$(Po)	630,79 (7)	0,0166 (14)
$\gamma_{15,4}$(Po)	633,14 (10)	0,055 (3)
$\gamma_{29,12}$(Po)	634,72 (21)	0,0064 (23)
$\gamma_{16,4}$(Po)	639,67 (10)	0,034 (5)
$\gamma_{20,6}$(Po)	649,18 (7)	0,054 (7)
$\gamma_{27,11}$(Po)	658,7 (2)	0,017 (4)
$\gamma_{21,6}$(Po)	661,1 (2)	0,054 (4)
$\gamma_{3,1}$(Po)	665,453 (22)	1,530 (7)
$\gamma_{38,16}$(Po)	677,41 (15)	0,0055 (23)
$\gamma_{28,11}$(Po)	683,22 (6)	0,084 (6)
$\gamma_{39,15}$(Po)	687,6 (3)	0,0066 (14)
$\gamma_{27,9}$(Po)	693,3 (5)	0,0059 (15)
$\gamma_{8,2}$(Po)	697,90 (25)	0,067 (4)
$\gamma_{38,14}$(Po)	699,82 (18)	0,016 (5)
$\gamma_{18,5}$(Po)	703,11 (4)	0,479 (11)
$\gamma_{28,10}$(Po)	704,9 (3)	0,051 (10)
$\gamma_{41,15}$(Po)	708,8 (3)	0,0119 (20)
$\gamma_{17,4}$(Po)	710,67 (10)	0,076 (4)
$\gamma_{14,3}$(Po)	719,86 (3)	0,393 (10)
$\gamma_{23,6}$(Po)	722,98 (12)	0,037 (7)
$\gamma_{42,14}$(Po)	733,80 (15)	0,038 (3)
$\gamma_{18,4}$(Po)	740,73 (18)	0,0428 (21)
$\gamma_{29,9}$(Po)	752,84 (3)	0,126 (8)
$\gamma_{4,1}$(Po)	768,356 (10)	4,892 (16)
$\gamma_{28,7}$(Po)	786,1 (4)	0,31 (5)
$\gamma_{21,5}$(Po)	788,6 (5)	0,015 (5)
$\gamma_{5,1}$(Po)	806,174 (18)	1,262 (6)
$\gamma_{20,4}$(Po)	815,0 (1)	0,039 (3)
$\gamma_{29,7}$(Po)	821,18 (3)	0,166 (10)

	Energy keV	Photons per 100 disint.
$\gamma_{21,4}$(Po)	826,3 (2)	0,129 (11)
$\gamma_{12,2}$(Po)	832,39 (11)	0,035 (2)
$\gamma_{38,12}$(Po)	847,16 (11)	0,016 (6)
$\gamma_{19,3}$(Po)	873,07 (19)	0,019 (3)
$\gamma_{24,5}$(Po)	878,03 (12)	0,0118 (27)
$\gamma_{28,6}$(Po)	904,29 (10)	0,066 (8)
$\gamma_{24,4}$(Po)	915,74 (15)	0,023 (5)
$\gamma_{20,3}$(Po)	917,8 (3)	0,005 (3)
$\gamma_{38,11}$(Po)	930,2 (2)	0,043 (8)
$\gamma_{6,1}$(Po)	934,061 (12)	3,10 (1)
$\gamma_{29,6}$(Po)	939,6 (5)	0,016 (4)
$\gamma_{35,7}$(Po)	943,34 (12)	0,017 (3)
$\gamma_{37,8}$(Po)	949,8 (5)	0,0055 (23)
$\gamma_{38,10}$(Po)	952,2 (8)	0,0059 (23)
$\gamma_{30,6}$(Po)	961,61 (17)	0,0101 (14)
$\gamma_{42,11}$(Po)	964,08 (3)	0,363 (12)
$\gamma_{41,10}$(Po)	976,18 (12)	0,0151 (21)
$\gamma_{23,3}$(Po)	991,49 (19)	0,011 (3)
$\gamma_{48,12}$(Po)	1013,8 (2)	0,0087 (19)
$\gamma_{44,11}$(Po)	1021,0 (5)	0,016 (3)
$\gamma_{28,5}$(Po)	1032,37 (8)	0,061 (4)
$\gamma_{39,7}$(Po)	1038,0 (3)	0,0086 (15)
$\gamma_{27,4}$(Po)	1045,6 (2)	0,023 (3)
$\gamma_{7,1}$(Po)	1051,96 (3)	0,324 (8)
$\gamma_{42,7}$(Po)	1067,2 (3)	0,024 (7)
$\gamma_{28,4}$(Po)	1069,96 (8)	0,271 (10)
$\gamma_{8,1}$(Po)	1103,64 (19)	0,106 (15)
$\gamma_{29,4}$(Po)	1104,79 (19)	0,073 (14)
$\gamma_{37,6}$(Po)	1118,9 (5)	0,010 (4)
$\gamma_{9,1}$(Po)	1120,287 (10)	14,91 (3)
$\gamma_{31,4}$(Po)	1130,29 (19)	0,036 (3)
$\gamma_{10,1}$(Po)	1133,66 (3)	0,254 (8)
$\gamma_{11,1}$(Po)	1155,19 (2)	1,635 (7)
$\gamma_{32,4}$(Po)	1167,3 (2)	0,0123 (17)
$\gamma_{28,3}$(Po)	1172,98 (10)	0,055 (7)
$\gamma_{29,3}$(Po)	1207,68 (3)	0,454 (12)
$\gamma_{(-1,4)}$(Po)	1226,7 (3)	0,018 (8)
$\gamma_{30,3}$(Po)	1230,6 (4)	0,007 (5)
$\gamma_{12,1}$(Po)	1238,111 (12)	5,831 (14)
$\gamma_{13,1}$(Po)	1280,96 (2)	1,435 (6)
$\gamma_{37,4}$(Po)	1284 (1)	0,013 (6)
$\gamma_{41,5}$(Po)	1303,76 (8)	0,105 (5)
$\gamma_{38,4}$(Po)	1316,96 (15)	0,077 (7)
$\gamma_{35,3}$(Po)	1330,0 (2)	0,0120 (14)
$\gamma_{41,4}$(Po)	1341,49 (16)	0,0214 (27)
$\gamma_{42,4}$(Po)	1351 (1)	0,0042 (11)
$\gamma_{65,7}$(Po)	1353,4 (8)	0,0036 (9)

	Energy keV	Photons per 100 disint.
$\gamma_{4,0}$(Po)	1377,669 (12)	3,968 (11)
$\gamma_{14,1}$(Po)	1385,31 (3)	0,795 (5)
$\gamma_{43,4}$(Po)	1392,5 (4)	0,0087 (19)
$\gamma_{15,1}$(Po)	1401,50 (4)	1,330 (7)
$\gamma_{16,1}$(Po)	1407,98 (4)	2,389 (8)
$\gamma_{38,3}$(Po)	1419,7 (3)	0,0055 (10)
$\gamma_{65,6}$(Po)	1470,9 (3)	0,0094 (13)
$\gamma_{17,1}$(Po)	1479,15 (14)	0,051 (4)
$\gamma_{18,1}$(Po)	1509,228 (15)	2,128 (10)
$\gamma_{51,4}$(Po)	1515,5 (3)	0,0072 (21)
$\gamma_{19,1}$(Po)	1538,50 (6)	0,401 (22)
$\gamma_{6,0}$(Po)	1543,32 (6)	0,302 (13)
$\gamma_{20,1}$(Po)	1583,22 (4)	0,707 (5)
$\gamma_{21,1}$(Po)	1594,73 (8)	0,274 (15)
$\gamma_{22,1}$(Po)	1599,31 (6)	0,322 (15)
$\gamma_{65,4}$(Po)	1636,3 (2)	0,0111 (16)
$\gamma_{23,1}$(Po)	1657,00 (19)	0,047 (5)
$\gamma_{7,0}$(Po)	1661,28 (6)	1,048 (9)
$\gamma_{57,3}$(Po)	1665,8 (2)	0,015 (6)
$\gamma_{24,1}$(Po)	1683,99 (4)	0,217 (3)
$\gamma_{61,3}$(Po)	1711,0 (8)	0,023 (5)
$\gamma_{9,0}$(Po)	1729,595 (15)	2,844 (10)
$\gamma_{26,1}$(Po)	1751,4 (8)	0,0009 (5)
$\gamma_{11,0}$(Po)	1764,494 (14)	15,31 (5)
$\gamma_{27,1}$(Po)	1813,73 (14)	0,0108 (9)
$\gamma_{28,1}$(Po)	1838,36 (5)	0,343 (10)
$\gamma_{12,0}$(Po)	1847,420 (25)	2,025 (12)
$\gamma_{29,1}$(Po)	1873,16 (6)	0,212 (8)
$\gamma_{13,0}$(Po)	1890,30 (15)	0,078 (4)
$\gamma_{30,1}$(Po)	1895,92 (14)	0,146 (8)
$\gamma_{31,1}$(Po)	1898,7 (4)	0,049 (8)
$\gamma_{32,1}$(Po)	1935,5 (2)	0,032 (7)
$\gamma_{35,1}$(Po)	1994,6 (6)	0,0024 (5)
$\gamma_{15,0}$(Po)	2010,78 (12)	0,0434 (17)
$\gamma_{36,1}$(Po)	2021,6 (2)	0,0214 (21)
$\gamma_{37,1}$(Po)	2052,94 (12)	0,069 (4)
$\gamma_{38,1}$(Po)	2085,1 (2)	0,0082 (5)
$\gamma_{40,1}$(Po)	2089,7 (2)	0,0443 (22)
$\gamma_{41,1}$(Po)	2109,92 (12)	0,084 (3)
$\gamma_{18,0}$(Po)	2118,55 (3)	1,158 (5)
$\gamma_{19,0}$(Po)	2147,9 (2)	0,0134 (13)
$\gamma_{43,1}$(Po)	2160,4 (3)	0,007 (5)
$\gamma_{44,1}$(Po)	2176,5 (2)	0,0033 (6)
$\gamma_{20,0}$(Po)	2192,58 (16)	0,038 (3)
$\gamma_{21,0}$(Po)	2204,21 (4)	4,913 (23)
$\gamma_{48,1}$(Po)	2251,6 (2)	0,0055 (5)
$\gamma_{49,1}$(Po)	2260,3 (2)	0,0087 (4)

	Energy keV	Photons per 100 disint.
$\gamma_{23,0}$(Po)	2266,51 (13)	0,0165 (8)
$\gamma_{50,1}$(Po)	2270,9 (4)	0,0014 (3)
$\gamma_{51,1}$(Po)	2284,3 (2)	0,0050 (4)
$\gamma_{52,1}$(Po)	2287,65 (23)	0,0046 (5)
$\gamma_{24,0}$(Po)	2293,40 (12)	0,306 (4)
$\gamma_{53,1}$(Po)	2310,2 (3)	0,0014 (9)
$\gamma_{54,1}$(Po)	2312,4 (2)	0,0086 (8)
$\gamma_{55,1}$(Po)	2319,3 (3)	0,0014 (9)
$\gamma_{56,1}$(Po)	2325,0 (3)	0,0017 (3)
$\gamma_{57,1}$(Po)	2331,3 (2)	0,026 (4)
$\gamma_{25,0}$(Po)	2348,0 (13)	0,0014 (9)
$\gamma_{58,1}$(Po)	2353,5 (7)	0,00036 (14)
$\gamma_{26,0}$(Po)	2361,00 (19)	0,0021 (6)
$\gamma_{60,1}$(Po)	2369,0 (4)	0,0028 (4)
$\gamma_{61,1}$(Po)	2376,9 (2)	0,0086 (8)
$\gamma_{62,1}$(Po)	2390,8 (2)	0,00156 (14)
$\gamma_{65,1}$(Po)	2405,1 (5)	0,0011 (7)
$\gamma_{27,0}$(Po)	2423,27 (13)	0,0048 (6)
$\gamma_{69,1}$(Po)	2444,7 (8)	0,008 (4)
$\gamma_{28,0}$(Po)	2447,86 (10)	1,548 (7)
$\gamma_{70,1}$(Po)	2459,0 (8)	0,00141 (23)
$\gamma_{29,0}$(Po)	2482,8 (4)	0,00096 (18)
$\gamma_{30,0}$(Po)	2505,4 (2)	0,0056 (6)
$\gamma_{77,1}$(Po)	2550,7 (7)	0,00032 (9)
$\gamma_{34,0}$(Po)	2562,0 (6)	0,00018 (9)
$\gamma_{79,1}$(Po)	2564,0 (6)	0,00014 (9)
$\gamma_{35,0}$(Po)	2604,5 (5)	0,00036 (9)
$\gamma_{36,0}$(Po)	2630,9 (3)	0,00086 (23)
$\gamma_{37,0}$(Po)	2662,4 (10)	0,000200 (41)
$\gamma_{38,0}$(Po)	2694,7 (2)	0,033 (3)
$\gamma_{40,0}$(Po)	2699,4 (3)	0,00282 (23)
$\gamma_{41,0}$(Po)	2719,3 (2)	0,00170 (17)
$\gamma_{43,0}$(Po)	2769,9 (2)	0,0225 (8)
$\gamma_{44,0}$(Po)	2785,9 (2)	0,0055 (5)
$\gamma_{47,0}$(Po)	2826,98 (20)	0,00218 (17)
$\gamma_{48,0}$(Po)	2861,08 (40)	0,00041 (13)
$\gamma_{50,0}$(Po)	2880,3 (2)	0,0101 (16)
$\gamma_{51,0}$(Po)	2893,5 (2)	0,0057 (5)
$\gamma_{54,0}$(Po)	2921,9 (2)	0,0134 (5)
$\gamma_{55,0}$(Po)	2928,6 (3)	0,00109 (9)
$\gamma_{56,0}$(Po)	2934,6 (3)	0,00046 (12)
$\gamma_{60,0}$(Po)	2978,9 (2)	0,0137 (4)
$\gamma_{62,0}$(Po)	2999,98 (20)	0,0089 (7)
$\gamma_{69,0}$(Po)	3053,88 (20)	0,022 (3)
$\gamma_{72,0}$(Po)	3081,7 (3)	0,0052 (7)
$\gamma_{73,0}$(Po)	3093,98 (40)	0,00037 (4)
$\gamma_{75,0}$(Po)	3142,58 (40)	0,00118 (9)

	Energy keV	Photons per 100 disint.
$\gamma_{76,0}$(Po)	3149,0 (5)	0,00019
$\gamma_{77,0}$(Po)	3160,6 (6)	0,00047 (8)
$\gamma_{80,0}$(Po)	3183,57 (40)	0,0011 (5)

7 Main Production Modes

Ra – 226 decay chain
Possible impurities : Bi – 210

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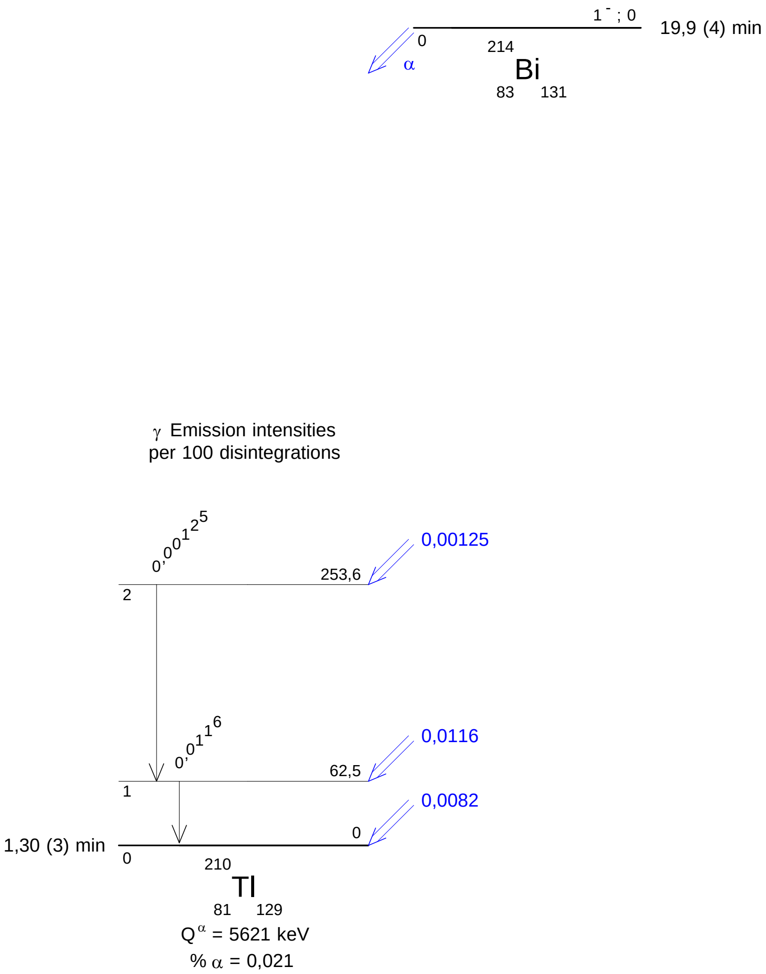
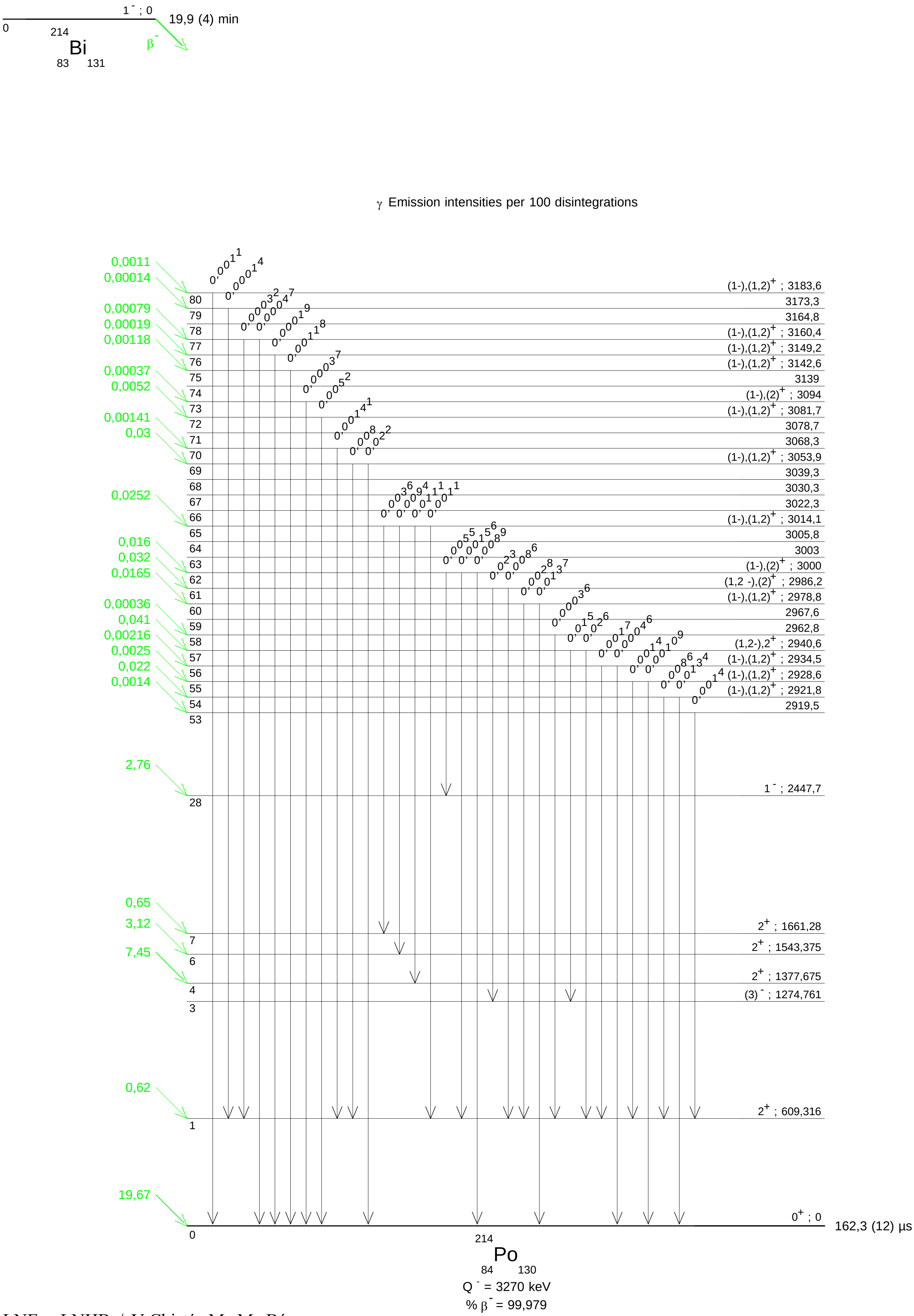
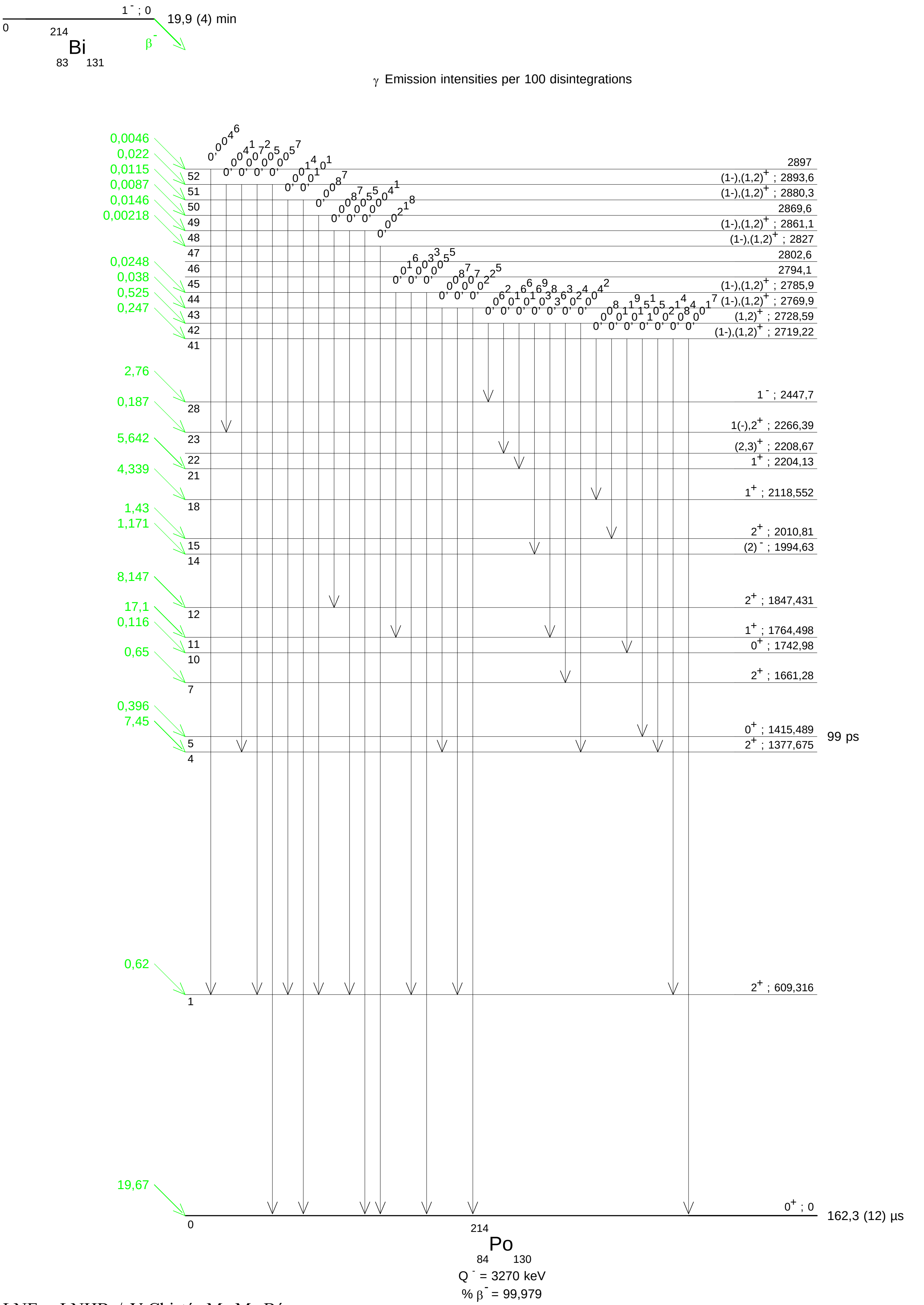
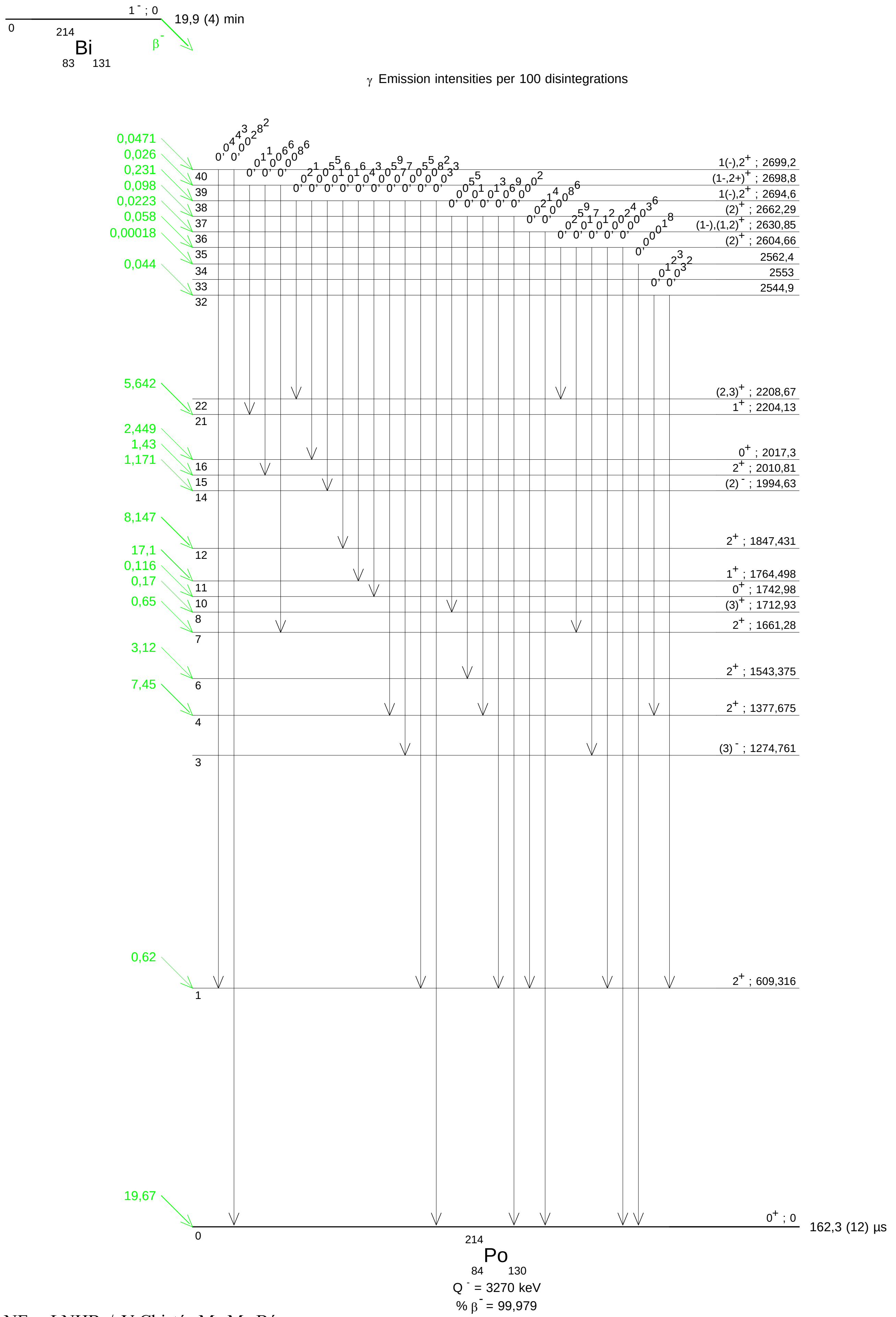
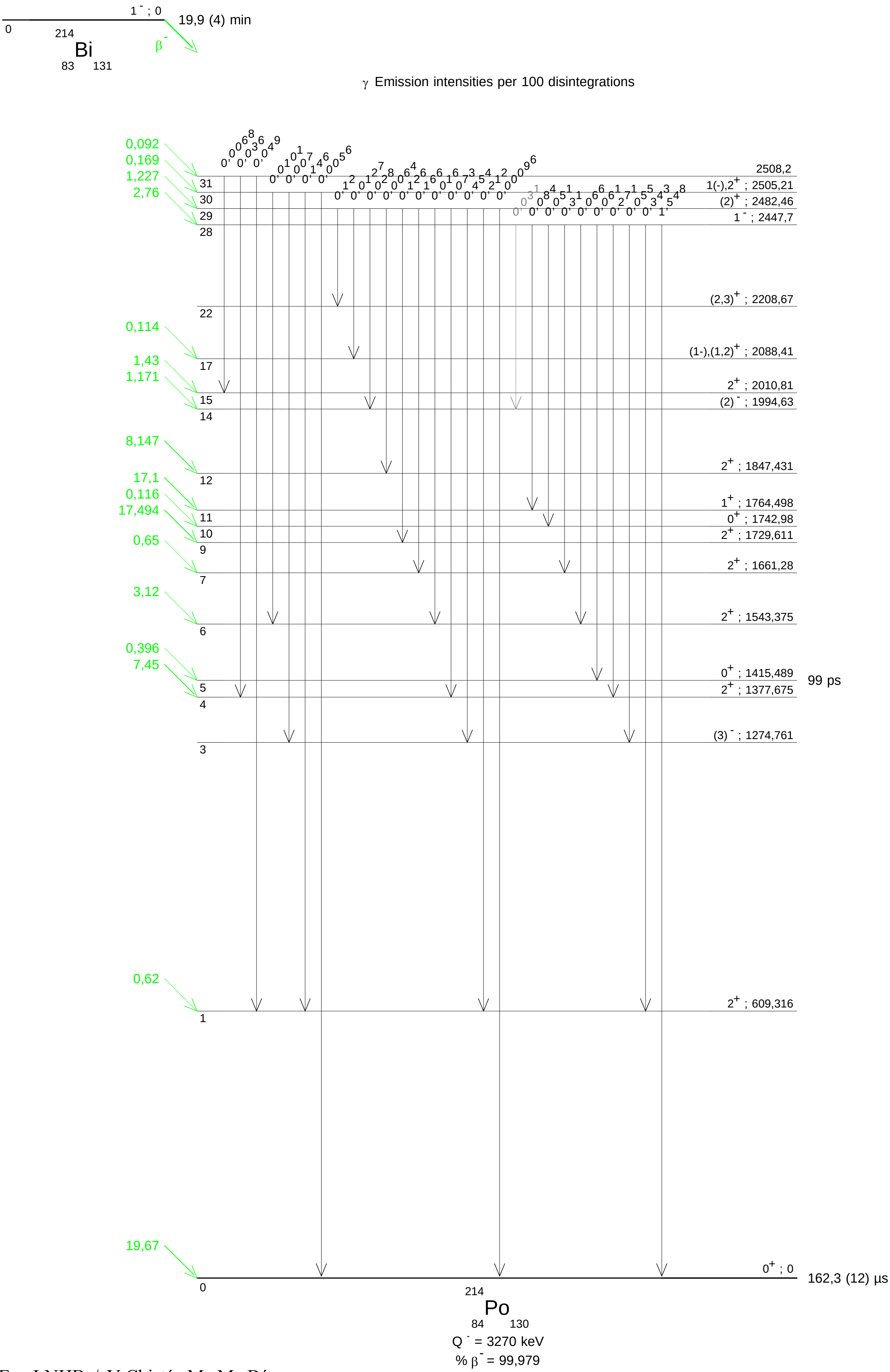

1⁻ ; 0
19,9 (4) min
0
α
214
Bi
83 131
γ Emission intensities
per 100 disintegrations
0,00125
0,00125
253,6
2
0,0116
0,0116
62,5
1
0,0082
1,30 (3) min
0
0
210
Tl
81 129
Qα = 5621 keV
% α = 0,021

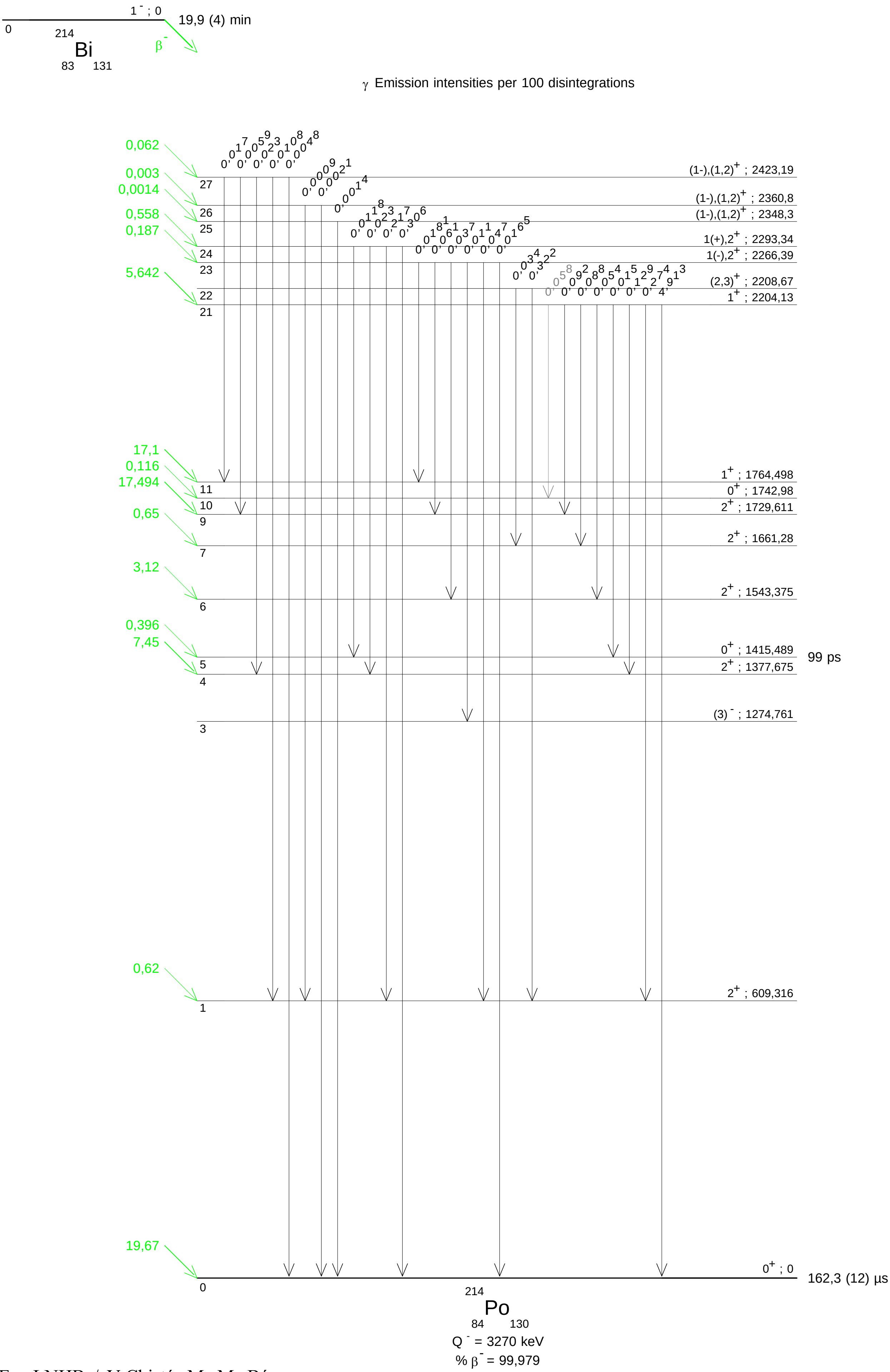

1 - ; 0
19,9 (4) min
0
214 Bi 83 131
β-
γ Emission intensities per 100 disintegrations
(1-),(1,2)+ ; 3183,6
3173,3
3164,8
(1-),(1,2)+ ; 3160,4
(1-),(1,2)+ ; 3149,2
(1-),(1,2)+ ; 3142,6
3139
(1-),(2)+ ; 3094
(1-),(1,2)+ ; 3081,7
3078,7
3068,3
(1-),(1,2)+ ; 3053,9
3039,3
3030,3
3022,3
(1-),(1,2)+ ; 3014,1
3005,8
3003
(1-),(2)+ ; 3000
(1,2 -),(2)+ ; 2986,2
(1-),(1,2)+ ; 2978,8
2967,6
2962,8
(1,2-),2+ ; 2940,6
(1-),(1,2)+ ; 2934,5
(1-),(1,2)+ ; 2928,6
(1-),(1,2)+ ; 2921,8
2919,5
1 - ; 2447,7
2+ ; 1661,28
2+ ; 1543,375
2+ ; 1377,675
(3) - ; 1274,761
2+ ; 609,316
0+ ; 0
162,3 (12) µs
0,0011
0,00014
0,00079
0,00019
0,00118
0,00037
0,0052
0,00141
0,03
0,0252
0,016
0,032
0,0165
0,00036
0,041
0,00216
0,0025
0,022
0,0014
2,76
0,65
3,12
7,45
0,62
19,67
214 Po 84 130
Q - = 3270 keV
% β- = 99,979


1 - ; 0
0
214
Bi
83 131
β-
19,9 (4) min
γ Emission intensities per 100 disintegrations
0,0046
0,022
0,0115
0,0087
0,0146
0,00218
0,0248
0,038
0,525
0,247
2,76
0,187
5,642
4,339
1,43
1,171
8,147
17,1
0,116
0,65
0,396
7,45
0,62
19,67
52
51
50
49
48
47
46
45
44
43
42
41
28
23
22
21
18
15
14
12
11
10
7
5
4
1
0
2897
(1-),(1,2)+ ; 2893,6
(1-),(1,2)+ ; 2880,3
2869,6
(1-),(1,2)+ ; 2861,1
(1-),(1,2)+ ; 2827
2802,6
2794,1
(1-),(1,2)+ ; 2785,9
(1-),(1,2)+ ; 2769,9
(1,2)+ ; 2728,59
(1-),(1,2)+ ; 2719,22
1 - ; 2447,7
1(-),2+ ; 2266,39
(2,3)+ ; 2208,67
1+ ; 2204,13
1+ ; 2118,552
2+ ; 2010,81
(2) - ; 1994,63
2+ ; 1847,431
1+ ; 1764,498
0+ ; 1742,98
2+ ; 1661,28
0+ ; 1415,489
2+ ; 1377,675
99 ps
2+ ; 609,316
0+ ; 0
162,3 (12) µs
214
Po
84 130
Q - = 3270 keV
% β- = 99,979

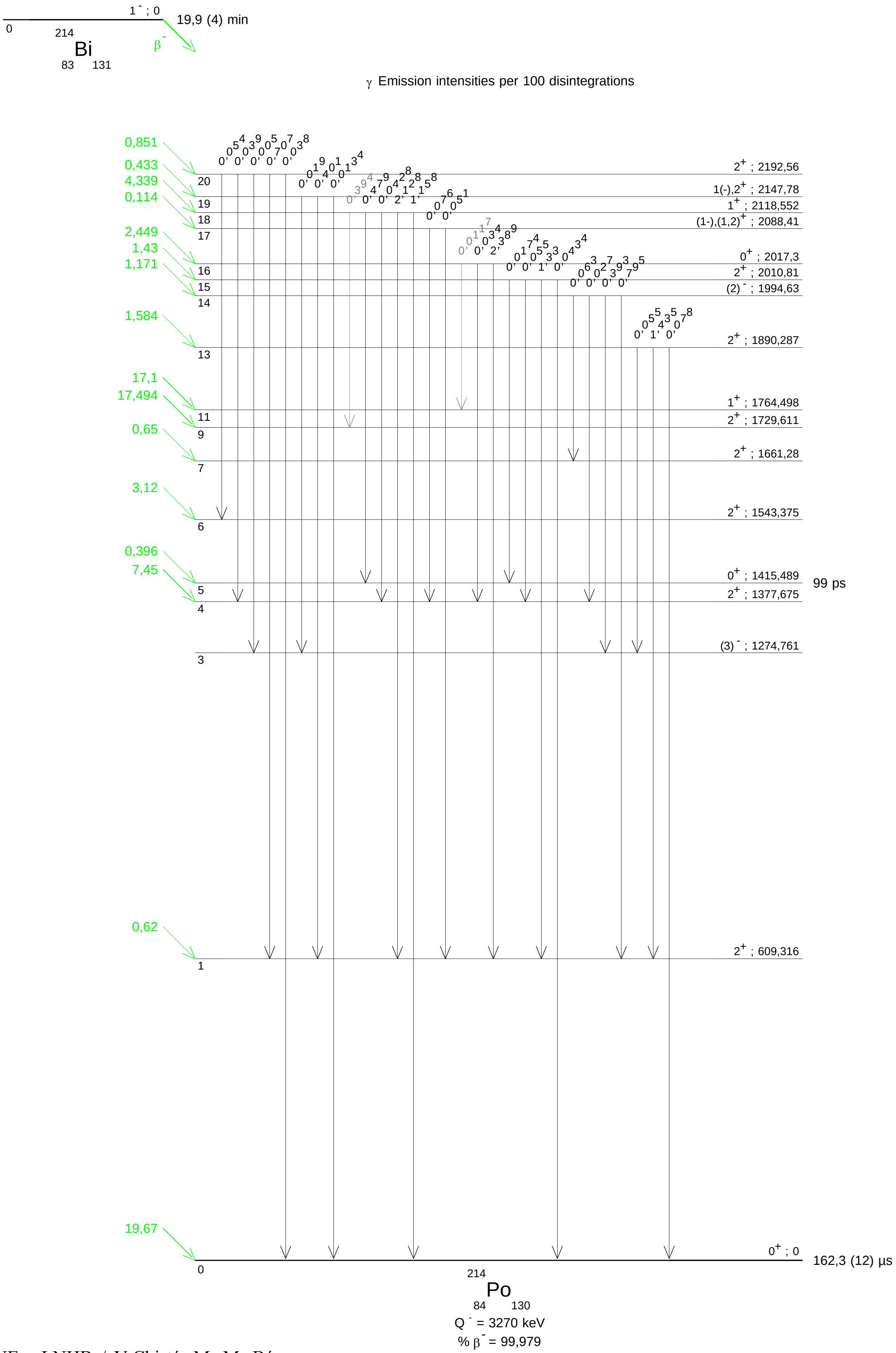


LNE - LNHB / V.Chisté, M. M. Bé

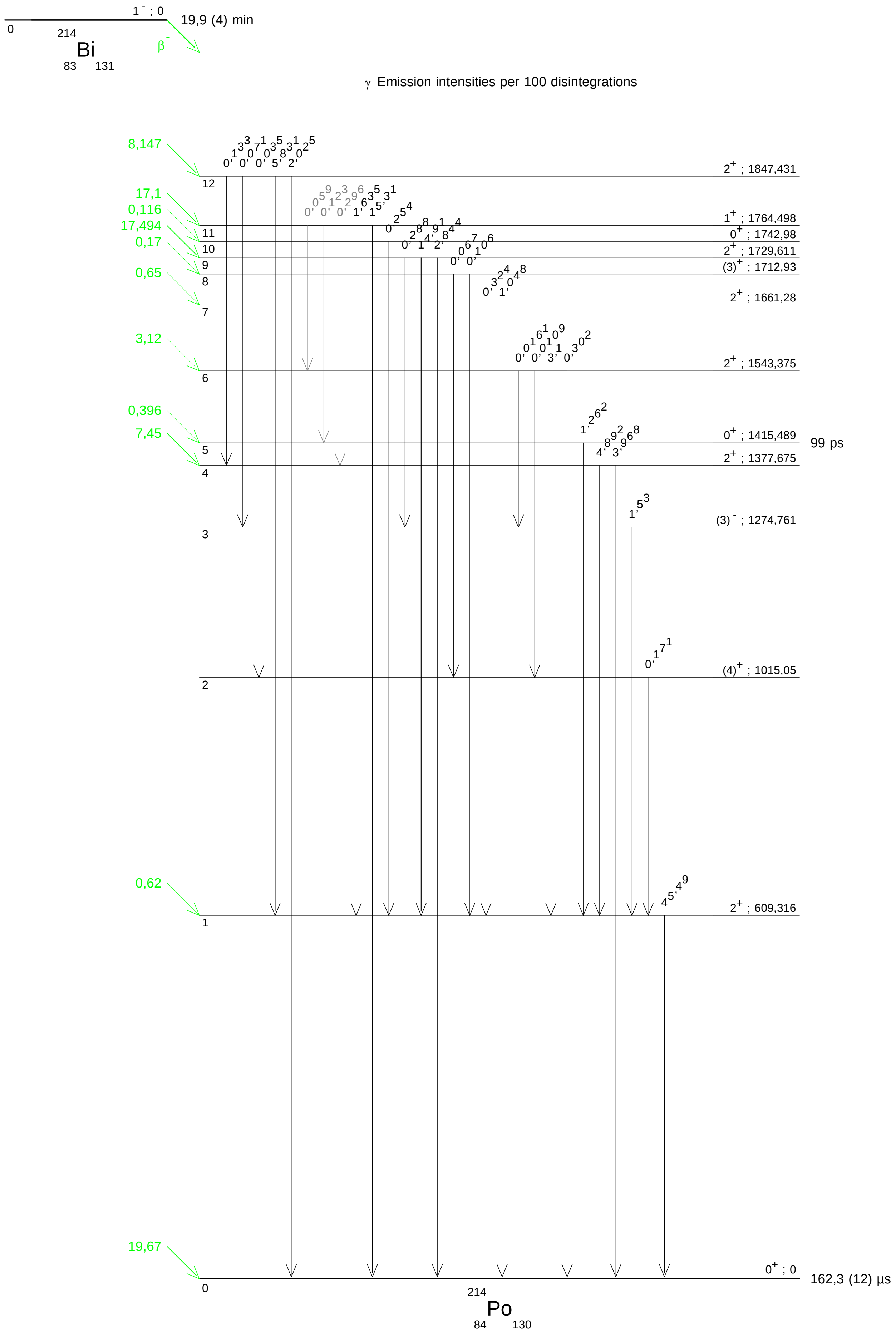

1 - ; 0
19,9 (4) min
214 Bi 83 131
β-
γ Emission intensities per 100 disintegrations
0,092
0,169
1,227
2,76
0,114
1,43
1,171
8,147
17,1
0,116
17,494
0,65
3,12
0,396
7,45
0,62
19,67
2508,2
1(-),2+ ; 2505,21
(2)+ ; 2482,46
1 - ; 2447,7
(2,3)+ ; 2208,67
(1-),(1,2)+ ; 2088,41
2+ ; 2010,81
(2) - ; 1994,63
2+ ; 1847,431
1+ ; 1764,498
0+ ; 1742,98
2+ ; 1729,611
2+ ; 1661,28
2+ ; 1543,375
0+ ; 1415,489
99 ps
2+ ; 1377,675
(3) - ; 1274,761
2+ ; 609,316
0+ ; 0
162,3 (12) µs
214 Po 84 130
Q - = 3270 keV
% β- = 99,979



LNE - LNHB / V.Chisté, M. M. Bé



LNE - LNHB / V.Chisté, M. M. Bé



LNE - LNHB / V.Chisté, M. M. Bé

$^{214}_{84}$Po $_{130}$

1 Decay Scheme

Po-214 decays by alpha emission mainly to the Pb-210 ground state level.
Le polonium 214 se désintègre par émission alpha principalement vers le niveau fondamental du plomb 210.

2 Nuclear Data

$T_{1/2}(^{214}Po)$	:	162,3	(12)	10^{-6} s
$T_{1/2}(^{210}Pb)$	:	22,23	(12)	a
$Q^{\alpha}(^{214}Po)$	:	7833,46	(6)	keV

2.1 α Transitions

	Energy keV	Probability × 100	F
$\alpha_{0,2}$	6735,8 (10)	0,000058 (2)	400
$\alpha_{0,1}$	7033,76 (21)	0,0105 (7)	27
$\alpha_{0,0}$	7833,46 (6)	99,9895 (7)	1

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{2,1}$(Pb)	298 (1)	0,000058 (20)	E2	0,0661 (11)	0,0389 (8)	0,00999 (20)	0,1180 (21)
$\gamma_{1,0}$(Pb)	799,7 (1)	0,0105 (7)	E2	0,00810 (12)	0,001763 (25)	0,000425 (6)	0,01042 (15)

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		59,5
	$K\alpha_1$	74,97		100
	$K\beta_3$	84,451	}	
	$K\beta_1$	84,937	}	
	$K\beta_5''$	85,47	}	34,2
	$K\beta_2$	87,238	}	
	$K\beta_4$	87,58	}	10,3
	$KO_{2,3}$	87,911	}	
X_L				
	$L\ell$	9,19		
	$L\alpha$	10,4495 – 10,5512		
	$L\eta$	11,3495		
	$L\beta$	12,1443 – 12,7953		
	$L\gamma$	14,3078 – 15,22		

4 α Emissions

	Energy keV	Probability × 100
$\alpha_{0,2}$	6610,1 (10)	0,000058 (2)
$\alpha_{0,1}$	6902,6 (3)	0,0105 (7)
$\alpha_{0,0}$	7686,82 (6)	99,9895 (7)

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Pb)	9,19 — 15,22		0,0000347 (13)	
$XK\alpha_2$	(Pb)	72,8049		0,0000246 (15)	} $K\alpha$
$XK\alpha_1$	(Pb)	74,97		0,0000414 (25)	}
$XK\beta_3$	(Pb)	84,451	}		
$XK\beta_1$	(Pb)	84,937	}	0,0000141 (9)	$K'\beta_1$
$XK\beta_5''$	(Pb)	85,47	}		
$XK\beta_2$	(Pb)	87,238	}		
$XK\beta_4$	(Pb)	87,58	}	0,00000427 (27)	$K'\beta_2$
$XKO_{2,3}$	(Pb)	87,911	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{2,1}$(Pb)	298 (1)	0,000052 (18)
$\gamma_{1,0}$(Pb)	799,7 (1)	0,0104 (6)

6 Main Production Modes

Ra – 226 decay chain

7 References

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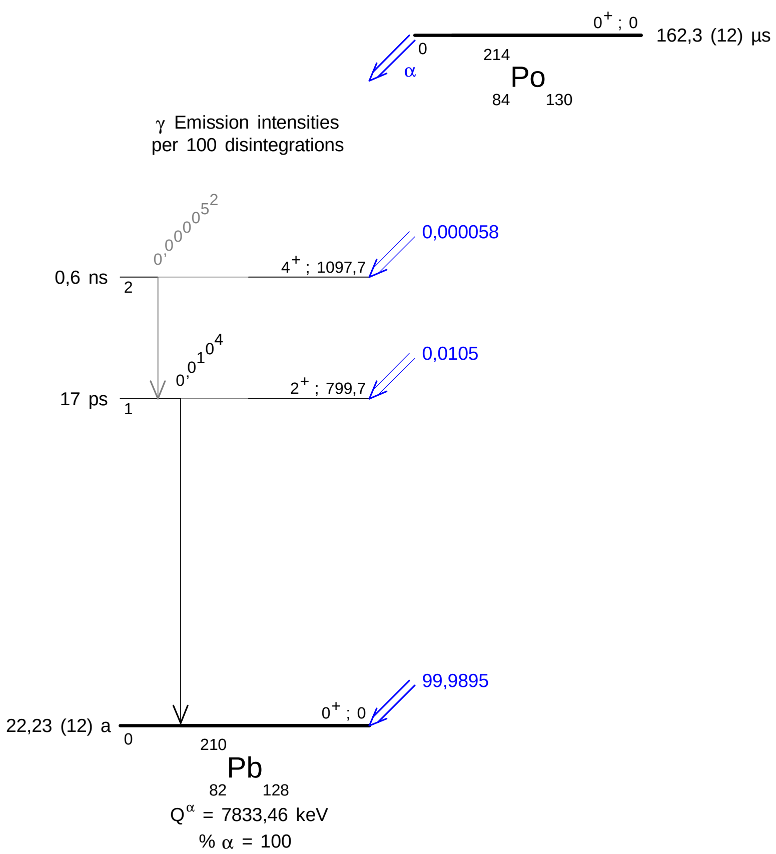
0+ ; 0
162,3 (12) µs
0
α
214
Po
84
130
γ Emission intensities
per 100 disintegrations
0,000052
0,000058
4+ ; 1097,7
0,6 ns
2
0,0104
0,0105
2+ ; 799,7
17 ps
1
99,9895
0+ ; 0
22,23 (12) a
0
210
Pb
82
128
Qα = 7833,46 keV
% α = 100

$^{217}_{86}$Rn $_{131}$

1 Decay Scheme

Alpha decay of Rn-217 occurs directly to the ground state level of Po-213.
Le radon 217 se désintègre par émission alpha à 100% vers le niveau fondamental de polonium 213.

2 Nuclear Data

$T_{1/2}(^{217}\text{Rn})$	:	0,54	(5)	10^{-3} s
$T_{1/2}(^{213}\text{Po})$	:	3,70	(5)	10^{-6} s
$Q^{\alpha}(^{217}\text{Rn})$	:	7887	(3)	keV

2.1 α Transitions

	Energy keV	Probability × 100	F
$\alpha_{0,0}$	7887 (3)	100	1,49

3 α Emissions

	Energy keV	Probability × 100
$\alpha_{0,0}$	7742 (3)	100

4 Main Production Modes

Descendant of Th – 229

CNDC /Huang Xiaolong, Wang Baosong

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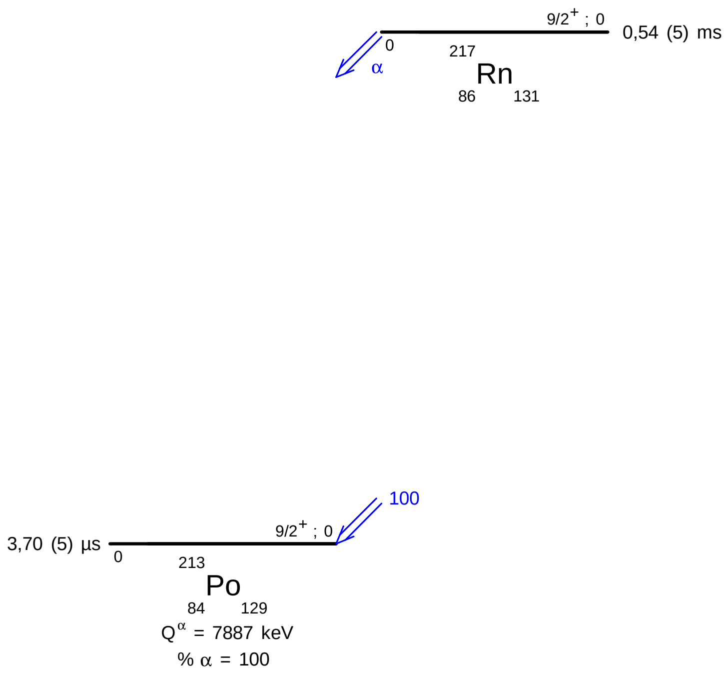
  (NDS)



CNDC / Huang Xiaolong, Wang Baosong

$$^{218}_{84}\mathrm{Po}_{134}$$

1 Decay Scheme

Po-218 disintegrates mainly (99,978 (3) %) by alpha emission to the Pb-214 ground state. A weak beta minus emission (0,022 (3) %) to At-218 has been pointed out.
Le polonium 218 se désintègre par émission alpha principalement (99,978 (3) %) vers le niveau fondamental de plomb 214. Une désintégration bêta moins vers l'astate 218 de probabilité 0,022 (3) % a été mise en évidence.

2 Nuclear Data

$T_{1/2}(^{218}\mathrm{Po})$	:	3,094	(6)	min
$T_{1/2}(^{218}\mathrm{At})$	:	1,4	(2)	s
$T_{1/2}(^{214}\mathrm{Pb})$	:	26,8	(9)	min
$Q^-(^{218}\mathrm{Po})$	:	260	(12)	keV
$Q^\alpha(^{218}\mathrm{Po})$	:	6114,68	(9)	keV

2.1 α Transitions

	Energy keV	Probability × 100	F
$\alpha_{0,1}$	5277,68 (9)	0,0011 (11)	7,5
$\alpha_{0,0}$	6114,68 (9)	99,9769 (32)	1

2.2 β^- Transitions

	Energy keV	Probability × 100
$\beta^-_{0,0}$	260 (12)	0,022 (3)

2.3 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity
$\gamma_{1,0}$(Pb)	837 (2)	0,0011 (11)	(E2)

3 α Emissions

	Energy keV	Probability × 100
$\alpha_{0,1}$	5181 (2)	0,0011 (11)
$\alpha_{0,0}$	6002,35 (9)	99,9769 (32)

4 Electron Emissions

		Energy keV	Electrons per 100 disint.
$\beta^-_{0,0}$	max:	260 (12)	0,022 (3)
$\beta^-_{0,0}$	avg:	73 (4)	

5 Photon Emissions

5.1 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Pb)	836 (2)	0,0011 (11)

6 Main Production Modes

$\left\{ \begin{array}{l} \text{Ra} - 226 \text{ decay chain} \\ \text{Possible impurities : Po} - 214, \text{Po} - 210. \end{array} \right.$

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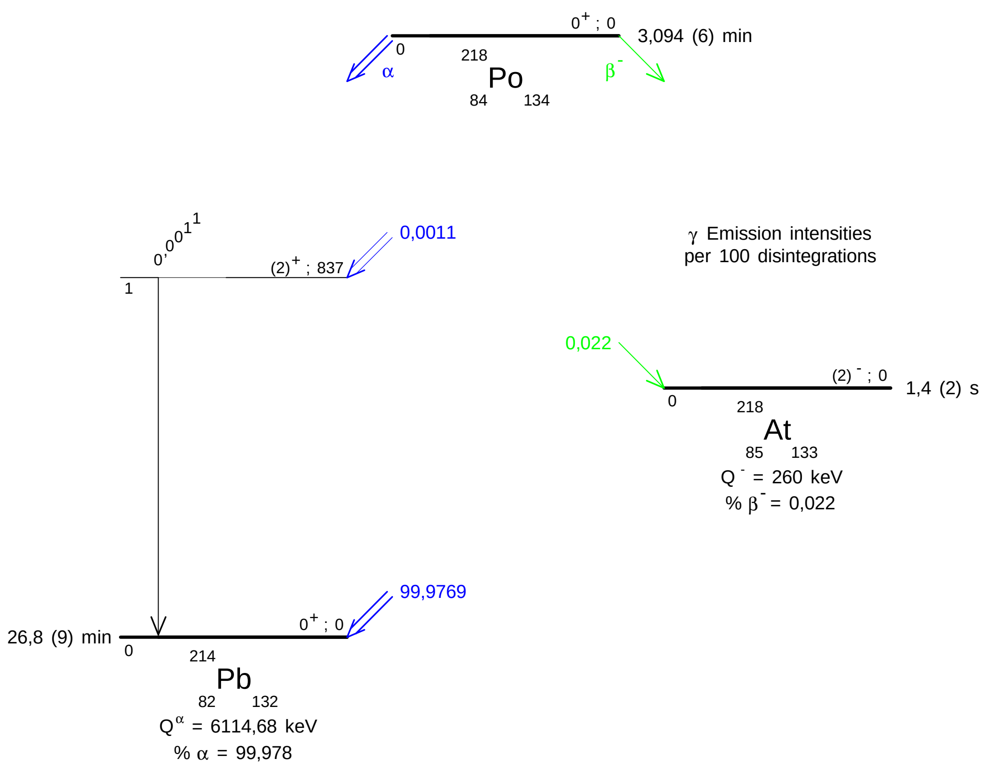
0+ ; 0
3,094 (6) min
0
218
Po
84
134
α
β-
0,0011
(2)+ ; 837
1
26,8 (9) min
0+ ; 0
99,9769
0
214
Pb
82
132
Qα = 6114,68 keV
% α = 99,978
γ Emission intensities
per 100 disintegrations
0,022
(2)- ; 0
1,4 (2) s
0
218
At
85
133
Q- = 260 keV
% β- = 0,022

$^{218}_{85}$At $_{133}$

1 Decay Scheme

At-218 disintegrates by alpha emission to Bi-214 mainly . Gamma transitions between the Bi-214 levels have not been observed. The disintegration by beta minus emission to Rn-218 was measured.
L'astate 218 se désintègre principalement par émission alpha vers des niveaux excités et le niveau fondamental de bismuth 214. Des transitions gamma entre les niveaux de bismuth 214 n'ont pas été mises en évidence. Une désintégration par émission bêta moins d'intensité 0,1% vers le radon 218 a été mesurée.

2 Nuclear Data

$T_{1/2}(^{218}$At)	:	1,4	(2)	s
$T_{1/2}(^{218}$Rn)	:	36,0	(19)	10^{-3} s
$T_{1/2}(^{214}$Bi)	:	19,9	(4)	min
$Q^{-}(^{218}$At)	:	2881	(12)	keV
$Q^{\alpha}(^{218}$At)	:	6874	(3)	keV

2.1 α Transitions

	Energy keV	Probability × 100	F
$\alpha_{0,2}$	6771 (7)	6,4 (1)	38
$\alpha_{0,1}$	6811 (3)	90,0 (1)	3,9
$\alpha_{0,0}$	6874 (3)	3,6 (1)	150

2.2 β^{-} Transitions

	Energy keV	Probability × 100
$\beta^{-}_{0,0}$	2881 (12)	0,1 (1)

3 α Emissions

	Energy keV	Probability × 100
$\alpha_{0,2}$	6653 (5)	6,4 (1)
$\alpha_{0,1}$	6694 (3)	90,0 (1)
$\alpha_{0,0}$	6756 (5)	3,6 (1)

4 Electron Emissions

		Energy keV	Electrons per 100 disint.
$\beta^-_{0,0}$	max:	2881 (12)	0,1 (1)
$\beta^-_{0,0}$	avg:	1095 (12)	

5 Main Production Modes

Ra – 226 decay chain

6 References

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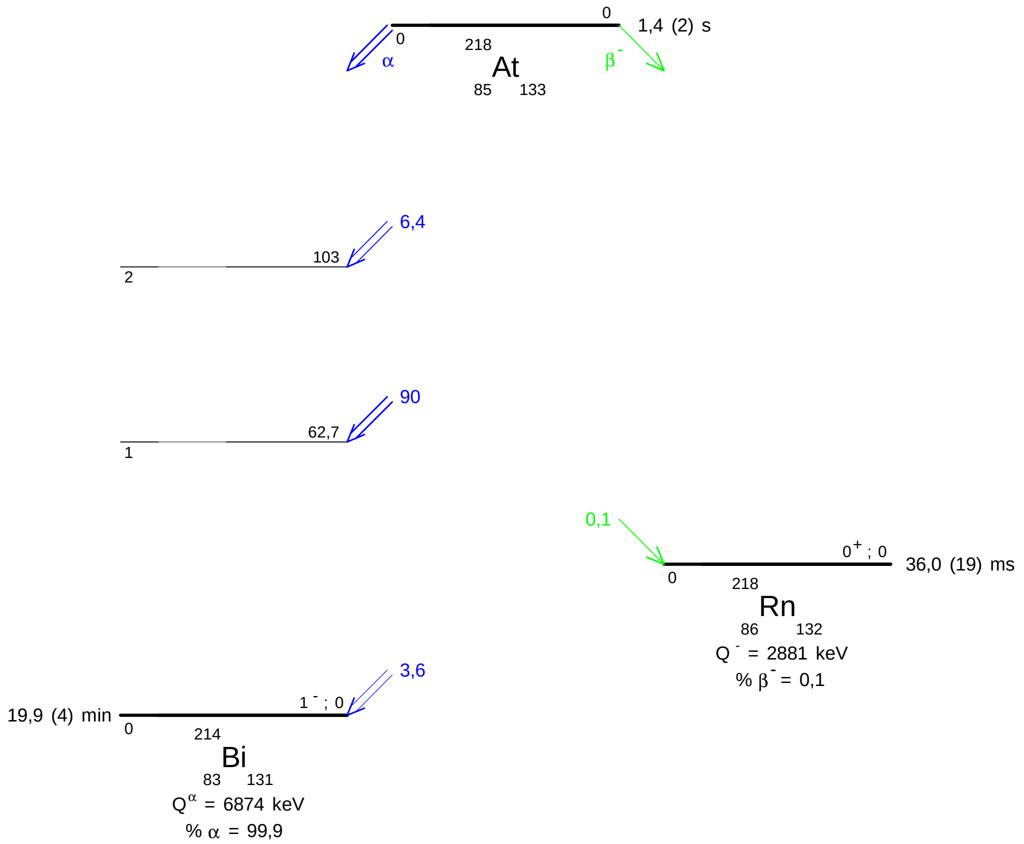
(Q.)
- A.K. Jain, B. Singh. Nucl. Data Sheets 107 (2006) 1027
(Alpha emission probabilities and energies,spin and parity.)


0
1,4 (2) s
0
218
At
85
133
α
β-
6,4
103
2
90
62,7
1
0,1
0+ ; 0
36,0 (19) ms
0
218
Rn
86
132
Q- = 2881 keV
% β- = 0,1
3,6
1- ; 0
19,9 (4) min
0
214
Bi
83
131
Qα = 6874 keV
% α = 99,9

$^{218}_{86}$Rn $_{132}$

1 Decay Scheme

Rn-218 disintegrates by alpha emission to the 609 keV level (0,127 (7) %) and to the ground state (99,873 (7) %) of Po-214.
Le radon 218 se désintègre par émission alpha vers le niveau excité de 609 keV (0,126 (8) %) et le fondamental (99,874 (8) %) du polonium 214.

2 Nuclear Data

$T_{1/2}(^{218}\mathrm{Rn})$	:	36,0	(19)	10^{-3} s
$T_{1/2}(^{214}\mathrm{Po})$	:	162,3	(12)	10^{-6} s
$Q^{\alpha}(^{218}\mathrm{Rn})$	:	7262,5	(19)	keV

2.1 α Transitions

	Energy keV	Probability × 100	F
$\alpha_{0,1}$	6653,2 (19)	0,127 (7)	4,8
$\alpha_{0,0}$	7262,5 (19)	99,873 (7)	1

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{1,0}$(Po)	609,31 (6)	0,127 (7)	E2	0,01487 (21)	0,00416 (6)	0,001030 (15)	0,0204 (3)

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		60,05
	$K\alpha_1$	79,293		100
	$K\beta_3$	89,256	}	
	$K\beta_1$	89,807	}	
	$K\beta_5''$	90,363	}	34,43
	$K\beta_2$	92,263	}	
	$K\beta_4$	92,618	}	10,71
	$KO_{2,3}$	92,983	}	
X_L				
	$L\ell$	9,66		
	$L\alpha$	11,0161 – 11,1303		
	$L\eta$	12,0847		
	$L\beta$	12,8239 – 13,6358		
	$L\gamma$	15,251 – 16,21		

4 α Emissions

	Energy keV	Probability × 100
$\alpha_{0,1}$	6531,1 (19)	0,127 (7)
$\alpha_{0,0}$	7129,2 (19)	99,873 (7)

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Po)	9,66 — 16,21		0,00080 (3)	
$XK\alpha_2$	(Po)	76,864		0,00052 (4)	} $K\alpha$
$XK\alpha_1$	(Po)	79,293		0,00086 (6)	}
$XK\beta_3$	(Po)	89,256	}		
$XK\beta_1$	(Po)	89,807	}	0,000296 (21)	$K'\beta_1$
$XK\beta_5''$	(Po)	90,363	}		
$XK\beta_2$	(Po)	92,263	}		
$XK\beta_4$	(Po)	92,618	}	0,000092 (7)	$K'\beta_2$
$XKO_{2,3}$	(Po)	92,983	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Po)	609,31 (6)	0,124 (7)

6 Main Production Modes

Ra – 226 decay chain

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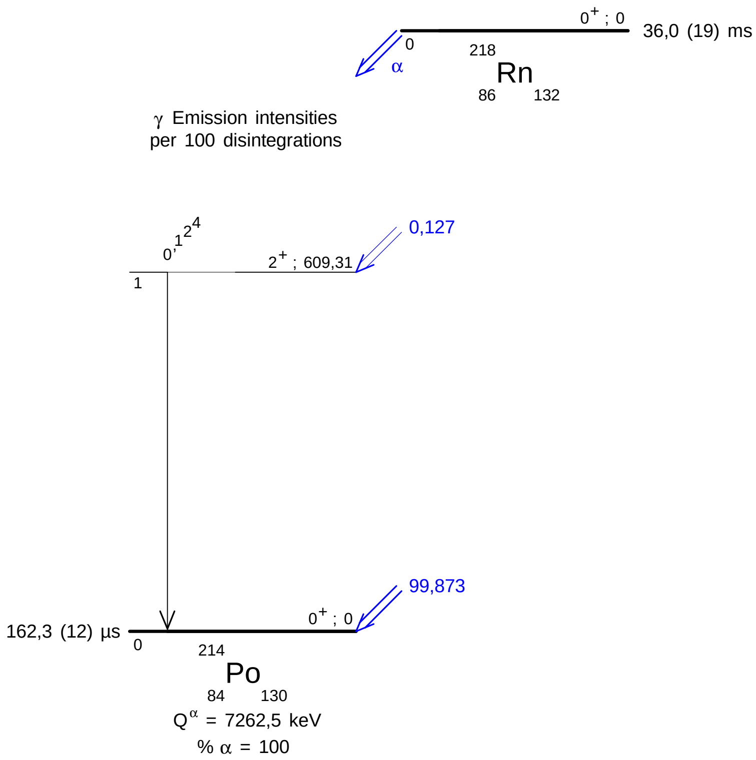
0+ ; 0
36,0 (19) ms
0
218
Rn
86
132
α
γ Emission intensities
per 100 disintegrations
0,127
2+ ; 609,31
1
99,873
0+ ; 0
162,3 (12) µs
0
214
Po
84
130
Qα = 7262,5 keV
% α = 100

221 Fr
$^{221}_{87}\mathrm{Fr}_{134}$

1 Decay Scheme

Fr-221 disintegrates 99.9952(15)% by alpha emission to levels in At-217 and 0.0048(15)% by beta minus emission to levels in Ra-221. The beta minus decay scheme of Fr-221 has not been studied.
Le francium 221 se désintègre par transitions alpha vers des niveaux excités d'astate 217. Un faible branchement bêta moins n'est pas inclus ici.

2 Nuclear Data

$T_{1/2}(^{221}\mathrm{Fr})$	:	4,79	(2)	min
$T_{1/2}(^{221}\mathrm{Ra})$	:	28	(2)	s
$T_{1/2}(^{217}\mathrm{At})$	:	32,3	(4)	10^{-3} s
$Q^{-}(^{221}\mathrm{Fr})$	:	314	(6)	keV
$Q^{\alpha}(^{221}\mathrm{Fr})$	:	6457,8	(14)	keV

2.1 α Transitions

	Energy keV	Probability × 100	F
$\alpha_{0,14}$	5601 (40)	0,000038 (10)	61
$\alpha_{0,13}$	5632 (25)	0,00010 (2)	60
$\alpha_{0,12}$	5794 (3)	0,0025 (5)	111
$\alpha_{0,11}$	5802 (4)	0,0003	828
$\alpha_{0,10}$	5882 (3)	0,064 (4)	11,7
$\alpha_{0,9}$	5890 (4)	0,0031 (6)	290
$\alpha_{0,8}$	5920 (3)	0,006 (1)	197
$\alpha_{0,7}$	6034 (3)	0,0285 (24)	143
$\alpha_{0,6}$	6048,4 (20)	0,128 (3)	36,4
$\alpha_{0,5}$	6075,9 (25)	0,064 (16)	117
$\alpha_{0,4}$	6090,1 (20)	0,39 (7)	27
$\alpha_{0,3}$	6187,9 (20)	0,15 (3)	65

	Energy keV	Probability × 100	F
$\alpha_{0,2}$	6239,2 (15)	15,1 (2)	2,2
$\alpha_{0,1}$	6358 (2)	1,34 (7)	120
$\alpha_{0,0}$	6458,0 (13)	82,8 (2)	3,44

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{3,2}$(At)	53,81 (3)	0,220 (38)	M1		10,79 (15)	2,56 (4)	14,17 (20)
$\gamma_{4,3}$(At)	96,3 (3)	0,046 (26)	M1+E2		4,1 (18)	1,1 (5)	5,6 (24)
$\gamma_{1,0}$(At)	100,25 (2)	2,02 (17)	M1	9,66 (14)	1,758 (25)	0,416 (6)	11,97 (17)
$\gamma_{2,1}$(At)	117,82 (3)	0,19 (14)	M1	6,13 (9)	1,104 (16)	0,261 (4)	7,58 (11)
$\gamma_{4,2}$(At)	150,21 (3)	0,216 (12)	M1	3,08 (5)	0,550 (8)	0,1303 (19)	3,80 (5)
$\gamma_{3,1}$(At)	171,83 (3)	0,129 (17)	E2	0,226 (4)	0,471 (7)	0,1257 (18)	0,863 (12)
$\gamma_{10,4}$(At)	208,3 (6)	0,0073 (14)	[E2]	0,1519 (24)	0,206 (4)	0,0547 (11)	0,430 (8)
$\gamma_{2,0}$(At)	218,12 (2)	15,61 (21)	E2	0,1375 (20)	0,1701 (24)	0,0451 (7)	0,367 (5)
$\gamma_{12,5}$(At)	282,12 (9)						
$\gamma_{5,1}$(At)	282,12 (9)	0,0097 (20)	[M1,E2]	0,30 (23)	0,077 (17)	0,019 (4)	0,41 (25)
$\gamma_{7,1}$(At)	324,10 (6)	0,0252 (17)	M1	0,362 (5)	0,0639 (9)	0,01510 (22)	0,446 (6)
$\gamma_{10,2}$(At)	359,86 (4)	0,0514 (20)	M1	0,272 (4)	0,0479 (7)	0,01133 (16)	0,335 (5)
$\gamma_{5,0}$(At)	382,34 (4)	0,0437 (18)	M1	0,231 (4)	0,0406 (6)	0,00960 (14)	0,284 (4)
$\gamma_{6,0}$(At)	410,64 (5)	0,1270 (26)	E2	0,0344 (5)	0,01528 (22)	0,00392 (6)	0,0548 (8)
$\gamma_{8,1}$(At)	437,00 (5)	0,0010 (1)					
$\gamma_{12,2}$(At)	446,30 (8)	0,0017 (4)	E1 + M2				
$\gamma_{9,1}$(At)	468,3 (7)	0,0018 (3)					
$\gamma_{8,0}$(At)	537,8 (8)	0,0045 (8)					
$\gamma_{12,1}$(At)	562,3 (12)	0,005 (5)					
$\gamma_{9,0}$(At)	568,5 (3)	0,0012 (4)					
$\gamma_{10,0}$(At)	576,9 (4)	0,0033 (7)	[M1]	0,0772 (11)	0,01342 (19)	0,00317 (5)	0,0948 (13)
$\gamma_{11,0}$(At)	652 (2)	0,0004 (4)					
$\gamma_{12,0}$(At)	665 (2)	0,0009 (9)					
$\gamma_{13,0}$(At)	809,3 (2)	0,00010 (2)					
$\gamma_{14,0}$(At)	891,9 (3)	0,000038 (10)					

3 Atomic Data

3.1 At

ω_K	:	0,966	(4)
$\bar{\omega}_L$	:	0,416	(17)
n_{KL}	:	0,805	(5)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	78,94		60,33
	$K\alpha_1$	81,51		100
	$K\beta_3$	91,73	}	
	$K\beta_1$	92,315	}	
	$K\beta_5''$	92,883	}	34,63
	$K\beta_2$	94,846	}	
	$K\beta_4$	95,211	}	10,9
	$KO_{2,3}$	95,595	}	
X_L				
	$L\ell$	9,8964		
	$L\gamma$	– 16,7291		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	60,489 – 67,031	100
KLX	73,811 – 81,516	56,8
KXY	87,10 – 95,72	8,07
Auger L	5,6 – 17,4	

4 α Emissions

	Energy keV	Probability × 100
$\alpha_{0,14}$	5500 (40)	0,000038 (10)
$\alpha_{0,13}$	5530 (25)	0,00010 (2)
$\alpha_{0,12}$	5689 (3)	0,0025 (5)
$\alpha_{0,11}$	5697 (4)	0,0003
$\alpha_{0,10}$	5776 (3)	0,064 (4)
$\alpha_{0,9}$	5783 (4)	0,0031 (6)
$\alpha_{0,8}$	5813 (3)	0,006 (1)
$\alpha_{0,7}$	5925 (3)	0,0285 (24)
$\alpha_{0,6}$	5938,9 (20)	0,128 (3)
$\alpha_{0,5}$	5965,9 (25)	0,064 (16)
$\alpha_{0,4}$	5979,9 (20)	0,39 (7)
$\alpha_{0,3}$	6075,9 (20)	0,15 (3)
$\alpha_{0,2}$	6126,3 (15)	15,1 (2)
$\alpha_{0,1}$	6243 (2)	1,34 (7)
$\alpha_{0,0}$	6341,0 (13)	82,8 (2)

5 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(At)	5,6 - 17,4		3,05 (10)
e_{AK}	(At)			0,114 (6)
	KLL	60,489 - 67,031	}	
	KLX	73,811 - 81,516	}	
	KXY	87,10 - 95,72	}	
$ec_{1,0\ K}$	(At)	4,53 (2)		1,51 (13)
$ec_{2,1\ K}$	(At)	22,10 (3)		0,13 (10)
$ec_{3,2\ L}$	(At)	36,33 - 39,60		0,156 (27)
$ec_{4,2\ K}$	(At)	54,49 (3)		0,138 (8)
$ec_{1,0\ L}$	(At)	82,77 - 86,04		0,274 (23)
$ec_{1,0\ M}$	(At)	95,94 - 97,47		0,065 (5)
$ec_{2,0\ T}$	(At)	122,40 - 218,08		4,19 (8)
$ec_{2,0\ K}$	(At)	122,40 (2)		1,570 (31)
$ec_{2,0\ L}$	(At)	200,64 - 203,91		1,943 (37)
$ec_{2,0\ M}$	(At)	213,81 - 215,34		0,515 (10)

6 Photon Emissions

6.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(At)	9,8964 — 16,7291		2,18 (7)	
$XK\alpha_2$	(At)	78,94		0,96 (5)	} $K\alpha$
$XK\alpha_1$	(At)	81,51		1,59 (9)	}
$XK\beta_3$	(At)	91,73	}		
$XK\beta_1$	(At)	92,315	}	0,55 (6)	$K'\beta_1$
$XK\beta_5''$	(At)	92,883	}		
$XK\beta_2$	(At)	94,846	}		
$XK\beta_4$	(At)	95,211	}	0,18 (2)	$K'\beta_2$
$XKO_{2,3}$	(At)	95,595	}		

6.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{3,2}$(At)	53,81 (3)	0,0145 (25)
$\gamma_{4,3}$(At)	96,3 (3)	0,007 (3)
$\gamma_{1,0}$(At)	100,25 (2)	0,156 (13)
$\gamma_{2,1}$(At)	117,82 (3)	0,022 (16)
$\gamma_{4,2}$(At)	150,21 (3)	0,0449 (25)
$\gamma_{3,1}$(At)	171,83 (3)	0,069 (9)
$\gamma_{10,4}$(At)	208,3 (6)	0,0051 (10)
$\gamma_{2,0}$(At)	218,12 (2)	11,42 (15)
$\gamma_{5,1}$(At)	282,12 (9)	0,0069 (7)
$\gamma_{7,1}$(At)	324,10 (6)	0,0174 (12)
$\gamma_{10,2}$(At)	359,86 (4)	0,0385 (15)
$\gamma_{5,0}$(At)	382,34 (4)	0,0340 (14)
$\gamma_{6,0}$(At)	410,64 (5)	0,1204 (25)
$\gamma_{8,1}$(At)	437,00 (5)	0,0010 (1)
$\gamma_{12,2}$(At)	446,30 (8)	0,0017 (4)
$\gamma_{9,1}$(At)	468,3 (7)	0,0018 (3)
$\gamma_{8,0}$(At)	537,8 (8)	0,0045 (8)
$\gamma_{12,1}$(At)	562,3 (12)	0,005 (5)
$\gamma_{9,0}$(At)	568,5 (3)	0,0012 (4)
$\gamma_{10,0}$(At)	576,9 (4)	0,0030 (6)
$\gamma_{11,0}$(At)	652 (2)	0,0004 (4)
$\gamma_{12,0}$(At)	665 (2)	0,0009 (9)
$\gamma_{13,0}$(At)	809,3 (2)	0,00010 (2)
$\gamma_{14,0}$(At)	891,9 (3)	0,000038 (10)

7 Main Production Modes

Descendant Th – 229

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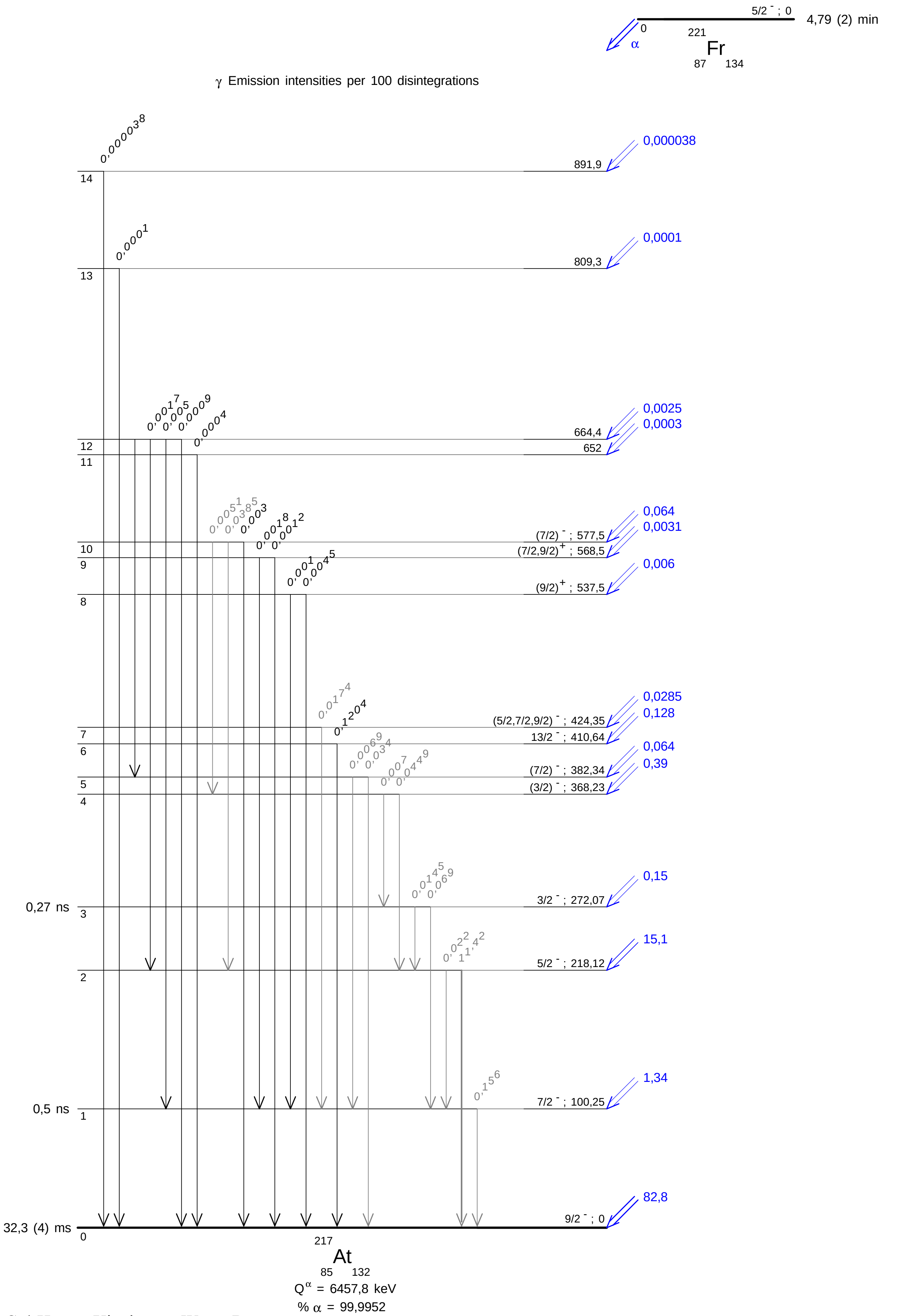

CNDC / Huang Xiaolong, Wang Baosong

$^{222}_{86}$Rn $_{136}$

1 Decay Scheme

Rn-222 disintegrates mainly to the ground state level in Rn-222.
Le radon 222 se désintègre par émission alpha principalement vers le niveau fondamental du polonium 218.

2 Nuclear Data

$T_{1/2}$(^{222}Rn)	:	3,8232	(8)	d
$T_{1/2}$(^{218}Po)	:	3,094	(6)	min
Q^{α}(^{222}Rn)	:	5590,3	(3)	keV

2.1 α Transitions

	Energy keV	Probability × 100	F
$\alpha_{0,2}$	4915 (5)	≈ 0,0005	≈ 30
$\alpha_{0,1}$	5080 (2)	0,078	1,9
$\alpha_{0,0}$	5590,3 (3)	99,92 (1)	1

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{1,0}$(Po)	511 (2)	0,078	[E2]	0,0213 (4)	0,00704 (13)	0,00177 (4)	0,0306 (6)

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		60,05
	$K\alpha_1$	79,293		100
	$K\beta_3$	89,256	}	
	$K\beta_1$	89,807	}	
	$K\beta_5''$	90,363	}	34,43
	$K\beta_2$	92,263	}	
	$K\beta_4$	92,618	}	10,71
	$KO_{2,3}$	92,983	}	
X_L				
	$L\ell$	9,66		
	$L\alpha$	11,0161 – 11,1303		
	$L\eta$	12,0847		
	$L\beta$	12,8239 – 14,2476		
	$L\gamma$	15,251 – 16,21		

4 α Emissions

	Energy keV	Probability × 100
$\alpha_{0,2}$	4827 (4)	≈ 0,0005
$\alpha_{0,1}$	4987 (1)	0,078
$\alpha_{0,0}$	5489,48 (30)	99,92 (1)

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Po)	9,66 — 16,21		0,000766 (15)	
$XK\alpha_2$	(Po)	76,864		0,000469 (10)	} $K\alpha$
$XK\alpha_1$	(Po)	79,293		0,000781 (16)	}
$XK\beta_3$	(Po)	89,256	}		
$XK\beta_1$	(Po)	89,807	}	0,000269 (7)	$K'\beta_1$
$XK\beta_5''$	(Po)	90,363	}		
$XK\beta_2$	(Po)	92,263	}		
$XK\beta_4$	(Po)	92,618	}	0,0000837 (25)	$K'\beta_2$
$XKO_{2,3}$	(Po)	92,983	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Po)	510 (2)	0,076

6 Main Production Modes

Ra – 226 decay chain()

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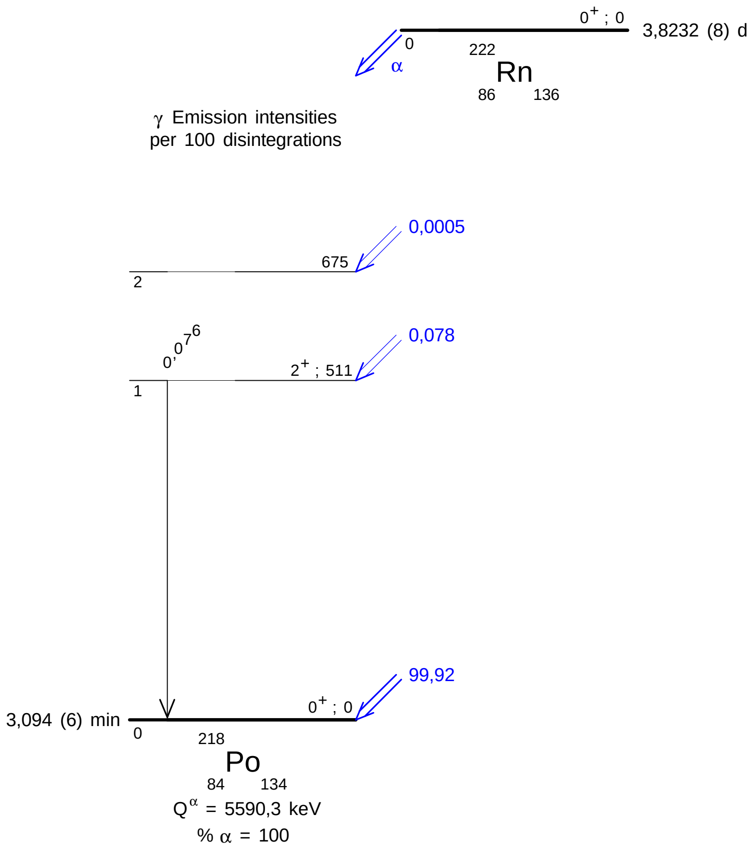

CEA/LNE-LNHB / V. Chisté, M.M. Bé

$^{226}_{88}$ Ra $_{138}$

1 Decay Scheme

Ra-226 disintegrates by alpha emission mainly to the 186 keV level and to the ground state level of Rn-222.

Le radium 226 se désintègre par émission alpha principalement vers le niveau excité de 186 keV et le niveau fondamental de radon 222.

2 Nuclear Data

$T_{1/2}(^{226}\text{Ra})$	:	1600	(7)	a
$T_{1/2}(^{222}\text{Rn})$	:	3,8232	(8)	d
$Q^{\alpha}(^{226}\text{Ra})$	:	4870,62	(25)	keV

2.1 α Transitions

	Energy keV	Probability × 100	F
$\alpha_{0,4}$	4235,15 (29)	0,0002	8,65
$\alpha_{0,3}$	4269,96 (26)	0,0008	4,5
$\alpha_{0,2}$	4422,25 (28)	0,0066 (22)	10,4
$\alpha_{0,1}$	4684,41 (25)	5,95 (4)	0,96
$\alpha_{0,0}$	4870,62 (25)	94,038 (40)	1

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{1,0}$(Rn)	186,211 (13)	5,962 (48)	E2	0,190 (3)	0,360 (5)	0,0963 (14)	0,677 (10)
$\gamma_{2,1}$(Rn)	262,27 (5)	0,0066 (22)	[E2]	0,0923 (14)	0,0868 (14)	0,0230 (4)	0,209 (4)
$\gamma_{3,1}$(Rn)	414,60 (5)	0,0003	[E1]	0,01329 (19)	0,00228 (4)	0,000537 (8)	0,01628 (23)
$\gamma_{4,1}$(Rn)	449,37 (10)	0,0002	[E1]	0,01123 (16)	0,00191 (3)	0,000449 (7)	0,01373 (20)
$\gamma_{3,0}$(Rn)	600,66 (5)	0,0005	[E1]	0,00627 (9)	0,001034 (15)	0,000243 (4)	0,00762 (11)

3 Atomic Data

3.1 Rn

ω_K	:	0,967	(4)
$\bar{\omega}_L$	:	0,428	(17)
n_{KL}	:	0,804	(5)

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	}	11,1
	$KO_{2,3}$	98,357	}	
X_L				
	$L\ell$	10,14		
	$L\alpha$	11,5981 – 11,7259		
	$L\eta$	12,8551		
	$L\beta$	13,5219 – 15,1631		
	$L\gamma$	16,2398 – 17,26		

4 α Emissions

	Energy keV	Probability × 100
$\alpha_{0,4}$	4160 (2)	0,0002
$\alpha_{0,3}$	4191 (2)	0,0008
$\alpha_{0,2}$	4340 (1)	0,0066 (22)
$\alpha_{0,1}$	4601 (1)	5,95 (4)
$\alpha_{0,0}$	4784,34 (25)	94,038 (40)

5 Electron Emissions

		Energy keV	Electrons per 100 disint.
$ec_{1,0\ T}$	(Rn)	87,814 - 186,168	2,407 (36)
$ec_{1,0\ K}$	(Rn)	87,814 (13)	0,675 (11)
$ec_{1,0\ L}$	(Rn)	168,163 - 171,600	1,280 (18)
$ec_{1,0\ M}$	(Rn)	181,738 - 183,327	0,342 (5)
$ec_{1,0\ N}$	(Rn)	185,120 - 185,989	0,0892 (14)

6 Photon Emissions

6.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Rn)	10,14 — 17,26		0,807 (14)	
$XK\alpha_2$	(Rn)	81,07		0,192 (4)	} $K\alpha$
$XK\alpha_1$	(Rn)	83,78		0,317 (6)	}
$XK\beta_3$	(Rn)	94,247	}		
$XK\beta_1$	(Rn)	94,868	}	0,1098 (25)	$K'\beta_1$
$XK\beta_5''$	(Rn)	95,449	}		
$XK\beta_2$	(Rn)	97,48	}		
$XK\beta_4$	(Rn)	97,853	}	0,0351 (10)	$K'\beta_2$
$XKO_{2,3}$	(Rn)	98,357	}		

6.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Rn)	186,211 (13)	3,555 (19)
$\gamma_{2,1}$(Rn)	262,27 (5)	0,0055 (18)
$\gamma_{3,1}$(Rn)	414,60 (5)	0,0003
$\gamma_{4,1}$(Rn)	449,37 (10)	0,0002
$\gamma_{3,0}$(Rn)	600,66 (5)	0,0005

7 Main Production Modes

U – 238 decay chain

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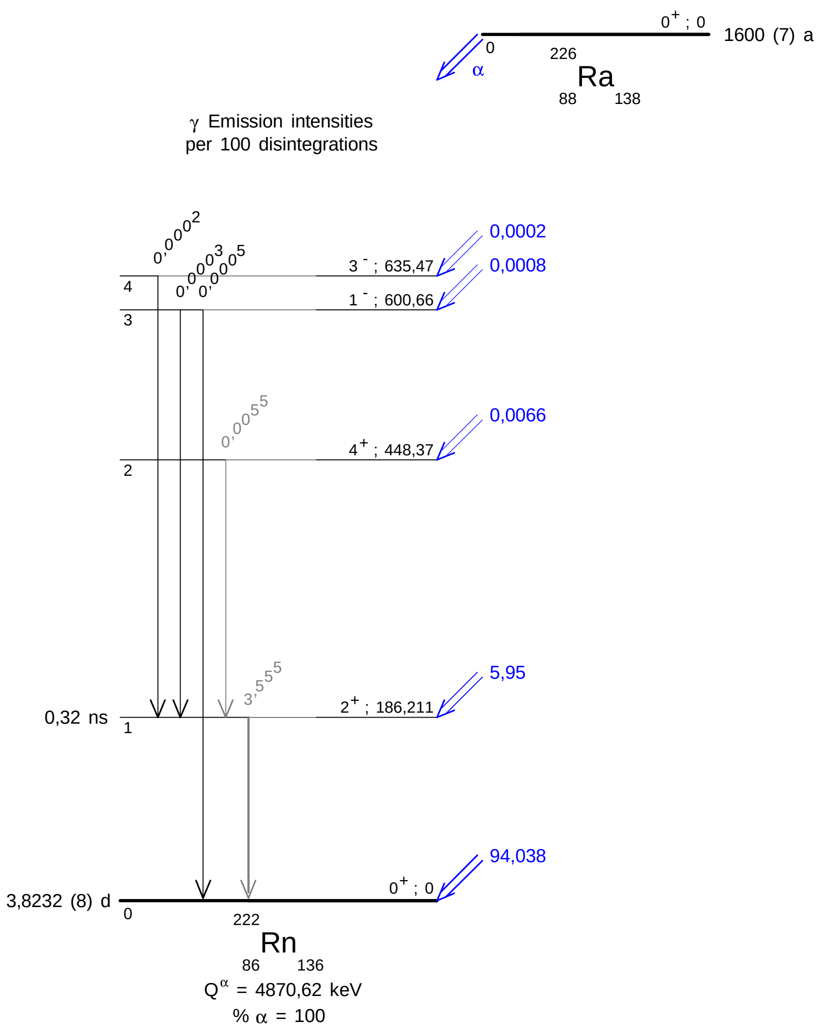

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227	Ac	
89		138

1 Decay Scheme

Ac-227 disintegrates mainly by beta minus transitions to excited levels in Th-227 and, by weak alpha transitions to Fr-223.
L'actinium 227 se désintègre principalement par transitions bêta vers des niveaux excités du thorium 227, et pour une faible partie par transitions alpha vers le francium 223.

2 Nuclear Data

$T_{1/2}(^{227}\mathrm{Ac})$	:	21,772	(3)	a
$T_{1/2}(^{227}\mathrm{Th})$	:	18,718	(5)	d
$T_{1/2}(^{223}\mathrm{Fr})$	:	22,00	(7)	min
$Q^{\alpha}(^{227}\mathrm{Ac})$	:	5042,19	(14)	keV
$Q^{-}(^{227}\mathrm{Ac})$	:	44,8	(8)	keV

2.1 α Transitions

	Energy keV	Probability × 100	F
$\alpha_{0,24}$	4441,19 (16)	≈ 0,00004	8
$\alpha_{0,23}$	4501,45 (29)	≈0,00008	12
$\alpha_{0,22}$	4526,99 (26)	≈0,0007	2,1
$\alpha_{0,21}$	4539 (7)	≈0,00007	26
$\alpha_{0,20}$	4593 (5)	≈0,00004	108
$\alpha_{0,19}$	4663 (7)	≈0,00004	340
$\alpha_{0,18}$	4676,72 (17)	≈0,0003	65
$\alpha_{0,16}$	4797,53 (21) ↑		
$\alpha_{0,15}$	4798,34 (19) |		
$\alpha_{0,14}$	4799,56 (16) ↓	0,006 (3)	23
$\alpha_{0,13}$	4819,44 (17) ↑		
$\alpha_{0,12}$	4822,58 (17) ↓	0,0012	142
$\alpha_{0,11}$	4853,09 (16) ↑		
$\alpha_{0,10}$	4855,01 (17) ↓	0,025 (7)	11

	Energy keV	Probability × 100	F
$\alpha_{0,9}$	4870,11 (15)	0,0011	329
$\alpha_{0,8}$	4881,71 (16)	0,014 (7)	31
$\alpha_{0,6}$	4907,68 (15)	0,001	663
$\alpha_{0,5}$	4941,19 (15) ↑		
$\alpha_{0,4}$	4942,56 (15) ↓	0,08 (1)	13
$\alpha_{0,3}$	4960,06 (15)	0,087 (7)	16
$\alpha_{0,2}$	4987,22 (16)	0,0015	1360
$\alpha_{0,1}$	5029,30 (15)	0,546 (17)	7
$\alpha_{0,0}$	5042,19 (14)	0,658 (14)	7

2.2 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,3}$	6,9 (8)	0,3	allowed	6,9
$\beta^-_{0,2}$	20,5 (8)	≈ 10	1st forbidden	6,8
$\beta^-_{0,1}$	35,5 (8)	≈ 35	1st forbidden	7
$\beta^-_{0,0}$	44,8 (8)	≈ 53	1st forbidden	7,1

2.3 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{1,0}$(Th)	9,3	≈ 36	E2			244000 (5000)	326000
$\gamma_{1,0}$(Fr)	12,9 (1)	0,698	(E2)			37740 (800)	49860 (1000)
$\gamma_{2,1}$(Th)	15,2 (1)	≈ 0,15	M1			177 (4)	238 (5)
$\gamma_{2,0}$(Th)	24,33 (5)	≈ 9,5	M1+E2		254 (8)	64,0 (23)	340 (11)
$\gamma_{8,6}$(Fr)	25,95	0,00000055					
$\gamma_{3,1}$(Th)	28,57 (5)	≈ 0,18	E1		2,42 (5)	0,616 (13)	3,24 (7)
$\gamma_{6,5}$(Fr)	33,5 (1)	0,00033 (9)	[E1]		1,50 (3)	0,371 (8)	1,99 (4)
$\gamma_{6,4}$(Fr)	35,0 (2)	0,000078 (28)	[E1]		1,34 (3)	0,330 (7)	1,77 (4)
$\gamma_{3,0}$(Th)	37,90 (3)	≈ 0,12	E1		1,16 (3)	0,288 (6)	1,54 (3)
$\gamma_{4,2}$(Fr)	44,7 (1)	0,025 (23)	[M1+E2]		165 (150)	44 (40)	223 (200)
$\gamma_{13,9}$(Fr)	51,06	0,00000028					
$\gamma_{10,6}$(Fr)	52,32	0,0000014					
$\gamma_{14,11}$(Fr)	53,7 (2)	0,000064 (16)	[E1]		0,427 (9)	0,104 (2)	0,563 (11)
$\gamma_{2,0}$(Fr)	55,0 (1)	0,0077 (14)	M1+E2		12,5 (6)	2,98 (16)	16,4 (8)
$\gamma_{16,11}$(Fr)	55,80 (5)	0,0000039					
$\gamma_{16,10}$(Fr)	57,56 (5)	0,0000032					
$\gamma_{8,5}$(Fr)	59,4 (2)	0,000059 (14)	[E1]		0,326 (7)	0,0790 (16)	0,430 (9)
$\gamma_{8,4}$(Fr)	60,6 (3)	0,000058 (14)	[E1]		0,309 (6)	0,0749 (15)	0,408 (9)

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{3,1}$(Fr)	69,28 (8)	0,076 (14)	M1+E2		13,7 (14)	3,6 (4)	18,4 (19)
$\gamma_{14,10}$(Fr)	70,6 (2)	0,0023 (18)	[M1+E2]		20 (14)	5 (4)	27 (19)
$\gamma_{9,4}$(Fr)	72,5 (2)	0,000086 (38)	[E1]		0,191 (4)	0,0462 (10)	0,252 (5)
$\gamma_{16,9}$(Fr)	72,5 (2)	0,000086 (38)	[E1]		0,191 (4)	0,0462 (10)	0,252 (5)
$\gamma_{6,2}$(Fr)	79,54 (8)	0,00132 (12)	E1		0,149 (3)	0,0360 (7)	0,197 (4)
$\gamma_{3,0}$(Fr)	82,2 (1)	0,0192 (23)	E2		16,25 (30)	4,40 (9)	22,1 (5)
$\gamma_{15,8}$(Fr)	83,0 (1)	0,0000014					
$\gamma_{12,6}$(Fr)	85,0 (5)	0,000011					
$\gamma_{10,5}$(Fr)	86,1 (1)	0,00047					
$\gamma_{4,1}$(Fr)	86,7 (2)	0,034 (20)	[M1+E2]		8 (5)	2,1 (14)	11 (7)
$\gamma_{11,5}$(Fr)	88,1 (1)	0,0076 (43)	[M1+E2]		8 (5)	2,0 (13)	10 (6)
$\gamma_{5,1}$(Fr)	88,1 (1)	0,0076 (43)	[M1+E2]		8 (5)	2,0 (13)	10 (6)
$\gamma_{13,6}$(Fr)	88,5 (6)	0,00000097					
$\gamma_{9,3}$(Fr)	90,0 (1)	0,00021 (8)	[E1]		0,107 (2)	0,0259 (5)	0,142 (3)
$\gamma_{4,0}$(Fr)	99,6 (1)	0,036 (16)	M1+E2		4,4 (22)	1,2 (7)	6 (3)
$\gamma_{5,0}$(Fr)	101,0 (1)	0,0048 (29)	[M1+E2]		4,1 (21)	1,1 (6)	6 (3)
$\gamma_{10,3}$(Fr)	105,0 (2)	0,0046 (16)	M1	9,96 (20)	1,86 (4)	0,443 (9)	12,4 (25)
$\gamma_{11,3}$(Fr)	106,85 (10)	0,0110 (34)	M(+E2)	5 (2)	3,2 (15)	0,8 (4)	9 (3)
$\gamma_{14,6}$(Fr)	108,0 (3)	0,00041 (16)	[M1+E2]	5 (2)	3,1 (15)	0,8 (4)	9 (3)
$\gamma_{12,5}$(Fr)	118,7 (4)	0,000054 (13)	[E1]	0,244 (5)	0,0516 (11)	0,0124 (3)	0,312 (6)
$\gamma_{6,1}$(Fr)	121,6 (1)	0,00155 (39)	[E1]	0,231 (5)	0,0485 (10)	0,0116 (3)	0,295 (6)
$\gamma_{18,15}$(Fr)	121,6 (1)	0,00155 (39)	[E1]	0,231 (5)	0,0485 (10)	0,0116 (3)	0,295 (6)
$\gamma_{6,0}$(Fr)	134,5 (1)	0,00068 (12)	E1	0,182 (4)	0,0372 (8)	0,00891 (18)	0,230 (5)
$\gamma_{12,3}$(Fr)	137,4 (1)	0,00050 (12)	[E1]	0,172 (4)	0,0352 (7)	0,00843 (17)	0,220 (5)
$\gamma_{13,3}$(Fr)	140,9 (1)	0,00025 (7)	[E1]	0,162 (4)	0,0330 (7)	0,00789 (16)	0,206 (4)
$\gamma_{18,13}$(Fr)	143,0 (1)	0,0013 (6)	[M1+E2]	2,2 (11)	1,0 (5)	0,26 (13)	3,6 (18)
$\gamma_{14,4}$(Fr)	143,0 (1)	0,00034 (7)	[E1]	0,157 (3)	0,0317 (7)	0,00759 (15)	0,198 (4)
$\gamma_{16,5}$(Fr)	143,65 (5)	0,00015886	M1	4,12 (8)	0,755 (15)	0,180 (4)	5,11 (11)
$\gamma_{18,12}$(Fr)	146,0 (2)	0,0000088					
$\gamma_{8,1}$(Fr)	147,61 (8)	0,00296 (36)	E1	0,145 (3)	0,0292 (6)	0,00699 (14)	0,184 (4)
$\gamma_{7,0}$(Fr)	149,3 (3)	0,000014					
$\gamma_{9,1}$(Fr)	159,2 (1)	0,00063 (12)	[E1]	0,121 (3)	0,0240 (5)	0,00574 (11)	0,153 (3)
$\gamma_{8,0}$(Fr)	160,49 (10)	0,00506 (46)	E1	0,119 (3)	0,0235 (5)	0,00562 (11)	0,150 (3)
$\gamma_{15,3}$(Fr)	161,4 (4)	0,00049 (23)	[M1+E2]	1,6 (15)	0,64 (9)	0,16 (4)	2,5 (13)
$\gamma_{16,3}$(Fr)	162,6 (2)	0,00019 (12)	M1,E2	1,6 (15)	0,62 (9)	0,16 (4)	2,4 (13)
$\gamma_{9,0}$(Fr)	172,0 (1)	0,00109 (11)	E1	0,101 (2)	0,0197 (4)	0,0047 (1)	0,127 (3)
$\gamma_{10,1}$(Fr)	174,3 (1)	0,00081 (35)	[M1+E2]	1,3 (11)	0,48 (4)	0,122 (17)	1,9 (11)
$\gamma_{18,11}$(Fr)	176,1 (1)	0,000370 (45)	[E1]	0,095 (2)	0,0185 (4)	0,00443 (9)	0,120 (3)
$\gamma_{11,1}$(Fr)	176,1 (1)	0,00096 (40)	M1,E2	1,3 (11)	0,46 (4)	0,117 (17)	1,9 (11)
$\gamma_{12,1}$(Fr)	206,8 (1)	0,00105 (11)	E1	0,0651 (13)	0,0124 (3)	0,00294 (6)	0,0814 (17)
$\gamma_{17,1}$(Fr)	216,6 (3)	0,00011 (7)	[M1+E2]	0,7 (6)	0,221 (20)	0,0556 (18)	1,0 (7)
$\gamma_{(-1,1)}$(Fr)	219,2 (4)	0,0000140 (4)					
$\gamma_{14,1}$(Fr)	229,7 (1)	0,00044 (7)	[E1]	0,0509 (11)	0,00951 (19)	0,00226 (5)	0,0634 (13)
$\gamma_{15,1}$(Fr)	230,9 (5)	0,0000252	[M1+E2]	0,6 (5)	0,177 (24)	0,045 (4)	0,8 (5)
$\gamma_{16,1}$(Fr)	231,79 (5)	0,0000072					
$\gamma_{14,0}$(Fr)	242,6 (2)	0,00030 (7)	[E1]	0,0448 (9)	0,00831 (17)	0,00198 (4)	0,0558 (12)
$\gamma_{15,0}$(Fr)	243,9 (4)	0,0000358 (10)	[E2]	0,108 (2)	0,126 (3)	0,0335 (7)	0,279 (6)
$\gamma_{18,3}$(Fr)	283,4 (3)	0,000057 (31)	[E1]	0,0314 (7)	0,00570 (12)	0,00136 (3)	0,0389 (8)
$\gamma_{23,11}$(Fr)	351,7 (3)	0,000056 (31)	[E1]	0,0195 (4)	0,00344 (7)	0,000815 (17)	0,0240 (5)
$\gamma_{22,4}$(Fr)	415,6 (3)	0,00024 (7)		0,13 (10)	0,028 (12)	0,007 (3)	0,16 (11)
$\gamma_{23,5}$(Fr)	439,60 (5)	0,000034 (1)					
$\gamma_{23,4}$(Fr)	441,0 (4)	0,000056 (30)	[E1]	0,0120 (3)	0,00207 (4)	0,00049 (1)	0,0148 (3)
$\gamma_{22,2}$(Fr)	460,2 (3)	0,00024 (7)	M1+E2	0,10 (8)	0,021 (10)	0,0051 (22)	0,12 (9)
$\gamma_{23,1}$(Fr)	527,6 (1)	0,000029					
$\gamma_{23,0}$(Fr)	540,40 (5)	0,00007					

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				
	$K\alpha_2$	89,954		61,82
	$K\alpha_1$	93,351		100
	$K\beta_3$	104,819	}	
	$K\beta_1$	105,604	}	
	$K\beta_5''$	106,239	}	35,58
	$K\beta_2$	108,509	}	
	$K\beta_4$	108,955	}	11,99
	$KO_{2,3}$	109,442	}	
X_L				
	$L\ell$	11,118		
	$L\alpha$	12,809 – 12,968		
	$L\eta$	14,511		
	$L\beta$	14,97 – 16,426		
	$L\gamma$	18,98 – 19,599		

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	

3.2 Fr

ω_K	:	0,967	(4)
$\bar{\omega}_L$	:	0,440	(18)
n_{KL}	:	0,803	(5)

3.2.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	83,23		60,92
	$K\alpha_1$	86,1		100
	$K\beta_3$	96,815	}	
	$K\beta_1$	97,474	}	
	$K\beta_5''$	98,069	}	34,88
	$K\beta_2$	100,16	}	
	$K\beta_4$	100,548	}	11,3
	$KO_{2,3}$	100,972	}	
X_L				
	$L\ell$	10,381		
	$L\alpha$	11,896 – 12,032		
	$L\eta$	13,255		
	$L\beta$	13,877 – 14,978		
	$L\gamma$	17,302 – 17,839		

3.2.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	63,576 – 70,787	100
KLX	77,720 – 86,101	57,4
KXY	91,84 – 101,12	8,24
Auger L	5,73 – 18,52	

4 α Emissions

	Energy keV	Probability × 100
$\alpha_{0,24}$	4362,83 (15)	≈ 0,00004
$\alpha_{0,23}$	4422,03 (28)	≈ 0,00008
$\alpha_{0,22}$	4447,12 (26)	≈ 0,0007
$\alpha_{0,21}$	4459 (7)	≈ 0,00007
$\alpha_{0,20}$	4512 (5)	≈ 0,00004
$\alpha_{0,19}$	4581 (7)	≈ 0,00004
$\alpha_{0,18}$	4594,21 (17)	≈ 0,0003
$\alpha_{0,16}$	4712,89 (20) ↑	
$\alpha_{0,15}$	4713,68 (19) |	
$\alpha_{0,14}$	4714,88 (15) ↓	0,006 (3)
$\alpha_{0,13}$	4734,41 (17) ↑	
$\alpha_{0,12}$	4737,50 (16) ↓	0,0012
$\alpha_{0,11}$	4767,47 (15) ↑	
$\alpha_{0,10}$	4769,35 (17) ↓	0,025 (7)
$\alpha_{0,9}$	4784,19 (15)	0,0011
$\alpha_{0,8}$	4795,58 (15)	0,014 (7)
$\alpha_{0,6}$	4821,09 (15)	0,001
$\alpha_{0,5}$	4854,01 (15) ↑	
$\alpha_{0,4}$	4855,36 (15) ↓	0,08 (1)
$\alpha_{0,3}$	4872,55 (15)	0,087 (7)
$\alpha_{0,2}$	4899,23 (15)	0,0015
$\alpha_{0,1}$	4940,57 (15)	0,546 (17)
$\alpha_{0,0}$	4953,23 (14)	0,658 (14)

5 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Th)	5,8 - 20,3		≈ 3,9
e_{AK}	(Th)			
	KLL	68,406 - 76,745	}	
	KLX	83,857 - 93,345	}	
	KXY	99,29 - 109,64	}	
e_{AL}	(Fr)	5,73 - 18,52		0,097 (10)
e_{AK}	(Fr)			0,00050 (15)
	KLL	63,576 - 70,787	}	
	KLX	77,720 - 86,101	}	
	KXY	91,84 - 101,12	}	

		Energy keV			Electrons per 100 disint.
$ec_{2,0\ L}$	(Th)	3,9	-	8,0	≈ 7,1
$ec_{1,0\ M}$	(Th)	4,1	-	6,0	≈ 27
$ec_{3,1\ L}$	(Th)	8,1	-	12,3	≈ 0,1016 (21)
$ec_{1,0\ M}$	(Fr)	8,3	-	9,9	0,528 (11)
$ec_{2,1\ M}$	(Th)	10,0	-	11,9	≈ 0,11
$ec_{3,0\ L}$	(Th)	17,4	-	21,6	≈ 0,0568 (15)
$ec_{2,0\ M}$	(Th)	19,2	-	21,0	≈ 1,8
$ec_{3,1\ M}$	(Th)	23,39	-	25,24	≈ 0,0259 (5)
$ec_{4,2\ L}$	(Fr)	26,1	-	29,7	0,018 (17)
$ec_{3,0\ M}$	(Th)	32,7	-	34,6	≈ 0,01411 (29)
$ec_{3,1\ L}$	(Fr)	50,65	-	54,26	0,053 (10)
$ec_{3,0\ L}$	(Fr)	63,6	-	67,2	0,0135 (16)
$ec_{3,1\ M}$	(Fr)	64,64	-	66,29	0,0140 (27)
$ec_{4,1\ L}$	(Fr)	68,1	-	71,7	0,022 (14)
$ec_{4,0\ L}$	(Fr)	81,0	-	84,6	0,022 (12)
$\beta^-_{0,3}$	max:	6,9		(8)	0,3
$\beta^-_{0,3}$	avg:	1,7		(3)	
$\beta^-_{0,2}$	max:	20,5		(8)	≈ 10
$\beta^-_{0,2}$	avg:	5,1		(3)	
$\beta^-_{0,1}$	max:	35,5		(8)	≈ 35
$\beta^-_{0,1}$	avg:	9,0		(3)	
$\beta^-_{0,0}$	max:	44,8		(8)	≈ 53
$\beta^-_{0,0}$	avg:	11,4		(3)	

6 Photon Emissions

6.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Th)	11,118 — 19,599		≈ 2,64	
XL	(Fr)	10,381 — 17,839		0,074 (8)	
$XK\alpha_2$	(Fr)	83,23		0,0043 (12)	} $K\alpha$
$XK\alpha_1$	(Fr)	86,1		0,0070 (19)	}
$XK\beta_3$	(Fr)	96,815	}		
$XK\beta_1$	(Fr)	97,474	}	0,0024 (7)	$K'\beta_1$
$XK\beta_5''$	(Fr)	98,069	}		
$XK\beta_2$	(Fr)	100,16	}		
$XK\beta_4$	(Fr)	100,548	}	0,00079 (22)	$K'\beta_2$
$XKO_{2,3}$	(Fr)	100,972	}		

6.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Th)	9,3	0,00011
$\gamma_{1,0}$(Fr)	12,9 (1)	0,000014
$\gamma_{2,1}$(Th)	15,2 (1)	0,00062
$\gamma_{2,0}$(Th)	24,33 (5)	0,028
$\gamma_{8,6}$(Fr)	25,95	0,00000055
$\gamma_{3,1}$(Th)	28,57 (5)	0,042
$\gamma_{6,5}$(Fr)	33,5 (1)	0,00011 (3)
$\gamma_{6,4}$(Fr)	35,0 (2)	0,000028 (10)
$\gamma_{9,1}$(Fr)	37,47	0,0000028
$\gamma_{3,0}$(Th)	37,90 (3)	0,049
$\gamma_{4,2}$(Fr)	44,7 (1)	0,00011 (3)
$\gamma_{13,9}$(Fr)	51,06	0,00000028
$\gamma_{10,6}$(Fr)	52,32	0,0000014
$\gamma_{14,11}$(Fr)	53,7 (2)	0,000041 (10)
$\gamma_{2,0}$(Fr)	55,0 (1)	0,00044 (8)
$\gamma_{16,11}$(Fr)	55,80 (5)	0,0000039
$\gamma_{16,10}$(Fr)	57,56 (5)	0,0000032
$\gamma_{8,5}$(Fr)	59,4 (2)	0,000041 (10)
$\gamma_{8,4}$(Fr)	60,6 (3)	0,000041 (10)
$\gamma_{3,1}$(Fr)	69,28 (8)	0,0039 (6)
$\gamma_{14,10}$(Fr)	70,6 (2)	0,000083 (30)
$\gamma_{9,4}$(Fr)	72,5 (2)	0,000069 (30)
$\gamma_{16,9}$(Fr)	72,5 (2)	0,000069 (30)
$\gamma_{6,2}$(Fr)	79,54 (8)	0,0011 (1)
$\gamma_{3,0}$(Fr)	82,2 (1)	0,00083 (10)
$\gamma_{15,8}$(Fr)	83,0 (1)	0,0000014
$\gamma_{12,6}$(Fr)	85,0 (5)	0,000011
$\gamma_{10,5}$(Fr)	86,1 (1)	0,00047
$\gamma_{4,1}$(Fr)	86,7 (2)	0,0028 (4)
$\gamma_{11,5}$(Fr)	88,1 (1)	0,00069 (10)
$\gamma_{5,1}$(Fr)	88,1 (1)	0,00069 (10)
$\gamma_{13,6}$(Fr)	88,5 (6)	0,00000097
$\gamma_{9,3}$(Fr)	90,0 (1)	0,00018 (7)
$\gamma_{4,0}$(Fr)	99,6 (1)	0,0051 (7)
$\gamma_{5,0}$(Fr)	101,0 (1)	0,00069 (30)
$\gamma_{10,3}$(Fr)	105,0 (2)	0,00034 (10)
$\gamma_{11,3}$(Fr)	106,85 (10)	0,0011 (1)
$\gamma_{14,6}$(Fr)	108,0 (3)	0,000041 (10)
$\gamma_{12,5}$(Fr)	118,7 (4)	0,000041 (10)
$\gamma_{6,1}$(Fr)	121,6 (1)	0,0012 (3)
$\gamma_{18,15}$(Fr)	121,6 (1)	0,0012 (3)
$\gamma_{6,0}$(Fr)	134,5 (1)	0,00055 (10)
$\gamma_{12,3}$(Fr)	137,4 (1)	0,00041 (10)
$\gamma_{13,3}$(Fr)	140,9 (1)	0,00021 (6)
$\gamma_{14,4}$(Fr)	143,0 (1)	0,00028 (6)

	Energy keV	Photons per 100 disint.
$\gamma_{18,13}$(Fr)	143,0 (1)	0,00028 (6)
$\gamma_{16,5}$(Fr)	143,65 (5)	0,000026
$\gamma_{18,12}$(Fr)	146,0 (2)	0,0000088
$\gamma_{8,1}$(Fr)	147,61 (8)	0,0025 (3)
$\gamma_{7,0}$(Fr)	149,3 (3)	0,000014
$\gamma_{9,1}$(Fr)	159,2 (1)	0,00055 (10)
$\gamma_{8,0}$(Fr)	160,49 (10)	0,0044 (4)
$\gamma_{15,3}$(Fr)	161,4 (4)	0,00014 (4)
$\gamma_{16,3}$(Fr)	162,6 (2)	0,000055 (30)
$\gamma_{9,0}$(Fr)	172,0 (1)	0,00097 (10)
$\gamma_{10,1}$(Fr)	174,3 (1)	0,00028 (6)
$\gamma_{18,11}$(Fr)	176,1 (1)	0,00033 (4)
$\gamma_{11,1}$(Fr)	176,1 (1)	0,00033 (6)
$\gamma_{12,1}$(Fr)	206,8 (1)	0,00097 (10)
$\gamma_{17,1}$(Fr)	216,6 (3)	0,000055 (30)
$\gamma_{(-1,1)}$(Fr)	219,2 (4)	0,0000140 (4)
$\gamma_{14,1}$(Fr)	229,7 (1)	0,00041 (7)
$\gamma_{15,1}$(Fr)	230,9 (5)	0,000014
$\gamma_{16,1}$(Fr)	231,79 (5)	0,0000072
$\gamma_{14,0}$(Fr)	242,6 (2)	0,00028 (7)
$\gamma_{15,0}$(Fr)	243,9 (4)	0,0000280 (8)
$\gamma_{18,3}$(Fr)	283,4 (3)	0,000055 (30)
$\gamma_{23,11}$(Fr)	351,7 (3)	0,000055 (30)
$\gamma_{22,4}$(Fr)	415,6 (3)	0,00021 (6)
$\gamma_{23,5}$(Fr)	439,60 (5)	0,000034 (1)
$\gamma_{23,4}$(Fr)	441,0 (4)	0,000055 (30)
$\gamma_{22,2}$(Fr)	460,2 (3)	0,00021 (6)
$\gamma_{23,1}$(Fr)	527,6 (1)	0,000029
$\gamma_{23,0}$(Fr)	540,40 (5)	0,00007

7 Main Production Modes

Ra – 226(n,γ)Ra – 227

Ra – 227(β^-)Ac – 227

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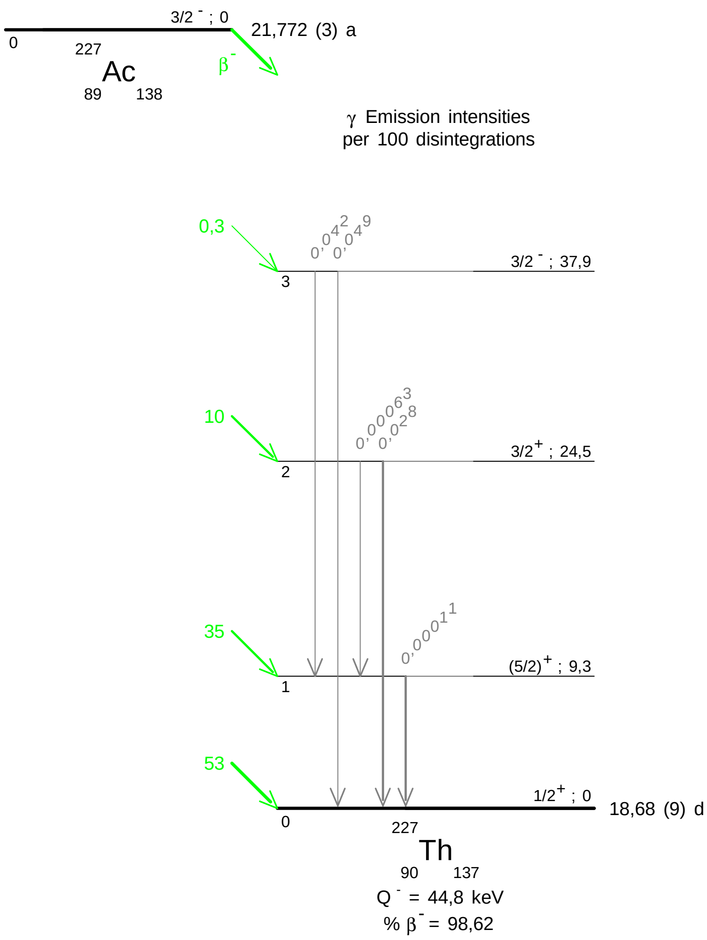

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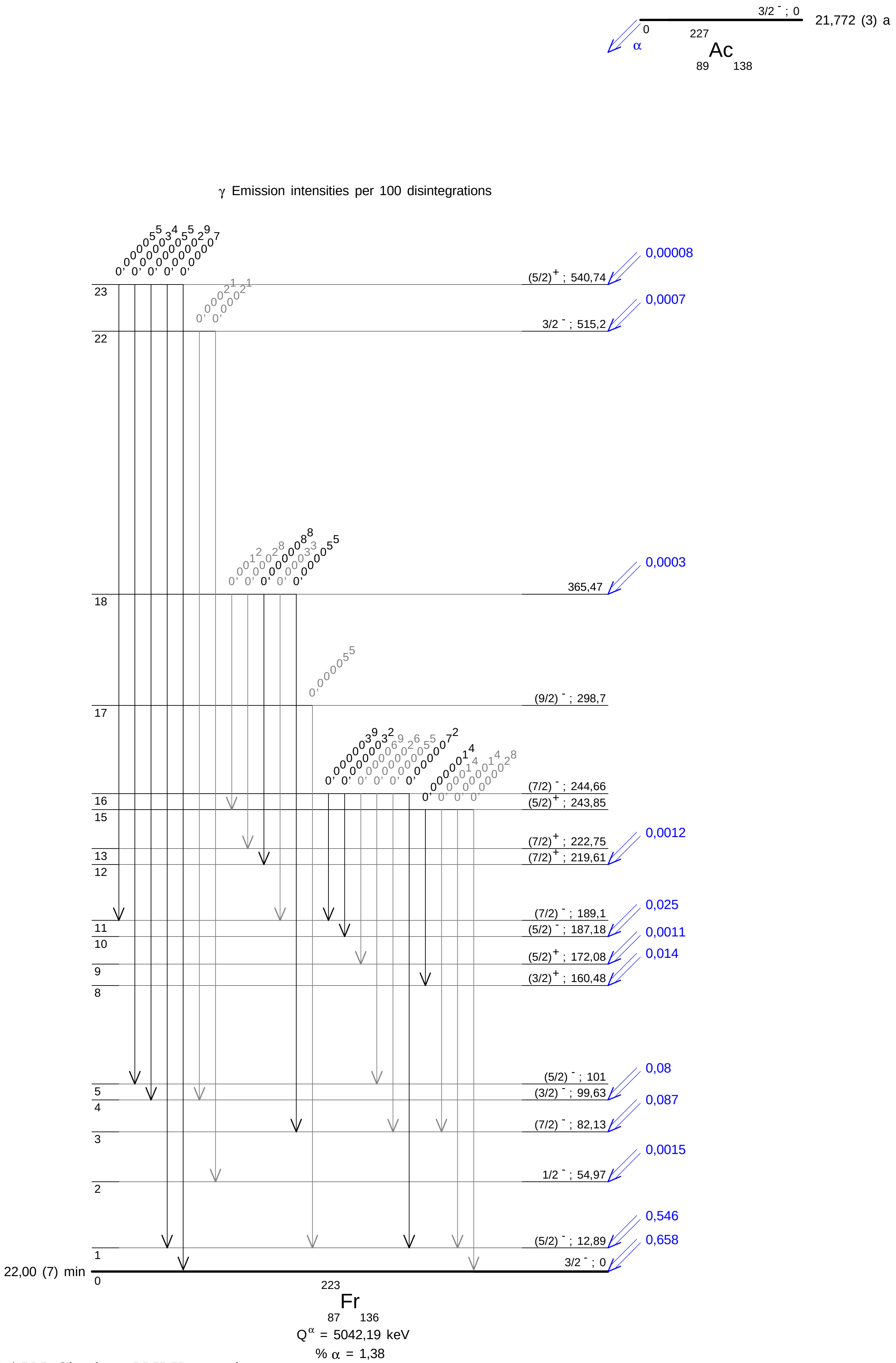
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0
α
227
Ac
89 138
γ Emission intensities per 100 disintegrations
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0,00008
3/2 - ; 515,2
0,0007
365,47
0,0003
(9/2) - ; 298,7
(7/2) - ; 244,66
(5/2)+ ; 243,85
(7/2)+ ; 222,75
(7/2)+ ; 219,61
0,0012
(7/2) - ; 189,1
(5/2) - ; 187,18
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0,0015
(5/2) - ; 12,89
0,546
3/2 - ; 0
0,658
23
22
18
17
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15
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12
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2
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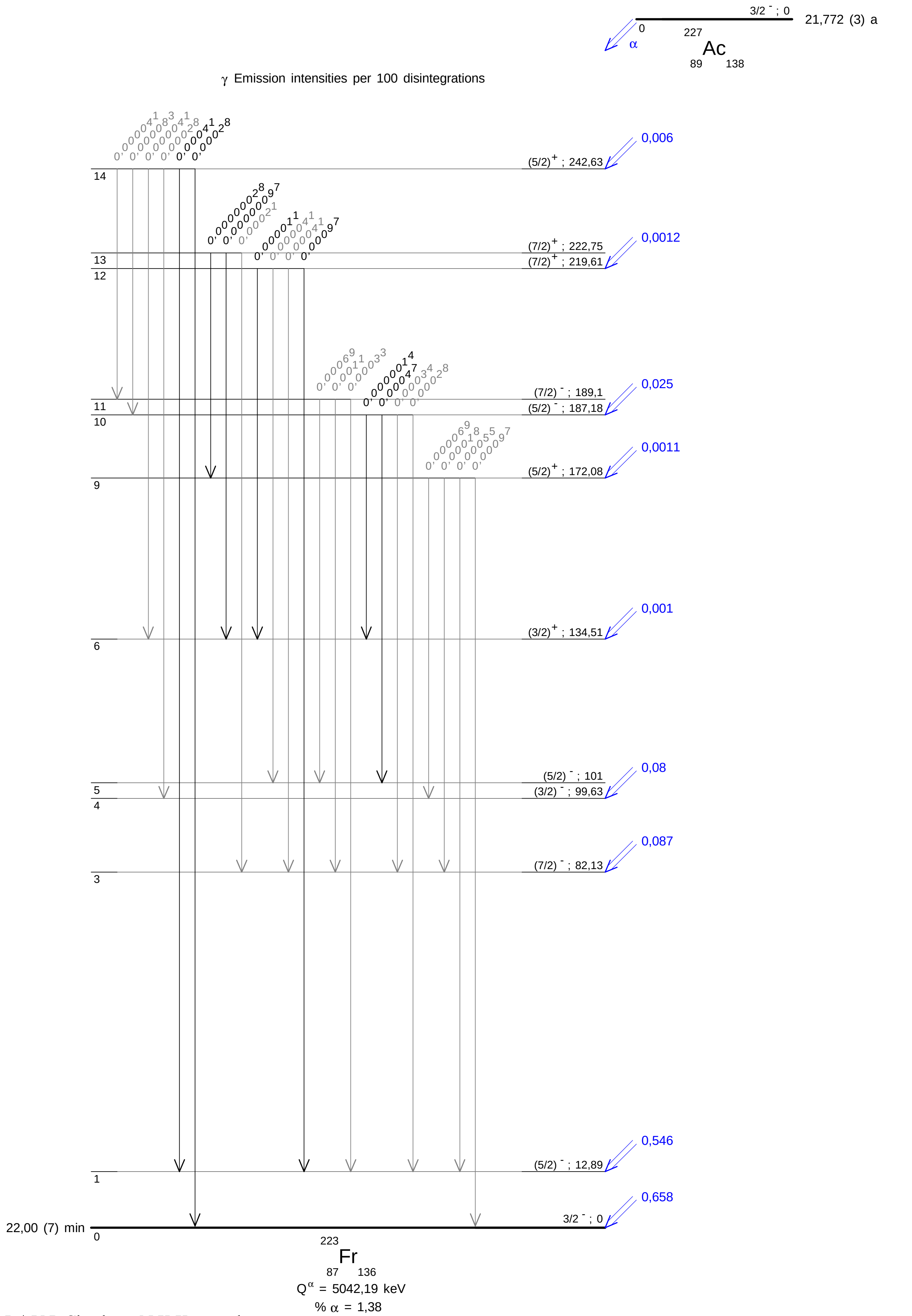
22,00 (7) min
223
Fr
87 136
Q^α = 5042,19 keV
% α = 1,38



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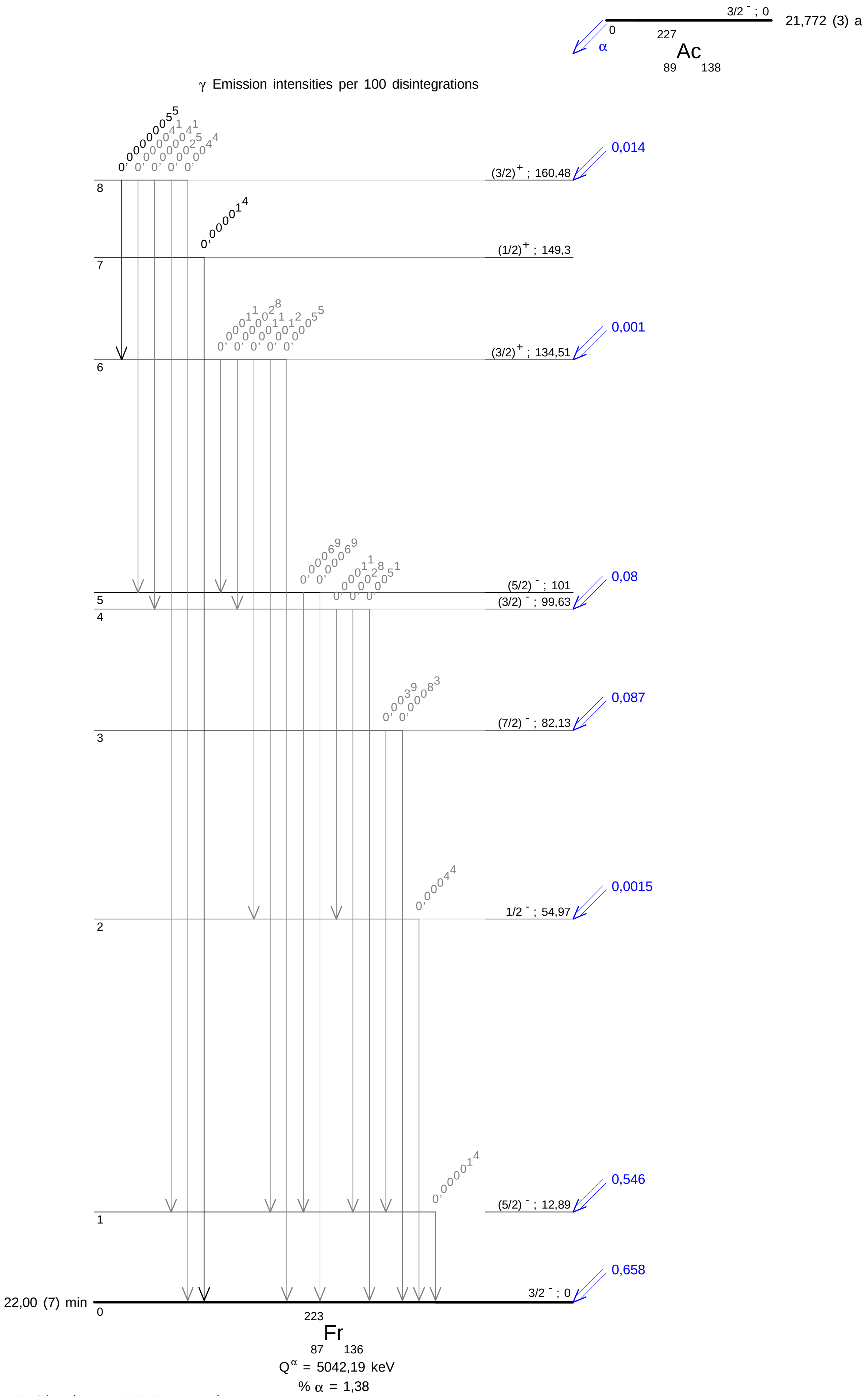

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$^{232}_{92}U_{140}$

1 Decay Scheme

Uranium 232 decays primarily by alpha decay to excited states in Th-228. A small branching of exotic decay via Ne-24 emission and a smaller branching of spontaneous fission have been reported.
L'uranium 232 se désintègre essentiellement par transitions alpha vers des niveaux excités de thorium 228. De faibles décroissances par fission spontanée et par émission de néon 24 ont été observées.

2 Nuclear Data

$T_{1/2}(^{232}U)$	:	70,6	(11)	a
$T_{1/2}(^{228}Th)$	:	1,9127	(6)	a
$Q^{\alpha}(^{232}U)$	:	5413,63	(9)	keV

2.1 α Transitions

	Energy keV	Probability × 100	F
$\alpha_{0,8}$	4539,16 (9)	0,0000033 (9)	33
$\alpha_{0,7}$	4581,81 (9)	0,0000214 (16)	10,6
$\alpha_{0,6}$	4894,44 (9)	0,000054 (4)	712
$\alpha_{0,5}$	5017,55 (9)	0,000048 (4)	5270
$\alpha_{0,4}$	5035,45 (9)	0,000051 (6)	6490
$\alpha_{0,3}$	5085,63 (9)	0,00622 (9)	112
$\alpha_{0,2}$	5226,81 (9)	0,325 (6)	16,4
$\alpha_{0,1}$	5355,87 (9)	30,6 (6)	1,04
$\alpha_{0,0}$	5413,63 (9)	69,1 (6)	1

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{1,0}$(Th)	57,752 (13)	30,8 (8)	E2	0	112,2 (16)	30,7 (5)	153,2 (22)
$\gamma_{2,1}$(Th)	129,064 (6)	0,325 (5)	E2	0,264 (4)	2,54 (4)	0,697 (10)	3,74 (6)
$\gamma_{6,4}$(Th)	141,013 (12)	0,0000038 (16)	E1	0,1690 (24)	0,0362 (5)	0,00876 (13)	0,217 (3)
$\gamma_{4,2}$(Th)	191,356 (11)	0,000055 (5)	E2	0,1710 (24)	0,443 (7)	0,1209 (17)	0,776 (11)
$\gamma_{5,2}$(Th)	209,255 (11)	0,0000119 (33)	E1	0,0672 (10)	0,01333 (19)	0,00321 (5)	0,0848 (12)
$\gamma_{3,1}$(Th)	270,244 (6)	0,00332 (7)	E1	0,0376 (6)	0,00716 (10)	0,001717 (24)	0,0470 (7)
$\gamma_{3,0}$(Th)	328,003 (4)	0,00292 (7)	E1	0,0245 (4)	0,00455 (7)	0,001089 (16)	0,0305 (5)
$\gamma_{6,2}$(Th)	332,369 (7)	0,0000505 (31)	E1	0,0238 (4)	0,00441 (7)	0,001056 (15)	0,0297 (5)
$\gamma_{5,1}$(Th)	338,319 (11)	0,0000381 (19)	E1	0,0229 (4)	0,00424 (6)	0,001014 (15)	0,0285 (4)
$\gamma_{8,5}$(Th)	478,395 (21)	0,0000014 (6)	E1	0,011180 (16)	0,00198 (3)	0,000471 (7)	0,01379 (20)
$\gamma_{7,3}$(Th)	503,820 (11)	0,0000147 (9)	E1	0,01009 (15)	0,001775 (25)	0,000422 (6)	0,01243 (18)
$\gamma_{8,3}$(Th)	546,470 (18)	0,0000010 (6)	E1	0,00861 (12)	0,001500 (21)	0,000357 (5)	0,01058 (15)
$\gamma_{7,1}$(Th)	774,064 (11)	0,0000048 (8)	E2	0,01204 (17)	0,00333 (5)	0,000835 (12)	0,01649 (23)
$\gamma_{8,1}$(Th)	816,714 (18)	0,00000083 (31)	M1+E2	0,0284 (4)	0,00566 (8)	0,001369 (20)	0,0359 (5)
$\gamma_{7,0}$(Th)	831,823 (10)	0,000002 (1)	E0				

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				
	$K\alpha_2$	89,954		61,82
	$K\alpha_1$	93,351		100
	$K\beta_3$	104,819	}	
	$K\beta_1$	105,604	}	
	$K\beta_5''$	106,239	}	35,58
	$K\beta_2$	108,509	}	
	$K\beta_4$	108,955	}	11,99
	$KO_{2,3}$	109,442	}	
X_L				
	$L\ell$	11,1177		
	$L\alpha$	12,8085 – 12,967		
	$L\eta$	14,509		
	$L\beta$	14,972 – 16,4253		
	$L\gamma$	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 α Emissions

	Energy keV	Probability × 100
$\alpha_{0,8}$	4460,86 (9)	0,0000033 (9)
$\alpha_{0,7}$	4502,77 (9)	0,0000214 (16)
$\alpha_{0,6}$	4810,01 (9)	0,000054 (4)
$\alpha_{0,5}$	4931,00 (9)	0,000048 (4)
$\alpha_{0,4}$	4948,59 (9)	0,000051 (6)
$\alpha_{0,3}$	4997,90 (9)	0,00622 (9)
$\alpha_{0,2}$	5136,64 (9)	0,325 (6)
$\alpha_{0,1}$	5263,48 (9)	30,6 (6)
$\alpha_{0,0}$	5320,24 (9)	69,1 (6)

5 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Th)	5,8 - 20,3		11,62 (22)
e_{AK}	(Th)			0,00057 (8)
	KLL	68,406 - 76,745	}	
	KLX	83,857 - 93,345	}	
	KXY	99,29 - 109,64	}	
$ec_{1,0\ L}$	(Th)	37,28 - 41,50		22,4 (6)
$ec_{1,0\ M}$	(Th)	52,57 - 54,42		6,14 (16)
$ec_{1,0\ N}$	(Th)	56,420 - 57,417		1,646 (41)
$ec_{2,1\ L}$	(Th)	108,592 - 112,800		0,1742 (33)

6 Photon Emissions

6.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Th)	11,1177 — 19,5043		11,00 (24)	
$XK\alpha_2$	(Th)	89,954		0,00524 (11)	} $K\alpha$
$XK\alpha_1$	(Th)	93,351		0,00847 (16)	}
$XK\beta_3$	(Th)	104,819	}		
$XK\beta_1$	(Th)	105,604	}	0,00301 (7)	$K'\beta_1$
$XK\beta_5''$	(Th)	106,239	}		
$XK\beta_2$	(Th)	108,509	}		
$XK\beta_4$	(Th)	108,955	}	0,001016 (29)	$K'\beta_2$
$XKO_{2,3}$	(Th)	109,442	}		

6.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Th)	57,752 (13)	0,200 (4)
$\gamma_{2,1}$(Th)	129,065 (3)	0,0686 (7)
$\gamma_{6,4}$(Th)	140,999 (20)	0,0000031 (13)
$\gamma_{4,2}$(Th)	191,351 (11)	0,000031 (3)
$\gamma_{5,2}$(Th)	209,252 (6)	0,000011 (3)
$\gamma_{3,1}$(Th)	270,245 (7)	0,00317 (7)
$\gamma_{3,0}$(Th)	328,004 (7)	0,00283 (7)
$\gamma_{6,2}$(Th)	332,371 (6)	0,000049 (3)
$\gamma_{5,1}$(Th)	338,320 (5)	0,0000370 (18)
$\gamma_{8,5}$(Th)	478,41 (5)	0,0000014 (6)
$\gamma_{7,3}$(Th)	503,819 (23)	0,0000145 (9)
$\gamma_{8,3}$(Th)	546,454 (21)	0,0000010 (6)
$\gamma_{7,1}$(Th)	774,05 (9)	0,0000047 (8)
$\gamma_{8,1}$(Th)	816,62 (700)	0,0000008 (3)

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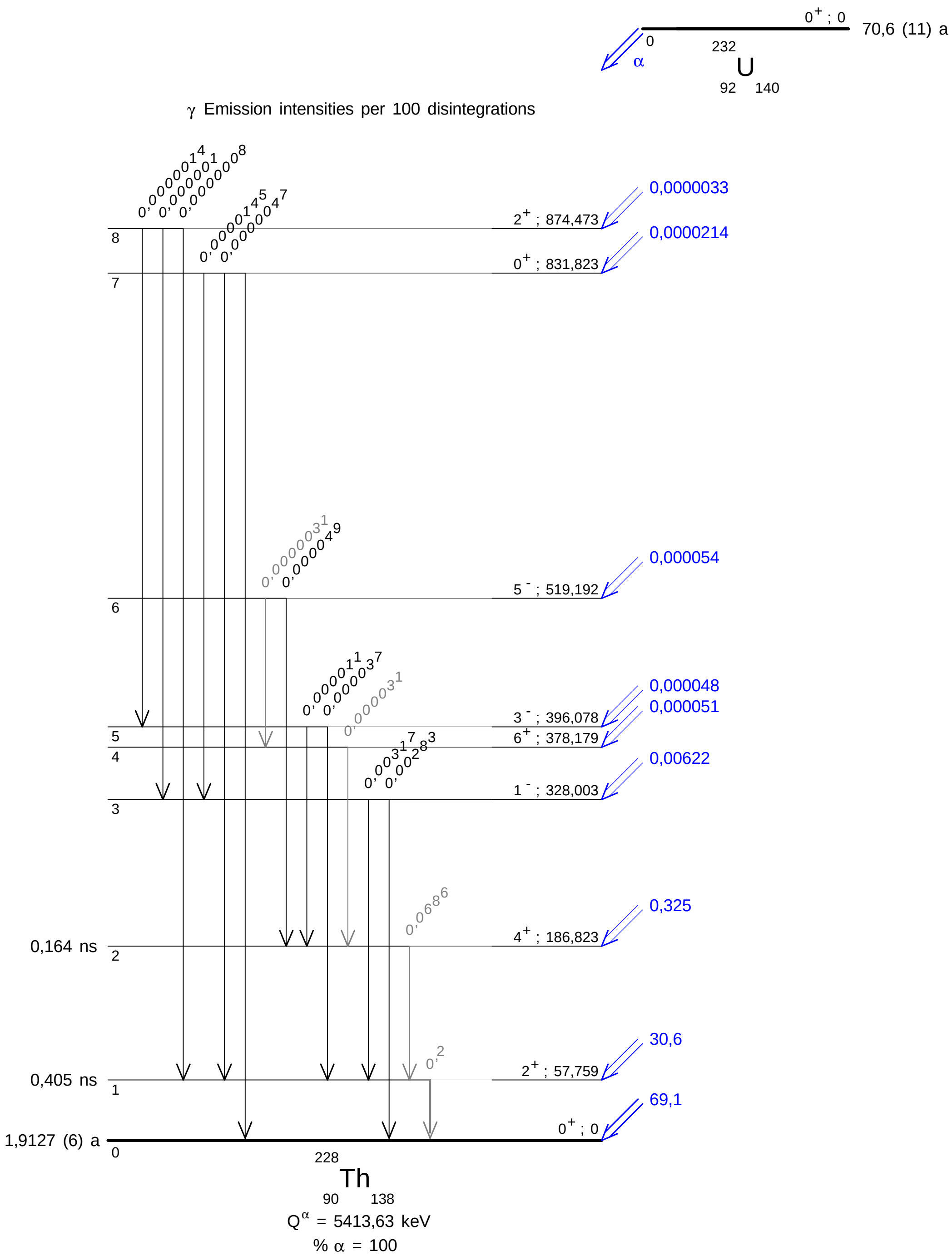
0+ ; 0
70,6 (11) a
0
α
232 U 92 140
γ Emission intensities per 100 disintegrations
2+ ; 874,473
0,0000033
0+ ; 831,823
0,0000214
5- ; 519,192
0,000054
3- ; 396,078
0,000048
6+ ; 378,179
0,000051
1- ; 328,003
0,00622
4+ ; 186,823
0,325
0,164 ns
2+ ; 57,759
30,6
0,405 ns
0+ ; 0
69,1
1,9127 (6) a
228 Th 90 138
Qα = 5413,63 keV
% α = 100

NPL / A. Pearce

236	U	
92		144

1 Decay Scheme

U-236 disintegrates by alpha emission mainly to the ground and 49-keV states in Th-232, and by 9,3 $\times 10^{-8}$ % spontaneous fission.
L'uranium 236 se désintègre par émission alpha et par fission spontanée dans une proportion p (FS) = 9,3 $\times 10^{-8}$ *%. L'émission alpha a lieu principalement vers le niveau excité de 49 keV et le niveau fondamental de thorium 232. Le nombre moyen n (FS) de neutrons émis par transformation nucléaire de U-236 est:*
n (FS) = p (FS) $\times\ \nu = 1{,}76\ 10^{-9}$
avec p (FS) = 9,3 10^{-10}
ν *égal à 1,89 ± 0,05 est le nombre moyen de neutrons émis par fission spontanée.*

2 Nuclear Data

$T_{1/2}(^{236}U)$	:	23,43	(6)	10^6 a
$T_{1/2}(^{232}Th)$	:	14,05	(6)	10^9 a
$Q^{\alpha}(^{236}U)$	:	4573,1	(9)	keV

2.1 α Transitions

	Energy keV	Probability × 100	F
$\alpha_{0,3}$	4240	0,00014 (5)	1160
$\alpha_{0,2}$	4407 (8)	0,149 (22)	27,3
$\alpha_{0,1}$	4522 (5)	26,1 (40)	1,2
$\alpha_{0,0}$	4571 (3)	73,8 (40)	1

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{1,0}$(Th)	49,46 (10)	26,3 (40)	E2		237 (7)	65,0 (19)	324 (10)
$\gamma_{2,1}$(Th)	112,79 (10)	0,150 (24)	E2	0,229 (7)	4,71 (14)	1,295 (39)	6,67 (20)
$\gamma_{3,2}$(Th)	171,15 (20)	0,000142 (48)	E2	0,204 (6)	0,719 (22)	0,197 (6)	1,186 (36)

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				
	$K\alpha_2$	89,954		61,82
	$K\alpha_1$	93,351		100
	$K\beta_3$	104,819	}	
	$K\beta_1$	105,604	}	
	$K\beta_5''$	106,239	}	35,58
	$K\beta_2$	108,509	}	
	$K\beta_4$	108,955	}	11,99
	$KO_{2,3}$	109,442	}	
X_L				
	$L\ell$	11,118		
	$L\alpha$	12,809 – 12,968		
	$L\eta$	14,511		
	$L\beta$	14,97 – 16,426		
	$L\gamma$	18,98 – 19,599		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	68,406 – 76,745	100
KLX	83,857 – 93,345	59,7
KXY	99,29 – 109,64	8,67
Auger L	5,8 – 20,3	

4 α Emissions

	Energy keV	Probability × 100
$\alpha_{0,3}$	4168	0,00014 (5)
$\alpha_{0,2}$	4332 (8)	0,149 (22)
$\alpha_{0,1}$	4445 (5)	26,1 (40)
$\alpha_{0,0}$	4494 (3)	73,8 (40)

5 Electron Emissions

		Energy keV	Electrons per 100 disint.
e_{AL}	(Th)	5,8 - 20,3	10,1 (12)
e_{AK}	(Th)		0,000139 (30)
	KLL	68,406 - 76,745	}
	KLX	83,857 - 93,345	}
	KXY	99,29 - 109,64	}
$ec_{1,0\ L}$	(Th)	28,99 - 33,20	19,2 (29)
$ec_{1,0\ M}$	(Th)	44,28 - 46,13	5,3 (8)
$ec_{1,0\ N}$	(Th)	48,13 - 49,12	1,41 (21)
$ec_{2,1\ L}$	(Th)	92,32 - 96,50	0,092 (15)
$ec_{2,1\ M}$	(Th)	107,61 - 109,46	0,0253 (41)

6 Photon Emissions

6.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Th)	11,118 — 19,599		9,4 (10)	
$XK\alpha_2$	(Th)	89,954		0,00128 (22)	} $K\alpha$
$XK\alpha_1$	(Th)	93,351		0,0021 (4)	}
$XK\beta_3$	(Th)	104,819	}		
$XK\beta_1$	(Th)	105,604	}	0,00074 (13)	$K'\beta_1$
$XK\beta_5''$	(Th)	106,239	}		
$XK\beta_2$	(Th)	108,509	}		
$XK\beta_4$	(Th)	108,955	}	0,00025 (5)	$K'\beta_2$
$XKO_{2,3}$	(Th)	109,442	}		

6.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Th)	49,46 (10)	0,081 (12)
$\gamma_{2,1}$(Th)	112,79 (10)	0,0195 (31)
$\gamma_{3,2}$(Th)	171,15 (20)	0,000065 (22)

7 Main Production Modes

U – 235(n,γ)U – 236 σ : 98,3 (8) barns

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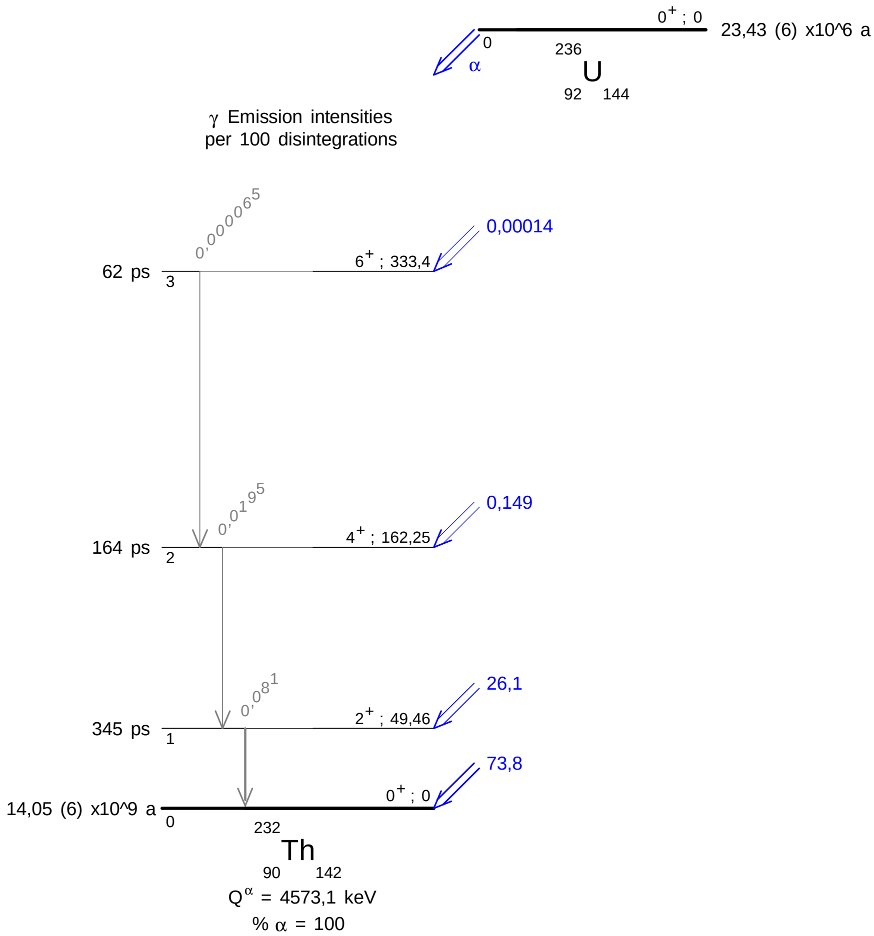

IFIN-HH / A. Luca

$^{237}_{93}$ Np 144

1 Decay Scheme

Le neptunium 237 se désintègre par émission alpha vers les niveaux excités et le niveau fondamental de protactinium 233 de 27 jours de période.
Np-237 disintegrates by alpha emission to the excited levels and to the fundamental level of Pa-233 which has a half-life of 27 days.

2 Nuclear Data

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

2.1 α Transitions

	Energy keV	Probability × 100	F
$\alpha_{0,20}$	4592,6 (19)	0,038 (4)	65
$\alpha_{0,19}$	4628,6 (22)	0,011 (3)	84000
$\alpha_{0,18}$	4652 (3)	0,048 (23)	139
$\alpha_{0,17}$	4657,2 (14)	0,393 (23)	19,1
$\alpha_{0,16}$	4678,1 (18)	0,373 (9)	27
$\alpha_{0,15}$	4699,0 (21)	0,032 (8)	46000
$\alpha_{0,14}$	4720 (1)	6,43 (3)	3,14
$\alpha_{0,13}$	4745,0 (9)	3,46 (3)	8,9
$\alpha_{0,12}$	4756,7	0,38 (2)	
$\alpha_{0,11}$	4778,9 (8)	0,535 (10)	99
$\alpha_{0,10}$	4789,1 (20) }		56
$\alpha_{0,9}$	4793,2 (20) }	1,174 (13)	51
$\alpha_{0,8}$	4822,7 (20)	0,019	5932
$\alpha_{0,7}$	4848,3 (8)	9,5 (3)	17,9
$\alpha_{0,6}$	4853,3 (8)	23,0 (3)	7,8
$\alpha_{0,4}$	4870,0 (9)	47,64 (6)	5

KRI /Chechev V.P. and Kuzmenko N.K.

	Energy keV	Probability × 100	F
$\alpha_{0,3}$	4886 (1)	2,02 (2)	152
$\alpha_{0,2}$	4899,5 (10)	2,430 (17)	156
$\alpha_{0,1}$	4949,9 (14)	0,51 (3)	1570
$\alpha_{0,0}$	4956,4 (14)	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)			2231	3016
$\gamma_{5,4}$(Pa)	8,22 (5)	9					
$\gamma_{6,5}$(Pa)	9						
$\gamma_{13,12}$(Pa)	10,7						
$\gamma_{6,4}$(Pa)	17,40 (5)						
$\gamma_{(-1,1)}$(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)	57,2 (21)	E1		2,30 (5)	0,586 (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+E2		74 (14)	18 (4)	99 (20)
$\gamma_{13,10}$(Pa)	43,2						
$\gamma_{6,2}$(Pa)	46,53 (6)	0,205 (12)	[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)	65,7 (30)	E2		128 (3)	35,3 (7)	176 (4)
$\gamma_{17,14}$(Pa)	62,59 (10)	0,4 (3)	[M1+E2]		47 (35)	13 (10)	65 (48)
$\gamma_{3,1}$(Pa)	63,9 (1)	1,10 (5)	(E2)		74,7 (15)	20,6 (4)	102 (2)
$\gamma_{3,0}$(Pa)	70,49 (10)	0,4 (3)	[M1+E2]		28 (18)	7,5 (54)	38 (26)
$\gamma_{10,5}$(Pa)	74,54 (10)	0,13 (3)	[M1]		7,42 (15)	1,79 (4)	9,83 (20)
$\gamma_{4,0}$(Pa)	86,477 (10)	29,7 (10)	E1		1,13 (5)	0,22 (6)	1,43 (8)
$\gamma_{5,1}$(Pa)	87,99 (3)	0,17 (1)	[E1]		0,128 (3)	0,0312 (6)	0,169 (4)
$\gamma_{5,0}$(Pa)	94,64 (5)	0,0670 (15)	E1		0,106 (2)	0,0257 (5)	0,140 (3)
$\gamma_{9,2}$(Pa)	106,15 (25)	0,50 (1)	[E2]		6,78 (14)	1,87 (4)	9,28 (19)
$\gamma_{13,6}$(Pa)	108,7	0,32 (4)	M1+E2		2,6 (4)	0,6 (1)	3,5 (5)
$\gamma_{11,3}$(Pa)	109,1 (1)						
$\gamma_{12,4}$(Pa)	115,40 (35)	0,0026 (8)	[M1+E2]				
$\gamma_{13,5}$(Pa)	117,702 (20)	2,24 (11)	M1+E2	9,3 (5)	2,16 (11)	0,53 (4)	12,2 (6)
$\gamma_{12,3}$(Pa)	131,101 (25)	0,105 (6)	E1	0,202 (4)	0,0451 (9)	0,0109 (2)	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)	0,006 (5)	[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+E2	5,38 (12)	1,17 (3)	0,287 (6)	6,94 (14)
$\gamma_{14,4}$(Pa)	151,414 (20)	1,37 (10)	M1+E2	3,4 (5)	1,08 (5)	0,277 (14)	4,9 (6)
$\gamma_{15,6}$(Pa)	153,37		E1+M2				
$\gamma_{20,13}$(Pa)	153,37 (10)	0,021 (6)	[E2]	0,226 (5)	1,267 (3)	0,349 (7)	1,96 (4)
$\gamma_{13,2}$(Pa)	155,239 (20)	0,10 (1)	E1	0,137 (3)	0,0292 (6)	0,00708 (14)	0,176 (4)
$\gamma_{15,5}$(Pa)	162,41						
$\gamma_{10,1}$(Pa)	162,41 (8)	0,038 (1)	[E1]	0,123 (3)	0,0260 (5)	0,00631 (13)	0,158 (3)
$\gamma_{10,0}$(Pa)	169,156 (20)	0,0768 (4)	[E1]	0,112 (2)	0,0235 (5)	0,00568 (11)	0,143 (3)
$\gamma_{15,4}$(Pa)	170,59						

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{16,7}$(Pa)	170,59 (6)	0,09 (2)	[M1+E2]	3,1 (4)	0,70 (7)	0,17 (1)	4,0 (5)
$\gamma_{16,6}$(Pa)	176,12 (6)	0,07 (2)	[M1+E2]	2,8 (4)	0,63 (7)	0,16 (1)	3,7 (5)
$\gamma_{14,2}$(Pa)	180,794 (19)	0,018 (1)	[E1]	0,0960 (19)	0,0199 (4)	0,0048 (1)	0,122 (3)
$\gamma_{15,3}$(Pa)	186,86						
$\gamma_{20,11}$(Pa)	186,86 (35)	0,003 (3)	[E1]	0,0889 (19)	0,0183 (4)	0,00442 (9)	0,113 (2)
$\gamma_{17,7}$(Pa)	191,46 (5)	0,074 (9)	[M1+E2]	2,2 (3)	0,49 (5)	0,12 (1)	2,9 (4)
$\gamma_{16,4}$(Pa)	193,26 (5)	0,17 (2)	[M1+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)	0,102 (2)
$\gamma_{17,6}$(Pa)	196,86 (5)	0,078 (7)	[M1+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)	0,043 (1)	E1	0,0746 (15)	0,0151 (3)	0,00365 (7)	0,0946 (19)
$\gamma_{20,9}$(Pa)	202,9 (2)	0,005 (2)	[E1]	0,0735 (15)	0,0149 (3)	0,00360 (7)	0,0932 (19)
$\gamma_{16,3}$(Pa)	209,19 (5)	0,016 (2)	[E1]	0,0686 (14)	0,0138 (3)	0,00333 (7)	0,0868 (17)
$\gamma_{13,0}$(Pa)	212,29 (5)	0,182 (11)	E1	0,00214 (4)	0,0133 (3)	0,00321 (7)	0,0839 (17)
$\gamma_{17,4}$(Pa)	214,01 (5)	0,114 (13)	[M1+E2]	1,6 (2)	0,35 (1)	0,09 (1)	2,1 (3)
$\gamma_{19,4}$(Pa)	219,8						
$\gamma_{16,2}$(Pa)	222,6 (2)	0,002 (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)	0,0101 (2)	0,00243 (5)	0,0645 (13)
$\gamma_{19,2}$(Pa)	248,95 (10)	0,012 (3)	[M1+E2]	1,1 (2)	0,22 (1)	0,055 (6)	1,4 (2)
$\gamma_{15,1}$(Pa)	250,58						
$\gamma_{15,0}$(Pa)	257,09						
$\gamma_{20,7}$(Pa)	257,09 (20)	0,048 (24)	[M1]	1,12 (2)	0,215 (5)	0,0518 (11)	1,41 (3)
$\gamma_{20,6}$(Pa)	262,44 (20)	0,01118 (49)	[M1]	1,06 (2)	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				
	Kα_2	92,288		62,14
	Kα_1	95,869		100
	Kβ_3	107,595	}	
	Kβ_1	108,422	}	
	Kβ_5''	109,072	}	35,84
	Kβ_2	111,405	}	
	Kβ_4	111,87	}	12,15
	KO$_{2,3}$	112,38	}	
X_L				
	Lℓ	11,368		
	Lα	13,121 – 13,289		
	Lη	14,949		
	Lβ	15,358 – 17,666		
	Lγ	18,94 – 20,113		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	70,081 – 78,822	100
KLX	85,989 – 95,858	59,2
KXY	101,87 – 112,59	8,76
Auger L	5,9 – 21,6	

4 α Emissions

	Energy keV	Probability × 100
$\alpha_{0,20}$	4515,1 (19)	0,038 (4)
$\alpha_{0,19}$	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)	5,9 - 21,6		62 (6)
e_{AK}	(Pa)			0,182 (24)
	KLL	70,081 - 78,822	}	
	KLX	85,989 - 95,858	}	
	KXY	101,87 - 112,59	}	
$ec_{13,5\ T}$	(Pa)	5,106 - 117,695		2,10 (11)
$ec_{13,5\ K}$	(Pa)	5,11 (2)		1,6 (1)
$ec_{4,2\ L}$	(Pa)	8,269 - 12,641		32,4 (13)
$ec_{14,5\ T}$	(Pa)	10,8 - 123,4		2,91 (28)
$ec_{14,5\ K}$	(Pa)	11 (3)		2,24 (22)
$ec_{14,6\ K}$	(Pa)	21,69 (2)		0,42 (8)
$ec_{4,2\ M}$	(Pa)	24,013 - 25,932		8,26 (34)
$ec_{6,2\ L}$	(Pa)	25,42 - 29,80		0,074 (4)

		Energy keV	Electrons per 100 disint.
$ec_{2,0\ L}$	(Pa)	35,999 - 40,371	47,7 (23)
$ec_{14,4\ K}$	(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	0,81 (3)
$ec_{3,0\ L}$	(Pa)	49,38 - 53,76	0,3 (2)
$ec_{2,0\ M}$	(Pa)	51,743 - 53,662	13,0 (6)
$ec_{17,14\ M}$	(Pa)	57,23 - 59,15	0,08 (6)
$ec_{16,7\ K}$	(Pa)	57,99 (6)	0,056 (14)
$ec_{3,1\ M}$	(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)	65,37 - 69,74	13,8 (6)
$ec_{16,4\ K}$	(Pa)	80,66 (5)	0,097 (13)
$ec_{4,0\ M}$	(Pa)	81,12 - 83,04	2,7 (7)
$ec_{9,2\ L}$	(Pa)	85,04 - 89,42	0,332 (10)
$ec_{13,6\ L}$	(Pa)	87,6 - 92,0	0,185 (29)
$ec_{13,5\ L}$	(Pa)	96,60 - 100,97	0,37 (2)
$ec_{9,2\ M}$	(Pa)	100,79 - 102,71	0,0916 (27)
$ec_{17,4\ K}$	(Pa)	101,41 (5)	0,059 (8)
$ec_{14,5\ L}$	(Pa)	102,3 - 106,7	0,49 (5)
$ec_{13,5\ M}$	(Pa)	112,34 - 114,26	0,091 (7)
$ec_{14,6\ L}$	(Pa)	113,180 - 117,552	0,104 (22)
$ec_{14,5\ M}$	(Pa)	118 - 120	0,120 (12)
$ec_{14,4\ L}$	(Pa)	130,309 - 134,681	0,252 (12)
$ec_{19,2\ K}$	(Pa)	136,4 (1)	0,055 (15)
$ec_{14,4\ M}$	(Pa)	146,053 - 147,972	0,065 (3)

6 Photon Emissions

6.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Pa)	11,368 — 20,113		59,4 (50)	
$XK\alpha_2$	(Pa)	92,288		1,81 (3)	} $K\alpha$
$XK\alpha_1$	(Pa)	95,869		2,90 (2)	}
$XK\beta_3$	(Pa)	107,595	}		
$XK\beta_1$	(Pa)	108,422	}	0,97 (11)	$K'\beta_1$
$XK\beta_5''$	(Pa)	109,072	}		
$XK\beta_2$	(Pa)	111,405	}		
$XK\beta_4$	(Pa)	111,87	}	0,37 (1)	$K'\beta_2$
$XKO_{2,3}$	(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)	14,1 (5)
$\gamma_{12,10}$(Pa)	32,46	0,005 (1)
$\gamma_{14,12}$(Pa)	36,32 (2)	0,005 (1)
$\gamma_{6,2}$(Pa)	46,53 (6)	0,107 (6)
$\gamma_{2,0}$(Pa)	57,104 (20)	0,372 (16)
$\gamma_{17,14}$(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)	12,22 (12)
$\gamma_{5,1}$(Pa)	87,99 (3)	0,142 (3)
$\gamma_{5,0}$(Pa)	94,64 (5)	0,0585 (13)
$\gamma_{9,2}$(Pa)	106,15 (25)	0,049 (1)
$\gamma_{13,6}$(Pa)	108,7	0,071 (3)
$\gamma_{12,4}$(Pa)	115,40 (35)	0,0026 (8)
$\gamma_{13,5}$(Pa)	117,702 (20)	0,170 (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)
$\gamma_{20,13}$(Pa)	153,37 (10)	0,007 (2)
$\gamma_{13,2}$(Pa)	155,239 (20)	0,088 (8)
$\gamma_{15,5}$(Pa)	162,41	0,0324 (12)
$\gamma_{10,1}$(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)

	Energy keV	Photons per 100 disint.
$\gamma_{16,2}$(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

U – 238(n,2n)U – 237

U – 237(β^-)Np – 237

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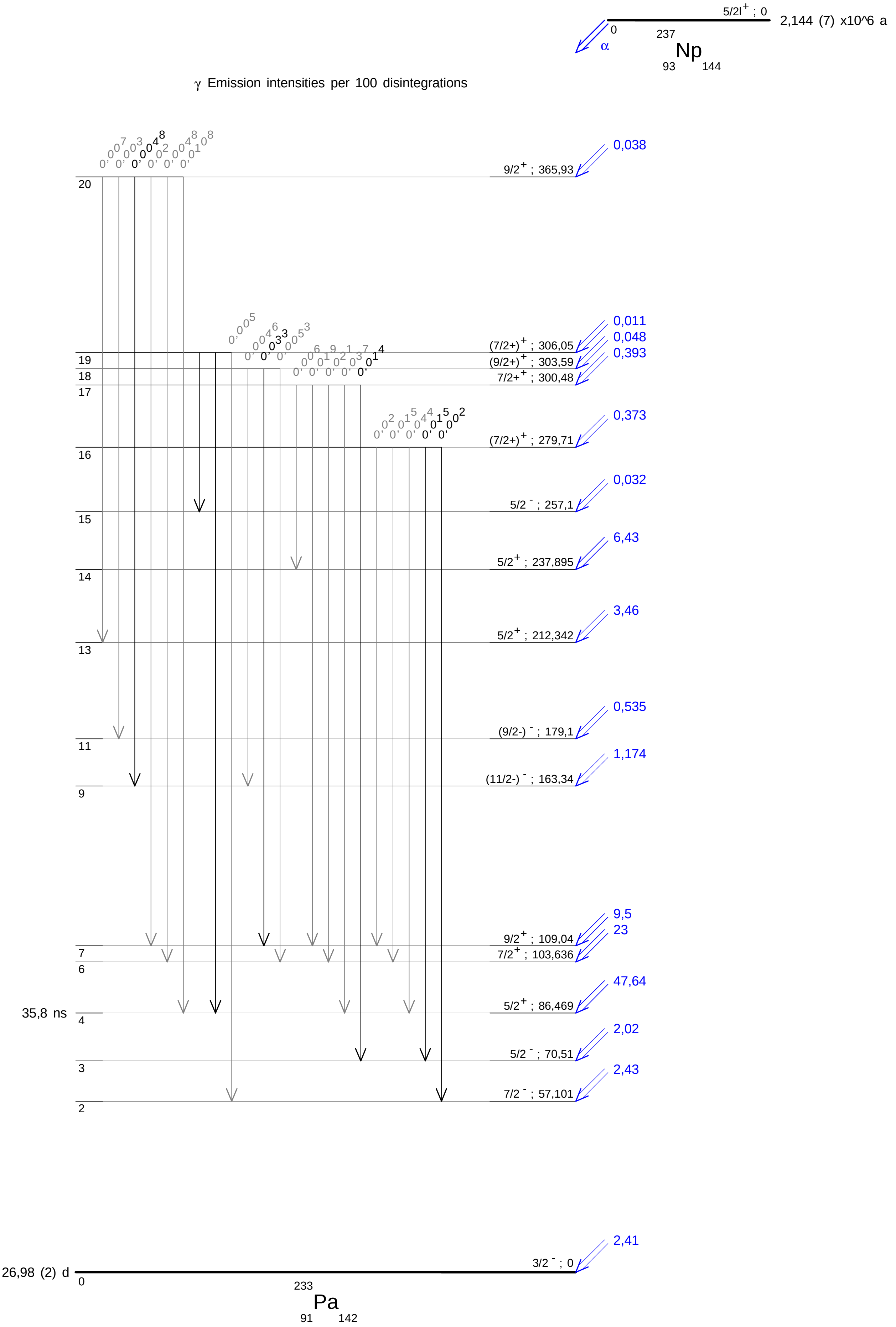

Q^{α} = 4958,3 keV

% α = 100

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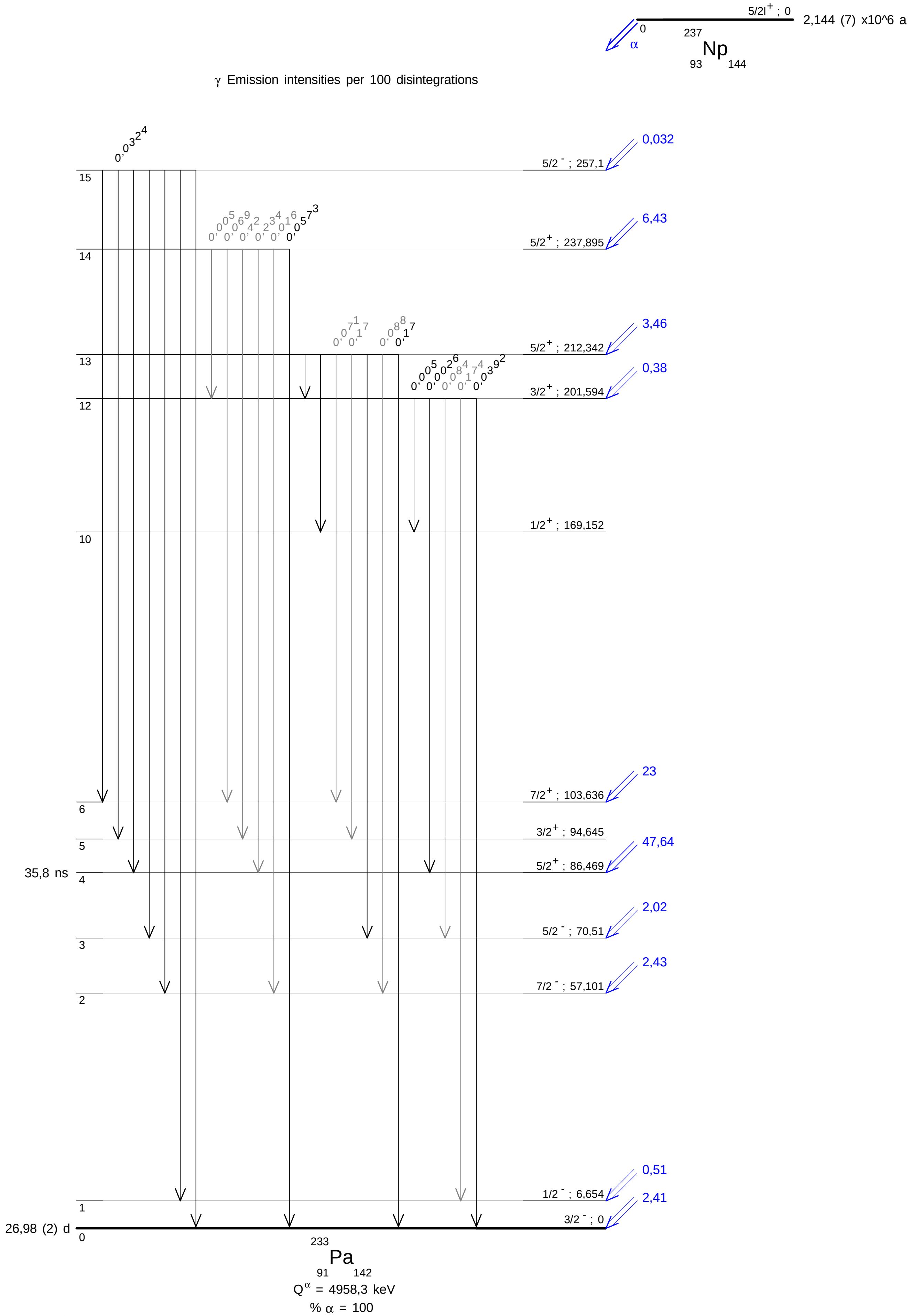

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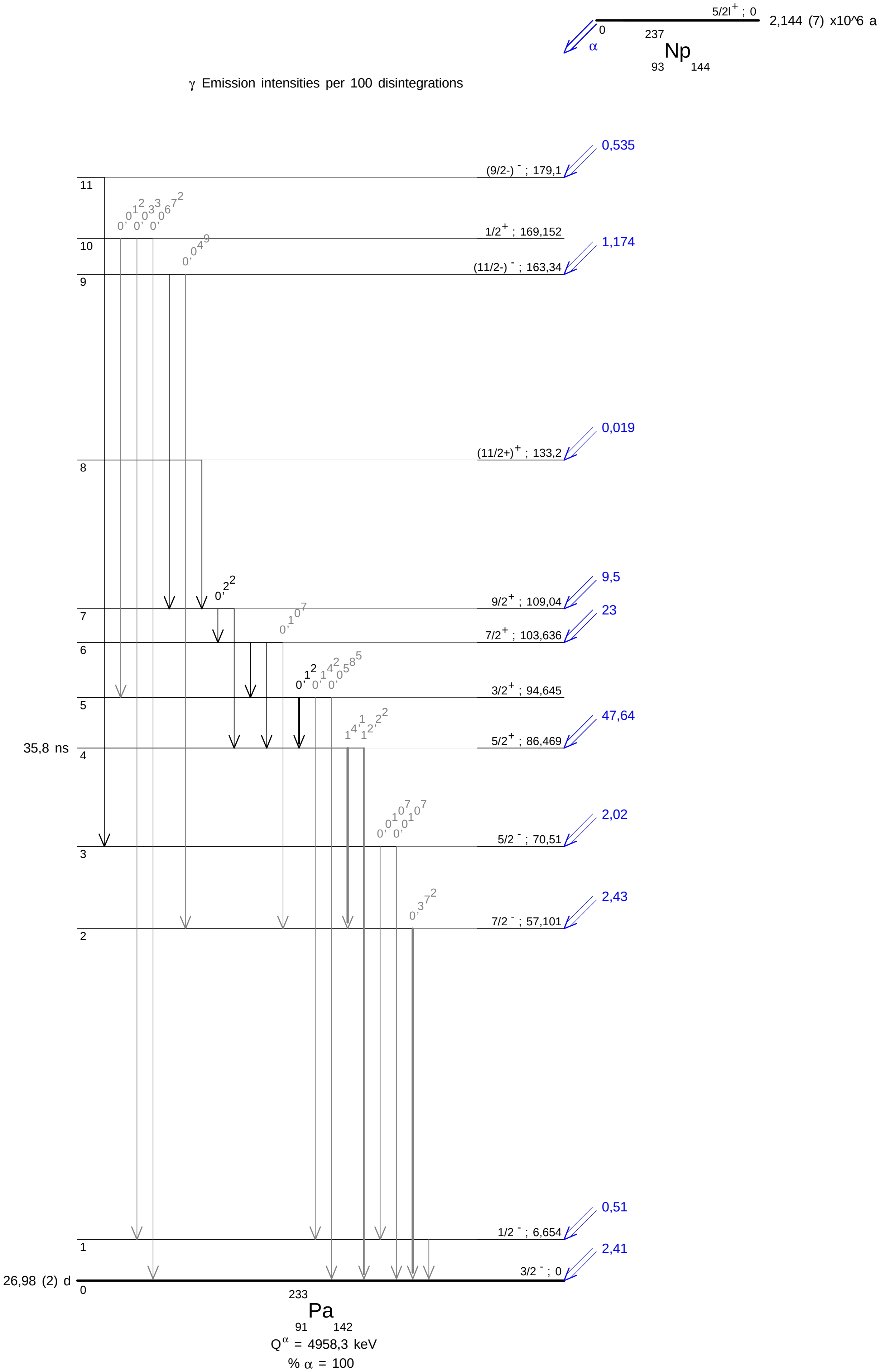

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$^{\mathbf{238}}_{93}\mathrm{Np}_{145}$

1 Decay Scheme

Np-238 decays 100% by beta transitions to levels of Pu-238

Le neptunium 238 se désintègre par transitions bêta vers des niveaux excités du plutonium 238.

2 Nuclear Data

$T_{1/2}(^{238}\mathrm{Np})$	:	2,102	(5)	d
$T_{1/2}(^{238}\mathrm{Pu})$	:	87,74	(3)	a
$Q^{-}(^{238}\mathrm{Np})$	:	1291,5	(4)	keV

2.1 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,15}$	89,0 (4)	0,51 (6)	1st forbidden	6,57
$\beta^-_{0,13}$	221,6 (4)	11,50 (7)	Allowed	6,44
$\beta^-_{0,12}$	263,0 (4)	44,75 (19)	Allowed	6,09
$\beta^-_{0,11}$	306,0 (4)	0,49 (1)	1st forbidden	8,25
$\beta^-_{0,10}$	308,4 (4)	0,27 (3)	Allowed	8,51
$\beta^-_{0,9}$	323,3 (6)	0,082 (6)	1st forbidden	9,11
$\beta^-_{0,8}$	328,7 (4)	1,25 (1)	1st forbidden	7,95
$\beta^-_{0,5}$	630,1 (4)	0,036 (3)	1st forbidden	10,44
$\beta^-_{0,4}$	686,4 (4)	0,103 (3)	1st forbidden	10,08
$\beta^-_{0,1}$	1247,4 (4)	41,0 (25)	Allowed	8,38

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{1,0}$(Pu)	44,07 (2)	80,7 (23)	E2		572 (12)	160 (3)	788 (16)
$\gamma_{2,1}$(Pu)	101,88 (2)	3,90 (14)	E2		10,5 (2)	2,94 (6)	14,5 (3)
$\gamma_{(-1,1)}$(Pu)	103,74 (2)	0,312 (3)					
$\gamma_{14,9}$(Pu)	114,4 (4)	0,055 (10)	[E2]		6,15 (12)	1,72 (14)	8,47 (17)
$\gamma_{(-1,2)}$(Pu)	116,27 (8)	0,04					
$\gamma_{(-1,3)}$(Pu)	117,27 (8)	0,074					
$\gamma_{15,14}$(Pu)	120,11 (5)	0,48 (6)	M1(+E2)		2,8 (6)	0,69 (6)	3,8 (6)
$\gamma_{(-1,4)}$(Pu)	120,5	0,02					
$\gamma_{(-1,5)}$(Pu)	127,70 (8)	0,010 (1)					
$\gamma_{15,13}$(Pu)	132,5 (1)	0,0018 (10)	[E1]	0,203 (4)	0,048 (1)	0,0118 (2)	0,267 (5)
$\gamma_{3,2}$(Pu)	157,42 (5)	0,003	[E2]	0,193 (4)	1,45 (3)	0,405 (8)	2,19 (4)
$\gamma_{15,12}$(Pu)	174,08 (5)	0,0261 (9)	[E1]	0,110 (2)	0,0241 (5)	0,0059 (1)	0,142 (3)
$\gamma_{(-1,6)}$(Pu)	220,87 (11)	0,037 (9)	(M2)	6,7 (15)	4 (1)		11,4 (20)
$\gamma_{8,5}$(Pu)	301,37 (7)	0,0128 (12)	E2	0,0766 (16)	0,096 (2)	0,0264 (5)	0,208 (4)
$\gamma_{14,6}$(Pu)	319,29 (11)	0,013 (3)	M1+E2	0,43 (22)	0,118 (25)	0,030 (5)	0,59 (25)
$\gamma_{10,5}$(Pu)	321,75 (20)	0,0013					
$\gamma_{11,5}$(Pu)	324,02 (9)	0,0184 (14)	M1+E2	0,15 (6)	0,082 (7)	0,022 (2)	0,26 (7)
$\gamma_{7,4}$(Pu)	336,36 (15)	0,00020 (13)	[E1]	0,0257 (5)	0,00503 (10)	0,00122 (3)	0,0324 (7)
$\gamma_{8,4}$(Pu)	357,64 (7)	0,0612 (17)	M1 + E2	0,133 (12)	0,060 (5)	0,0158 (12)	0,214 (16)
$\gamma_{10,4}$(Pu)	378,05 (13)	0,003					
$\gamma_{11,4}$(Pu)	380,31 (10)	0,0180 (8)	[M1]	0,493 (10)	0,098 (2)	0,0237 (5)	0,623 (9)
$\gamma_{14,5}$(Pu)	421,1 (1)	0,0309 (15)	[M1]	0,374 (8)	0,0737 (15)	0,0179 (4)	0,472 (7)
$\gamma_{6,3}$(Pu)	459,8 (2)	0,0023					
$\gamma_{5,2}$(Pu)	515,51 (7)	0,0386 (11)	E1+M2	0,017 (3)	0,0037 (7)	0,00092 (17)	0,022 (4)
$\gamma_{4,1}$(Pu)	561,14 (5)	0,1072 (15)	E1	0,00929 (19)	0,00169 (4)	0,000407 (8)	0,0115 (2)
$\gamma_{4,0}$(Pu)	605,16 (5)	0,078 (2)	E1	0,00806 (16)	0,00146 (3)	0,000350 (7)	0,0100 (2)
$\gamma_{5,1}$(Pu)	617,39 (5)	0,0604 (7)	E1+M2	0,0095 (11)	0,00185 (22)	0,00045 (5)	0,0120 (14)
$\gamma_{6,2}$(Pu)	617,4	0,008 (0)					
$\gamma_{10,2}$(Pu)	836,96 (7)	0,0210 (8)	[E2]	0,0125 (3)	0,00366 (8)	0,00093 (2)	0,0174 (4)
$\gamma_{12,2}$(Pu)	882,63 (3)	0,816 (9)	(E2)	0,0114 (2)	0,00320 (7)	0,00081 (2)	0,0157 (3)
$\gamma_{(-1,7)}$(Pu)	885	0,040 (5)					
$\gamma_{7,1}$(Pu)	897,34 (10)	0,0074 (10)	(E2)	0,0111 (2)	0,00308 (6)	0,00078 (2)	0,0152 (3)
$\gamma_{8,1}$(Pu)	918,70 (4)	0,531 (6)	E1	0,00383 (8)	0,00066 (1)	0,000158 (3)	0,0047 (1)
$\gamma_{13,2}$(Pu)	923,99 (2)	2,64 (2)	(M1+E2)	0,0099 (4)			0,014 (1)
$\gamma_{9,1}$(Pu)	924	0,065					
$\gamma_{14,2}$(Pu)	936,60 (5)	0,369 (5)	[E1+M2]	0,0089 (17)	0,0018 (4)	0,00044 (10)	0,0112 (22)
$\gamma_{10,1}$(Pu)	938,94 (10)	0,18 (2)	E0+E2	3,5 (4)	0,67 (7)		4,4 (4)
$\gamma_{11,1}$(Pu)	941,40 (4)	0,504	[E1+M2]				
$\gamma_{7,0}$(Pu)	941,5 (3)	0,0106	E0				
$\gamma_{8,0}$(Pu)	962,76 (2)	0,648 (8)	E1	0,00352 (7)	0,00061 (1)	0,000145 (3)	0,00433 (9)
$\gamma_{9,0}$(Pu)	968,9 (4)	0,017 (6)	[M2]	0,089 (2)	0,0200 (4)	0,0050 (1)	0,116 (3)
$\gamma_{10,0}$(Pu)	983,0 (3)	0,07 (2)	[E2]	0,00947 (19)	0,00247 (5)	0,00062 (1)	0,0128 (3)
$\gamma_{12,1}$(Pu)	984,45 (2)	25,50 (13)	M1+E2	0,0096 (3)	0,0022 (1)	0,0006 (1)	0,0125 (5)
$\gamma_{13,1}$(Pu)	1025,87 (2)	8,86 (7)	M1+E2	0,0091 (4)	0,0021 (1)	0,0006 (1)	0,0120 (5)
$\gamma_{12,0}$(Pu)	1028,54 (2)	18,46 (13)	E2	0,00875 (18)	0,00222 (5)	0,00055 (1)	0,0117 (2)

3 Atomic Data

3.1 Pu

ω_K : 0,971 (4)
$\bar{\omega}_L$: 0,521 (21)
n_{KL} : 0,790 (5)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	99,525		63,17
	$K\alpha_1$	103,734		100
	$K\beta_3$	116,244	}	
	$K\beta_1$	117,228	}	
	$K\beta_5''$	117,918	}	36,70
	$K\beta_2$	120,54	}	
	$K\beta_4$	120,969	}	12,74
	$KO_{2,3}$	121,543	}	
X_L				
	$L\ell$	12,125		
	$L\alpha$	14,083 – 14,279		
	$L\eta$	16,334		
	$L\beta$	16,499 – 19,331		
	$L\gamma$	20,708 – 21,984		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	75,26 – 85,36	100
KLX	92,607 – 103,729	60,6
KXY	109,93 – 121,78	9,18
Auger L	6,10 – 22,99	

4 Electron Emissions

		Energy keV	Electrons per 100 disint.
e_{AL}	(Pu)	6,10 - 22,99	29,7 (14)
e_{AK}	(Pu)		0,021 (8)
	KLL	75,26 - 85,36	}
	KLX	92,607 - 103,729	}
	KXY	109,93 - 121,78	}
$ec_{15,13\ K}$	(Pu)	10,7 (1)	0,00028 (16)
$ec_{1,0\ L}$	(Pu)	20,97 - 26,01	58,6 (17)
$ec_{3,2\ K}$	(Pu)	35,63 (5)	0,00019 (4)
$ec_{1,0\ M}$	(Pu)	38,14 - 40,30	16,4 (5)
$ec_{15,12\ K}$	(Pu)	52,29 (5)	0,00251 (10)
$ec_{2,1\ L}$	(Pu)	78,78 - 83,82	2,65 (10)
$ec_{14,9\ L}$	(Pu)	91,3 - 96,3	0,036 (6)
$ec_{2,1\ M}$	(Pu)	95,95 - 98,10	0,74 (3)
$ec_{15,14\ L}$	(Pu)	97,01 - 102,05	0,28 (6)
$ec_{14,9\ M}$	(Pu)	108,5 - 110,6	0,0100 (19)
$ec_{15,14\ M}$	(Pu)	114,18 - 116,34	0,070 (7)
$ec_{3,2\ L}$	(Pu)	134,32 - 139,36	0,0014 (3)
$ec_{15,12\ L}$	(Pu)	150,98 - 156,02	0,000552 (21)
$ec_{3,2\ M}$	(Pu)	151,49 - 153,64	0,00040 (8)
$ec_{15,12\ M}$	(Pu)	168,15 - 170,30	0,000135 (5)
$ec_{8,5\ K}$	(Pu)	179,58 (7)	0,00081 (8)
$ec_{14,6\ K}$	(Pu)	197,50 (11)	0,0036 (19)
$ec_{11,5\ K}$	(Pu)	202,23 (9)	0,0021 (9)
$ec_{8,4\ K}$	(Pu)	235,83 (7)	0,0067 (6)
$ec_{11,4\ K}$	(Pu)	258,5 (1)	0,0055 (3)
$ec_{8,5\ L}$	(Pu)	278,27 - 283,31	0,00102 (10)
$ec_{8,5\ M}$	(Pu)	295,44 - 297,60	0,00028 (3)
$ec_{14,6\ L}$	(Pu)	296,19 - 301,23	0,00098 (23)
$ec_{14,5\ K}$	(Pu)	299,3 (1)	0,0078 (4)
$ec_{11,5\ L}$	(Pu)	300,92 - 305,96	0,00120 (12)
$ec_{14,6\ M}$	(Pu)	313,36 - 315,52	0,000249 (5)
$ec_{11,5\ M}$	(Pu)	318,09 - 320,24	0,00032 (3)
$ec_{8,4\ L}$	(Pu)	334,52 - 339,56	0,0030 (3)
$ec_{8,4\ M}$	(Pu)	351,69 - 353,84	0,00080 (6)
$ec_{11,4\ L}$	(Pu)	357,21 - 362,25	0,00108 (5)
$ec_{11,4\ M}$	(Pu)	374,38 - 376,54	0,000263 (13)
$ec_{5,2\ K}$	(Pu)	393,72 (7)	0,00064 (11)
$ec_{14,5\ L}$	(Pu)	398 - 403	0,00155 (8)
$ec_{14,5\ M}$	(Pu)	415,2 - 417,3	0,000376 (20)
$ec_{4,1\ K}$	(Pu)	439,35 (5)	0,00098 (3)
$ec_{4,0\ K}$	(Pu)	483,37 (5)	0,00062 (2)
$ec_{5,2\ L}$	(Pu)	492,41 - 497,45	0,00014 (3)
$ec_{5,1\ K}$	(Pu)	495,60 (5)	0,00056 (7)

		Energy keV	Electrons per 100 disint.
$ec_{4,1\ L}$	(Pu)	538,04 - 543,08	0,000179 (5)
$ec_{4,0\ L}$	(Pu)	582,06 - 587,10	0,000112 (4)
$ec_{5,1\ L}$	(Pu)	594,29 - 599,33	0,000110 (13)
$ec_{10,2\ K}$	(Pu)	715,17 (7)	0,00026 (1)
$ec_{12,2\ K}$	(Pu)	760,84 (3)	0,0092 (2)
$ec_{8,1\ K}$	(Pu)	796,91 (4)	0,00202 (5)
$ec_{13,2\ K}$	(Pu)	802,20 (2)	0,0258 (11)
$ec_{14,2\ K}$	(Pu)	814,81 (5)	0,0032 (6)
$ec_{10,1\ K}$	(Pu)	817,1 (1)	0,114 (16)
$ec_{7,0\ K}$	(Pu)	829,7 (3)	0,0085 (7)
$ec_{8,0\ K}$	(Pu)	840,97 (2)	0,0023 (4)
$ec_{9,0\ K}$	(Pu)	847,1 (4)	0,0013 (7)
$ec_{12,2\ L}$	(Pu)	859,53 - 864,57	0,00257 (6)
$ec_{10,0\ K}$	(Pu)	861,20 (3)	0,0006 (2)
$ec_{12,1\ K}$	(Pu)	862,66 (2)	0,242 (8)
$ec_{12,2\ M}$	(Pu)	876,70 - 878,86	0,00065 (2)
$ec_{8,1\ L}$	(Pu)	895,6 - 900,6	0,00035 (7)
$ec_{13,1\ K}$	(Pu)	904,08 (2)	0,080 (4)
$ec_{12,0\ K}$	(Pu)	906,75 (2)	0,160 (3)
$ec_{14,2\ L}$	(Pu)	913,5 - 918,5	0,00066 (15)
$ec_{10,1\ L}$	(Pu)	915,84 - 920,88	0,022 (3)
$ec_{7,0\ L}$	(Pu)	918,4 - 923,4	0,00166 (14)
$ec_{14,2\ M}$	(Pu)	930,7 - 932,8	0,00016 (4)
$ec_{8,0\ L}$	(Pu)	939,66 - 944,70	0,000393 (8)
$ec_{9,0\ L}$	(Pu)	945,8 - 950,8	0,0003 (1)
$ec_{10,0\ L}$	(Pu)	959,9 - 964,9	0,00017 (5)
$ec_{12,1\ L}$	(Pu)	961,35 - 966,39	0,055 (3)
$ec_{12,1\ M}$	(Pu)	978,52 - 980,68	0,015 (3)
$ec_{13,1\ L}$	(Pu)	1002,77 - 1007,81	0,0184 (9)
$ec_{12,0\ L}$	(Pu)	1005,44 - 1010,48	0,0405 (10)
$ec_{13,1\ M}$	(Pu)	1019,94 - 1022,09	0,0053 (9)
$ec_{12,0\ M}$	(Pu)	1022,61 - 1024,76	0,0101 (2)
$\beta^-_{0,15}$	max:	89,0 (4)	0,51 (6)
$\beta^-_{0,15}$	avg:	23,0 (2)	
$\beta^-_{0,13}$	max:	221,6 (4)	11,50 (7)
$\beta^-_{0,13}$	avg:	59,9 (2)	
$\beta^-_{0,12}$	max:	263,0 (4)	44,75 (19)
$\beta^-_{0,12}$	avg:	72,0 (2)	
$\beta^-_{0,11}$	max:	306,0 (4)	0,49 (1)
$\beta^-_{0,11}$	avg:	84,9 (2)	
$\beta^-_{0,10}$	max:	308,4 (4)	0,27 (3)
$\beta^-_{0,10}$	avg:	85,6 (2)	
$\beta^-_{0,9}$	max:	323,3 (6)	0,082 (6)
$\beta^-_{0,9}$	avg:	90,1 (2)	
$\beta^-_{0,8}$	max:	328,7 (4)	1,25 (1)

		Energy keV		Electrons per 100 disint.
$\beta^-_{0,8}$	avg:	91,8	(2)	
$\beta^-_{0,5}$	max:	630,1	(4)	0,036 (3)
$\beta^-_{0,5}$	avg:	189,2	(2)	
$\beta^-_{0,4}$	max:	686,4	(4)	0,103 (3)
$\beta^-_{0,4}$	avg:	208,4	(2)	
$\beta^-_{0,1}$	max:	1247,4	(4)	41,0 (25)
$\beta^-_{0,1}$	avg:	412,2	(2)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Pu)	12,125 — 21,984		32,4 (14)	
XKα_2	(Pu)	99,525		0,210 (8)	} Kα
XKα_1	(Pu)	103,734		0,332 (12)	}
XKβ_3	(Pu)	116,244	}		
XKβ_1	(Pu)	117,228	}	0,122 (5)	K$'\beta_1$
XKβ_5''	(Pu)	117,918	}		
XKβ_2	(Pu)	120,54	}		
XKβ_4	(Pu)	120,969	}	0,042 (2)	K$'\beta_2$
XKO$_{2,3}$	(Pu)	121,543	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Pu)	44,07 (2)	0,1024 (21)
$\gamma_{2,1}$(Pu)	101,88 (2)	0,252 (8)
$\gamma_{(-1,1)}$(Pu)	103,74 (2)	0,312 (3)
$\gamma_{14,9}$(Pu)	114,4 (4)	0,0058 (10)
$\gamma_{(-1,2)}$(Pu)	116,27 (8)	0,04
$\gamma_{(-1,3)}$(Pu)	117,27 (8)	0,074
$\gamma_{15,14}$(Pu)	120,11 (5)	0,101 (5)
$\gamma_{(-1,4)}$(Pu)	120,5	0,02
$\gamma_{(-1,5)}$(Pu)	121,70 (8)	0,010 (1)
$\gamma_{15,13}$(Pu)	132,5 (1)	0,0014 (8)

	Energy keV	Photons per 100 disint.
$\gamma_{3,2}$(Pu)	157,42 (5)	0,001
$\gamma_{15,12}$(Pu)	174,08 (5)	0,0229 (8)
$\gamma_{(-1,6)}$(Pu)	220,87 (11)	0,0030 (5)
$\gamma_{8,5}$(Pu)	301,37 (7)	0,0106 (10)
$\gamma_{14,6}$(Pu)	319,29 (11)	0,0083 (10)
$\gamma_{10,5}$(Pu)	321,75 (20)	0,0013 (8)
$\gamma_{11,5}$(Pu)	324,02 (9)	0,0146 (8)
$\gamma_{7,4}$(Pu)	336,36 (15)	0,0002 (1)
$\gamma_{8,4}$(Pu)	357,64 (7)	0,0504 (13)
$\gamma_{10,4}$(Pu)	378,05 (13)	0,0030 (5)
$\gamma_{11,4}$(Pu)	380,31 (10)	0,0111 (5)
$\gamma_{14,5}$(Pu)	421,1 (1)	0,021 (1)
$\gamma_{6,3}$(Pu)	459,8 (2)	0,0023 (15)
$\gamma_{5,2}$(Pu)	515,51 (7)	0,0378 (11)
$\gamma_{4,1}$(Pu)	561,14 (5)	0,106 (2)
$\gamma_{4,0}$(Pu)	605,16 (5)	0,077 (2)
$\gamma_{5,1}$(Pu)	617,39 (5)	0,0593
$\gamma_{6,2}$(Pu)	617,4	0,008
$\gamma_{10,2}$(Pu)	836,96 (7)	0,0206 (8)
$\gamma_{12,2}$(Pu)	882,63 (3)	0,803 (9)
$\gamma_{(-1,7)}$(Pu)	885	0,040 (5)
$\gamma_{7,1}$(Pu)	897,34 (10)	0,0073 (10)
$\gamma_{8,1}$(Pu)	918,70 (4)	0,529 (6)
$\gamma_{13,2}$(Pu)	923,99 (2)	2,604 (20)
$\gamma_{9,1}$(Pu)	924	0,065
$\gamma_{14,2}$(Pu)	936,60 (5)	0,365 (5)
$\gamma_{10,1}$(Pu)	938,94 (10)	0,0327 (25)
$\gamma_{11,1}$(Pu)	941,40 (4)	0,504 (6)
$\gamma_{8,0}$(Pu)	962,76 (2)	0,645 (8)
$\gamma_{9,0}$(Pu)	968,9 (4)	0,015 (8)
$\gamma_{10,0}$(Pu)	983,0 (3)	0,068 (20)
$\gamma_{12,1}$(Pu)	984,45 (2)	25,18 (13)
$\gamma_{13,1}$(Pu)	1025,87 (2)	8,76 (6)
$\gamma_{12,0}$(Pu)	1028,54 (2)	18,25 (13)

6 Main Production Modes

Np – 237(n,γ)Np – 238

U – 238(p,n)Np – 238

U – 238(d,2n)Np – 238

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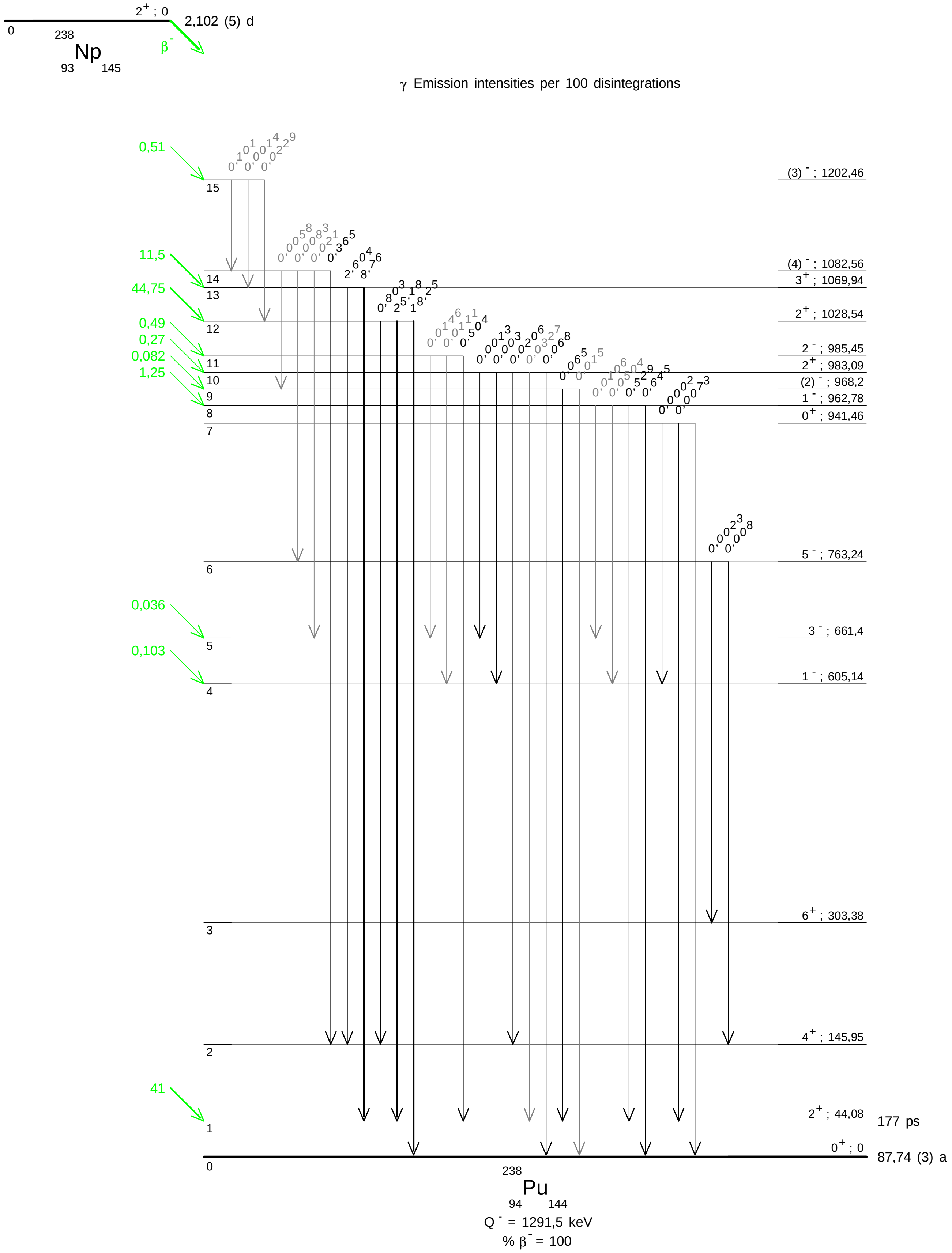

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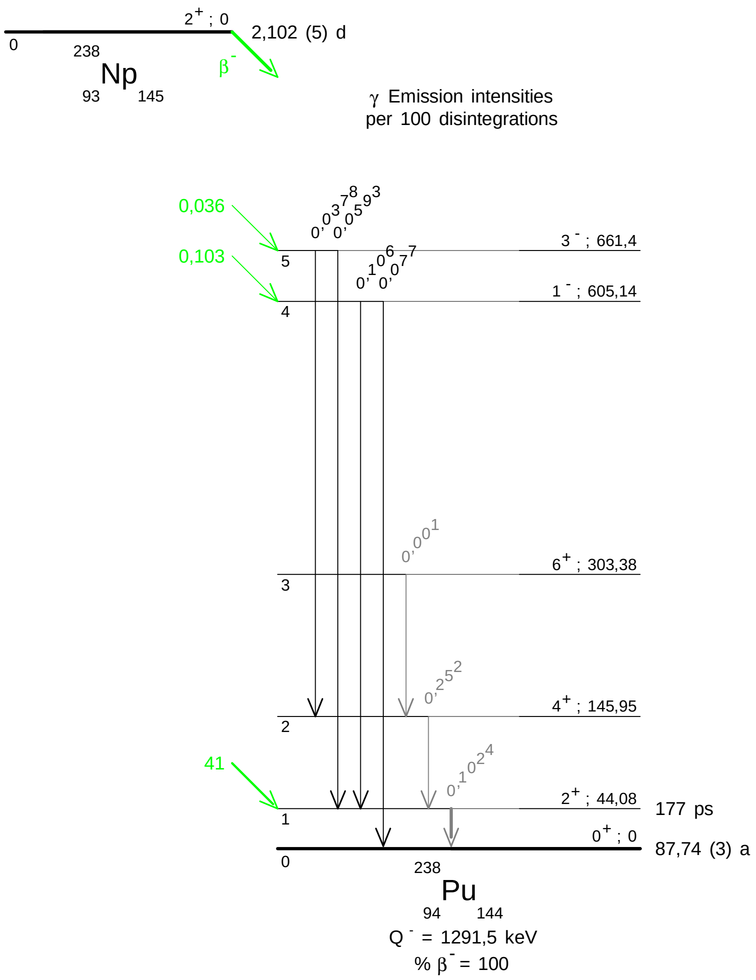

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239	U	
92		147

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

$T_{1/2}(^{239}U)$	:	23,46	(4)	min
$T_{1/2}(^{239}Np)$	:	2,356	(3)	d
$Q^-(^{239}U)$	:	1261,5	(16)	keV

2.1 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,33}$	164,5 (16)	0,0033 (2)		
$\beta^-_{0,32}$	212,3 (16)	0,0091 (2)		
$\beta^-_{0,31}$	221,1 (16)	0,0074 (5)		
$\beta^-_{0,30}$	247,9 (16)	0,0045 (3)		
$\beta^-_{0,29}$	269,3 (16)	0,0106 (2)		
$\beta^-_{0,28}$	295,0 (16)	0,0057 (3)		
$\beta^-_{0,27}$	297,3 (16)	0,192 (8)		
$\beta^-_{0,26}$	302,3 (16)	0,0239 (4)		
$\beta^-_{0,25}$	398,1 (16)	0,0046 (5)		
$\beta^-_{0,24}$	417,4 (16)	0,201 (5)		
$\beta^-_{0,23}$	442,2 (16)	0,229 (7)		
$\beta^-_{0,19}$	566,3 (16)	0,0143 (7)		
$\beta^-_{0,18}$	599,2 (16)	0,248 (5)	1st forbidden	7,35
$\beta^-_{0,15}$	697,6 (16)	0,0253 (6)		
$\beta^-_{0,14}$	731,2 (16)	0,0040 (4)		
$\beta^-_{0,13}$	743,5 (16)	0,065 (2)		
$\beta^-_{0,12}$	787,1 (16)	0,0032 (4)		

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,4}$	1143,8 (16)	2,05 (22)	1st Forbidden	7,4
$\beta^-_{0,3}$	1186,5 (16)	70,4 (16)	1st Forbidden	5,93
$\beta^-_{0,1}$	1230,4 (16)	10,1 (13)	Allowed	6,83
$\beta^-_{0,0}$	1261,5 (16)	16,5 (18)	Allowed	6,65

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{1,0}$(Np)	31,131 (2)	19,7 (15)	M1+3,08%E2		202 (10)	52,8 (28)	273 (14)
$\gamma_{4,3}$(Np)	43,1	1,92 (0)	M1+12,6%E2		114 (13)	30 (4)	154 (18)
$\gamma_{3,1}$(Np)	43,533 (1)	9,3 (6)	E1		0,856 (17)	0,215 (4)	1,14 (23)
$\gamma_{(-1,1)}$(Np)	46,6	0,009 (4)					
$\gamma_{6,4}$(Np)	55,18	0,0073 (23)	M1+26,4%E2		63 (20)	17 (6)	86 (27)
$\gamma_{2,0}$(Np)	71,21 (2)	0,16 (3)	E2		52,3 (10)	14,6 (3)	71,9 (14)
$\gamma_{3,0}$(Np)	74,664 (1)	63,2 (14)	E1		0,208 (4)	0,0512 (10)	0,276 (6)
$\gamma_{4,1}$(Np)	86,72 (7)	0,065 (6)	E1		0,140 (3)	0,0344 (7)	0,186 (4)
$\gamma_{15,11}$(Np)	111,0 (2)	0,0202 (5)					
$\gamma_{4,0}$(Np)	117,66 (3)	0,122 (10)	E1		0,0631 (13)	0,0155 (3)	0,0841 (17)
$\gamma_{(-1,2)}$(Np)	134,71 (13)	0,0018 (3)					
$\gamma_{(-1,3)}$(Np)	142,5 (1)	0,0043 (5)					
$\gamma_{7,2}$(Np)	170,2	0,029 (1)					
$\gamma_{(-1,4)}$(Np)	174,07 (6)	0,0097 (3)					
$\gamma_{8,3}$(Np)	186,15 (4)	0,0276 (3)	[M1+E2]				
$\gamma_{10,8}$(Np)	187,28 (8)	0,0054 (3)	[M1+E2]				
$\gamma_{25,18}$(Np)	201,09 (18)	0,0005 (2)					
$\gamma_{(-1,5)}$(Np)	220,52 (4)	0,0271 (3)					
$\gamma_{(-1,6)}$(Np)	236,28 (14)	0,0009 (2)					
$\gamma_{(-1,7)}$(Np)	240,00 (15)	0,0008 (2)					
$\gamma_{23,15}$(Np)	255,71 (12)	0,0011 (2)					
$\gamma_{31,21}$(Np)	258,80 (16)	0,0007 (2)					
$\gamma_{8,0}$(Np)	260,86 (9)	0,0031 (2)	[E1]	0,0434 (9)	0,00870 (17)	0,00211 (4)	0,0549 (11)
$\gamma_{(-1,8)}$(Np)	262,89 (19)	0,0008 (3)					
$\gamma_{(-1,9)}$(Np)	265,44 (17)	0,0009 (3)					
$\gamma_{29,19}$(Np)	296,93 (13)	0,0014 (2)	[M1+E2]				
$\gamma_{27,18}$(Np)	301,64 (15)	0,0011 (3)					
$\gamma_{(-1,10)}$(Np)	326,21 (7)	0,0042 (2)					
$\gamma_{(-1,11)}$(Np)	330,14 (14)	0,0007 (1)					
$\gamma_{(-1,12)}$(Np)	332,06 (14)	0,0011 (2)					
$\gamma_{31,19}$(Np)	345,13 (8)	0,0038 (2)					
$\gamma_{(-1,13)}$(Np)	348,23 (18)	0,0007 (3)					
$\gamma_{(-1,14)}$(Np)	351,33 (15)	0,0007 (2)					
$\gamma_{(-1,15)}$(Np)	361,83 (8)	0,0043 (3)					
$\gamma_{10,3}$(Np)	373,51 (4)	0,024 (2)	[M1+E2]				
$\gamma_{11,3}$(Np)	378,06 (6)	0,0096 (3)					
$\gamma_{11,2}$(Np)	381,27 (16)	0,0006 (2)					
$\gamma_{(-1,16)}$(Np)	393,01 (18)	0,0006 (2)					
$\gamma_{26,15}$(Np)	395,19 (11)	0,0020 (2)					
$\gamma_{12,3}$(Np)	399,13 (13)	0,0015 (3)					
$\gamma_{(-1,17)}$(Np)	400,55 (15)	0,0009 (2)					

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{(-1,18)}$(Np)	404,84 (18)	0,0008 (3)					
$\gamma_{33,18}$(Np)	434,44 (13)	0,0011 (2)	[E1]	0,0148 (3)	0,00276 (6)	0,000660 (13)	0,0185 (4)
$\gamma_{(-1,19)}$(Np)	445,81 (12)	0,0011 (2)					
$\gamma_{10,0}$(Np)	448,19 (6)	0,0085 (2)	[E1]	0,0139 (3)	0,00258 (5)	0,000620 (12)	0,0173 (4)
$\gamma_{(-1,20)}$(Np)	452,17 (12)	0,0015 (2)					
$\gamma_{14,3}$(Np)	455,26 (18)	0,0008 (3)					
$\gamma_{12,0}$(Np)	474,50 (11)	0,0017 (2)					
$\gamma_{(-1,21)}$(Np)	478,13 (19)	0,0005 (2)					
$\gamma_{(-1,22)}$(Np)	479,55 (14)	0,0010 (2)					
$\gamma_{13,1}$(Np)	486,87 (3)	0,061 (3)	[E1]	0,0118 (2)	0,00217 (4)	0,00052 (1)	0,0147 (4)
$\gamma_{(-1,23)}$(Np)	490,33 (13)	0,0007 (1)					
$\gamma_{15,2}$(Np)	492,76 (7)	0,0048 (2)					
$\gamma_{14,1}$(Np)	499,1 (1)	0,0020 (2)					
$\gamma_{(-1,24)}$(Np)	502,12 (17)	0,0006 (2)					
$\gamma_{16,3}$(Np)	504,76 (8)	0,0051 (3)	[E2]	0,0293 (6)	0,0143 (3)	0,0038 (1)	0,0488 (10)
$\gamma_{(-1,25)}$(Np)	506,80 (14)	0,0010 (2)					
$\gamma_{13,0}$(Np)	518,01 (9)	0,0044 (3)	[E1]	0,0105 (2)	0,00191 (4)	0,00046 (1)	0,0185 (4)
$\gamma_{19,6}$(Np)	522,12 (10)	0,0024 (2)	[M1+E2]				
$\gamma_{15,1}$(Np)	532,86 (10)	0,0022 (2)					
$\gamma_{(-1,26)}$(Np)	541,32 (10)	0,0028 (2)					
$\gamma_{18,4}$(Np)	544,48 (9)	0,0034 (3)	[M1+E2]				
$\gamma_{16,1}$(Np)	547,99 (12)	0,0020 (3)	[E1]	0,00941 (19)	0,00170 (3)	0,00041 (1)	0,0117 (2)
$\gamma_{(-1,27)}$(Np)	558,46 (17)	0,0006 (2)					
$\gamma_{(-1,28)}$(Np)	560,63 (7)	0,0056 (3)					
$\gamma_{15,0}$(Np)	564,09 (20)	0,0004 (2)					
$\gamma_{(-1,29)}$(Np)	567,88 (18)	0,0004 (1)					
$\gamma_{(-1,30)}$(Np)	575,27 (5)	0,0121 (3)					
$\gamma_{(-1,31)}$(Np)	577,15 (14)	0,0013 (3)					
$\gamma_{(-1,32)}$(Np)	585,49 (14)	0,0012 (2)					
$\gamma_{18,3}$(Np)	587,63 (5)	0,0184 (3)	[M1+E2]				
$\gamma_{(-1,33)}$(Np)	588,70 (8)	0,0053 (3)					
$\gamma_{(-1,34)}$(Np)	591,82 (19)	0,0009 (4)					
$\gamma_{(-1,35)}$(Np)	599,13 (15)	0,0007 (2)					
$\gamma_{(-1,36)}$(Np)	602,79 (8)	0,0047 (2)					
$\gamma_{(-1,37)}$(Np)	604,85 (6)	0,0009 (3)					
$\gamma_{(-1,38)}$(Np)	607,96 (15)	0,0013 (3)					
$\gamma_{(-1,39)}$(Np)	614,53 (17)	0,0006 (2)					
$\gamma_{(-1,40)}$(Np)	618,03 (16)	0,0007 (2)					
$\gamma_{19,2}$(Np)	624,11 (7)	0,0060 (2)	[E1]	0,00737 (15)	0,00131 (3)	0,00031 (1)	0,00910 (18)
$\gamma_{(-1,41)}$(Np)	629,00 (11)	0,0026 (3)					
$\gamma_{18,1}$(Np)	631,10 (3)	0,0656 (3)	[E1]	0,00722 (14)	0,00128 (3)	0,000307 (6)	0,00892 (18)
$\gamma_{(-1,42)}$(Np)	644,12 (14)	0,0019 (4)					
$\gamma_{23,6}$(Np)	646,26 (10)	0,0027 (3)					
$\gamma_{(-1,43)}$(Np)	649,79 (19)	0,0009 (4)					
$\gamma_{18,0}$(Np)	662,26 (2)	0,163 (5)	[E1]	0,00660 (13)	0,00117 (2)	0,00028 (1)	0,00815 (16)
$\gamma_{19,1}$(Np)	664,17 (9)	0,0051 (4)	[E1]	0,00657 (13)	0,00116 (2)	0,00028 (1)	0,00811 (16)
$\gamma_{(-1,44)}$(Np)	668,76 (18)	0,0005 (2)					
$\gamma_{(-1,45)}$(Np)	670,88 (20)	0,0006 (3)					
$\gamma_{(-1,46)}$(Np)	691,01 (6)	0,0071 (3)					
$\gamma_{(-1,47)}$(Np)	692,61 (13)	0,0016 (3)					
$\gamma_{19,0}$(Np)	695,18 (8)	0,0034 (3)	[E1]	0,00604 (12)	0,00106 (2)	0,00025 (1)	0,00745 (15)
$\gamma_{(-1,48)}$(Np)	701,21 (10)	0,0023 (2)					
$\gamma_{27,8}$(Np)	703,63 (10)	0,0023 (2)	[E2]	0,0162 (3)	0,00537 (11)	0,00138 (3)	0,0234 (5)
$\gamma_{21,2}$(Np)	707,38 (9)	0,0022 (2)					
$\gamma_{(-1,49)}$(Np)	714,22 (9)	0,0029 (3)					
$\gamma_{27,7}$(Np)	722,85 (4)	0,0264 (3)	[E2]	0,0138 (3)	0,00418 (8)	0,00106 (2)	0,0194 (4)
$\gamma_{(-1,50)}$(Np)	727,52 (10)	0,0025 (2)					
$\gamma_{(-1,51)}$(Np)	730,95 (6)	0,0090 (2)					
$\gamma_{(-1,52)}$(Np)	746,06 (11)	0,0041 (5)					

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{23,2}$(Np)	748,09 (3)	0,0850 (4)					
$\gamma_{30,8}$(Np)	752,39 (14)	0,0012 (3)					
$\gamma_{(-1,53)}$(Np)	764,04 (11)	0,0025 (3)					
$\gamma_{(-1,54)}$(Np)	768,15 (11)	0,0020 (2)					
$\gamma_{(-1,55)}$(Np)	769,52 (17)	0,0004 (1)					
$\gamma_{24,2}$(Np)	772,94 (9)	0,0028 (2)					
$\gamma_{(-1,56)}$(Np)	774,77 (4)	0,015 (2)					
$\gamma_{31,8}$(Np)	779,57 (14)	0,0006 (1)					
$\gamma_{23,1}$(Np)	788,19 (7)	0,0046 (2)					
$\gamma_{(-1,57)}$(Np)	791,33 (6)	0,0072 (2)					
$\gamma_{(-1,58)}$(Np)	795,13 (15)	0,0008 (2)					
$\gamma_{24,1}$(Np)	812,89 (3)	0,0657 (3)					
$\gamma_{23,0}$(Np)	819,19 (2)	0,123 (2)					
$\gamma_{(-1,59)}$(Np)	829,59 (17)	0,0004 (1)					
$\gamma_{(-1,60)}$(Np)	831,89 (9)	0,0020 (2)					
$\gamma_{(-1,61)}$(Np)	841,48 (12)	0,0024 (4)					
$\gamma_{24,0}$(Np)	844,05 (2)	0,133 (2)					
$\gamma_{(-1,62)}$(Np)	846,39 (4)	0,0298 (4)					
$\gamma_{28,4}$(Np)	849,44 (9)	0,0020 (2)					
$\gamma_{(-1,63)}$(Np)	862,56 (18)	0,0004 (1)					
$\gamma_{31,6}$(Np)	867,11 (11)	0,00073 (8)					
$\gamma_{(-1,64)}$(Np)	869,57 (9)	0,0016 (1)					
$\gamma_{29,4}$(Np)	874,22 (7)	0,0031 (1)	[M1+E2]				
$\gamma_{26,3}$(Np)	884,45 (5)	0,0082 (2)					
$\gamma_{(-1,65)}$(Np)	887,83 (10)	0,0023 (2)					
$\gamma_{27,3}$(Np)	889,49 (4)	0,0200 (2)	[M1+E2]				
$\gamma_{28,2}$(Np)	895,15 (15)	0,0008 (2)					
$\gamma_{(-1,66)}$(Np)	913,68 (9)	0,0018 (1)					
$\gamma_{29,3}$(Np)	917,40 (8)	0,0025 (1)	[M1+E2]				
$\gamma_{29,2}$(Np)	920,95 (8)	0,0025 (1)	[E1]	0,00366 (8)	0,000630 (13)	0,00015 (1)	0,00450 (9)
$\gamma_{31,4}$(Np)	922,83 (13)	0,0005 (1)					
$\gamma_{26,1}$(Np)	928,00 (6)	0,0049 (1)					
$\gamma_{32,4}$(Np)	931,97 (7)	0,0051 (2)	[M1+E2]				
$\gamma_{27,1}$(Np)	933,09 (3)	0,0252 (2)	[E1]	0,00358 (7)	0,000610 (12)	0,00015 (1)	0,00439 (9)
$\gamma_{30,3}$(Np)	938,59 (16)	0,00030 (8)					
$\gamma_{(-1,67)}$(Np)	948,88 (19)	0,00023 (9)					
$\gamma_{26,0}$(Np)	959,48 (6)	0,0076 (2)					
$\gamma_{29,1}$(Np)	960,99 (5)	0,0100 (2)	[E1]	0,00340 (7)	0,00058 (1)	0,00014 (1)	0,00417 (9)
$\gamma_{27,0}$(Np)	964,30 (3)	0,0871 (4)	[E1]	0,00338 (7)	0,000580 (12)	0,00014 (1)	0,00415 (9)
$\gamma_{(-1,68)}$(Np)	970,07 (14)	0,0009 (1)					
$\gamma_{32,3}$(Np)	974,91 (14)	0,00039 (8)	[E1]	0,00332 (7)	0,00057 (1)	0,000130 (12)	0,00407 (9)
$\gamma_{(-1,69)}$(Np)	988,51 (14)	0,00042 (9)					
$\gamma_{29,0}$(Np)	992,00 (7)	0,0027 (1)	[E1]	0,00322 (7)	0,000550 (11)	0,00013 (1)	0,00395 (8)
$\gamma_{(-1,70)}$(Np)	1002,40 (13)	0,00046 (9)					
$\gamma_{(-1,71)}$(Np)	1005,27 (13)	0,0006 (1)					
$\gamma_{(-1,72)}$(Np)	1009,38 (18)	0,0003 (1)					
$\gamma_{31,0}$(Np)	1040,19 (9)	0,0011 (1)					
$\gamma_{33,1}$(Np)	1065,76 (12)	0,00057 (8)	[M1+E2]				
$\gamma_{33,0}$(Np)	1096,92 (8)	0,0016 (1)	[M1+E2]				
$\gamma_{(-1,73)}$(Np)	1101,99 (16)	0,00030 (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				
	$K\alpha_2$	97,069		62,82
	$K\alpha_1$	101,059		100
	$K\beta_3$	113,303	}	
	$K\beta_1$	114,234	}	
	$K\beta_5''$	114,912	}	36,21
	$K\beta_2$	117,463	}	
	$K\beta_4$	117,876	}	12,47
	$KO_{2,3}$	118,429	}	
X_L				
	$L\ell$	11,871		
	$L\alpha$	13,671 – 13,946		
	$L\eta$	15,861		
	$L\beta$	16,109 – 17,992		
	$L\gamma$	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		19,4 (60)
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 - 13,521		14,5 (10)
$ec_{4,3\ L}$	(Np)	20,7 - 25,5		1,41
$ec_{3,1\ L}$	(Np)	21,106 - 25,920		3,72 (25)
$ec_{1,0\ M}$	(Np)	25,392 - 27,467		3,8 (3)
$ec_{6,4\ L}$	(Np)	32,75 - 37,57		0,0053 (17)
$ec_{4,3\ M}$	(Np)	37,4 - 39,4		0,37
$ec_{3,1\ M}$	(Np)	37,79 - 39,87		0,94 (7)
$ec_{2,0\ L}$	(Np)	48,78 - 53,60		0,115 (21)
$ec_{6,4\ M}$	(Np)	49,44 - 51,52		0,0014 (5)
$ec_{3,0\ L}$	(Np)	52,237 - 57,054		10,3 (3)
$ec_{4,1\ L}$	(Np)	64,29 - 69,11		0,0077 (7)
$ec_{2,0\ M}$	(Np)	65,47 - 67,55		0,032 (6)
$ec_{3,0\ M}$	(Np)	68,93 - 71,00		2,53 (8)
$ec_{4,1\ M}$	(Np)	80,98 - 83,06		0,00189 (18)
$ec_{4,0\ L}$	(Np)	95,23 - 100,05		0,0071 (6)
$ec_{4,0\ M}$	(Np)	111,92 - 114,00		0,00175 (14)
$\beta^-_{0,33}$	max:	164,5	(16)	0,0033 (2)
$\beta^-_{0,33}$	avg:	43,7	(5)	
$\beta^-_{0,32}$	max:	212,3	(16)	0,0091 (2)
$\beta^-_{0,32}$	avg:	57,3	(5)	
$\beta^-_{0,31}$	max:	221,1	(16)	0,0074 (5)
$\beta^-_{0,31}$	avg:	59,9	(5)	
$\beta^-_{0,30}$	max:	247,9	(16)	0,0045 (3)
$\beta^-_{0,30}$	avg:	67,6	(5)	
$\beta^-_{0,29}$	max:	269,3	(16)	0,0106 (2)
$\beta^-_{0,29}$	avg:	74,0	(5)	
$\beta^-_{0,28}$	max:	295,0	(16)	0,0057 (3)
$\beta^-_{0,28}$	avg:	81,7	(5)	
$\beta^-_{0,27}$	max:	297,3	(16)	0,192 (8)
$\beta^-_{0,27}$	avg:	82,4	(5)	
$\beta^-_{0,26}$	max:	302,3	(16)	0,0239 (4)
$\beta^-_{0,26}$	avg:	83,9	(5)	
$\beta^-_{0,25}$	max:	398,1	(16)	0,0046 (5)
$\beta^-_{0,25}$	avg:	113,4	(5)	
$\beta^-_{0,24}$	max:	417,4	(16)	0,201 (5)

		Energy keV		Electrons per 100 disint.
$\beta^-_{0,24}$	avg:	119,6	(5)	
$\beta^-_{0,23}$	max:	442,2	(16)	0,229 (7)
$\beta^-_{0,23}$	avg:	127,4	(5)	
$\beta^-_{0,19}$	max:	566,3	(16)	0,0143 (7)
$\beta^-_{0,19}$	avg:	168,0	(5)	
$\beta^-_{0,18}$	max:	599,2	(16)	0,248 (5)
$\beta^-_{0,18}$	avg:	179,0	(5)	
$\beta^-_{0,15}$	max:	697,6	(16)	0,0253 (6)
$\beta^-_{0,15}$	avg:	212,6	(5)	
$\beta^-_{0,14}$	max:	731,2	(16)	0,0040 (4)
$\beta^-_{0,14}$	avg:	224,3	(5)	
$\beta^-_{0,13}$	max:	743,5	(16)	0,065 (2)
$\beta^-_{0,13}$	avg:	228,6	(5)	
$\beta^-_{0,12}$	max:	787,1	(16)	0,0032 (4)
$\beta^-_{0,12}$	avg:	244,0	(5)	
$\beta^-_{0,4}$	max:	1143,8	(16)	2,05 (22)
$\beta^-_{0,4}$	avg:	374,0	(5)	
$\beta^-_{0,3}$	max:	1186,5	(16)	70,4 (16)
$\beta^-_{0,3}$	avg:	390,4	(5)	
$\beta^-_{0,1}$	max:	1230,4	(16)	10,1 (13)
$\beta^-_{0,1}$	avg:	406,8	(5)	
$\beta^-_{0,0}$	max:	1261,5	(16)	16,5 (18)
$\beta^-_{0,0}$	avg:	418,6	(5)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Np)	11,871 — 21,491		14,9 (4)	
XKα_2	(Np)	97,069		0,091 (3)	} Kα
XKα_1	(Np)	101,059		0,144 (5)	}
XKβ_3	(Np)	113,303	}		
XKβ_1	(Np)	114,234	}	0,052 (2)	K$'\beta_1$
XKβ_5''	(Np)	114,912	}		
XKβ_2	(Np)	117,463	}		
XKβ_4	(Np)	117,876	}	0,018 (1)	K$'\beta_2$
XKO$_{2,3}$	(Np)	118,429	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Np)	31,131 (2)	0,072 (4)
$\gamma_{4,3}$(Np)	43,1	0,0124
$\gamma_{3,1}$(Np)	43,533 (1)	4,35 (28)
$\gamma_{(-1,1)}$(Np)	46,6	0,009 (4)
$\gamma_{6,4}$(Np)	55,18	0,0000836 (20)
$\gamma_{2,0}$(Np)	71,21 (2)	0,0022 (4)
$\gamma_{3,0}$(Np)	74,664 (1)	49,5 (11)
$\gamma_{4,1}$(Np)	86,72 (7)	0,055 (5)
$\gamma_{15,11}$(Np)	111,0 (2)	0,0202 (5)
$\gamma_{4,0}$(Np)	117,66 (3)	0,113 (9)
$\gamma_{(-1,2)}$(Np)	134,71 (13)	0,0018 (3)
$\gamma_{(-1,3)}$(Np)	142,5 (1)	0,0043 (5)
$\gamma_{7,2}$(Np)	170,2	0,029 (1)
$\gamma_{(-1,4)}$(Np)	174,07 (6)	0,0097 (3)
$\gamma_{8,3}$(Np)	186,15 (4)	0,0276 (3)
$\gamma_{10,8}$(Np)	187,28 (8)	0,0054 (3)
$\gamma_{25,18}$(Np)	201,09 (18)	0,0005 (2)
$\gamma_{(-1,5)}$(Np)	220,52 (4)	0,0271 (3)
$\gamma_{(-1,6)}$(Np)	236,28 (14)	0,0009 (2)
$\gamma_{(-1,7)}$(Np)	240,00 (15)	0,0008 (2)
$\gamma_{23,15}$(Np)	255,71 (12)	0,0011 (2)
$\gamma_{31,21}$(Np)	258,80 (16)	0,0007 (2)
$\gamma_{8,0}$(Np)	260,86 (9)	0,0029 (2)
$\gamma_{(-1,8)}$(Np)	262,89 (19)	0,0008 (3)
$\gamma_{(-1,9)}$(Np)	265,44 (17)	0,0009 (3)
$\gamma_{29,19}$(Np)	296,93 (13)	0,0014 (2)
$\gamma_{27,18}$(Np)	301,64 (15)	0,0011 (3)
$\gamma_{(-1,10)}$(Np)	326,21 (7)	0,0042 (2)
$\gamma_{(-1,11)}$(Np)	330,14 (14)	0,0007 (1)
$\gamma_{(-1,12)}$(Np)	332,06 (14)	0,0011 (2)
$\gamma_{31,19}$(Np)	345,13 (8)	0,0038 (2)
$\gamma_{(-1,13)}$(Np)	348,23 (18)	0,0007 (3)
$\gamma_{(-1,14)}$(Np)	351,33 (15)	0,0007 (2)
$\gamma_{(-1,15)}$(Np)	361,83 (8)	0,0043 (3)
$\gamma_{10,3}$(Np)	373,51 (4)	0,024 (2)
$\gamma_{11,3}$(Np)	378,06 (6)	0,0096 (3)
$\gamma_{11,2}$(Np)	381,27 (16)	0,0006 (2)
$\gamma_{(-1,16)}$(Np)	393,01 (18)	0,0006 (2)
$\gamma_{26,15}$(Np)	395,19 (11)	0,0020 (2)
$\gamma_{12,3}$(Np)	399,13 (13)	0,0015 (3)
$\gamma_{(-1,17)}$(Np)	400,55 (15)	0,0009 (2)
$\gamma_{(-1,18)}$(Np)	404,84 (18)	0,0008 (3)
$\gamma_{33,18}$(Np)	434,44 (13)	0,0011 (2)
$\gamma_{(-1,19)}$(Np)	445,81 (12)	0,0011 (2)
$\gamma_{10,0}$(Np)	448,19 (6)	0,0084 (2)

	Energy keV	Photons per 100 disint.
$\gamma_{(-1,20)}$(Np)	452,17 (12)	0,0015 (2)
$\gamma_{14,3}$(Np)	455,26 (18)	0,0008 (3)
$\gamma_{12,0}$(Np)	474,50 (11)	0,0017 (2)
$\gamma_{(-1,21)}$(Np)	478,13 (19)	0,0005 (2)
$\gamma_{(-1,22)}$(Np)	479,55 (14)	0,0010 (2)
$\gamma_{13,1}$(Np)	486,87 (3)	0,060 (3)
$\gamma_{(-1,23)}$(Np)	490,33 (13)	0,0007 (1)
$\gamma_{15,2}$(Np)	492,76 (7)	0,0048 (2)
$\gamma_{14,1}$(Np)	499,1 (1)	0,0020 (2)
$\gamma_{(-1,24)}$(Np)	502,12 (17)	0,0006 (2)
$\gamma_{16,3}$(Np)	504,76 (8)	0,0049 (3)
$\gamma_{(-1,25)}$(Np)	506,80 (14)	0,0010 (2)
$\gamma_{13,0}$(Np)	518,01 (9)	0,0043 (3)
$\gamma_{19,6}$(Np)	522,12 (10)	0,0024 (2)
$\gamma_{15,1}$(Np)	532,86 (10)	0,0022 (2)
$\gamma_{(-1,26)}$(Np)	541,32 (10)	0,0028 (2)
$\gamma_{18,4}$(Np)	544,48 (9)	0,0034 (3)
$\gamma_{16,1}$(Np)	547,99 (12)	0,0019 (3)
$\gamma_{(-1,27)}$(Np)	558,46 (17)	0,0006 (2)
$\gamma_{(-1,28)}$(Np)	560,63 (7)	0,0056 (3)
$\gamma_{15,0}$(Np)	564,09 (20)	0,0004 (2)
$\gamma_{(-1,29)}$(Np)	567,88 (18)	0,0004 (1)
$\gamma_{(-1,30)}$(Np)	575,27 (5)	0,0121 (3)
$\gamma_{(-1,31)}$(Np)	577,15 (14)	0,0013 (3)
$\gamma_{(-1,32)}$(Np)	585,49 (14)	0,0012 (2)
$\gamma_{18,3}$(Np)	587,63 (5)	0,0184 (3)
$\gamma_{(-1,33)}$(Np)	588,70 (8)	0,0053 (3)
$\gamma_{(-1,34)}$(Np)	591,82 (19)	0,0009 (4)
$\gamma_{(-1,35)}$(Np)	599,13 (15)	0,0007 (2)
$\gamma_{(-1,36)}$(Np)	602,79 (8)	0,0047 (2)
$\gamma_{(-1,37)}$(Np)	604,85 (6)	0,0009 (3)
$\gamma_{(-1,38)}$(Np)	607,96 (15)	0,0013 (3)
$\gamma_{(-1,39)}$(Np)	614,53 (17)	0,0006 (2)
$\gamma_{(-1,40)}$(Np)	618,03 (16)	0,0007 (2)
$\gamma_{19,2}$(Np)	624,11 (7)	0,0059 (2)
$\gamma_{(-1,41)}$(Np)	629,00 (11)	0,0026 (3)
$\gamma_{18,1}$(Np)	631,10 (3)	0,0650 (3)
$\gamma_{(-1,42)}$(Np)	644,12 (14)	0,0019 (4)
$\gamma_{23,6}$(Np)	646,26 (10)	0,0027 (3)
$\gamma_{(-1,43)}$(Np)	649,79 (19)	0,0009 (4)
$\gamma_{18,0}$(Np)	662,26 (2)	0,162 (5)
$\gamma_{19,1}$(Np)	664,17 (9)	0,0051 (4)
$\gamma_{(-1,44)}$(Np)	668,76 (18)	0,0005 (2)
$\gamma_{(-1,45)}$(Np)	670,88 (20)	0,0006 (3)
$\gamma_{(-1,46)}$(Np)	691,01 (6)	0,0071 (3)
$\gamma_{(-1,47)}$(Np)	692,61 (13)	0,0016 (3)
$\gamma_{19,0}$(Np)	695,18 (8)	0,0034 (3)

	Energy keV	Photons per 100 disint.
$\gamma_{(-1,48)}$(Np)	701,21 (10)	0,0023 (2)
$\gamma_{27,8}$(Np)	703,63 (10)	0,0023 (2)
$\gamma_{21,2}$(Np)	707,38 (9)	0,0022 (2)
$\gamma_{(-1,49)}$(Np)	714,22 (9)	0,0029 (3)
$\gamma_{27,7}$(Np)	722,85 (4)	0,0259 (3)
$\gamma_{(-1,50)}$(Np)	727,52 (10)	0,0025 (2)
$\gamma_{(-1,51)}$(Np)	730,95 (6)	0,0090 (2)
$\gamma_{(-1,52)}$(Np)	746,06 (11)	0,0041 (5)
$\gamma_{23,2}$(Np)	748,09 (3)	0,0850 (4)
$\gamma_{30,8}$(Np)	752,39 (14)	0,0012 (3)
$\gamma_{(-1,53)}$(Np)	764,04 (11)	0,0025 (3)
$\gamma_{(-1,54)}$(Np)	768,15 (11)	0,0020 (2)
$\gamma_{(-1,55)}$(Np)	769,52 (17)	0,0004 (1)
$\gamma_{24,2}$(Np)	772,94 (9)	0,0028 (2)
$\gamma_{(-1,56)}$(Np)	774,77 (4)	0,015 (2)
$\gamma_{31,8}$(Np)	779,57 (14)	0,0006 (1)
$\gamma_{23,1}$(Np)	788,19 (7)	0,0046 (2)
$\gamma_{(-1,57)}$(Np)	791,33 (6)	0,0072 (2)
$\gamma_{(-1,58)}$(Np)	795,13 (15)	0,0008 (2)
$\gamma_{24,1}$(Np)	812,89 (3)	0,0657 (3)
$\gamma_{23,0}$(Np)	819,19 (2)	0,123 (2)
$\gamma_{(-1,59)}$(Np)	829,59 (17)	0,0004 (1)
$\gamma_{(-1,60)}$(Np)	831,89 (9)	0,0020 (2)
$\gamma_{(-1,61)}$(Np)	841,48 (12)	0,0024 (4)
$\gamma_{24,0}$(Np)	844,05 (2)	0,133 (2)
$\gamma_{(-1,62)}$(Np)	846,39 (4)	0,0298 (4)
$\gamma_{28,4}$(Np)	849,44 (9)	0,0020 (2)
$\gamma_{(-1,63)}$(Np)	862,56 (18)	0,0004 (1)
$\gamma_{31,6}$(Np)	867,11 (11)	0,00073 (8)
$\gamma_{(-1,64)}$(Np)	869,57 (9)	0,0016 (1)
$\gamma_{29,4}$(Np)	874,22 (7)	0,0031 (1)
$\gamma_{26,3}$(Np)	884,45 (5)	0,0082 (2)
$\gamma_{(-1,65)}$(Np)	887,83 (10)	0,0023 (2)
$\gamma_{27,3}$(Np)	889,49 (4)	0,0200 (2)
$\gamma_{28,2}$(Np)	895,15 (15)	0,0008 (2)
$\gamma_{(-1,66)}$(Np)	913,68 (9)	0,0018 (1)
$\gamma_{29,3}$(Np)	917,40 (8)	0,0025 (1)
$\gamma_{29,2}$(Np)	920,95 (8)	0,0025 (1)
$\gamma_{31,4}$(Np)	922,83 (13)	0,0005 (1)
$\gamma_{26,1}$(Np)	928,00 (6)	0,0049 (1)
$\gamma_{32,4}$(Np)	931,97 (7)	0,0051 (2)
$\gamma_{27,1}$(Np)	933,09 (3)	0,0251 (2)
$\gamma_{30,3}$(Np)	938,59 (16)	0,00030 (8)
$\gamma_{(-1,67)}$(Np)	948,88 (19)	0,00023 (9)
$\gamma_{26,0}$(Np)	959,48 (6)	0,0076 (2)
$\gamma_{29,1}$(Np)	960,99 (5)	0,0100 (2)
$\gamma_{27,0}$(Np)	964,30 (3)	0,0867 (4)

	Energy keV	Photons per 100 disint.
$\gamma_{(-1,68)}$(Np)	970,07 (14)	0,0009 (1)
$\gamma_{32,3}$(Np)	974,91 (14)	0,00039 (8)
$\gamma_{(-1,69)}$(Np)	988,51 (14)	0,00042 (9)
$\gamma_{29,0}$(Np)	992,00 (7)	0,0027 (1)
$\gamma_{(-1,70)}$(Np)	1002,40 (13)	0,00046 (9)
$\gamma_{(-1,71)}$(Np)	1005,27 (13)	0,0006 (1)
$\gamma_{(-1,72)}$(Np)	1009,38 (18)	0,0003 (1)
$\gamma_{31,0}$(Np)	1040,19 (9)	0,0011 (1)
$\gamma_{33,1}$(Np)	1065,76 (12)	0,00057 (8)
$\gamma_{33,0}$(Np)	1096,92 (8)	0,0016 (1)
$\gamma_{(-1,73)}$(Np)	1101,99 (16)	0,00030 (1)

6 Main Production Modes

U – 238(n,γ)U – 239
Possible impurities : U – 238

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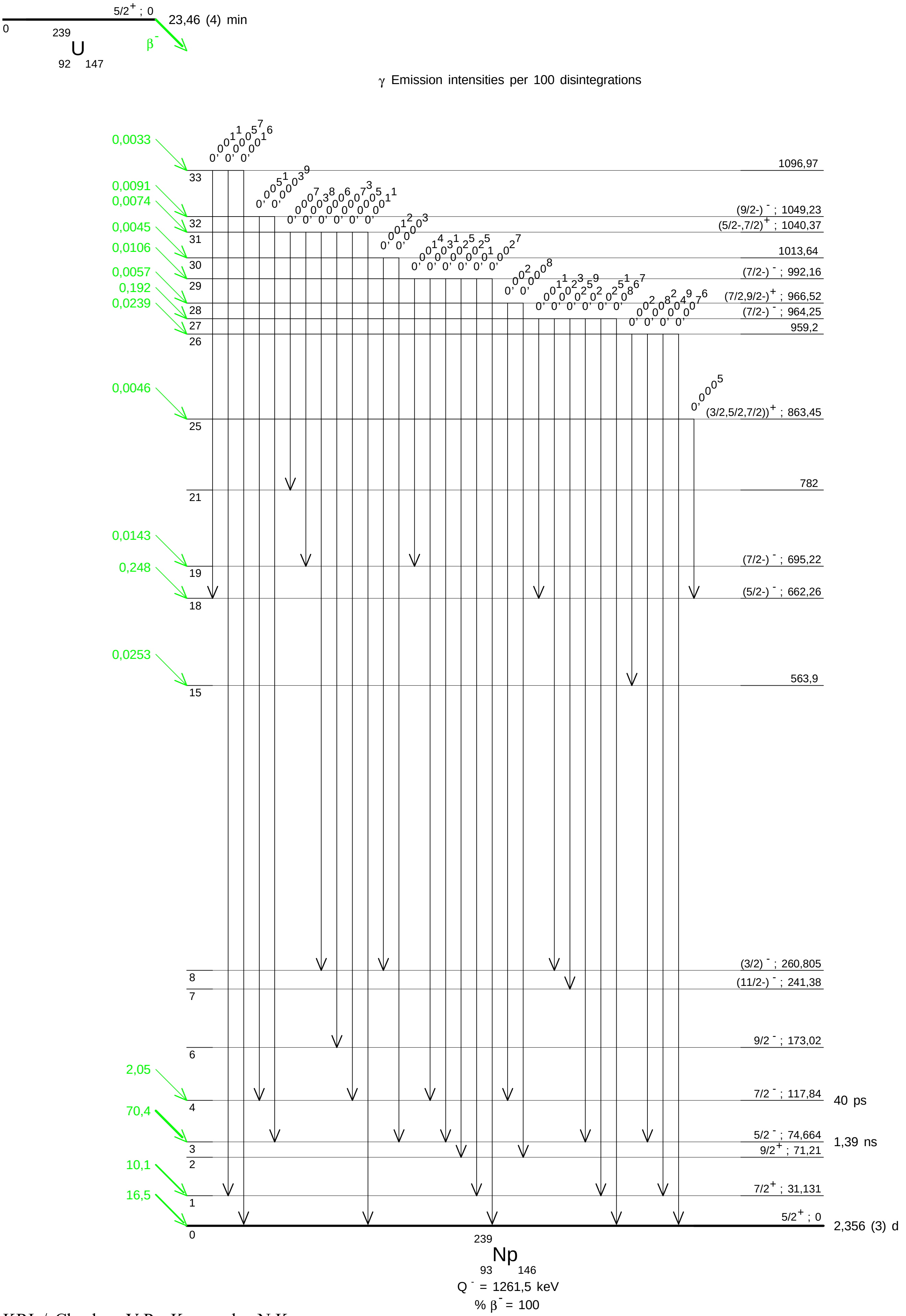

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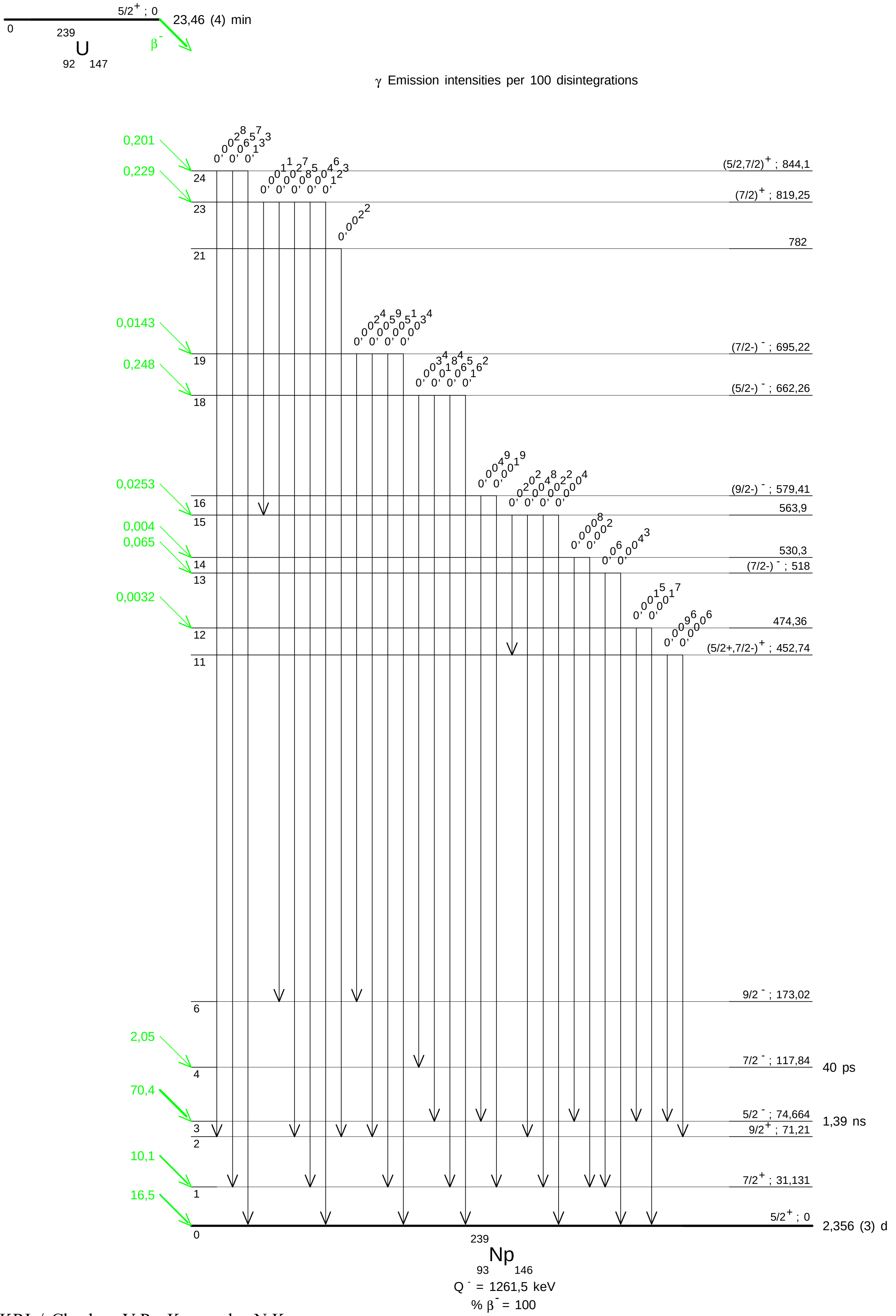

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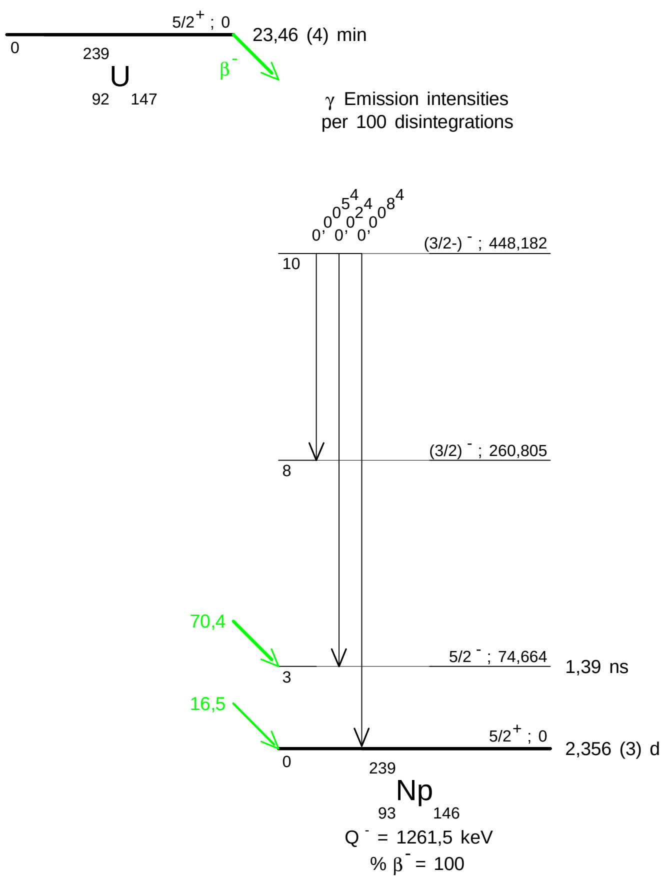

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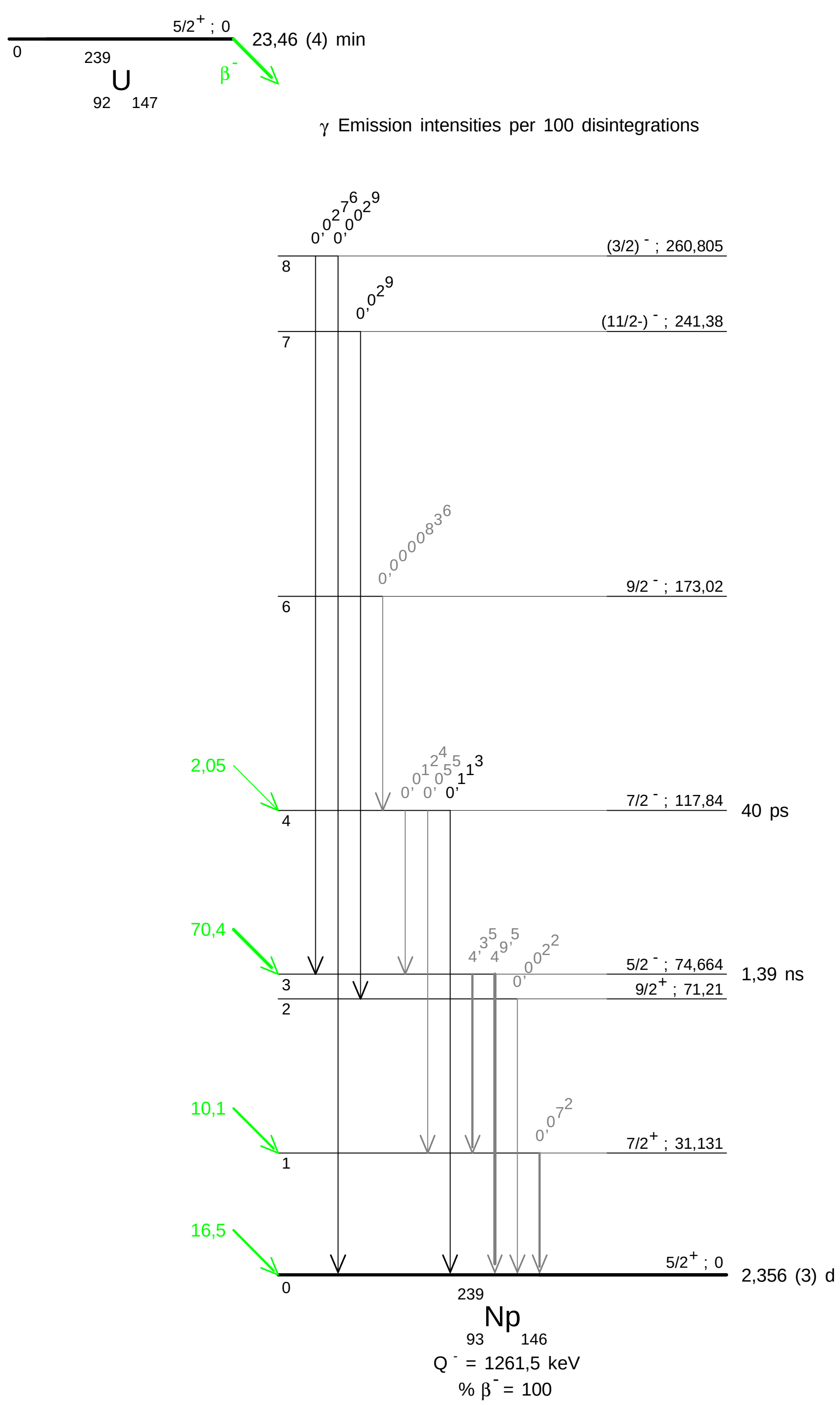

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$^{239}_{93}\mathrm{Np}_{146}$

1 Decay Scheme

Np-239 decays by beta minus emission to levels in Pu-239.
Le neptunium 239 se désintègre par émissions bêta moins vers le plutonium 239.

2 Nuclear Data

$T_{1/2}(^{239}\mathrm{Np})$	:	2,356	(3)	d
$T_{1/2}(^{239}\mathrm{Pu})$	:	24100	(11)	a
$Q^-(^{239}\mathrm{Np})$	:	722,5	(10)	keV

2.1 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,13}$	166,3 (5)	0,0026	1st forbidden	9,7
$\beta^-_{0,12}$	210,7 (5)	1,56 (16)	Allowed	7,3
$\beta^-_{0,11}$	217,3 (5)	0,0074	1st forbidden	9,7
$\beta^-_{0,10}$	230,3 (5)	0,02	1st forbidden	9,3
$\beta^-_{0,9}$	252,7 (5)	0,0027	1st forbidden unique	9,9
$\beta^-_{0,8}$	330,9 (5)	38,8 (9)	1st forbidden	6,3
$\beta^-_{0,7}$	335,1 (5)		2nd forbidden	
$\beta^-_{0,6}$	392,4 (5)	9,4 (14)	Allowed	7,4
$\beta^-_{0,5}$	437,0 (5)	43,0 (22)	Allowed	6,9
$\beta^-_{0,4}$	558,7 (5)		2nd forbidden	
$\beta^-_{0,3}$	646,8 (5)		Allowed	
$\beta^-_{0,2}$	665,2 (5)	0,4 (72)	Allowed	
$\beta^-_{0,1}$	714,6 (5)	6,5 (10)	Allowed	8,4
$\beta^-_{0,0}$	722,5 (5)		2nd forbidden unique	

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2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{1,0}$(Pu)	7,861 (2)	70 (8)	M1+0,3%E2			4220 (270)	5716 (400)
$\gamma_{3,2}$(Pu)	18,430 (4)	5,5 (30)	[M1+E2]				
$\gamma_{6,5}$(Pu)	44,663 (5)	11,3 (14)	M1+4%E2		64 (6)	16,3 (16)	86 (8)
$\gamma_{2,1}$(Pu)	49,415 (3)	18 (5)	M1+20%E2		92 (6)	24,8 (15)	126 (8)
$\gamma_{2,0}$(Pu)	57,273 (4)	27 (7)	E2		161 (3)	45,0 (9)	222 (5)
$\gamma_{7,6}$(Pu)	57,3	≈ 0,2	M1(+E2)				
$\gamma_{8,6}$(Pu)	61,460 (2)	1,900 (32)	E1		0,354 (7)	0,0881 (18)	0,473 (10)
$\gamma_{3,1}$(Pu)	67,841 (7)	9,9 (30)	E2		71,3 (14)	20,0 (4)	98,3 (20)
$\gamma_{4,3}$(Pu)	88,06 (3)	0,078 (44)	M1+20%E2		9 (4)	2,4 (13)	12 (6)
$\gamma_{7,5}$(Pu)	101,96 (2)	0,12 (3)	E2		10,5 (2)	2,93 (6)	14,4 (3)
$\gamma_{8,5}$(Pu)	106,125 (2)	32,6 (9)	E1(+M2)		0,19 (3)	0,050 (8)	0,26 (3)
$\gamma_{4,2}$(Pu)	106,50 (3)	0,63 (10)	E2		8,55 (17)	2,39 (5)	11,8 (3)
$\gamma_{12,7}$(Pu)	124,4	0,15	E2	10,4 (2)	2,39 (5)	0,591 (12)	13,6 (3)
$\gamma_{6,4}$(Pu)	166,39 (6)	0,12 (5)	M1(+20%E2)	4,92 (10)	0,987 (20)	0,240 (5)	6,23 (13)
$\gamma_{12,6}$(Pu)	181,70 (3)	0,497 (14)	M1	3,76 (8)	0,768 (15)	0,187 (4)	4,78 (10)
$\gamma_{5,3}$(Pu)	209,753 (2)	13,47 (24)	M1+2%E2	2,27 (5)	0,501 (10)	0,123 (25)	2,94 (6)
$\gamma_{12,5}$(Pu)	226,38 (2)	0,91 (5)	M1+12%E2	2,04 (7)	0,411 (12)	0,100 (3)	2,58 (8)
$\gamma_{8,4}$(Pu)	227,83	0,54 (11)	M1+1,7%E2	0,0597 (12)	0,0125 (3)	0,00303 (6)	0,0762 (15)
$\gamma_{5,2}$(Pu)	228,183 (1)	38,6 (12)	M1+7,3%E2	1,89 (6)	0,396 (12)	0,097 (3)	2,41 (8)
$\gamma_{6,3}$(Pu)	254,40 (3)	0,314 (10)	M1+2,5%E2	1,46 (3)	0,295 (6)	0,0718 (15)	1,85 (4)
$\gamma_{6,2}$(Pu)	272,84 (3)	0,194 (8)	M1+2,6%E2	1,20 (3)	0,242 (5)	0,0589 (12)	1,52 (3)
$\gamma_{5,1}$(Pu)	277,599 (1)	34,8 (9)	M1+5%E2	1,12 (5)	0,228 (6)	0,0556 (12)	1,42 (6)
$\gamma_{5,0}$(Pu)	285,460 (2)	0,973 (13)	E2	0,0843 (17)	0,119 (3)	0,0327 (7)	0,248 (5)
$\gamma_{7,3}$(Pu)	311,70 (2)	0,002 (2)	(M1+E2)				
$\gamma_{8,3}$(Pu)	315,880 (3)	1,649 (10)	E1(+0,006%M2)	0,0295 (6)		0,00141 (4)	0,0372 (8)
$\gamma_{6,1}$(Pu)	322,3 (2)	0,006	(E2)	0,0680 (14)		0,0203 (4)	0,170 (4)
$\gamma_{8,2}$(Pu)	334,310 (3)	2,107 (21)	E1(+0,004%M2)	0,0261 (5)		0,0012 (3)	0,0329 (7)
$\gamma_{13,4}$(Pu)	392,4 (5)	0,0016	(E1)				
$\gamma_{11,3}$(Pu)	429,5 (5)	0,0039					
$\gamma_{10,2}$(Pu)	434,7 (5)	0,013	E1(+M2)				
$\gamma_{11,2}$(Pu)	447,6 (5)	0,00026					
$\gamma_{12,2}$(Pu)	454,2 (5)	0,00082	(M1)				
$\gamma_{9,1}$(Pu)	461,9 (5)	0,0016	(E1)				
$\gamma_{9,0}$(Pu)	469,8 (5)	0,0011	(E1)				
$\gamma_{10,1}$(Pu)	484,3 (5)	0,001	(E1)				
$\gamma_{10,0}$(Pu)	492,3 (5)	0,006	(E1)				
$\gamma_{11,1}$(Pu)	497,8 (5)	0,0032					
$\gamma_{13,2}$(Pu)	498,7	0,001	(E1)				
$\gamma_{12,1}$(Pu)	504,2 (5)	0,00078	(E2)				

3 Atomic Data

3.1 Pu

ω_K : 0,971 (4)
$\bar{\omega}_L$: 0,521 (20)
n_{KL} : 0,790 (5)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	99,525		63,17
	$K\alpha_1$	103,734		100
	$K\beta_3$	116,244	}	
	$K\beta_1$	117,228	}	
	$K\beta_5''$	117,918	}	36,7
	$K\beta_2$	120,54	}	
	$K\beta_4$	120,969	}	12,74
	$KO_{2,3}$	121,543	}	
X_L				
	$L\ell$	12,125		
	$L\alpha$	14,083 – 14,279		
	$L\eta$	16,334		
	$L\beta$	16,499 – 19,331		
	$L\gamma$	20,708 – 21,984		

3.1.2 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	6,1 – 23,0	

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Pu)	6,1 - 23,0		47,9 (26)
e_{AK}	(Pu)			1,36 (19)
	KLL	75,26 - 85,36	}	
	KLX	92,61 - 103,73	}	
	KXY	109,93 - 121,78	}	

		Energy keV		Electrons per 100 disint.
$ec_{1,0\ M}$	(Pu)	1,928 - 4,086		51 (6)
$ec_{12,7\ K}$	(Pu)	2,6		0,1
$ec_{6,5\ L}$	(Pu)	21,559 - 26,606		8,3 (10)
$ec_{2,1\ L}$	(Pu)	26,311 - 31,358		13,3 (3)
$ec_{2,0\ L}$	(Pu)	34,169 - 39,216		20,8 (32)
$ec_{8,6\ L}$	(Pu)	38,36 - 43,40		0,457 (11)
$ec_{6,5\ M}$	(Pu)	38,730 - 40,888		2,12 (26)
$ec_{2,1\ M}$	(Pu)	43,482 - 45,640		3,6 (9)
$ec_{6,4\ K}$	(Pu)	44,60	(6)	0,08 (3)
$ec_{3,1\ L}$	(Pu)	44,74 - 49,78		7,1 (21)
$ec_{2,0\ M}$	(Pu)	51,340 - 53,498		5,8 (9)
$ec_{8,6\ M}$	(Pu)	55,53 - 57,68		0,114 (3)
$ec_{12,6\ K}$	(Pu)	59,91	(3)	0,323 (10)
$ec_{3,1\ M}$	(Pu)	61,91 - 64,07		2,0 (6)
$ec_{4,3\ L}$	(Pu)	64,96 - 70,00		0,054 (30)
$ec_{7,5\ L}$	(Pu)	78,86 - 83,90		0,084 (21)
$ec_{8,5\ L}$	(Pu)	83,02 - 88,07		4,9 (8)
$ec_{4,2\ L}$	(Pu)	83,37 - 88,41		0,42 (7)
$ec_{5,3\ T}$	(Pu)	87,962 - 209,746		10,05 (22)
$ec_{5,3\ K}$	(Pu)	87,962	(2)	7,76 (18)
$ec_{8,5\ M}$	(Pu)	100,19 - 102,35		1,30 (21)
$ec_{4,2\ M}$	(Pu)	100,54 - 102,69		0,117 (19)
$ec_{12,5\ K}$	(Pu)	104,59	(2)	0,52 (3)
$ec_{5,2\ T}$	(Pu)	106,392 - 228,176		27,3 (10)
$ec_{5,2\ K}$	(Pu)	106,392	(1)	21,4 (8)
$ec_{6,3\ K}$	(Pu)	132,61	(3)	0,161 (6)
$ec_{6,2\ K}$	(Pu)	151,05	(3)	0,092 (4)
$ec_{5,1\ K}$	(Pu)	155,808	(1)	16,1 (7)
$ec_{5,1\ T}$	(Pu)	155,808 - 277,592		20,4 (9)
$ec_{12,6\ L}$	(Pu)	158,59 - 163,63		0,066 (2)
$ec_{5,0\ K}$	(Pu)	163,669	(2)	0,066 (2)
$ec_{5,3\ L}$	(Pu)	186,65 - 191,70		1,71 (4)
$ec_{12,5\ L}$	(Pu)	203,28 - 208,32		0,105 (7)
$ec_{5,3\ M}$	(Pu)	203,82 - 205,98		0,42 (9)
$ec_{5,2\ L}$	(Pu)	205,08 - 210,13		4,48 (16)
$ec_{8,2\ K}$	(Pu)	212,519	(3)	0,0532 (11)
$ec_{5,2\ M}$	(Pu)	222,25 - 224,41		1,10 (4)
$ec_{5,1\ L}$	(Pu)	254,50 - 259,54		3,28 (9)
$ec_{5,0\ L}$	(Pu)	262,36 - 267,40		0,093 (3)
$ec_{5,1\ M}$	(Pu)	271,67 - 273,82		0,801 (18)
$\beta^-_{0,13}$	max:	166,3	(5)	0,0026
$\beta^-_{0,13}$	avg:	44,2	(2)	
$\beta^-_{0,12}$	max:	210,7	(5)	1,56 (16)
$\beta^-_{0,12}$	avg:	56,8	(2)	
$\beta^-_{0,11}$	max:	217,3	(5)	0,0074
$\beta^-_{0,11}$	avg:	58,7	(2)	

		Energy keV		Electrons per 100 disint.
$\beta^-_{0,10}$	max:	230,3	(5)	0,02
$\beta^-_{0,10}$	avg:	62,5	(2)	
$\beta^-_{0,9}$	max:	252,7	(5)	0,0027
$\beta^-_{0,9}$	avg:	74,7	(2)	
$\beta^-_{0,8}$	max:	330,9	(5)	38,8 (9)
$\beta^-_{0,8}$	avg:	98,3	(2)	
$\beta^-_{0,7}$	max:	335,1	(5)	
$\beta^-_{0,7}$	avg:			
$\beta^-_{0,6}$	max:	392,4	(5)	9,4 (14)
$\beta^-_{0,6}$	avg:	111,5	(2)	
$\beta^-_{0,5}$	max:	437,0	(5)	43,0 (22)
$\beta^-_{0,5}$	avg:	125,6	(2)	
$\beta^-_{0,4}$	max:	558,7	(5)	
$\beta^-_{0,4}$	avg:			
$\beta^-_{0,3}$	max:	646,8	(5)	
$\beta^-_{0,3}$	avg:			
$\beta^-_{0,2}$	max:	665,2	(5)	0,4 (72)
$\beta^-_{0,2}$	avg:			
$\beta^-_{0,1}$	max:	714,6	(5)	6,5 (10)
$\beta^-_{0,1}$	avg:	218,3	(2)	
$\beta^-_{0,0}$	max:	722,5	(5)	
$\beta^-_{0,0}$	avg:			

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Pu)	12,125 — 21,984		51,3 (24)	
XKα_2	(Pu)	99,525		13,5 (4)	} Kα
XKα_1	(Pu)	103,734		21,4 (6)	}
XKβ_3	(Pu)	116,244	}		
XKβ_1	(Pu)	117,228	}	7,84 (25)	K$'\beta_1$
XKβ_5''	(Pu)	117,918	}		
XKβ_2	(Pu)	120,54	}		
XKβ_4	(Pu)	120,969	}	2,72 (10)	K$'\beta_2$
XKO$_{2,3}$	(Pu)	121,543	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Pu)	7,861 (2)	0,0122 (12)
$\gamma_{3,2}$(Pu)	18,430 (4)	< 0,02
$\gamma_{6,5}$(Pu)	44,663 (5)	0,13 (1)
$\gamma_{2,1}$(Pu)	49,415 (3)	0,145 (35)
$\gamma_{2,0}$(Pu)	57,273 (4)	0,12 (3)
$\gamma_{7,6}$(Pu)	57,3	≈ 0,012
$\gamma_{8,6}$(Pu)	61,460 (2)	1,29 (2)
$\gamma_{3,1}$(Pu)	67,841 (7)	0,10 (3)
$\gamma_{4,3}$(Pu)	88,06 (3)	0,006 (2)
$\gamma_{7,5}$(Pu)	101,96 (2)	0,008 (2)
$\gamma_{8,5}$(Pu)	106,125 (2)	25,9 (3)
$\gamma_{4,2}$(Pu)	106,50 (3)	0,049 (8)
$\gamma_{12,7}$(Pu)	124,4	0,01
$\gamma_{6,4}$(Pu)	166,39 (6)	0,016 (7)
$\gamma_{12,6}$(Pu)	181,70 (3)	0,086 (2)
$\gamma_{5,3}$(Pu)	209,753 (2)	3,42 (3)
$\gamma_{12,5}$(Pu)	226,38 (2)	0,255 (14)
$\gamma_{8,4}$(Pu)	227,83	0,5 (1)
$\gamma_{5,2}$(Pu)	228,183 (1)	11,32 (22)
$\gamma_{6,3}$(Pu)	254,40 (3)	0,110 (3)
$\gamma_{6,2}$(Pu)	272,84 (3)	0,077 (3)
$\gamma_{5,1}$(Pu)	277,599 (1)	14,4 (1)
$\gamma_{5,0}$(Pu)	285,460 (2)	0,78 (1)
$\gamma_{7,3}$(Pu)	311,70 (2)	0,002 (2)
$\gamma_{8,3}$(Pu)	315,880 (3)	1,59 (1)
$\gamma_{6,1}$(Pu)	322,3 (2)	0,0052
$\gamma_{8,2}$(Pu)	334,310 (3)	2,04 (2)
$\gamma_{13,4}$(Pu)	392,4 (5)	0,0016
$\gamma_{11,3}$(Pu)	429,5 (5)	0,0039
$\gamma_{10,2}$(Pu)	434,7 (5)	0,013
$\gamma_{11,2}$(Pu)	447,6 (5)	0,00026
$\gamma_{12,2}$(Pu)	454,2 (5)	0,00082
$\gamma_{9,1}$(Pu)	461,9 (5)	0,0016
$\gamma_{9,0}$(Pu)	469,8 (5)	0,0011
$\gamma_{10,1}$(Pu)	484,3 (5)	0,001
$\gamma_{10,0}$(Pu)	492,3 (5)	0,006
$\gamma_{11,1}$(Pu)	497,8 (5)	0,0032
$\gamma_{13,2}$(Pu)	498,7	0,001
$\gamma_{12,1}$(Pu)	504,2 (5)	0,00078

6 Main Production Modes

$\left\{ \begin{array}{l} U-238(n,\gamma)U-239 \\ \text{Possible impurities : } Pu-239,\ Pu-240 \end{array} \right.$

$\left\{ \begin{array}{l} U-239(\beta^-,)Np-239 \\ \text{Possible impurities : } T_{1/2} = 23{,}46 \text{ min} \end{array} \right.$

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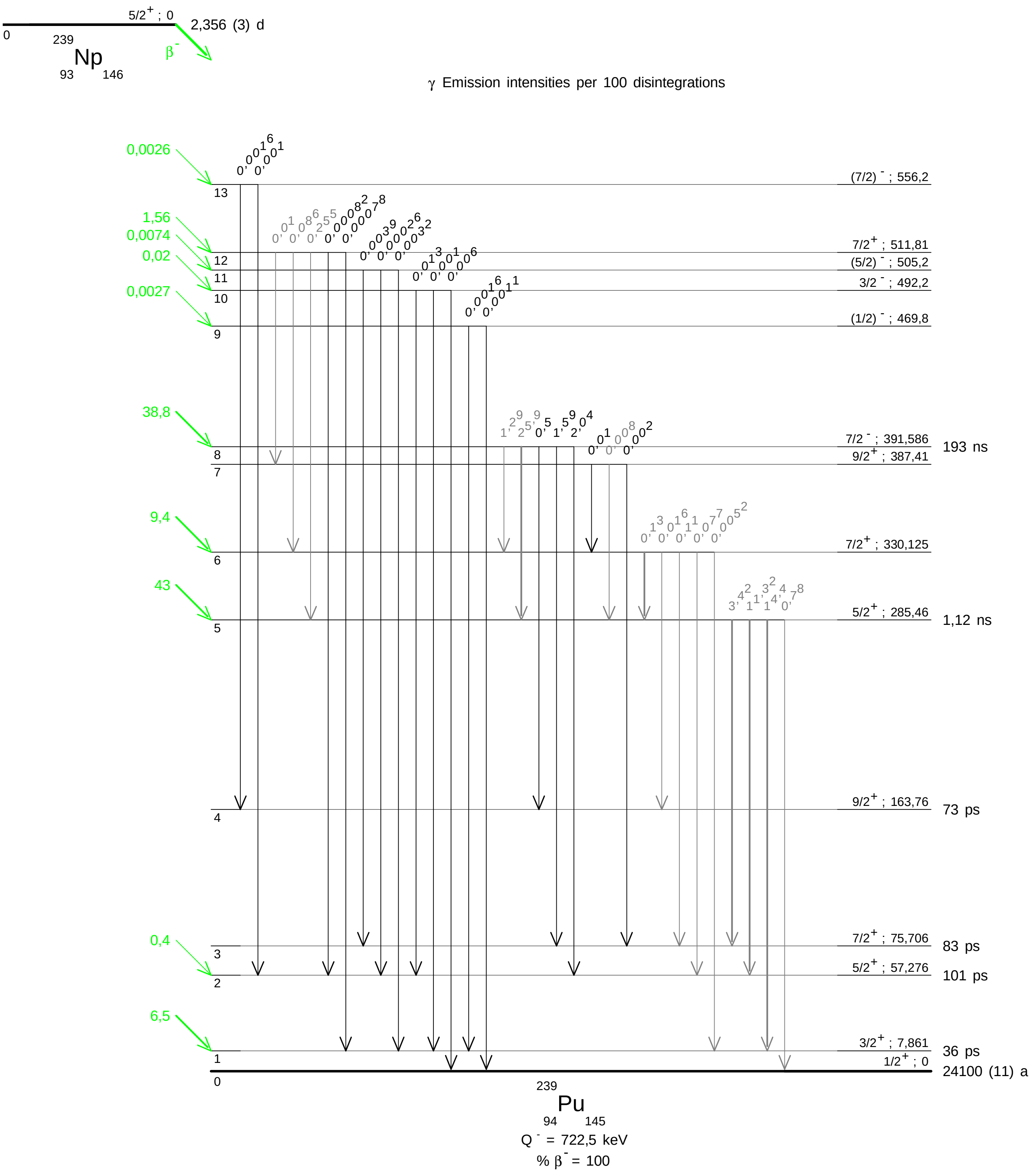

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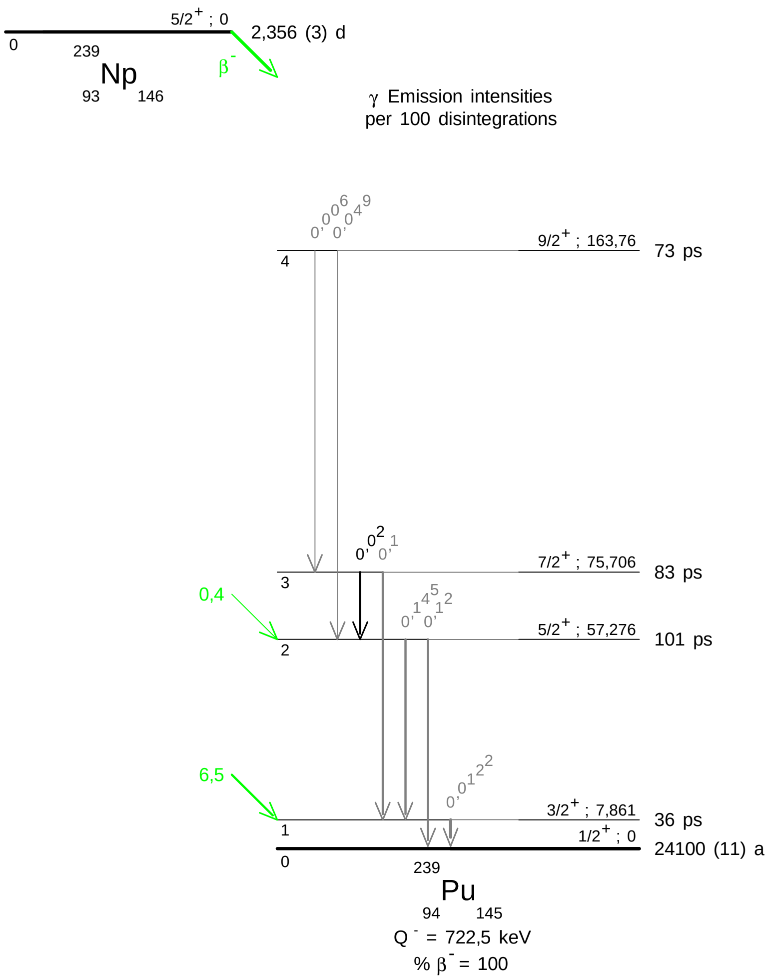

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$^{239}_{94}Pu_{145}$

1 Decay Scheme

Le Pu-239 se désintègre par émission alpha principalement vers le niveaux excités de 51,7 ; 13,0 et 0,07 keV de U-235.
Pu-239 mainly disintegrates to the 51,7; 13,0 and 0,07 keV excited levels of U-235.

2 Nuclear Data

$T_{1/2}(^{239}Pu)$	:	24100	(11)	a
$T_{1/2}(^{235}U)$	:	704	(1)	10^6 a
$Q^{\alpha}(^{239}Pu)$	:	5244,51	(21)	keV

2.1 α Transitions

	Energy keV	Probability × 100	F
$\alpha_{0,53}$	4128,3 (3)	0,000000021 (5)	41
$\alpha_{0,52}$	4186,93 (25)	0,000000093 (9)	31
$\alpha_{0,51}$	4251,8 (3)	0,00000020 (3)	53
$\alpha_{0,50}$	4257,86 (27)	0,000000077 (7)	156
$\alpha_{0,49}$	4274,0 (3)	0,000000041 (4)	402
$\alpha_{0,48}$	4276,06 (21)	0,000000061 (15)	281
$\alpha_{0,47}$	4352,62 (26)	0,000000199 (12)	380
$\alpha_{0,46}$	4379,16 (28)	0,000000098 (13)	1280
$\alpha_{0,45}$	4399,2 (10)	~ 0,000000042	~ 4360
$\alpha_{0,44}$	4400,65 (21)	0,000000228 (12)	825
$\alpha_{0,43}$	4423,26 (21)	0,00000030 (3)	960
$\alpha_{0,42}$	4438,79 (22)	0,000000084 (14)	4560
$\alpha_{0,41}$	4465,00 (21)	0,00000101 (11)	616
$\alpha_{0,40}$	4466,92 (28)	0,000000247 (19)	2610
$\alpha_{0,39}$	4475,0 (4)	0,0000103 (12)	73
$\alpha_{0,38}$	4475,24 (21)	0,000027 (3)	28
$\alpha_{0,37}$	4483,47 (22)	0,000000103 (17)	8500

	Energy keV	Probability × 100	F
$\alpha_{0,36}$	4494,44 (26)	0,00000034 (4)	3140
$\alpha_{0,35}$	4524,26 (21)	0,00000213 (9)	859
$\alpha_{0,34}$	4540,75 (21)	0,0000114 (3)	216
$\alpha_{0,33}$	4543,49 (21)	0,00000707 (13)	366
$\alpha_{0,32}$	4573,52 (21)	< 0,000000034	> 130000
$\alpha_{0,31}$	4579,97 (21)	0,00000631 (11)	784
$\alpha_{0,30}$	4585,46 (21)	0,0000264 (6)	207
$\alpha_{0,29}$	4606,70 (22)	0,00000322 (21)	2460
$\alpha_{0,28}$	4611,34 (22)	0,00000284 (7)	3025
$\alpha_{0,27}$	4636,43 (22)	0,000012 (4)	1110
$\alpha_{0,26}$	4711,28 (21)	0,00086 (3)	55,8
$\alpha_{0,25}$	4734,59 (27)	0,0000033 (7)	22000
$\alpha_{0,24}$	4770,21 (21)	0,00056 (5)	230
$\alpha_{0,23}$	4798,79 (21)	0,0000400 (11)	5200
$\alpha_{0,22}$	4817,76 (21)	0,00570 (5)	49,6
$\alpha_{0,21}$	4829,73 (21)	0,00075 (11)	460
$\alpha_{0,20}$	4851,29 (21)	0,00125 (3)	390
$\alpha_{0,19}$	4877,44 (21)	0,000944 (17)	788
$\alpha_{0,18}$	4887,21 (22)	0,000017 (4)	51000
$\alpha_{0,17}$	4905,99 (22)	≈ 0,000022	≈ 53000
$\alpha_{0,16}$	4911,67 (21)	0,00354 (7)	363
$\alpha_{0,15}$	4949,84 (21)	0,0018 (5)	1300
$\alpha_{0,14}$	4953,37 (21)	0,0007 (3)	3500
$\alpha_{0,13}$	4995,38 (21)	0,0030 (16)	1590
$\alpha_{0,12}$	5019,09 (21)	0,0050 (7)	1380
$\alpha_{0,11}$	5047,39 (21)	0,007 (1)	1520
$\alpha_{0,10}$	5073,12 (21)	0,0034 (10)	4600
$\alpha_{0,8}$	5094,04 (21)	0,0182 (27)	1180
$\alpha_{0,7}$	5115,12 (21)	0,013 (4)	2270
$\alpha_{0,6}$	5141,48 (21)	0,0375 (12)	1160
$\alpha_{0,5}$	5162,77 (21)	0,052 (8)	1150
$\alpha_{0,4}$	5192,81 (21)	11,87 (3)	7,81
$\alpha_{0,3}$	5198,30 (21)	< 0,02	> 5019
$\alpha_{0,2}$	5231,47 (21)	17,14 (4)	9,47
$\alpha_{0,1}$	5244,43 (14)	70,79 (10)	2,762
$\alpha_{0,0}$	5244,51 (21)	∼ 0,03	∼ 6500

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{1,0}$(U)	0,0765 (4)	100	E3				1 10^{10}
$\gamma_{2,1}$(U)	12,975 (10)	20,7 (8)	M1+0,19(2)%E2			451 (13)	607 (17)
$\gamma_{(-1,1)}$(U)	14,22 (3)	> 0,006					
$\gamma_{5,4}$(U)	30,04 (2)	0,0346 (14)	(M1)		118,0 (24)	28,7 (6)	157 (3)
$\gamma_{4,2}$(U)	38,661 (2)	3,56 (21)	M1+22,2(16)%E2		249 (14)	67 (4)	339 (19)
$\gamma_{(-1,2)}$(U)	40,41 (5)	> 0,0002					
$\gamma_{10,7}$(U)	41,93 (5)	0,0097 (5)	(M1)		44,2 (9)	10,71 (21)	58,6 (12)
$\gamma_{3,0}$(U)	46,21 (5)	0,0389 (21)	M1+1,8(5)%E2		39,4 (19)	9,8 (5)	52,6 (27)
$\gamma_{11,8}$(U)	46,68 (3)	0,0044 (13)	M1+9(5)%E2		63 (17)	17 (5)	86 (24)
$\gamma_{7,5}$(U)	47,60 (3)	0,00259 (11)	(M1)		30,4 (6)	7,37 (15)	40,4 (8)
$\gamma_{4,1}$(U)	51,624 (1)	8,38 (18)	E2		226 (5)	62,6 (13)	310 (6)
$\gamma_{12,10}$(U)	54,039 (8)	0,00560 (14)	M1		21,0 (4)	5,08 (10)	27,8 (6)
$\gamma_{6,3}$(U)	56,828 (3)	0,0382 (18)	M1+5,0(8)%E2		24,3 (11)	6,14 (30)	32,6 (15)
$\gamma_{14,12}$(U)	65,708 (30)	0,00095 (29)	M1+4(6)%E2		14 (5)	3,6 (13)	19 (6)
$\gamma_{9,6}$(U)	67,674 (12)	0,00283 (12)	M1+3,6(11)%E2		12,7 (4)	3,15 (9)	16,9 (5)
$\gamma_{5,2}$(U)	68,696 (6)	0,029 (8)	E2		57,3 (11)	15,9 (3)	78,6 (16)
$\gamma_{8,5}$(U)	68,73 (2)	0,0036 (17)	(M1+20%E2)		20	5,2	27
$\gamma_{(-1,3)}$(U)	74,96 (10)	> 0,00004					
$\gamma_{7,4}$(U)	77,592 (14)	0,0068 (38)	M1(+20(32)%E2)		12 (7)	3,2 (21)	17 (10)
$\gamma_{13,9}$(U)	78,43 (2)	0,0026 (15)	M1(+20(32)%E2)		12 (7)	3,1 (20)	16 (10)
$\gamma_{17,13}$(U)	89,39 (6)	~0,000015	[M1]		4,82 (10)	1,167 (23)	6,40 (13)
$\gamma_{10,5}$(U)	89,64 (3)	0,00040 (22)	(M1+E2)		11 (6)	2,8 (17)	14 (8)
$\gamma_{12,7}$(U)	96,14 (3)	0,00064 (3)	[E2]		11,67 (23)	3,24 (7)	16,0 (3)
$\gamma_{15,11}$(U)	97,6 (3)	0,0007 (5)	M1+20(19)%E2		5,2 (14)	1,3 (4)	7,0 (19)
$\gamma_{8,4}$(U)	98,78 (2)	0,0204 (17)	E2		10,28 (21)	2,85 (6)	14,1 (3)
$\gamma_{6,0}$(U)	103,06 (3)	0,00273 (9)	E2		8,44 (17)	2,34 (5)	11,58 (23)
$\gamma_{11,5}$(U)	115,38 (5)	0,00362 (40)	E2		5,0 (1)	1,39 (3)	6,87 (14)
$\gamma_{7,2}$(U)	116,26 (2)	0,0077 (15)	M1+24(36)%E2	8,4 (18)	2,9 (6)	0,74 (16)	12,2 (26)
$\gamma_{10,4}$(U)	119,70 (3)	0,00021 (9)	(M1+E2)	5 (5)	3,1 (11)	0,8 (3)	9 (4)
$\gamma_{14,10}$(U)	119,76 (2)	0,000063 (14)	[E2]	0,200 (4)	4,22 (8)	1,169 (23)	5,99 (12)
$\gamma_{12,6}$(U)	122,35 (12)	0,00000125 (17)	(E1)	0,238 (5)	0,0556 (11)	0,0135 (3)	0,312 (6)
$\gamma_{37,29}$(U)	123,228 (5)	0,000000021 (5)	(M1)	9,66 (19)	1,91 (4)	0,461 (9)	12,19 (24)
$\gamma_{21,14}$(U)	123,62 (5)	0,000310 (13)	[M1]	9,57 (19)	1,89 (4)	0,457 (9)	12,08 (24)
$\gamma_{9,3}$(U)	124,51 (3)	0,000413 (13)	E2	0,214 (4)	3,53 (7)	0,978 (20)	5,06 (10)
$\gamma_{10,3}$(U)	125,21 (10)	0,0000730 (21)	[E1]	0,227 (5)	0,0523 (10)	0,0128 (3)	0,296 (6)
$\gamma_{7,0}$(U)	129,296 (1)	0,00805 (6)	E1	0,211 (4)	0,0482 (10)	0,01173 (24)	0,275 (6)
$\gamma_{19,12}$(U)	141,657 (20)	0,000296 (11)	[M1]	6,52 (13)	1,28 (3)	0,309 (6)	8,22 (16)
$\gamma_{12,5}$(U)	143,35 (20)	0,000110 (46)	[M1+E2]	3,3 (30)	1,5 (3)	0,41 (11)	5,3 (26)
$\gamma_{15,8}$(U)	144,201 (3)	0,00106 (3)	E2	0,225 (5)	1,82 (4)	0,502 (10)	2,72 (5)
$\gamma_{13,6}$(U)	146,094 (6)	0,000432 (12)	E2	0,223 (4)	1,71 (3)	0,474 (10)	2,57 (5)
$\gamma_{10,2}$(U)	158,1 (3)	0,0000029 (3)	[E2]	0,211 (4)	1,200 (24)	0,333 (7)	1,86 (4)
$\gamma_{18,11}$(U)	160,19 (5)	0,0000172 (36)	[E2]	0,208 (4)	1,140 (23)	0,314 (6)	1,77 (4)
$\gamma_{16,10}$(U)	161,450 (15)	0,000814 (42)	(M1)	4,51 (9)	0,880 (18)	0,213 (4)	5,67 (11)
$\gamma_{17,9}$(U)	167,81 (5)	0,0000074 (20)	[E2]	0,198 (4)	0,925 (19)	0,256 (5)	1,47 (3)
$\gamma_{10,0}$(U)	171,393 (6)	0,0001255 (34)	[E1]	0,1103 (22)	0,0235 (5)	0,00570 (11)	0,141 (3)
$\gamma_{42,28}$(U)	172,560 (8)	~0,000000017	M1	3,73 (8)	0,728 (15)	0,176 (4)	4,70 (9)
$\gamma_{12,4}$(U)	173,70 (5)	0,0000071 (18)	[E2]	0,190 (4)	0,795 (16)	0,220 (4)	1,28 (3)
$\gamma_{12,3}$(U)	179,220 (12)	0,0000739 (22)	[E1]	0,0995 (20)	0,0210 (4)	0,00509 (10)	0,127 (3)
$\gamma_{(-1,4)}$(U)	184,55 (5)	0,000010 (3)	[M1]	3,08 (6)	0,601 (12)	0,146 (3)	3,87 (8)
$\gamma_{14,6}$(U)	188,23 (10)	0,0000123 (12)	[E1]	0,0889 (18)	0,0186 (4)	0,00450 (9)	0,1140 (23)
$\gamma_{21,12}$(U)	189,36 (1)	0,00027 (11)	[M1+E2]	1,5 (13)	0,553 (11)	0,143 (8)	2,3 (14)
$\gamma_{(-1,5)}$(U)	193,13 (12)	> 0,000009					
$\gamma_{19,10}$(U)	195,679 (8)	0,000456 (11)	M1	2,62 (5)	0,51 (1)	0,123 (3)	3,30 (7)
$\gamma_{(-1,6)}$(U)	196,87 (5)	>0,000004					
$\gamma_{16,7}$(U)	203,550 (5)	0,002224 (49)	M1	2,35 (5)	0,456 (9)	0,1103 (22)	2,95 (6)
$\gamma_{21,11}$(U)	218,0 (5)	> 0,000002					
$\gamma_{12,0}$(U)	225,42 (4)	0,0000161 (4)	[E1]	0,0589 (12)	0,01190 (24)	0,00288 (6)	0,0747 (15)

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{19,7}$(U)	237,77 (10)	0,0000422 (18)	[M1]	1,52 (3)	0,295 (6)	0,0712 (14)	1,91 (4)
$\gamma_{26,14}$(U)	242,08 (3)	0,0000209 (14)	[M1]	1,45 (3)	0,280 (6)	0,0678 (14)	1,82 (4)
$\gamma_{21,10}$(U)	243,38 (3)	0,000053 (18)	[M1+E2]	0,8 (6)	0,23 (4)	0,059 (7)	1,1 (7)
$\gamma_{14,3}$(U)	244,92 (5)	0,0000054 (5)	[E1]	0,0485 (10)	0,00973 (19)	0,00235 (5)	0,0618 (12)
$\gamma_{24,12}$(U)	248,95 (5)	0,0000188 (16)	[M1]	1,34 (3)	0,259 (5)	0,0626 (14)	1,68 (3)
$\gamma_{22,10}$(U)	255,384 (15)	0,000204 (6)	[M1]	1,25 (3)	0,241 (5)	0,0583 (12)	1,57 (3)
$\gamma_{20,7}$(U)	263,95 (3)	0,0000629 (26)	M1	1,140 (23)	0,220 (4)	0,0532 (11)	1,43 (3)
$\gamma_{30,20}$(U)	265,7 (3)	0,0000017 (4)	[E1]	0,0408 (8)	0,00802 (16)	0,00194 (4)	0,0514 (10)
$\gamma_{16,4}$(U)	281,2 (2)	0,0000036 (12)	[M1+E2]	0,5 (4)	0,14 (4)	0,036 (8)	0,7 (5)
$\gamma_{19,5}$(U)	285,3 (2)	0,0000032 (12)	[M1+E2]	0,5 (4)	0,14 (4)	0,035 (8)	0,7 (5)
$\gamma_{22,7}$(U)	297,46 (3)	0,000100 (3)	[M1]	0,816 (16)	0,158 (3)	0,0381 (8)	1,025 (21)
$\gamma_{24,10}$(U)	302,87 (5)	0,0000097 (8)	[M1]	0,777 (16)	0,150 (3)	0,0362 (7)	0,976 (20)
$\gamma_{26,12}$(U)	307,85 (5)	0,0000101 (8)	[M1]	0,743 (15)	0,143 (3)	0,0346 (7)	0,933 (19)
$\gamma_{21,6}$(U)	311,78 (4)	0,0000266 (8)	[E1]	0,0287 (6)	0,00552 (11)	0,00133 (3)	0,0361 (7)
$\gamma_{23,7}$(U)	316,41 (3)	0,0000248 (10)	M1	0,689 (14)	0,133 (3)	0,0321 (6)	0,865 (17)
$\gamma_{16,2}$(U)	319,68 (10)	0,0000073 (19)	[M1+E2]	0,37 (30)	0,10 (3)	0,024 (7)	0,50 (35)
$\gamma_{19,3}$(U)	320,862 (20)	0,0000558 (12)	[E1]	0,0269 (5)	0,00517 (10)	0,00125 (3)	0,0337 (7)
$\gamma_{24,8}$(U)	323,84 (3)	0,0000960 (25)	M1	0,646 (13)	0,1246 (25)	0,0301 (6)	0,811 (16)
$\gamma_{16,0}$(U)	332,845 (5)	0,000503 (8)	E1	0,0250 (5)	0,00476 (10)	0,001150 (23)	0,0313 (6)
$\gamma_{26,11}$(U)	336,113 (12)	0,000192 (5)	M1	0,583 (12)	0,1130 (23)	0,0272 (5)	0,733 (15)
$\gamma_{20,4}$(U)	341,506 (10)	0,0001106 (24)	M1	0,559 (11)	0,1080 (22)	0,0260 (5)	0,701 (14)
$\gamma_{24,7}$(U)	345,00 (2)	< 0,000084	(M1)	0,543 (11)	0,1050 (21)	0,0253 (5)	0,682 (14)
$\gamma_{22,5}$(U)	345,013 (4)	0,000922 (15)	M1	0,543 (11)	0,1050 (21)	0,0253 (5)	0,682 (14)
$\gamma_{(-1,7)}$(U)	350,8 (3)	> 0,000002					
$\gamma_{19,2}$(U)	354,0 (5)	0,00000085 (33)	[E2]	0,0549 (11)	0,0445 (9)	0,01200 (24)	0,1150 (23)
$\gamma_{26,10}$(U)	361,89 (5)	0,0000187 (11)	[M1]	0,477 (10)	0,0918 (18)	0,0222 (4)	0,598 (12)
$\gamma_{19,0}$(U)	367,073 (25)	0,0000893 (21)	[E1]	0,0203 (4)	0,00382 (8)	0,000920 (18)	0,0254 (5)
$\gamma_{21,3}$(U)	368,554 (20)	0,0000899 (14)	[E1]	0,0202 (4)	0,00378 (8)	0,000910 (18)	0,0252 (5)
$\gamma_{22,4}$(U)	375,054 (3)	0,002376 (37)	M1	0,432 (9)	0,0832 (17)	0,0201 (4)	0,543 (11)
$\gamma_{20,2}$(U)	380,191 (6)	0,000460 (7)	M1	0,417 (8)	0,0801 (16)	0,0193 (4)	0,523 (10)
$\gamma_{26,8}$(U)	382,75 (5)	0,000387 (7)	M1	0,409 (8)	0,0787 (16)	0,0190 (4)	0,513 (10)
$\gamma_{24,5}$(U)	392,53 (3)	0,000179 (24)	M1	0,382 (8)	0,0731 (15)	0,0177 (4)	0,479 (10)
$\gamma_{20,1}$(U)	393,14 (3)	0,000619 (25)	M1	0,380 (8)	0,0731 (15)	0,0176 (4)	0,477 (10)
$\gamma_{23,3}$(U)	399,53 (6)	0,00000625 (27)	[E1]	0,0171 (3)	0,00317 (6)	0,000761 (15)	0,0213 (4)
$\gamma_{25,6}$(U)	406,8 (2)	0,0000030 (7)	[E1]	0,0164 (3)	0,00304 (6)	0,000731 (15)	0,0204 (4)
$\gamma_{27,11}$(U)	411,2 (3)	0,000010 (4)	[M1]	0,337 (7)	0,0646 (13)	0,0156 (3)	0,422 (8)
$\gamma_{42,20}$(U)	412,49 (6)	~0,000000018	[E1]	0,0160 (3)	0,00296 (6)	0,000709 (14)	0,0199 (4)
$\gamma_{22,2}$(U)	413,713 (5)	0,00207 (3)	M1	0,331 (7)	0,0636 (13)	0,0153 (3)	0,415 (8)
$\gamma_{24,4}$(U)	422,598 (19)	0,0001669 (30)	M1	0,313 (6)	0,0560 (11)	0,0145 (3)	0,392 (8)
$\gamma_{22,1}$(U)	426,68 (3)	0,0000256 (6)	[E2]	0,0387 (8)	0,0230 (5)	0,00610 (12)	0,0699 (14)
$\gamma_{24,3}$(U)	428,4 (3)	0,00000103 (10)	[E1]	0,0147 (3)	0,00270 (5)	0,000653 (13)	0,0184 (4)
$\gamma_{26,6}$(U)	430,08 (10)	0,00000437 (19)	[E1]	0,0147 (3)	0,00270 (5)	0,000648 (13)	0,0183 (4)
$\gamma_{23,0}$(U)	445,72 (3)	0,00000892 (26)	E1	0,0137 (3)	0,00250 (5)	0,000560 (11)	0,0170 (3)
$\gamma_{(-1,8)}$(U)	446,82 (20)	0,0000009 (1)					
$\gamma_{26,5}$(U)	451,481 (10)	0,000223 (25)	M1(+50%E2)	0,15 (11)	0,035 (16)	0,009 (4)	0,19 (13)
$\gamma_{27,8}$(U)	457,61 (5)	0,00000199 (4)	[M1]	0,252 (5)	0,0483 (10)	0,01170 (23)	0,316 (6)
$\gamma_{24,2}$(U)	461,25 (5)	0,00000242 (5)	[E2]	0,0334 (7)	0,0177 (4)	0,00467 (9)	0,0575 (12)
$\gamma_{25,3}$(U)	463,9 (3)	0,000000284 (30)	[E1]	0,0126 (3)	0,00230 (5)	0,000551 (11)	0,0157 (3)
$\gamma_{24,0}$(U)	473,9 (5)	0,000000061 (30)	[E1]	0,01210 (24)	0,00220 (4)	0,000526 (11)	0,0150 (3)
$\gamma_{26,4}$(U)	481,66 (12)	0,00000485 (11)	[E2]	0,0309 (6)	0,0154 (3)	0,00404 (8)	0,0517 (10)
$\gamma_{26,3}$(U)	487,06 (10)	0,000000269 (19)	[E1]	0,01150 (23)	0,00208 (4)	0,000497 (10)	0,0142 (3)
$\gamma_{31,10}$(U)	493,08 (5)	0,00000089 (3)	[E1]	0,01119 (22)	0,00202 (4)	0,000484 (10)	0,0139 (3)
$\gamma_{(-1,9)}$(U)	497,0 (5)	0,000000044 (25)					
$\gamma_{27,5}$(U)	526,4 (4)	0,000000059 (19)	[E2]	0,0262 (5)	0,011600 (23)	0,00303 (6)	0,0419 (8)
$\gamma_{(-1,10)}$(U)	538,8 (2)	0,00000031 (2)					
$\gamma_{33,8}$(U)	550,5 (2)	0,000000440 (25)	(E1)	0,00904 (18)	0,00161 (3)	0,000385 (8)	0,01120 (22)
$\gamma_{(-1,11)}$(U)	557,3 (5)	0,00000004 (2)					
$\gamma_{36,10}$(U)	579,4 (3)	0,000000091 (20)	[E2]	0,0220 (4)	0,00867 (17)	0,00224 (4)	0,0337 (7)
$\gamma_{31,5}$(U)	582,89 (10)	0,00000624 (26)	[E1]	0,00811 (16)	0,00144 (3)	0,000343 (7)	0,0100 (2)

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{29,4}$(U)	586,3 (3)	0,000000155 (16)	[E1]	0,00802 (16)	0,00142 (3)	0,000339 (7)	0,0099 (2)
$\gamma_{43,12}$(U)	596,0 (5)	0,000000040 (12)	[E2]	0,0209 (4)	0,00797 (16)	0,00206 (4)	0,0317 (6)
$\gamma_{33,6}$(U)	597,99 (5)	0,00000179 (6)	[E2]	0,0208 (4)	0,00789 (16)	0,00204 (4)	0,0314 (6)
$\gamma_{36,8}$(U)	599,6 (2)	0,000000204 (25)	[E1]	0,00769 (15)	0,00136 (3)	0,000324 (6)	0,00948 (19)
$\gamma_{40,10}$(U)	606,9 (2)	0,000000136 (15)	M1(+E2)	0,09 (3)	0,019 (4)	0,0045 (9)	0,12 (3)
$\gamma_{(-1,12)}$(U)	608,9 (2)	0,00000012 (2)					
$\gamma_{31,4}$(U)	612,83 (3)	0,00000096 (5)	E1	0,00738 (15)	0,00130 (3)	0,000310 (6)	0,00910 (18)
$\gamma_{35,6}$(U)	617,1 (1)	0,00000154 (9)	[M1]	0,1130 (23)	0,0215 (4)	0,00518 (10)	0,142 (3)
$\gamma_{31,3}$(U)	618,28 (6)	0,00000212 (8)	(E2)	0,0196 (4)	0,00716 (14)	0,00184 (4)	0,0292 (6)
$\gamma_{33,5}$(U)	619,21 (6)	0,00000122 (8)	[E1]	0,00724 (14)	0,00127 (3)	0,000304 (6)	0,00892 (18)
$\gamma_{29,2}$(U)	624,78 (5)	0,000000464 (19)	[E1]	0,00712 (14)	0,001250 (25)	0,000299 (6)	0,00877 (18)
$\gamma_{32,3}$(U)	624,78 (3)	< 0,000000025	(M1)	0,1090 (22)	0,0208 (4)	0,00501 (10)	0,137 (3)
$\gamma_{28,0}$(U)	633,15 (6)	0,00000286 (7)	M1(+E2)	0,097 (8)	0,0187 (13)	0,0045 (3)	0,122 (11)
$\gamma_{29,1}$(U)	637,73 (5)	0,00000065 (6)	[E1]	0,00684 (14)	0,001200 (24)	0,000287 (6)	0,00844 (17)
$\gamma_{29,0}$(U)	637,80 (5)	0,00000197 (20)	E2	0,0185 (4)	0,00655 (13)	0,00167 (3)	0,0273 (5)
$\gamma_{38,7}$(U)	639,99 (10)	0,00000869 (21)	[E2]	0,0184 (4)	0,00648 (13)	0,00167 (3)	0,0271 (5)
$\gamma_{30,2}$(U)	645,94 (4)	0,0000150 (3)	E1	0,00669 (13)	0,001170 (24)	0,000280 (6)	0,00824 (16)
$\gamma_{33,4}$(U)	649,32 (6)	0,00000073 (5)	[E1]	0,00662 (13)	0,001160 (23)	0,000277 (6)	0,00816 (16)
$\gamma_{(-1,13)}$(U)	650,53 (6)	0,00000027 (4)					
$\gamma_{34,4}$(U)	652,05 (2)	0,00000668 (20)	E1	0,00657 (13)	0,001150 (23)	0,000274 (5)	0,00809 (16)
$\gamma_{33,3}$(U)	654,88 (8)	0,00000233 (5)	(E2)	0,0177 (4)	0,00607 (12)	0,00156 (3)	0,0258 (5)
$\gamma_{30,1}$(U)	658,86 (6)	0,00000967 (26)	E1	0,00645 (13)	0,001130 (23)	0,000269 (5)	0,00794 (16)
$\gamma_{31,0}$(U)	664,58 (5)	0,000001712 (41)	E2	0,0172 (4)	0,00583 (12)	0,00149 (3)	0,0251 (5)
$\gamma_{36,5}$(U)	668,2 (5)	0,000000040 (12)	[E1]	0,00628 (13)	0,001100 (22)	0,000262 (5)	0,00773 (15)
$\gamma_{43,8}$(U)	670,8 (5)	≤ 0,000000009 (3)					
$\gamma_{32,0}$(U)	670,99 (4)	≤ 0,000000009 (3)	[M1+E2]	0,05 (3)	0,0033 (17)	0,0025 (12)	0,06 (4)
$\gamma_{35,3}$(U)	674,043 (32)	0,000000556 (22)		0,0893 (18)	0,0169 (3)	0,00408 (8)	0,1120 (22)
$\gamma_{40,5}$(U)	674,4 (5)	0,000000111 (11)	(M1)	0,0892 (18)	0,0169 (3)	0,00408 (8)	0,1120 (22)
$\gamma_{(-1,14)}$(U)	685,97 (11)	0,00000127 (6)	E1	0,00599 (12)	0,001040 (21)	0,000248 (5)	0,00736 (15)
$\gamma_{(-1,15)}$(U)	688,1 (3)	0,000000114 (11)					
$\gamma_{34,2}$(U)	690,81 (8)	0,00000059 (5)	E1	0,00591 (12)	0,001030 (21)	0,000245 (5)	0,00727 (15)
$\gamma_{(-1,16)}$(U)	693,2 (5)	0,000000033 (13)					
$\gamma_{46,10}$(U)	693,81 (1)	0,000000019 (7)	(E2)	0,0159 (3)	0,00517 (10)	0,00132 (3)	0,0229 (5)
$\gamma_{41,5}$(U)	697,8 (5)	0,000000076 (15)					
$\gamma_{(-1,17)}$(U)	699,6 (5)	0,00000008 (2)					
$\gamma_{33,0}$(U)	701,1 (2)	0,000000555 (29)	[M1+E2]	0,05 (3)	0,010 (5)	0,0025 (12)	0,06 (4)
$\gamma_{34,1}$(U)	703,68 (5)	0,00000413 (13)	E1	0,00571 (12)	0,000993 (20)	0,000237 (5)	0,00702 (14)
$\gamma_{(-1,18)}$(U)	712,96 (5)	0,000000052 (6)					
$\gamma_{44,7}$(U)	714,71 (14)	0,000000081 (8)	E2	0,0151 (3)	0,00477 (10)	0,001225 (25)	0,0215 (4)
$\gamma_{39,4}$(U)	718,0 (5)	0,00000278 (6)	E1	0,00551 (11)	0,000960 (19)	0,000227 (5)	0,00677 (14)
$\gamma_{35,0}$(U)	720,3 (5)	0,000000029 (5)					
$\gamma_{47,10}$(U)	720,56 (3)	0,000000020 (2)					
$\gamma_{41,4}$(U)	727,9 (2)	0,000000136 (8)	M1	0,0728 (15)	0,0138 (3)	0,00332 (7)	0,0911 (18)
$\gamma_{46,7}$(U)	736,5 (5)	0,000000031 (9)	M1+59(8)%E2	0,0374 (7)	0,00807 (16)	0,00198 (4)	0,0481 (10)
$\gamma_{(-1,19)}$(U)	742,7 (5)	0,000000038 (11)					
$\gamma_{37,2}$(U)	747,4 (5)	0,000000082 (16)	E1	0,00512 (10)	0,000880 (18)	0,000211 (4)	0,00629 (13)
$\gamma_{38,2}$(U)	756,23 (6)	0,0000029 (5)	[M1+E2]	0,04 (3)	0,008 (4)	0,002 (1)	0,05 (3)
$\gamma_{39,2}$(U)	756,4 (4)	0,00000069 (19)	[E1]	0,00501 (10)	0,000865 (17)	0,000206 (4)	0,00615 (12)
$\gamma_{47,7}$(U)	762,6 (2)	~0,00000001					
$\gamma_{45,5}$(U)	763,60 (15)	> 0,000000042	E0(+M1)				>0,9
$\gamma_{41,2}$(U)	766,47 (3)	0,00000065 (11)	E0+M1				4,0 (4)
$\gamma_{51,12}$(U)	767,29 (4)	0,00000014 (3)					
$\gamma_{38,1}$(U)	769,15 (8)	0,0000153 (32)	M1+E0				2,0 (2)
$\gamma_{39,1}$(U)	769,4 (5)	0,0000068 (12)	E1	0,00486 (10)	0,000837 (17)	0,000199 (4)	0,00596 (12)
$\gamma_{43,4}$(U)	769,54 (4)	0,00000008 (2)	E0				
$\gamma_{(-1,20)}$(U)	777,1 (3)	0,000000028 (7)					
$\gamma_{41,1}$(U)	779,43 (3)	0,000000147 (10)	M1	0,0607 (12)	0,01148 (23)	0,00276 (6)	0,0759 (15)
$\gamma_{(-1,21)}$(U)	786,9 (2)	0,000000089 (9)	E2	0,0128 (3)	0,00370 (7)	0,000930 (19)	0,0177 (4)
$\gamma_{(-1,22)}$(U)	788,5 (3)	0,000000035 (7)					

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{42,2}$(U)	792,68 (6)	0,000000020 (4)	(E1)	0,00461 (9)	0,000790 (16)	0,000188 (4)	0,00565 (11)
$\gamma_{(-1,23)}$(U)	796,9 (3)	0,000000015 (3)					
$\gamma_{(-1,24)}$(U)	803,2 (2)	0,000000064 (5)					
$\gamma_{42,1}$(U)	805,65 (6)	0,000000029 (4)	E2	0,01220 (24)	0,00348 (7)	0,000880 (18)	0,0169 (3)
$\gamma_{43,2}$(U)	808,21 (4)	0,000000130 (6)	M1	0,0552 (11)	0,01040 (21)	0,00251 (5)	0,0690 (14)
$\gamma_{46,4}$(U)	813,7 (2)	0,000000048 (5)	M1	0,0542 (11)	0,01020 (21)	0,00246 (5)	0,0677 (14)
$\gamma_{50,9}$(U)	816,0 (2)	0,000000026 (4)	[M1+E2]	0,033 (21)	0,007 (3)	0,0016 (8)	0,042 (25)
$\gamma_{43,0}$(U)	821,25 (4)	0,000000050 (11)	E1+M2				
$\gamma_{51,10}$(U)	821,3 (2)	~0,000000006					
$\gamma_{(-1,25)}$(U)	826,8 (3)	0,000000018 (6)					
$\gamma_{(-1,26)}$(U)	828,9 (2)	0,00000014 (1)					
$\gamma_{52,12}$(U)	832,2 (2)	0,000000030 (4)					
$\gamma_{(-1,27)}$(U)	837,3 (2)	0,000000020 (4)					
$\gamma_{47,4}$(U)	840,4 (2)	0,000000056 (6)	M1(+E0)				0,14 (2)
$\gamma_{44,1}$(U)	843,78 (1)	0,000000147 (9)	M1(+E0)				0,09 (1)
$\gamma_{47,2}$(U)	879,2 (3)	0,000000037 (4)	[M1+E2]	0,027 (17)	0,006 (3)	0,0014 (7)	0,035 (20)
$\gamma_{47,1}$(U)	891,0 (3)	0,000000076 (8)	[E2]	0,0102 (2)	0,00270 (5)	0,000677 (14)	0,0139 (3)
$\gamma_{(-1,28)}$(U)	895,4 (3)	0,000000008 (3)					
$\gamma_{(-1,29)}$(U)	898,1 (3)	0,000000018 (4)					
$\gamma_{(-1,30)}$(U)	905,5 (3)	0,000000008 (3)					
$\gamma_{(-1,31)}$(U)	911,7 (3)	0,000000014 (3)					
$\gamma_{49,4}$(U)	918,7 (3)	0,000000009 (3)					
$\gamma_{(-1,32)}$(U)	931,9 (3)	0,000000013 (4)					
$\gamma_{50,3}$(U)	940,3 (3)	0,000000051 (5)	[E2]	0,00932 (19)	0,00237 (5)	0,000591 (12)	0,01250 (25)
$\gamma_{48,2}$(U)	955,41 (2)	0,000000032 (3)	M1+27(13)%E2	0,029 (3)	0,0055 (6)	0,00133 (13)	0,036 (4)
$\gamma_{49,2}$(U)	957,6 (3)	0,000000032 (3)					
$\gamma_{48,1}$(U)	968,37 (2)	0,000000029 (5)	M1+27(20)%E2	0,0028 (15)	0,0053 (29)	0,0013 (7)	0,035 (19)
$\gamma_{51,2}$(U)	979,7 (3)	0,000000029 (5)	[M1+E2]	0,021 (12)	0,0042 (20)	0,0010 (5)	0,026 (15)
$\gamma_{(-1,33)}$(U)	982,7 (3)	0,000000011 (3)					
$\gamma_{53,7}$(U)	986,90 (4)	0,000000021 (5)	E1	0,00313 (6)	0,000529 (11)	0,0001260 (25)	0,00383 (8)
$\gamma_{51,1}$(U)	992,64 (3)	0,000000027 (4)					
$\gamma_{52,4}$(U)	1005,7 (3)	0,000000018 (3)					
$\gamma_{(-1,34)}$(U)	1009,4 (3)	0,000000014 (3)					
$\gamma_{52,0}$(U)	1057,3 (2)	0,000000045 (7)					

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 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	71,78 – 80,95	100
KLX	88,15 – 98,34	59,6
KXY	104,42 – 115,40	8,88
Auger L	5,9 – 21,6	

4 α Emissions

	Energy keV	Probability × 100
$\alpha_{0,53}$	4059,1 (3)	0,000000021 (5)
$\alpha_{0,52}$	4116,78 (25)	0,000000093 (9)
$\alpha_{0,51}$	4180,6 (3)	0,00000020 (3)
$\alpha_{0,50}$	4186,53 (27)	0,000000077 (7)
$\alpha_{0,49}$	4202,4 (3)	0,000000041 (4)
$\alpha_{0,48}$	4204,42 (21)	0,000000061 (15)
$\alpha_{0,47}$	4279,70 (26)	0,000000199 (12)
$\alpha_{0,46}$	4305,79 (28)	0,000000098 (13)
$\alpha_{0,45}$	4325,5 (10)	∼ 0,000000042
$\alpha_{0,44}$	4326,92 (21)	0,000000228 (12)
$\alpha_{0,43}$	4349,15 (21)	0,00000030 (3)
$\alpha_{0,42}$	4364,42 (22)	0,000000084 (14)
$\alpha_{0,41}$	4390,20 (21)	0,00000101 (11)
$\alpha_{0,40}$	4392,08 (28)	0,000000247 (19)
$\alpha_{0,39}$	4400,0 (4)	0,0000103 (12)
$\alpha_{0,38}$	4400,26 (21)	0,000027 (3)
$\alpha_{0,37}$	4408,36 (22)	0,000000103 (17)
$\alpha_{0,36}$	4419,14 (26)	0,00000034 (4)
$\alpha_{0,35}$	4448,46 (21)	0,00000213 (9)
$\alpha_{0,34}$	4464,68 (21)	0,0000114 (3)
$\alpha_{0,33}$	4467,37 (21)	0,00000707 (13)
$\alpha_{0,32}$	4496,90 (21)	< 0,000000034
$\alpha_{0,31}$	4503,24 (21)	0,00000631 (11)
$\alpha_{0,30}$	4508,72 (21)	0,0000264 (6)
$\alpha_{0,29}$	4529,52 (22)	0,00000322 (21)
$\alpha_{0,28}$	4534,08 (22)	0,00000284 (7)
$\alpha_{0,27}$	4558,75 (22)	0,000012 (4)
$\alpha_{0,26}$	4632,35 (21)	0,00086 (3)
$\alpha_{0,25}$	4655,27 (27)	0,0000033 (7)
$\alpha_{0,24}$	4690,29 (21)	0,00056 (5)
$\alpha_{0,23}$	4718,39 (21)	0,0000400 (11)
$\alpha_{0,22}$	4737,05 (21)	0,00570 (5)
$\alpha_{0,21}$	4748,81 (21)	0,00075 (11)
$\alpha_{0,20}$	4770,01 (21)	0,00125 (3)
$\alpha_{0,19}$	4795,73 (21)	0,000944 (17)
$\alpha_{0,18}$	4805,33 (22)	0,000017 (4)
$\alpha_{0,17}$	4823,80 (22)	≈ 0,000022
$\alpha_{0,16}$	4829,38 (21)	0,00354 (7)
$\alpha_{0,15}$	4866,91 (21)	0,0018 (5)
$\alpha_{0,14}$	4870,38 (21)	0,0007 (3)
$\alpha_{0,13}$	4911,69 (21)	0,0030 (16)
$\alpha_{0,12}$	4935,00 (21)	0,0050 (7)
$\alpha_{0,11}$	4962,83 (21)	0,007 (1)
$\alpha_{0,10}$	4988,13 (21)	0,0034 (10)
$\alpha_{0,8}$	5008,70 (21)	0,0182 (27)

	Energy keV	Probability × 100
$\alpha_{0,7}$	5029,51 (21)	0,013 (4)
$\alpha_{0,6}$	5055,34 (21)	0,0375 (12)
$\alpha_{0,5}$	5076,28 (21)	0,052 (8)
$\alpha_{0,4}$	5105,81 (21)	11,87 (3)
$\alpha_{0,3}$	5111,21 (21)	< 0,02
$\alpha_{0,2}$	5143,82 (21)	17,14 (4)
$\alpha_{0,1}$	5156,59 (14)	70,79 (10)
$\alpha_{0,0}$	5156,65 (21)	~ 0,03

5 Electron Emissions

		Energy keV	Electrons per 100 disint.
e_{AL}	(U)	5,9 - 21,6	4,66 (19)
e_{AK}	(U)		0,00045 (6)
	KLL	71,78 - 80,95	}
	KLX	88,15 - 98,34	}
	KXY	104,42 - 115,40	}
$ec_{7,2\ K}$	(U)	0,66 (2)	0,0049 (11)
$ec_{10,4\ K}$	(U)	4,10 (3)	0,00011 (11)
$ec_{2,1\ M}$	(U)	7,427 - 9,425	15,4 (6)
$ec_{21,14\ K}$	(U)	8,02 (5)	0,000227 (10)
$ec_{5,4\ L}$	(U)	8,28 - 12,87	0,0259 (11)
$ec_{7,0\ K}$	(U)	13,694 (1)	0,00133 (3)
$ec_{4,2\ L}$	(U)	16,903 - 21,493	2,61 (16)
$ec_{10,7\ L}$	(U)	20,17 - 24,76	0,0072 (4)
$ec_{3,0\ L}$	(U)	24,45 - 29,04	0,0286 (16)
$ec_{5,4\ M}$	(U)	24,49 - 26,49	0,0063 (3)
$ec_{11,8\ L}$	(U)	24,92 - 29,51	0,0032 (9)
$ec_{7,5\ L}$	(U)	25,84 - 30,43	0,00190 (9)
$ec_{19,12\ K}$	(U)	26,055 (20)	0,000209 (8)
$ec_{4,1\ L}$	(U)	29,866 - 34,456	6,09 (15)
$ec_{12,10\ L}$	(U)	32,281 - 36,871	0,00408 (10)
$ec_{4,2\ M}$	(U)	33,113 - 35,111	0,70 (4)
$ec_{6,3\ L}$	(U)	35,07 - 39,66	0,0276 (13)
$ec_{10,7\ M}$	(U)	36,38 - 38,38	0,00175 (9)
$ec_{3,0\ M}$	(U)	40,66 - 42,66	0,0071 (4)
$ec_{11,8\ M}$	(U)	41,13 - 43,13	0,00085 (25)
$ec_{7,5\ M}$	(U)	42,05 - 44,05	0,00046 (2)
$ec_{14,12\ L}$	(U)	43,95 - 48,54	0,00066 (24)

		Energy keV	Electrons per 100 disint.
$ec_{16,10\ K}$	(U)	45,848 (15)	0,00055 (3)
$ec_{9,6\ L}$	(U)	45,916 - 50,506	0,00201 (9)
$ec_{4,1\ M}$	(U)	46,076 - 48,074	1,68 (4)
$ec_{5,2\ L}$	(U)	46,938 - 51,528	0,021 (6)
$ec_{8,5\ L}$	(U)	46,97 - 51,56	0,0026 (12)
$ec_{12,10\ M}$	(U)	48,491 - 50,489	0,000987 (24)
$ec_{6,3\ M}$	(U)	51,280 - 53,278	0,0070 (4)
$ec_{7,4\ L}$	(U)	55,834 - 60,424	0,005 (3)
$ec_{13,9\ L}$	(U)	56,664 - 61,254	0,0018 (11)
$ec_{14,12\ M}$	(U)	60,160 - 62,158	0,00017 (6)
$ec_{9,6\ M}$	(U)	62,126 - 64,124	0,000498 (21)
$ec_{5,2\ M}$	(U)	63,148 - 65,146	0,0057 (16)
$ec_{8,5\ M}$	(U)	63,18 - 65,18	0,0007 (3)
$ec_{10,5\ L}$	(U)	67,88 - 72,47	0,00030 (16)
$ec_{7,4\ M}$	(U)	72,050 - 74,048	0,0012 (8)
$ec_{13,9\ M}$	(U)	72,868 - 74,866	0,0005 (3)
$ec_{12,7\ L}$	(U)	74,38 - 78,97	0,00044 (2)
$ec_{15,11\ L}$	(U)	75,8 - 80,4	0,0005 (3)
$ec_{8,4\ L}$	(U)	77,02 - 81,61	0,0139 (12)
$ec_{6,0\ L}$	(U)	81,30 - 85,89	0,00183 (6)
$ec_{16,7\ K}$	(U)	87,948 (5)	0,00133 (3)
$ec_{12,7\ M}$	(U)	90,59 - 92,59	0,000123 (7)
$ec_{15,11\ M}$	(U)	92,1 - 94,1	0,00012 (8)
$ec_{8,4\ M}$	(U)	93,23 - 95,23	0,0039 (3)
$ec_{11,5\ L}$	(U)	93,62 - 98,21	0,0023 (3)
$ec_{7,2\ L}$	(U)	94,50 - 99,09	0,0017 (4)
$ec_{6,0\ M}$	(U)	97,51 - 99,51	0,000508 (18)
$ec_{7,0\ L}$	(U)	107,538 - 112,128	0,000304 (7)
$ec_{11,5\ M}$	(U)	109,83 - 111,83	0,00064 (7)
$ec_{7,2\ M}$	(U)	110,71 - 112,71	0,00043 (9)
$ec_{15,8\ L}$	(U)	122,443 - 127,033	0,000519 (16)
$ec_{15,8\ M}$	(U)	138,653 - 140,651	0,000143 (5)
$ec_{16,10\ L}$	(U)	139,692 - 144,282	0,000107 (6)
$ec_{16,7\ L}$	(U)	181,79 - 186,38	0,000257 (7)

6 Photon Emissions

6.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(U)	11,619 — 20,714		4,66 (5)	
$XK\alpha_2$	(U)	94,666		0,00418 (4)	} $K\alpha$
$XK\alpha_1$	(U)	98,44		0,00661 (9)	}
$XK\beta_3$	(U)	110,421	}		
$XK\beta_1$	(U)	111,298	}	0,00239 (3)	$K'\beta_1$
$XK\beta_5''$	(U)	111,964	}		
$XK\beta_2$	(U)	114,407	}		
$XK\beta_4$	(U)	115,012	}	0,00131 (6)	$K'\beta_2$
$XKO_{2,3}$	(U)	115,377	}		
$XK_{O,P}$	(U)	115,42		0,01447 (14)	

6.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(U)	0,0765 (4)	~0,00000001
$\gamma_{2,1}$(U)	12,975 (10)	0,0341 (9)
$\gamma_{(-1,1)}$(U)	14,22 (3)	0,0055 (4)
$\gamma_{5,4}$(U)	30,04 (2)	0,000219 (8)
$\gamma_{4,2}$(U)	38,661 (2)	0,01047 (21)
$\gamma_{(-1,2)}$(U)	40,41 (5)	0,000163 (16)
$\gamma_{10,7}$(U)	41,93 (5)	0,000163 (8)
$\gamma_{3,0}$(U)	46,21 (5)	0,000726 (13)
$\gamma_{11,8}$(U)	46,68 (3)	0,000050 (6)
$\gamma_{7,5}$(U)	47,60 (3)	0,0000625 (25)
$\gamma_{4,1}$(U)	51,624 (1)	0,02694 (26)
$\gamma_{12,10}$(U)	54,039 (8)	0,0001943 (28)
$\gamma_{6,3}$(U)	56,828 (3)	0,001136 (15)
$\gamma_{14,12}$(U)	65,708 (30)	0,0000473 (25)
$\gamma_{9,6}$(U)	67,674 (12)	0,000158 (5)
$\gamma_{5,2}$(U)	68,696 (6)	0,00036 (10)
$\gamma_{8,5}$(U)	68,73 (2)	0,00013 (6)
$\gamma_{(-1,3)}$(U)	74,96 (10)	0,000038 (6)
$\gamma_{7,4}$(U)	77,592 (14)	0,000380 (6)
$\gamma_{13,9}$(U)	78,43 (2)	0,0001533 (28)
$\gamma_{17,13}$(U)	89,39 (6)	~0,000002
$\gamma_{10,5}$(U)	89,64 (3)	0,000027 (2)
$\gamma_{12,7}$(U)	96,14 (3)	0,0000379 (19)
$\gamma_{15,11}$(U)	97,6 (3)	0,00009 (6)

	Energy keV	Photons per 100 disint.
$\gamma_{8,4}$(U)	98,78 (2)	0,00135 (11)
$\gamma_{6,0}$(U)	103,06 (3)	0,000217 (6)
$\gamma_{11,5}$(U)	115,38 (5)	0,00046 (5)
$\gamma_{7,2}$(U)	116,26 (2)	0,000581 (19)
$\gamma_{10,4}$(U)	119,70 (3)	0,000021 (3)
$\gamma_{14,10}$(U)	119,76 (2)	0,000009 (2)
$\gamma_{12,6}$(U)	122,35 (12)	0,00000095 (13)
$\gamma_{37,29}$(U)	123,228 (5)	0,0000000016 (4)
$\gamma_{21,14}$(U)	123,62 (5)	0,0000237 (9)
$\gamma_{9,3}$(U)	124,51 (3)	0,0000681 (19)
$\gamma_{10,3}$(U)	125,21 (10)	0,0000563 (16)
$\gamma_{7,0}$(U)	129,296 (1)	0,00631 (4)
$\gamma_{19,12}$(U)	141,657 (20)	0,0000321 (10)
$\gamma_{12,5}$(U)	143,35 (20)	0,0000174 (8)
$\gamma_{15,8}$(U)	144,201 (3)	0,000285 (7)
$\gamma_{13,6}$(U)	146,094 (6)	0,000121 (3)
$\gamma_{10,2}$(U)	158,1 (3)	0,00000101 (10)
$\gamma_{18,11}$(U)	160,19 (5)	0,0000062 (13)
$\gamma_{16,10}$(U)	161,450 (15)	0,000122 (6)
$\gamma_{17,9}$(U)	167,81 (5)	0,0000030 (8)
$\gamma_{10,0}$(U)	171,393 (6)	0,000110 (3)
$\gamma_{42,28}$(U)	172,560 (8)	0,000000003
$\gamma_{12,4}$(U)	173,70 (5)	0,0000031 (8)
$\gamma_{12,3}$(U)	179,220 (12)	0,0000656 (19)
$\gamma_{(-1,4)}$(U)	184,55 (5)	0,0000021 (6)
$\gamma_{14,6}$(U)	188,23 (10)	0,0000110 (11)
$\gamma_{21,12}$(U)	189,36 (1)	0,0000820 (14)
$\gamma_{(-1,5)}$(U)	193,13 (12)	0,0000090 (9)
$\gamma_{19,10}$(U)	195,679 (8)	0,000106 (2)
$\gamma_{(-1,6)}$(U)	196,87 (5)	0,0000037 (4)
$\gamma_{16,7}$(U)	203,550 (5)	0,000563 (9)
$\gamma_{21,11}$(U)	218,0 (5)	0,0000012 (10)
$\gamma_{12,0}$(U)	225,42 (4)	0,0000150 (4)
$\gamma_{19,7}$(U)	237,77 (10)	0,0000145 (6)
$\gamma_{26,14}$(U)	242,08 (3)	0,0000074 (5)
$\gamma_{21,10}$(U)	243,38 (3)	0,0000254 (7)
$\gamma_{14,3}$(U)	244,92 (5)	0,0000051 (5)
$\gamma_{24,12}$(U)	248,95 (5)	0,0000070 (6)
$\gamma_{22,10}$(U)	255,384 (15)	0,0000795 (20)
$\gamma_{20,7}$(U)	263,95 (3)	0,0000259 (10)
$\gamma_{30,20}$(U)	265,7 (3)	0,0000016 (4)
$\gamma_{16,4}$(U)	281,2 (2)	0,0000021 (3)
$\gamma_{19,5}$(U)	285,3 (2)	0,0000019 (4)
$\gamma_{22,7}$(U)	297,46 (3)	0,0000492 (13)
$\gamma_{24,10}$(U)	302,87 (5)	0,0000049 (4)
$\gamma_{26,12}$(U)	307,85 (5)	0,0000052 (4)
$\gamma_{21,6}$(U)	311,78 (4)	0,0000257 (8)

	Energy keV	Photons per 100 disint.
$\gamma_{23,7}$(U)	316,41 (3)	0,0000133 (5)
$\gamma_{16,2}$(U)	319,68 (10)	0,0000049 (5)
$\gamma_{19,3}$(U)	320,862 (20)	0,0000540 (12)
$\gamma_{24,8}$(U)	323,84 (3)	0,0000530 (13)
$\gamma_{16,0}$(U)	332,845 (5)	0,000488 (8)
$\gamma_{26,11}$(U)	336,113 (12)	0,0001111 (26)
$\gamma_{20,4}$(U)	341,506 (10)	0,0000650 (13)
$\gamma_{24,7}$(U)	345,00 (2)	$<$ 0,00005
$\gamma_{22,5}$(U)	345,013 (4)	0,000548 (8)
$\gamma_{(-1,7)}$(U)	350,8 (3)	0,0000018 (4)
$\gamma_{19,2}$(U)	354,0 (5)	0,00000076 (30)
$\gamma_{26,10}$(U)	361,89 (5)	0,0000117 (7)
$\gamma_{19,0}$(U)	367,073 (25)	0,0000871 (20)
$\gamma_{21,3}$(U)	368,554 (20)	0,0000877 (14)
$\gamma_{22,4}$(U)	375,054 (3)	0,001540 (21)
$\gamma_{20,2}$(U)	380,191 (6)	0,000302 (4)
$\gamma_{26,8}$(U)	382,75 (5)	0,000256 (4)
$\gamma_{24,5}$(U)	392,53 (3)	0,000121 (16)
$\gamma_{20,1}$(U)	393,14 (3)	0,000419 (17)
$\gamma_{23,3}$(U)	399,53 (6)	0,00000612 (26)
$\gamma_{25,6}$(U)	406,8 (2)	0,0000029 (7)
$\gamma_{27,11}$(U)	411,2 (3)	0,0000069 (30)
$\gamma_{42,20}$(U)	412,49 (6)	~0,000000018
$\gamma_{22,2}$(U)	413,713 (5)	0,001464 (21)
$\gamma_{24,4}$(U)	422,598 (19)	0,0001199 (20)
$\gamma_{22,1}$(U)	426,68 (3)	0,0000239 (6)
$\gamma_{24,3}$(U)	428,4 (3)	0,00000101 (10)
$\gamma_{26,6}$(U)	430,08 (10)	0,00000429 (19)
$\gamma_{23,0}$(U)	445,72 (3)	0,00000877 (26)
$\gamma_{(-1,8)}$(U)	446,82 (20)	0,00000085 (13)
$\gamma_{26,5}$(U)	451,481 (10)	0,000187 (3)
$\gamma_{27,8}$(U)	457,61 (5)	0,00000151 (3)
$\gamma_{24,2}$(U)	461,25 (5)	0,00000229 (5)
$\gamma_{25,3}$(U)	463,9 (3)	0,00000028 (3)
$\gamma_{24,0}$(U)	473,9 (5)	0,00000006 (3)
$\gamma_{26,4}$(U)	481,66 (12)	0,00000461 (10)
$\gamma_{26,3}$(U)	487,06 (10)	0,000000265 (19)
$\gamma_{31,10}$(U)	493,08 (5)	0,00000088 (3)
$\gamma_{(-1,9)}$(U)	497,0 (5)	0,000000044 (25)
$\gamma_{27,5}$(U)	526,4 (4)	0,000000057 (19)
$\gamma_{(-1,10)}$(U)	538,8 (2)	0,000000309 (19)
$\gamma_{33,8}$(U)	550,5 (2)	0,000000435 (25)
$\gamma_{(-1,11)}$(U)	557,3 (5)	0,000000038 (19)
$\gamma_{36,10}$(U)	579,4 (3)	0,000000088 (19)
$\gamma_{31,5}$(U)	582,89 (10)	0,000000618 (26)
$\gamma_{29,4}$(U)	586,3 (3)	0,000000153 (16)
$\gamma_{43,12}$(U)	596,0 (5)	0,000000039 (12)

	Energy keV	Photons per 100 disint.
$\gamma_{33,6}$(U)	597,99 (5)	0,00000174 (6)
$\gamma_{36,8}$(U)	599,6 (2)	0,000000202 (25)
$\gamma_{40,10}$(U)	606,9 (2)	0,000000121 (13)
$\gamma_{(-1,12)}$(U)	608,9 (2)	0,000000117 (12)
$\gamma_{31,4}$(U)	612,83 (3)	0,00000095 (5)
$\gamma_{35,6}$(U)	617,1 (1)	0,00000135 (8)
$\gamma_{31,3}$(U)	618,28 (6)	0,00000206 (8)
$\gamma_{33,5}$(U)	619,21 (6)	0,00000121 (8)
$\gamma_{32,3}$(U)	624,78 (3)	$<$ 0,000000022
$\gamma_{29,2}$(U)	624,78 (5)	0,000000460 (19)
$\gamma_{28,0}$(U)	633,15 (6)	0,00000255 (6)
$\gamma_{29,1}$(U)	637,73 (5)	0,00000064 (6)
$\gamma_{29,0}$(U)	637,80 (5)	0,00000192 (19)
$\gamma_{38,7}$(U)	639,99 (10)	0,00000846 (20)
$\gamma_{30,2}$(U)	645,94 (4)	0,0000149 (3)
$\gamma_{33,4}$(U)	649,32 (6)	0,00000072 (5)
$\gamma_{(-1,13)}$(U)	650,53 (6)	0,00000027 (4)
$\gamma_{34,4}$(U)	652,05 (2)	0,00000663 (20)
$\gamma_{33,3}$(U)	654,88 (8)	0,00000227 (5)
$\gamma_{30,1}$(U)	658,86 (6)	0,00000959 (26)
$\gamma_{31,0}$(U)	664,58 (5)	0,00000167 (4)
$\gamma_{36,5}$(U)	668,2 (5)	0,000000040 (12)
$\gamma_{43,8}$(U)	670,8 (5)	$<$ 0,000000009 (3)
$\gamma_{32,0}$(U)	670,99 (4)	$<$ 0,000000009 (3)
$\gamma_{35,3}$(U)	674,05 (3)	0,00000050 (2)
$\gamma_{40,5}$(U)	674,4 (5)	0,00000010 (1)
$\gamma_{(-1,14)}$(U)	685,97 (11)	0,00000126 (6)
$\gamma_{(-1,15)}$(U)	688,1 (3)	0,000000112 (11)
$\gamma_{34,2}$(U)	690,81 (8)	0,00000059 (5)
$\gamma_{(-1,16)}$(U)	693,2 (5)	0,000000032 (13)
$\gamma_{46,10}$(U)	693,81 (1)	0,000000019 (7)
$\gamma_{41,5}$(U)	697,8 (5)	0,000000074 (15)
$\gamma_{(-1,17)}$(U)	699,6 (5)	0,000000080 (16)
$\gamma_{33,0}$(U)	701,1 (2)	0,000000524 (19)
$\gamma_{34,1}$(U)	703,68 (5)	0,00000410 (13)
$\gamma_{(-1,18)}$(U)	712,96 (5)	0,000000052 (6)
$\gamma_{44,7}$(U)	714,71 (14)	0,000000079 (8)
$\gamma_{39,4}$(U)	718,0 (5)	0,00000276 (6)
$\gamma_{35,0}$(U)	720,3 (5)	0,000000029 (5)
$\gamma_{47,10}$(U)	720,55 (3)	0,000000020 (2)
$\gamma_{41,4}$(U)	727,9 (2)	0,000000125 (7)
$\gamma_{46,7}$(U)	736,5 (5)	0,000000030 (9)
$\gamma_{(-1,19)}$(U)	742,7 (5)	0,000000038 (11)
$\gamma_{37,2}$(U)	747,4 (5)	0,000000081 (16)
$\gamma_{38,2}$(U)	756,23 (6)	0,0000028 (5)
$\gamma_{39,2}$(U)	756,4 (4)	0,00000069 (19)
$\gamma_{47,7}$(U)	762,6 (2)	$\sim$0,00000001

	Energy keV	Photons per 100 disint.
$\gamma_{45,5}$(U)	763,60 (15)	~0,000000022
$\gamma_{41,2}$(U)	766,47 (3)	0,00000013 (2)
$\gamma_{51,12}$(U)	767,29 (4)	0,00000014 (3)
$\gamma_{38,1}$(U)	769,15 (8)	0,0000051 (10)
$\gamma_{39,1}$(U)	769,4 (5)	0,0000068 (12)
$\gamma_{(-1,20)}$(U)	777,1 (3)	0,000000028 (7)
$\gamma_{41,1}$(U)	779,43 (3)	0,000000137 (9)
$\gamma_{(-1,21)}$(U)	786,9 (2)	0,000000087 (9)
$\gamma_{(-1,22)}$(U)	788,5 (3)	0,000000035 (7)
$\gamma_{42,2}$(U)	792,68 (6)	0,000000020 (4)
$\gamma_{(-1,23)}$(U)	796,9 (3)	0,000000015 (3)
$\gamma_{(-1,24)}$(U)	803,2 (2)	0,000000064 (5)
$\gamma_{42,1}$(U)	805,65 (6)	0,000000028 (4)
$\gamma_{43,2}$(U)	808,21 (4)	0,000000122 (6)
$\gamma_{46,4}$(U)	813,7 (2)	0,000000045 (5)
$\gamma_{50,9}$(U)	816,0 (2)	0,000000025 (4)
$\gamma_{43,0}$(U)	821,25 (4)	0,000000050 (11)
$\gamma_{51,10}$(U)	821,3 (2)	~0,000000006
$\gamma_{(-1,25)}$(U)	826,8 (3)	0,000000018 (6)
$\gamma_{(-1,26)}$(U)	828,9 (2)	0,000000134 (8)
$\gamma_{52,12}$(U)	832,2 (2)	0,000000030 (4)
$\gamma_{(-1,27)}$(U)	837,3 (2)	0,000000020 (4)
$\gamma_{47,4}$(U)	840,4 (2)	0,000000049 (5)
$\gamma_{44,1}$(U)	843,78 (1)	0,000000135 (8)
$\gamma_{47,2}$(U)	879,2 (3)	0,000000036 (4)
$\gamma_{47,1}$(U)	891,0 (3)	0,000000075 (8)
$\gamma_{(-1,28)}$(U)	895,4 (3)	0,0000000076 (25)
$\gamma_{(-1,29)}$(U)	898,1 (3)	0,000000018 (4)
$\gamma_{(-1,30)}$(U)	905,5 (3)	0,0000000076 (25)
$\gamma_{(-1,31)}$(U)	911,7 (3)	0,000000014 (3)
$\gamma_{49,4}$(U)	918,7 (3)	0,0000000088 (30)
$\gamma_{(-1,32)}$(U)	931,9 (3)	0,000000013 (4)
$\gamma_{50,3}$(U)	940,3 (3)	0,000000050 (5)
$\gamma_{48,2}$(U)	955,41 (2)	0,000000031 (3)
$\gamma_{49,2}$(U)	957,6 (3)	0,000000032 (3)
$\gamma_{48,1}$(U)	968,37 (2)	~0,000000028
$\gamma_{51,2}$(U)	979,7 (3)	0,000000028 (5)
$\gamma_{(-1,33)}$(U)	982,7 (3)	0,0000000107 (25)
$\gamma_{53,7}$(U)	986,90 (4)	0,000000021 (5)
$\gamma_{51,1}$(U)	992,64 (3)	0,000000027 (4)
$\gamma_{52,4}$(U)	1005,7 (3)	0,0000000177 (25)
$\gamma_{(-1,34)}$(U)	1009,4 (3)	0,0000000139 (25)
$\gamma_{52,0}$(U)	1057,3 (2)	0,000000045 (7)

7 Main Production Modes

U – 238(n,γ)U – 239

U – 239(β^-)Np – 239
Possible impurities : $T_{1/2}$: 23,5 min

Np – 239(β^-)Pu – 239 σ : 2,7 (1) barns
Possible impurities : $T_{1/2}$: 2,35 d; Pu – 240, Pu – 241, Am – 241

U – 238(d,p)U – 239

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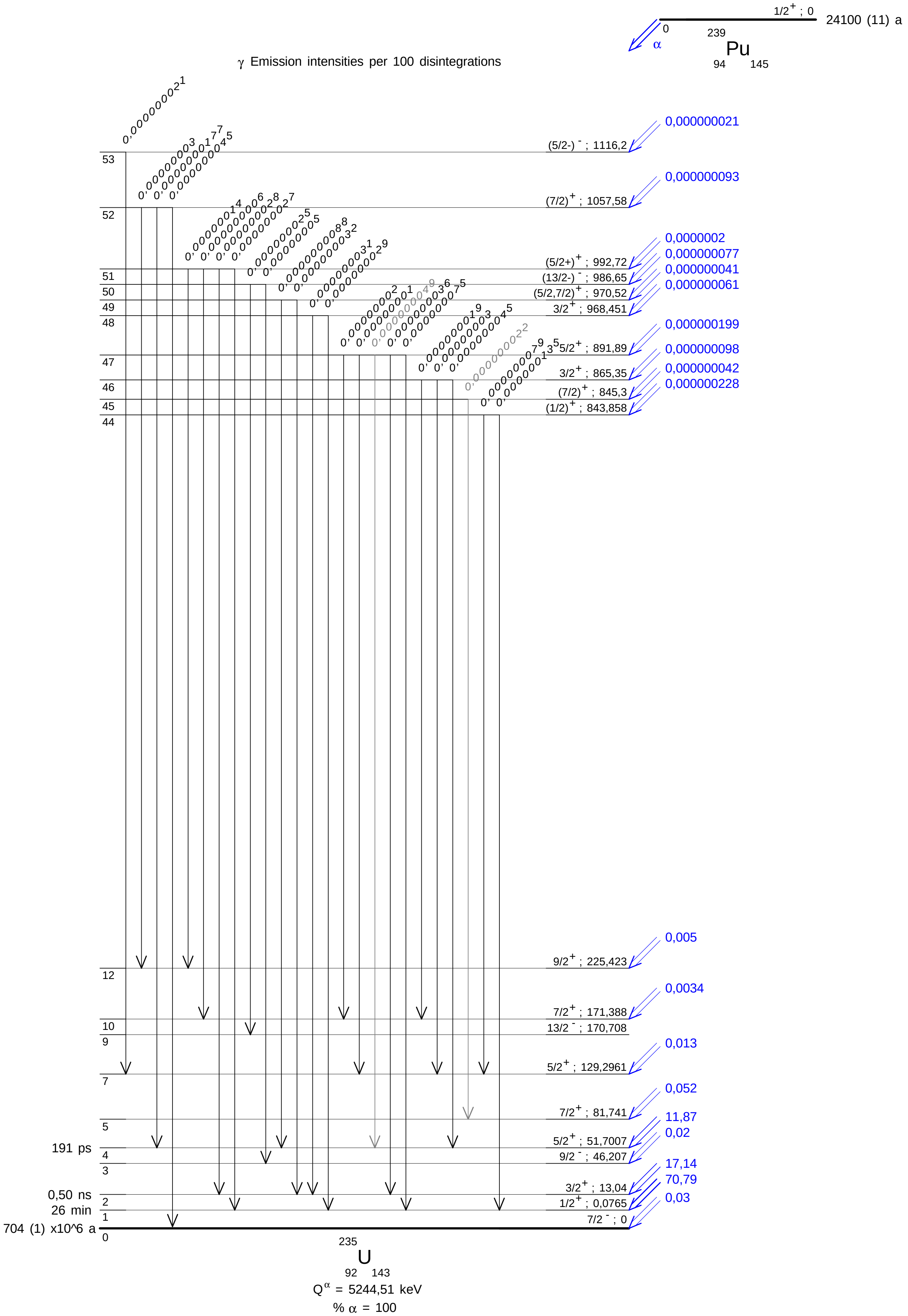

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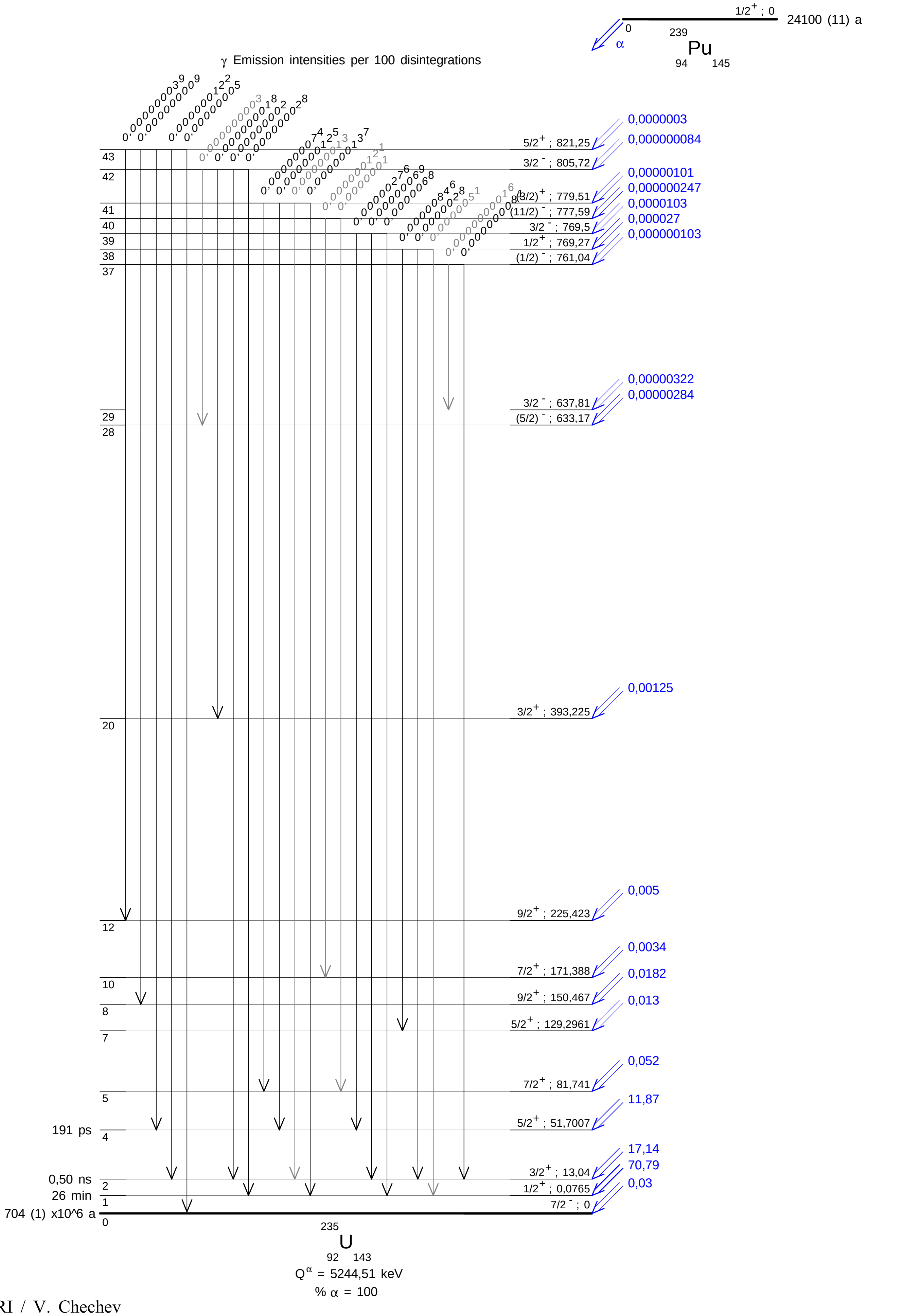

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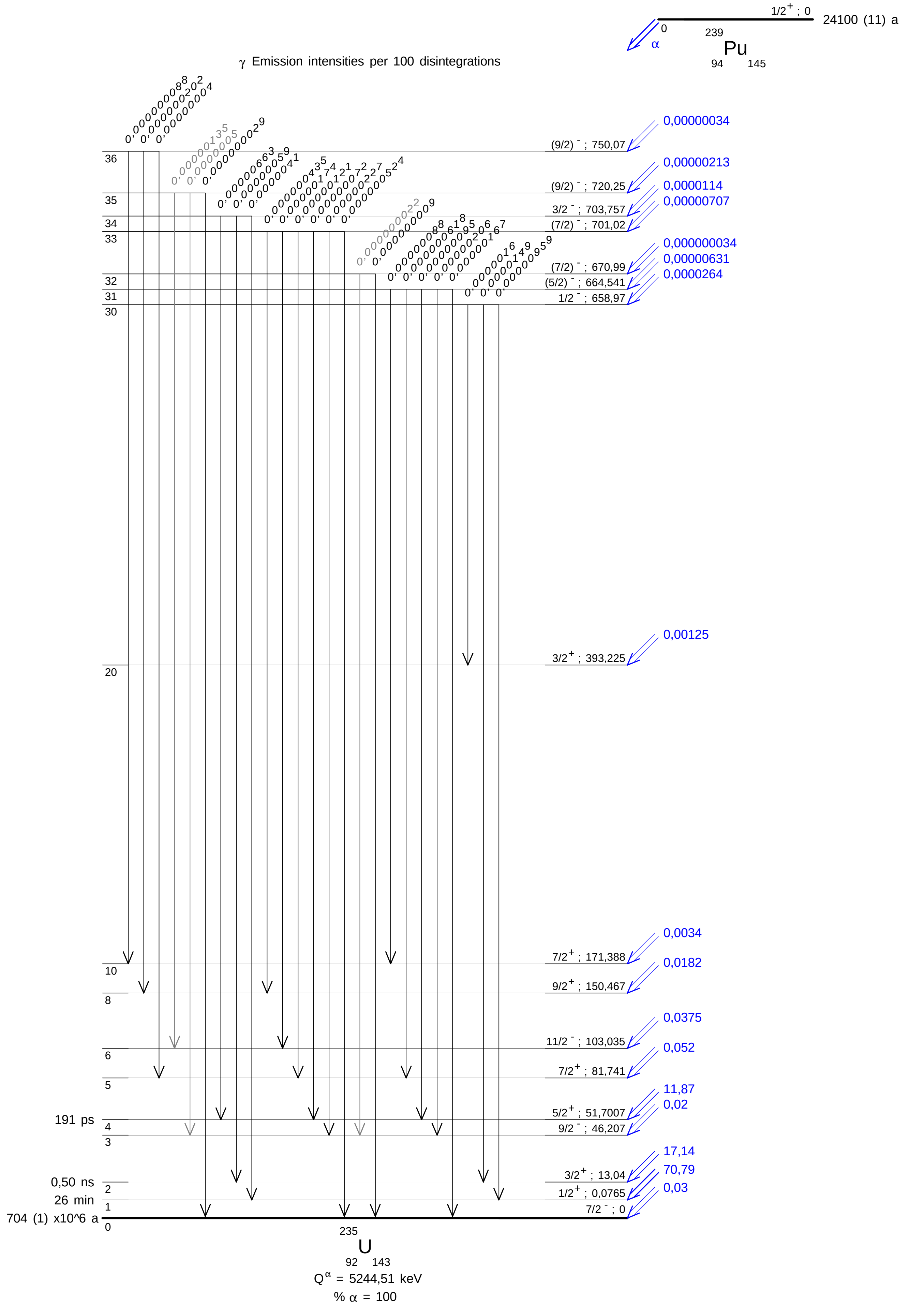

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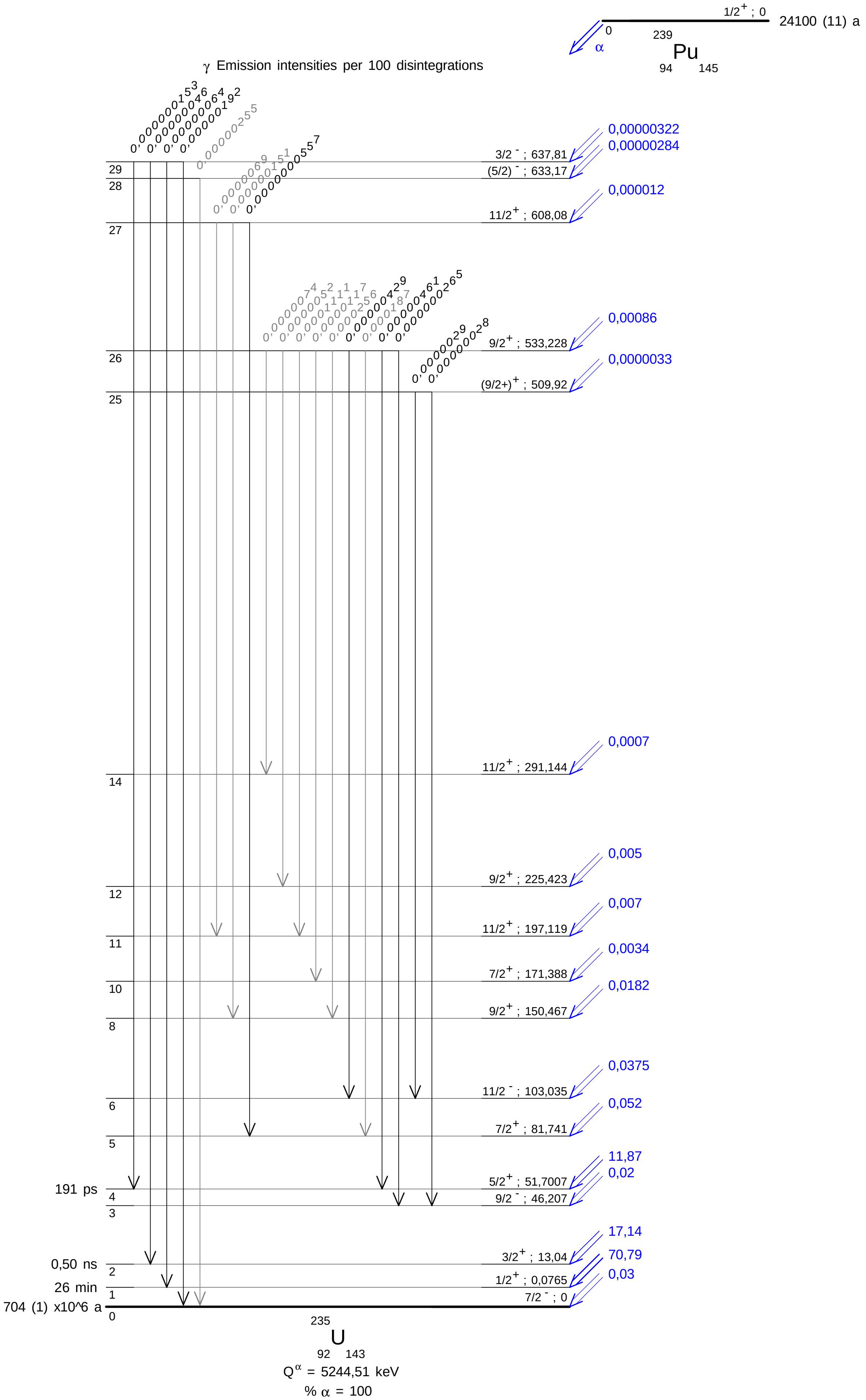

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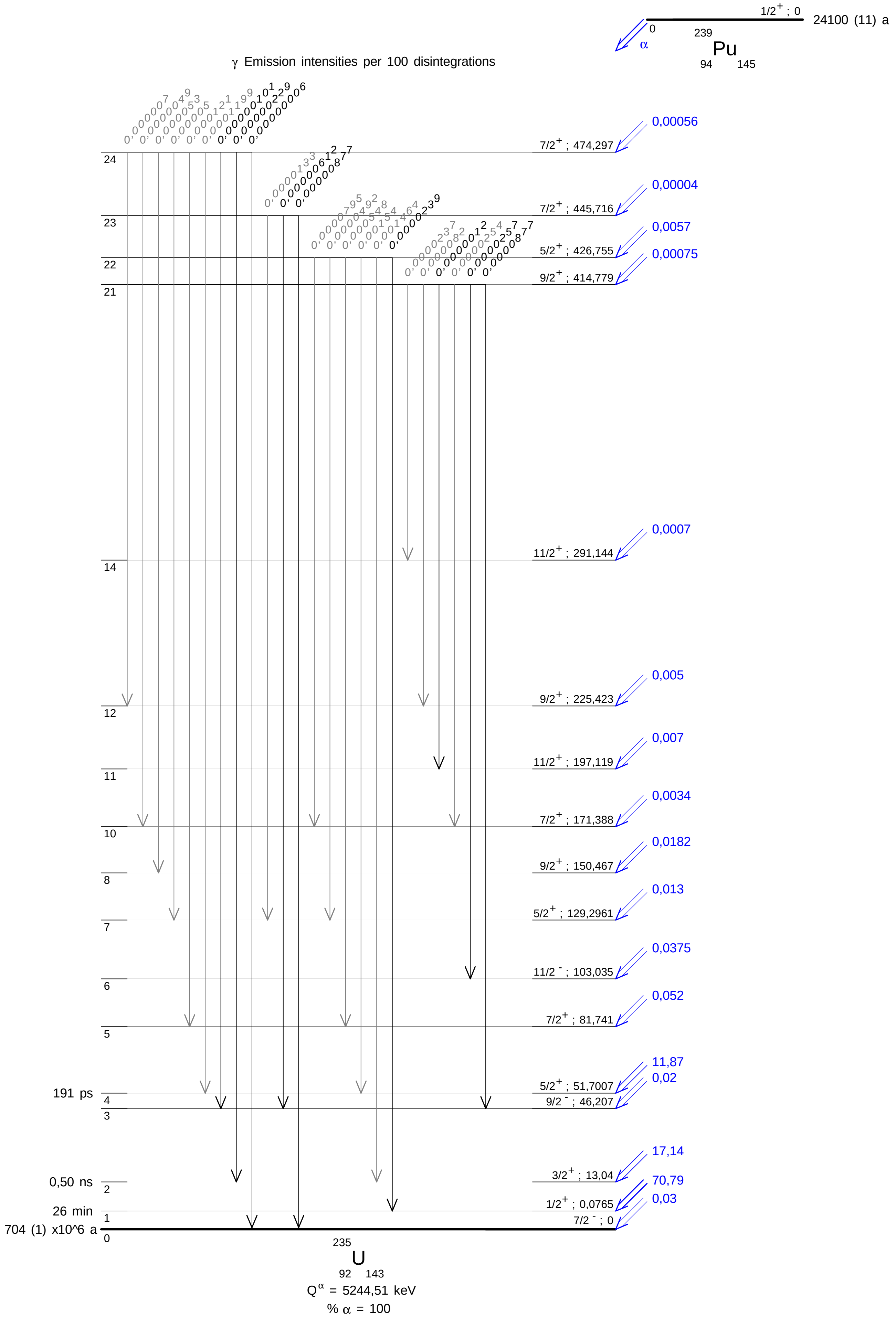

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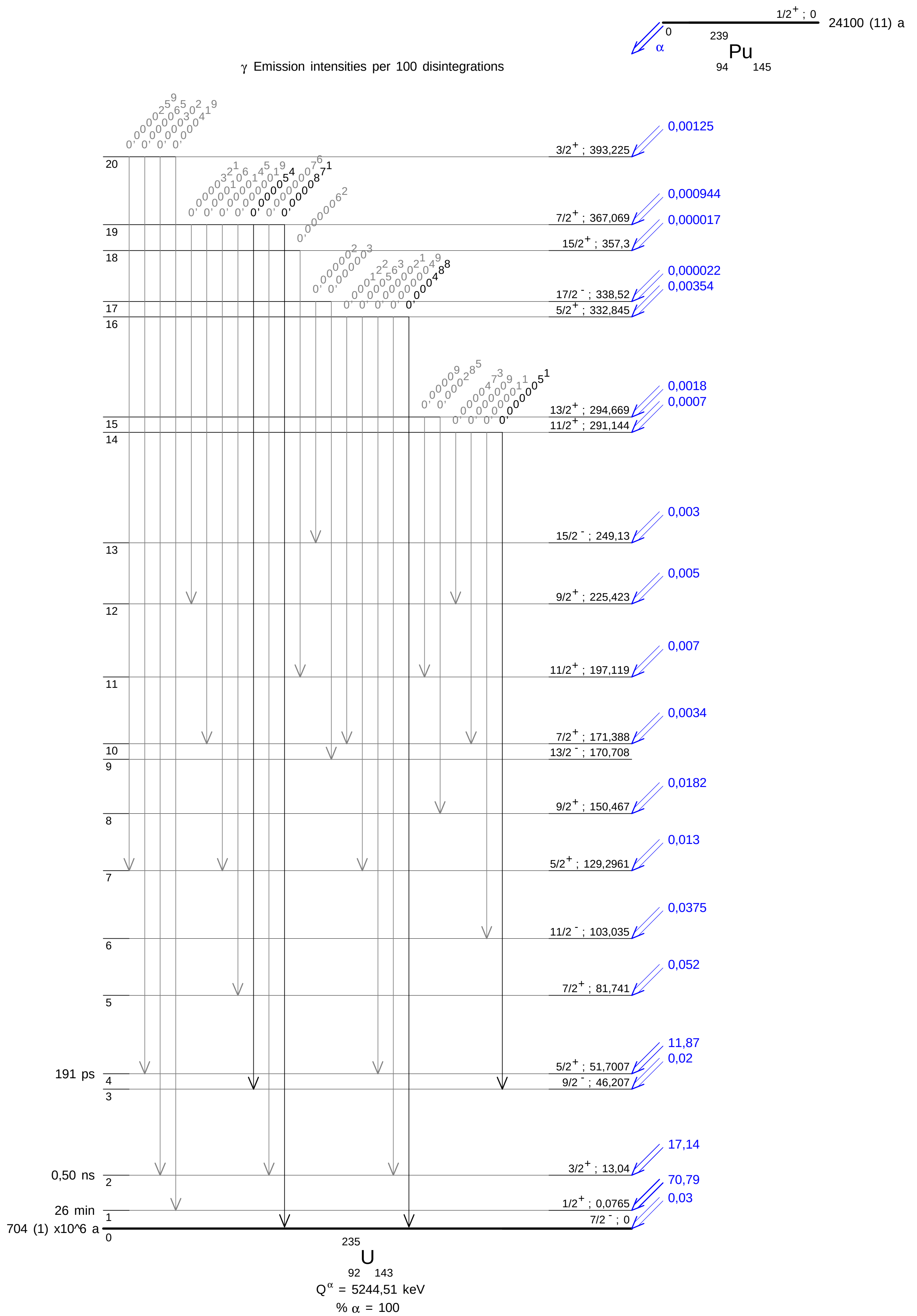

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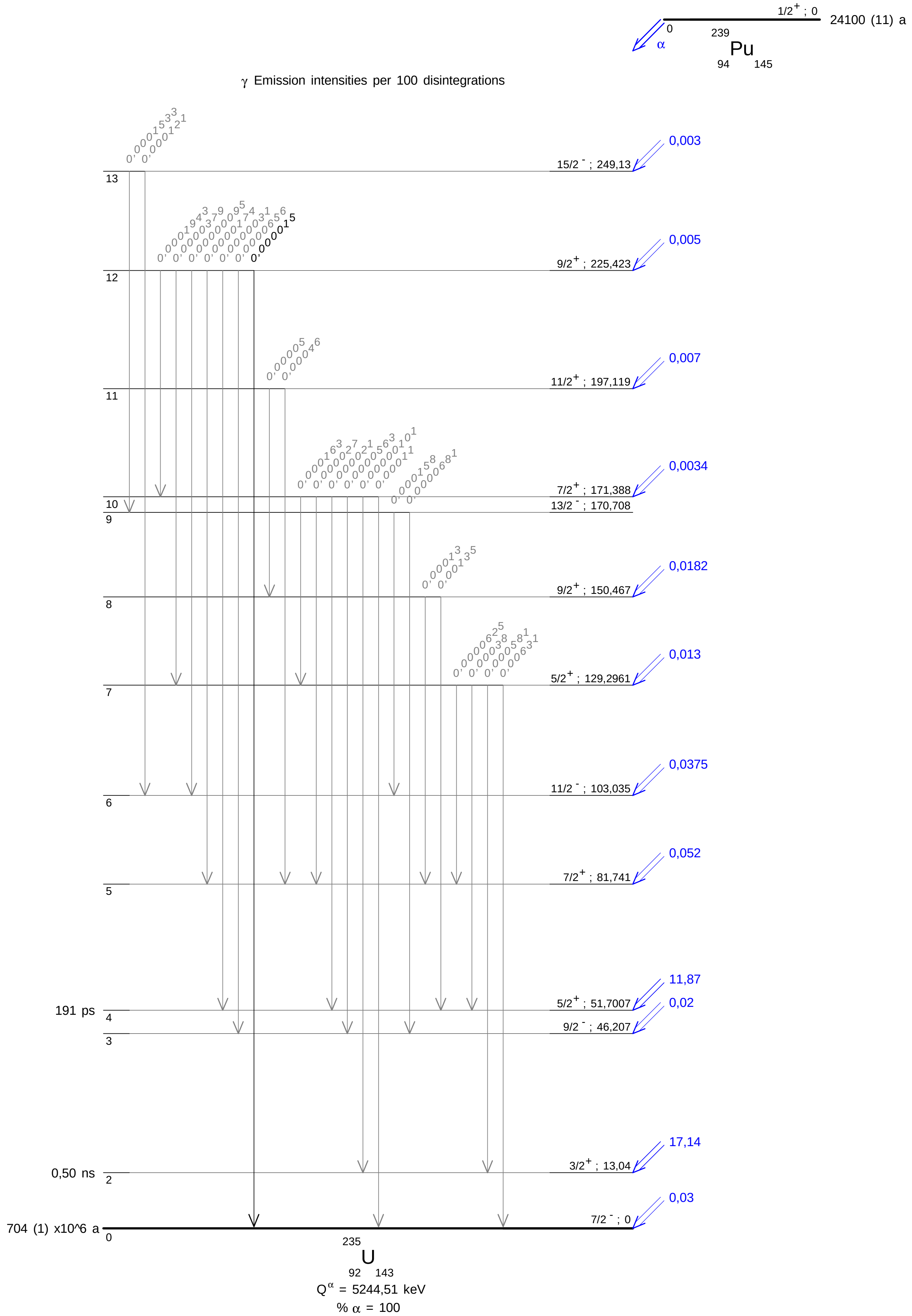

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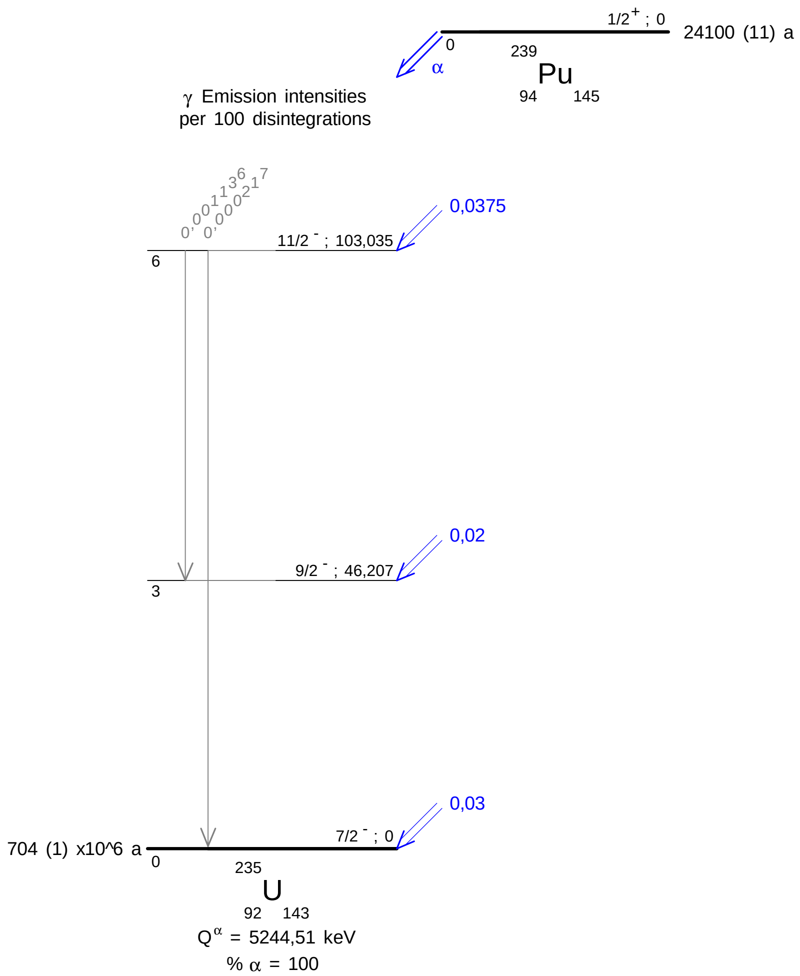

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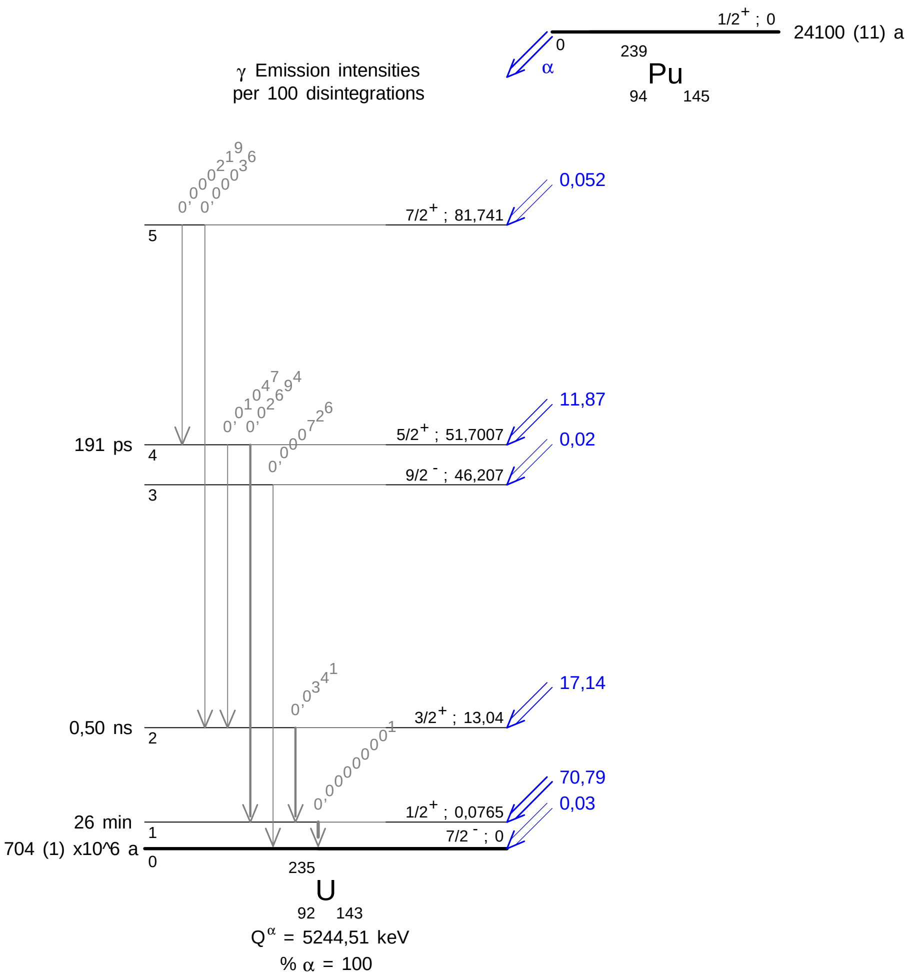
1/2+ ; 0
24100 (11) a
0
239
Pu
94
145
α
γ Emission intensities
per 100 disintegrations
0,000219
0,000036
7/2+ ; 81,741
0,052
5
0,01047
0,02694
0,000726
191 ps
4
5/2+ ; 51,7007
11,87
3
9/2 - ; 46,207
0,02
0,0341
0,50 ns
2
3/2+ ; 13,04
17,14
0,00000001
26 min
1
1/2+ ; 0,0765
70,79
704 (1) x10^6 a
0
7/2 - ; 0
0,03
235
U
92
143
Qα = 5244,51 keV
% α = 100

$^{241}_{94}\mathrm{Pu}_{147}$

1 Decay Scheme

Pu-241 decays approximately 100 % by beta minus emission to the ground state of Am-241 and 0,00244 % by alpha emission to levels of U-237. The Pu-241 spontaneous fission decay branching is 0,00244 %.
Le plutonium 241 se désintègre principalement par émission beta moins vers le niveau fondamental d'américium 241. L'intensité des émissions alpha conduisant aux niveaux excités et au niveau fondamental d'uranium 237 est de 0,00244 %.
Le plutonium 241 et l'uranium 237 sont à l'équilibre environ 68 jours après la formation de plutonium 241.

2 Nuclear Data

$T_{1/2}(^{241}\mathrm{Pu})$	:	14,33	(4)	a
$T_{1/2}(^{241}\mathrm{Am})$	:	432,6	(6)	a
$T_{1/2}(^{237}\mathrm{U})$	:	6,749	(16)	d
$Q^{-}(^{241}\mathrm{Pu})$	:	20,8	(2)	keV
$Q^{\alpha}(^{241}\mathrm{Pu})$	:	5140,0	(5)	keV

2.1 α Transitions

	Energy keV	Probability × 100	F
$\alpha_{0,10}$	4773 (3)	≈ 0,0000007	132
$\alpha_{0,9}$	4813 (3)	≈ 0,0000007	254
$\alpha_{0,8}$	4824 (5)	≈ 0,0000017	131
$\alpha_{0,7}$	4866,0 (11)	0,0000005 (2)	90
$\alpha_{0,6}$	4879,1 (5)	0,000029 (3)	18,6
$\alpha_{0,5}$	4935,8 (5)	0,000295 (8)	4,5
$\alpha_{0,4}$	4980,0 (5)	0,00203 (4)	1,3
$\alpha_{0,3}$	5057,0 (5)	0,000032 (3)	276
$\alpha_{0,2}$	5083,7 (5)	0,0000100 (12)	1300
$\alpha_{0,1}$	5128,6 (5)	0,000025 (2)	1000
$\alpha_{0,0}$	5140,0 (5)	0,0000086 (10)	3600

2.2 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,0}$	20,8 (2)	99,99756 (2)	first-forbidden	5,8

2.3 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{1,0}$(U)	11,39 (2)	0,00182 (3)					
$\gamma_{3,2}$(U)	26,67 (18)	0,000077 (15)	[M1+E2]				
$\gamma_{5,4}$(U)	44,18 (14)	0,000258 (17)	M1+1,7(5)%E2		45,3 (25)	11,2 (7)	60,4 (29)
$\gamma_{2,1}$(U)	44,86 (12)	0,000111 (25)	[M1+15(4)%E2]		96 (18)	25 (4)	131 (25)
$\gamma_{2,0}$(U)	56,30 (12)	0,00051 (4)	(E2)		149 (3)	41,1 (8)	204 (4)
$\gamma_{6,5}$(U)	56,76 (22)	0,0000280 (41)	M1+1,1(13)E2		21 (3)	5,0 (9)	27 (3)
$\gamma_{3,1}$(U)	71,64 (13)	0,000189 (14)	(E2)		46,8 (10)	13,0 (3)	64,3 (13)
$\gamma_{4,3}$(U)	77,01 (13)	0,000225 (6)	(M1)		7,44 (15)	1,8 (4)	9,86 (20)
$\gamma_{6,4}$(U)	100,94 (17)	0,00000099	(E2)		9,3 (2)	2,58 (5)	12,8 (3)
$\gamma_{4,2}$(U)	103,68 (12)	0,000536 (14)	[M1+0,47(1)%E2]		3,16 (7)	0,767 (15)	4,20 (9)
$\gamma_{7,4}$(U)	114 (1)	0,0000067 (13)	E1		0,0665 (13)	0,0163 (3)	0,0883 (17)
$\gamma_{5,3}$(U)	121,22 (19)	0,0000097 (10)	(M1)	10,1 (2)	2,00 (4)	0,484 (10)	12,8 (3)
$\gamma_{4,1}$(U)	148,567 (28)	0,00150 (3)	[M1+2,8(1)%E2]	5,55 (11)	1,13 (3)	0,275 (6)	7,05 (14)
$\gamma_{4,0}$(U)	159,96 (2)	0,0000179 (4)	(E2)	0,208 (4)	1,14 (3)	0,316 (7)	1,78 (3)

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

		Energy keV		Relative probability
	$K\beta_2$	114,407	}	
	$K\beta_4$	115,012	}	12,34
	$KO_{2,3}$	115,377	}	
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	71,776 – 80,954	100
KLX	88,153 – 98,429	59,6
KXY	104,51 – 115,59	8,88
Auger L	5,9 – 21,6	

4 α Emissions

	Energy keV	Alpha per 100 disint.
$\alpha_{0,10}$	4694 (3)	≈ 0,0000007
$\alpha_{0,9}$	4733 (3)	≈ 0,0000007
$\alpha_{0,8}$	4744 (5)	≈ 0,0000017
$\alpha_{0,7}$	4785,1 (11)	0,0000005 (2)
$\alpha_{0,6}$	4798,0 (5)	0,000029 (3)
$\alpha_{0,5}$	4853,8 (5)	0,000295 (8)
$\alpha_{0,4}$	4897,3 (5)	0,00203 (4)
$\alpha_{0,3}$	4973,1 (5)	0,000032 (3)
$\alpha_{0,2}$	4999,2 (5)	0,0000100 (12)
$\alpha_{0,1}$	5043,4 (5)	0,000025 (2)
$\alpha_{0,0}$	5054,6 (5)	0,0000086 (10)

5 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(U)	5,9 - 21,6		0,00117 (6)
e_{AK}	(U)			0,000031 (5)
	KLL	71,776 - 80,954	}	
	KLX	88,153 - 98,429	}	
	KXY	104,51 - 115,59	}	
$ec_{5,4\ L}$	(U)	22,42 - 27,01		0,000190 (14)
$ec_{4,1\ K}$	(U)	32,965 (10)		0,001034 (21)
$ec_{2,0\ L}$	(U)	34,54 - 39,13		0,00037 (3)
$ec_{3,1\ L}$	(U)	49,88 - 54,47		0,000136 (10)
$ec_{2,0\ M}$	(U)	50,75 - 52,75		0,000103 (8)
$ec_{4,3\ L}$	(U)	55,25 - 59,84		0,000154 (4)
$ec_{4,2\ L}$	(U)	81,922 - 86,512		0,000325 (10)
$ec_{4,1\ L}$	(U)	126,809 - 131,399		0,000211 (6)
$\beta^-_{0,0}$	max:	20,8 (2)		99,99756 (2)
$\beta^-_{0,0}$	avg:	5,8 (1)		

6 Photon Emissions

6.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(U)	11,619 — 20,714		0,001166 (40)	
$XK\alpha_2$	(U)	94,666		0,000300 (7)	} $K\alpha$
$XK\alpha_1$	(U)	98,44		0,000479 (10)	}
$XK\beta_3$	(U)	110,421	}		
$XK\beta_1$	(U)	111,298	}	0,000179 (5)	$K'\beta_1$
$XK\beta_5''$	(U)	111,964	}		
$XK\beta_2$	(U)	114,407	}		
$XK\beta_4$	(U)	115,012	}	0,000059 (2)	$K'\beta_2$
$XKO_{2,3}$	(U)	115,377	}		

6.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{5,4}$(U)	44,18 (3)	0,0000042 (2)
$\gamma_{2,1}$(U)	44,86 (10)	0,00000084 (10)
$\gamma_{2,0}$(U)	56,30 (12)	0,0000025 (2)
$\gamma_{6,5}$(U)	56,76 (10)	0,0000010 (1)
$\gamma_{3,1}$(U)	71,64 (9)	0,0000029 (2)
$\gamma_{4,3}$(U)	77,01 (4)	0,0000207 (4)
$\gamma_{6,4}$(U)	100,94 (11)	0,000000072
$\gamma_{4,2}$(U)	103,680 (5)	0,000103 (2)
$\gamma_{7,4}$(U)	114 (1)	0,0000062 (12)
$\gamma_{5,3}$(U)	121,22 (5)	0,00000070 (7)
$\gamma_{4,1}$(U)	148,567 (10)	0,0001863 (8)
$\gamma_{4,0}$(U)	159,96 (2)	0,00000645 (9)

7 Main Production Modes

U – 238(n,γ)U – 239

{ U – 239(β^-,)Np – 239
  Possible impurities : $T_{1/2}$ = 23,5 min

{ Np – 239(β^-,)Pu – 239
  Possible impurities : $T_{1/2}$ = 2,36 d

Pu – 239(n,γ)Pu – 240

$$\begin{cases} \text{Pu}-240(\text{n},\gamma)\text{Pu}-241 \\ \text{Possible impurities : } \text{Pu}-238,\ \text{Pu}-239,\ \text{Pu}-240 \end{cases}$$

$$\begin{cases} \text{U}-238(\alpha,\text{n})\text{Pu}-241 \\ \text{Possible impurities : } \text{Pu}-238,\ \text{Pu}-239,\ \text{Pu}-240 \end{cases}$$

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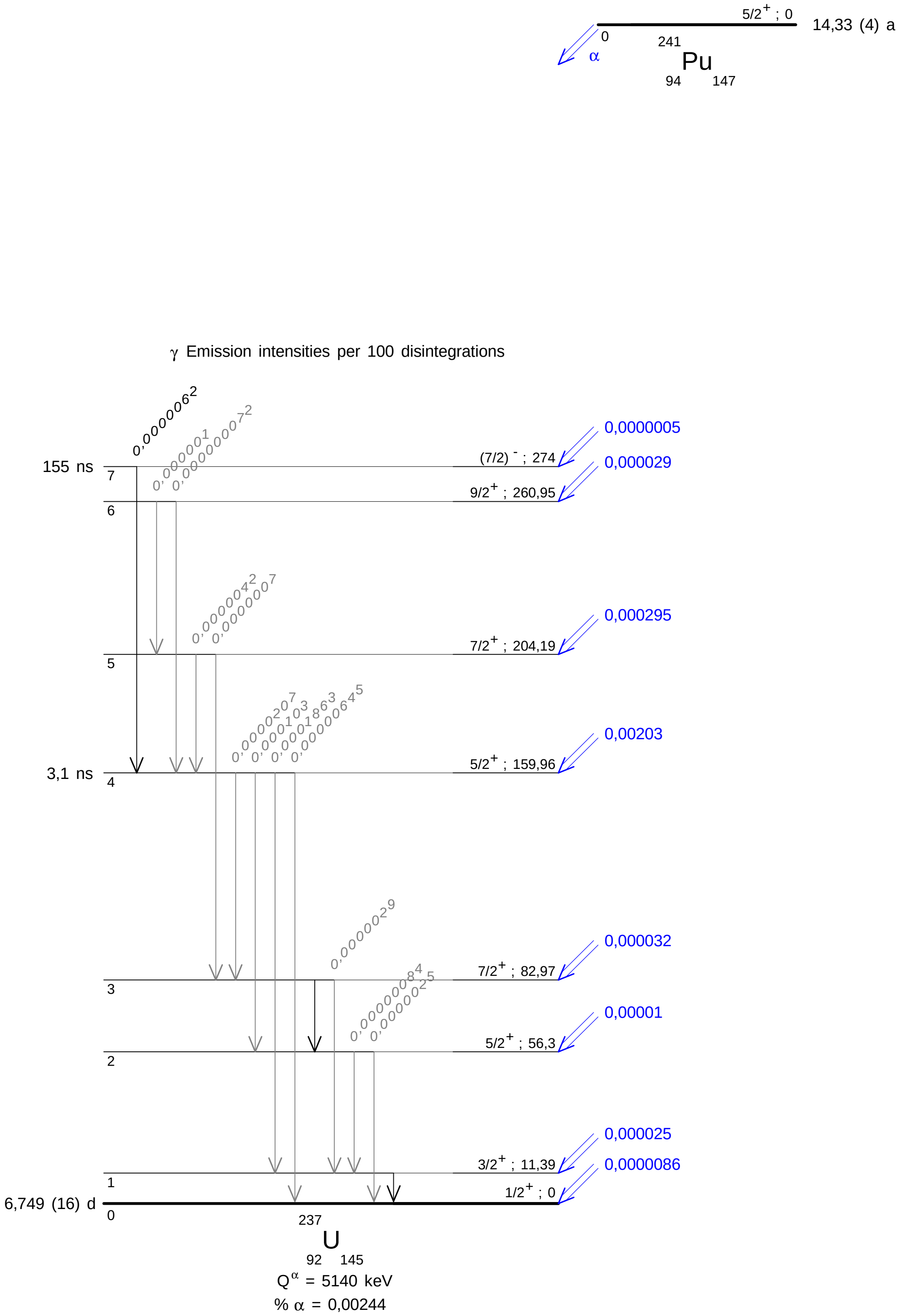

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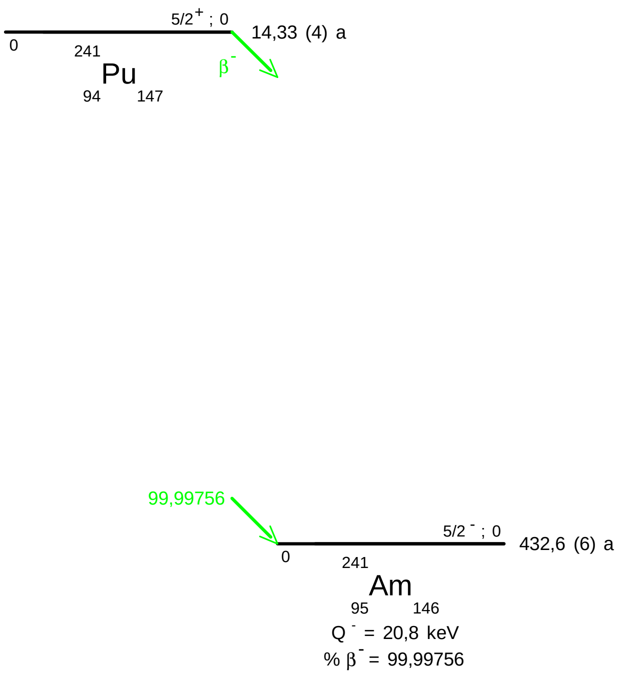

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$^{246}_{96}$Cm $_{150}$

1 Decay Scheme

Cm-246 disintegrates by alpha emissions (99,97385 %) and spontaneous fission (0,02615 %). The strongest alpha decay branch of 79,17 (22) % populates the Pu-242 ground state, while the first (44,545 keV) and the second (147,35 keV) excited states of Pu-242 are populated with intensities of 20,81 % and 0,020 %, respectively.
Le curium 246 se désintègre par émission alpha et par fission spontanée dans une proportion p(FS) = 0,02615 %.
L'émission alpha a lieu vers le niveau excité de 44,5 keV et le niveau fondamental du plutonium 242.
Le nombre moyen n(FS) de neutrons émis par transformation nucléaire de curium 246 est :
n(FS) = p(FS) × $\bar{\nu}$ = 0,0771
où $\bar{\nu}$ = 2,948 est le nombre moyen de neutrons émis par fission spontanée.

2 Nuclear Data

$T_{1/2}$(^{246}Cm)	:	4723	(27)	a
$T_{1/2}$(^{242}Pu)	:	3,73	(3)	10^5 a
Q^{α}(^{246}Cm)	:	5476,7	(9)	keV

2.1 α Transitions

	Energy keV	Probability × 100	F
$\alpha_{0,2}$	5329,2 (10)	0,020 (2)	500
$\alpha_{0,1}$	5432,0 (9)	20,81 (22)	2,05
$\alpha_{0,0}$	5476,5 (9)	79,17 (22)	1

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_L	α_M	α_T
$\gamma_{1,0}$(Pu)	44,545 (9)	20,82 (22)	E2	542 (16)	151,4 (45)	746 (22)
$\gamma_{2,1}$(Pu)	102,8 (1)	0,020 (2)	E2	10,06 (30)	2,82 (8)	13,86 (42)

3 Atomic Data

3.1 Pu

ω_K : 0,971 (4)
$\bar{\omega}_L$: 0,521 (20)
n_{KL} : 0,790 (5)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	99,525		63,17
	$K\alpha_1$	103,734		100
	$K\beta_3$	116,244	}	
	$K\beta_1$	117,228	}	
	$K\beta_5''$	117,918	}	36,70
	$K\beta_2$	120,54	}	
	$K\beta_4$	120,969	}	12,74
	$KO_{2,3}$	121,543	}	
X_L				
	$L\ell$	12,125		
	$L\alpha$	14,083 – 14,279		
	$L\eta$	16,334		
	$L\beta$	16,499 – 19,331		
	$L\gamma$	20,708 – 21,984		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	75,263 – 85,357	100
KLX	92,607 – 103,729	60,6
KXY	109,93 – 121,78	9,18
Auger L	6,12 – 22,99	

4 α Emissions

	Energy keV	Probability × 100
$\alpha_{0,2}$	5242,5 (10)	0,020 (2)
$\alpha_{0,1}$	5343,7 (9)	20,81 (22)
$\alpha_{0,0}$	5387,5 (9)	79,17 (22)

5 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Pu)	6,12 - 22,99		7,20 (21)
e_{AK}	(Pu)			
	KLL	75,263 - 85,357	}	
	KLX	92,607 - 103,729	}	
	KXY	109,93 - 121,78	}	
$ec_{1,0\ L}$	(Pu)	21,441 - 26,488		15,1 (6)
$ec_{1,0\ M}$	(Pu)	38,612 - 40,770		4,22 (17)
$ec_{1,0\ N}$	(Pu)	42,986 - 44,121		1,161 (47)
$ec_{2,1\ L}$	(Pu)	79,7 - 84,7		0,0135 (15)
$ec_{2,1\ M}$	(Pu)	96,9 - 99,0		0,00378 (41)
$ec_{2,1\ N}$	(Pu)	101,2 - 102,4		0,00104 (11)

6 Photon Emissions

6.1 X-Ray Emissions

		Energy keV	Photons per 100 disint.
XL	(Pu)	12,125 — 21,984	7,95 (24)

6.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Pu)	44,545 (9)	0,0279 (8)
$\gamma_{2,1}$(Pu)	102,8 (1)	0,00134 (14)

7 Main Production Modes

Cm – 245(n,γ)Cm – 246 σ : 15,2 (12) barns

Cf – 250(α)Cm – 246
Possible impurities : Cf – 250, $T_{1/2}$ = 13,08 a

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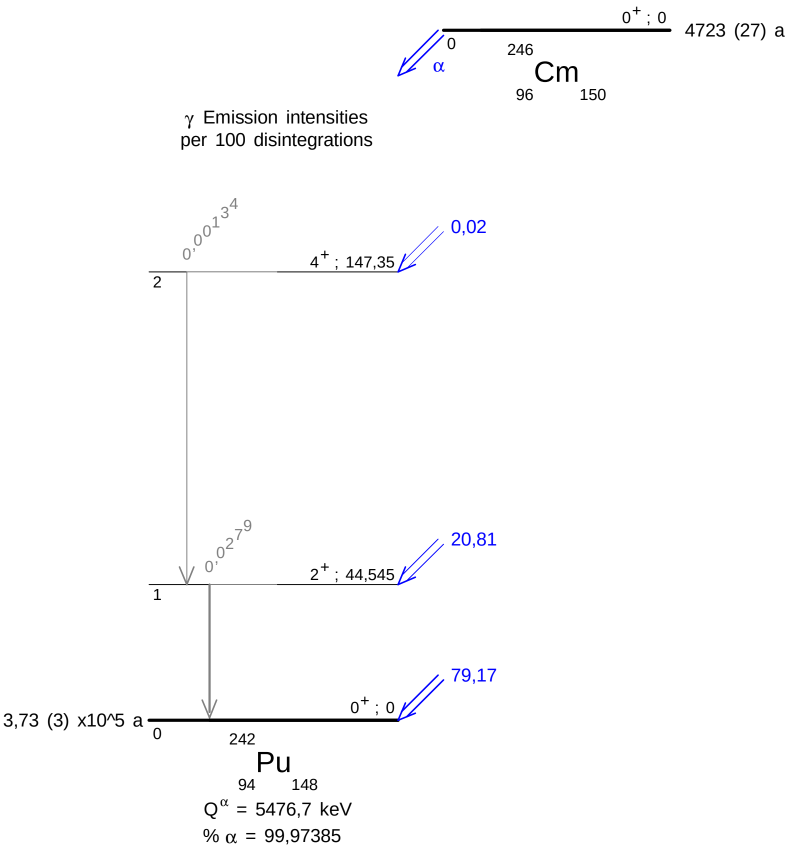

ANL / F.G. Kondev

252 Cf
98 Cf 154

1 Decay Scheme

Cf-252 disintegrates by alpha emissions mainly to the Cm-248 ground state level, and by spontaneous fission for 3,086(8) % .
The average number of neutrons emitted by spontaneous fission is: 3,7675 (40).
The average number of neutrons emitted per 100 disintegrations is :
n = 3,086 x 3,7675 = 11,627 (33) %
Le californium 252 se désintègre par émissions alpha principalement vers le niveau fondamental de Cm-248 et pour 3,086 % par fission spontanée.

2 Nuclear Data

$T_{1/2}(^{252}Cf)$	:	2,6470	(26)	a
$T_{1/2}(^{248}Cm)$	:	348	(6)	10^3 a
$Q^{\alpha}(^{252}Cf)$	:	6216,87	(4)	keV

2.1 α Transitions

	Energy keV	Probability × 100	F
$\alpha_{0,3}$	~ 5920,3	~ 0,0019	1200
$\alpha_{0,2}$	~ 6073	0,23 (4)	65
$\alpha_{0,1}$	6173,63 (11)	15,1 (3)	3,2
$\alpha_{0,0}$	6216,8 (1)	81,7 (3)	1

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{1,0}$(Cm)	43,40 (3)	15,2 (3)	E2		724 (11)	204 (3)	1000 (15)
$\gamma_{2,1}$(Cm)	100,2 (4)	0,232 (39)	E2		13,4 (4)	3,79 (9)	18,5 (5)
$\gamma_{3,2}$(Cm)	154,5 (6)	0,00192	E2	0,1741 (25)	1,87 (5)	0,526 (12)	2,76 (6)

3 Atomic Data

3.1 Cm

ω_K	:	0,972	(4)
$\bar{\omega}_L$	:	0,538	(23)
$\bar{\omega}_M$	:	0,061	(6)
n_{KL}	:	0,785	(5)
$\bar{n}_{LM}$	:	1,12	(4)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	104,59		63,87
	$K\alpha_1$	109,271		100
	$K\beta_3$	122,304	}	
	$K\beta_1$	123,403	}	
	$K\beta_5''$	124,124	}	37,45
	$K\beta_2$	126,889	}	
	$K\beta_4$	127,352	}	13,18
	$KO_{2,3}$	127,97	}	
X_L				
	$L\ell$	12,639		
	$L\alpha$	14,744 – 14,9560		
	$L\eta$	17,315		
	$L\beta$	17,288 – 20,515		
	$L\gamma$	21,969 – 23,319		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	78,858 – 89,973	100
KLX	97,226 – 109,267	61,8
KXY	115,57 – 128,23	9,5
Auger L	6,3 – 24,5	

4 α Emissions

	Energy keV	Probability × 100
$\alpha_{0,3}$	~ 5826,3	~ 0,0019
$\alpha_{0,2}$	~ 5976,6	0,23 (4)
$\alpha_{0,1}$	6075,64 (11)	15,1 (3)
$\alpha_{0,0}$	6118,1 (1)	81,7 (3)

5 Electron Emissions

		Energy keV	Electrons per 100 disint.
e_{AL}	(Cm)	6,3 - 24,5	5,02 (13)
e_{AK}	(Cm)		0,0000025 (4)
	KLL	78,858 - 89,973	}
	KLX	97,226 - 109,267	}
	KXY	115,57 - 128,23	}
$ec_{1,0\ L}$	(Cm)	18,9 - 24,4	10,93 (33)
$ec_{1,0\ M}$	(Cm)	37,1 - 39,4	3,08 (9)
$ec_{1,0\ N}$	(Cm)	41,7 - 42,9	0,856 (26)
$ec_{2,1\ L}$	(Cm)	75,7 - 81,2	0,159 (27)

6 Photon Emissions

6.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Cm)	12,634 — 23,319		6,07 (14)	
XKα_2	(Cm)	104,59		0,0000257 (7)	} Kα
XKα_1	(Cm)	109,271		0,0000402 (11)	}
XKβ_3	(Cm)	122,304	}		
XKβ_1	(Cm)	123,403	}	0,0000151 (5)	K$'\beta_1$
XKβ_5''	(Cm)	124,124	}		
XKβ_2	(Cm)	126,889	}		
XKβ_4	(Cm)	127,352	}	0,00000530 (19)	K$'\beta_2$
XKO$_{2,3}$	(Cm)	127,97	}		

6.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Cm)	43,399 (25)	0,0152 (4)
$\gamma_{2,1}$(Cm)	100,2 (4)	0,0119 (20)
$\gamma_{3,2}$(Cm)	154,5 (6)	0,00051

7 Main Production Modes

Pu – 239(multiple,n – captures)

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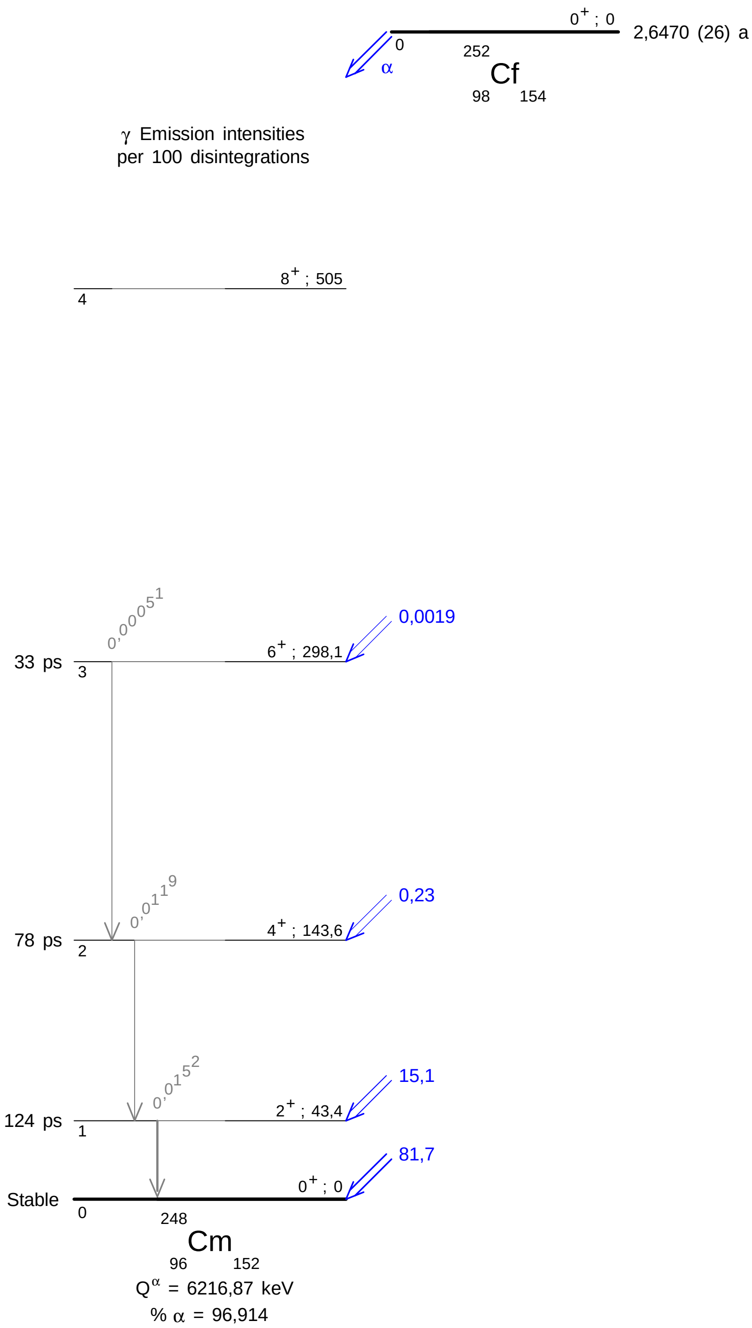

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