Table of radionuclides (Vol. 2 - A = 151 to 242)

Marie-Martine Bé, Vanessa Chisté, Christophe Dulieu, Edgardo Browne, Valery Chechev, Nikolay Kuzmenko, Richard L Helmer, Alan Nichols, Eckart Schönfeld, Rainer Dersch

Monographie BIPM-5

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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 set of sixty-eight radionuclides. Activity measurements for thirty-two of these radionuclides have already been the subject of comparisons under the auspices of Section II of the CCRI. The material for this monograph will be covered in two volumes. Volume 1 contains 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 radionuclides with mass number up to and including 150; Volume 2 contains the equivalent data for radionuclides with mass number over 150. The data have been collated and evaluated by an international working group (Decay Data Evaluation Project) led by the BNM-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.

G. Moscati
President of the CCRI

A.J. Wallard
Director of the BIPM

Note: Following Resolution 10 of the 22nd CGPM in 2003, a decimal point has been used as the decimal marker in the English text but in the data tables, which were edited in French, a decimal comma has been used. There should be no ambiguity in use.

Monographie BIPM-5 - Table of Radionuclides, Vol. 2 (A = 151 to 242)

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"TABLE DE RADIONUCLÉIDES"

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

^{7}Be, ^{11}C, ^{13}N, ^{15}O, ^{18}F, ^{24}Na, ^{32}P, ^{33}P, ^{44}Sc, ^{44}Ti, ^{46}Sc, ^{51}Cr, ^{54}Mn, ^{56}Mn, ^{57}Co, ^{57}Ni, ^{59}Fe, ^{64}Cu, ^{66}Ga, ^{67}Ga, ^{85}Kr, ^{85}Sr, ^{88}Y, ^{89}Sr, ^{93}Nb^{m}, ^{99}Mo, ^{99}Tc^{m}, ^{109}Cd, ^{110}Ag, ^{110}Ag^{m}, ^{123}I, ^{123}Te^{m}, ^{125}Sb, ^{129}I, ^{131}I, ^{131}Xe^{m}, ^{133}Ba, ^{140}Ba, ^{140}La, ^{152}Eu, ^{153}Gd, ^{153}Sm, ^{154}Eu, ^{155}Eu, ^{166}Ho, ^{166}Ho^{m}, ^{169}Yb, ^{170}Tm, ^{177}Lu, ^{186}Re, ^{198}Au, ^{201}Tl, ^{203}Hg, ^{204}Tl, ^{208}Tl, ^{212}Bi, ^{212}Pb, ^{212}Po, ^{216}Po, ^{220}Rn, ^{224}Ra, ^{226}Ra, ^{227}Th, ^{228}Th, ^{238}Pu, ^{240}Pu, ^{241}Am, ^{242}Pu.

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 :

^{7}Be, ^{11}C, ^{13}N, ^{15}O, ^{18}F, ^{24}Na, ^{32}P, ^{33}P, ^{44}Sc, ^{44}Ti, ^{46}Sc, ^{51}Cr, ^{54}Mn, ^{56}Mn, ^{57}Co, ^{57}Ni, ^{59}Fe, ^{64}Cu, ^{66}Ga, ^{67}Ga, ^{85}Kr, ^{85}Sr, ^{88}Y, ^{89}Sr, ^{93}Nb^{m}, ^{99}Mo, ^{99}Tc^{m}, ^{109}Cd, ^{110}Ag, ^{110}Ag^{m}, ^{123}I, ^{123}Te^{m}, ^{125}Sb, ^{129}I, ^{131}I, ^{131}Xe^{m}, ^{133}Ba, ^{140}Ba, ^{140}La, ^{152}Eu, ^{153}Gd, ^{153}Sm, ^{154}Eu, ^{155}Eu, ^{166}Ho, ^{166}Ho^{m}, ^{169}Yb, ^{170}Tm, ^{177}Lu, ^{186}Re, ^{198}Au, ^{201}Tl, ^{203}Hg, ^{204}Tl, ^{208}Tl, ^{212}Bi, ^{212}Pb, ^{212}Po, ^{216}Po, ^{220}Rn, ^{224}Ra, ^{226}Ra, ^{227}Th, ^{228}Th, ^{238}Pu, ^{240}Pu, ^{241}Am, ^{242}Pu.

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

^{7}Be, ^{11}C, ^{13}N, ^{15}O, ^{18}F, ^{24}Na, ^{32}P, ^{33}P, ^{44}Sc, ^{44}Ti, ^{46}Sc, ^{51}Cr, ^{54}Mn, ^{56}Mn, ^{57}Co, ^{57}Ni, ^{59}Fe, ^{64}Cu, ^{66}Ga, ^{67}Ga, ^{85}Kr, ^{85}Sr, ^{88}Y, ^{89}Sr, ^{93}Nb^{m}, ^{99}Mo, ^{99}Tc^{m}, ^{109}Cd, ^{110}Ag, ^{110}Ag^{m}, ^{123}I, ^{123}Te^{m}, ^{125}Sb, ^{129}I, ^{131}I, ^{131}Xe^{m}, ^{133}Ba, ^{140}Ba, ^{140}La, ^{152}Eu, ^{153}Gd, ^{153}Sm, ^{154}Eu, ^{155}Eu, ^{166}Ho, ^{166}Ho^{m}, ^{169}Yb, ^{170}Tm, ^{177}Lu, ^{186}Re, ^{198}Au, ^{201}Tl, ^{203}Hg, ^{204}Tl, ^{208}Tl, ^{212}Bi, ^{212}Pb, ^{212}Po, ^{216}Po, ^{220}Rn, ^{224}Ra, ^{226}Ra, ^{227}Th, ^{228}Th, ^{238}Pu, ^{240}Pu, ^{241}Am, ^{242}Pu.

In diesem Bericht sind evaluierte Werte der Halbwertszeiten, Übergangs-wahrscheinlichkeiten und Übergangsenergien von α, β^{-}-, β^{+}-, EC- und Gammaübergängen, Konversionskoeffizienten von Gammaübergängen, Emissions-wahrscheinlichkeiten von Röntgen- und Gammaquanten, Auger- und Konversions-elektronen.

“TABLA DE RADIONUCLEIDOS”

Prólogo – Este volúmen agrupa la evaluación de los radionucleidos siguientes :

^{7}Be, ^{11}C, ^{13}N, ^{15}O, ^{18}F, ^{24}Na, ^{32}P, ^{33}P, ^{44}Sc, ^{44}Ti, ^{46}Sc, ^{51}Cr, ^{54}Mn, ^{56}Mn, ^{57}Co, ^{57}Ni, ^{59}Fe, ^{64}Cu, ^{66}Ga, ^{67}Ga, ^{85}Kr, ^{85}Sr, ^{88}Y, ^{89}Sr, ^{93}Nb^{m}, ^{99}Mo, ^{99}Tc^{m}, ^{109}Cd, ^{110}Ag, ^{110}Ag^{m}, ^{123}I, ^{123}Te^{m}, ^{125}Sb, ^{129}I, ^{131}I, ^{131}Xe^{m}, ^{133}Ba, ^{140}Ba, ^{140}La, ^{152}Eu, ^{153}Gd, ^{153}Sm, ^{154}Eu, ^{155}Eu, ^{166}Ho, ^{166}Ho^{m}, ^{169}Yb, ^{170}Tm, ^{177}Lu, ^{186}Re, ^{198}Au, ^{201}Tl, ^{203}Hg, ^{204}Tl, ^{208}Tl, ^{212}Bi, ^{212}Pb, ^{212}Po, ^{216}Po, ^{220}Rn, ^{224}Ra, ^{226}Ra, ^{227}Th, ^{228}Th, ^{238}Pu, ^{240}Pu, ^{241}Am, ^{242}Pu.

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

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

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TABLE DE RADIONUCLÉIDES

INTRODUCTION

Le Laboratoire National Henri Becquerel (LNHB) a commencé l'étude des données nucléaires et atomiques qui caractérisent la décroissance des radionucléides en 1974. Ces évaluations ont fait l'objet de la publication des quatre volumes de la Table de Radionucléides [87Ta, 99Be]. 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, Allemagne) ont établi un accord de coopération. Ils ont ensuite été rejoints par Idaho National Engineering and Environmental Laboratory (INEEL, États-Unis), Lawrence Berkeley National Laboratory (LBNL, États-Unis) et Khlopin Radium Institute (KRI, Russie). 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.

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 *uc*, 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 :
$U(y) = k \cdot uc(y)$ 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 2004, pour toutes les nouvelles évaluations et mises à jour ultérieures le lecteur se référera aux documents accessibles sur :
http://www.nucleide.org/NucData.htm

TABLE OF RADIONUCLIDES

INTRODUCTION

The evaluation of decay data for the "Table de Radionucléides" by 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].
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 and 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.

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. With a weighted average, each weight is limited to 50 %. The uncertainty, designated *uc*, is the greatest of the internal or external uncertainty values. For a discrepant set of data, it 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 :
$U(y) = k.uc(y)$ where *k* is the coverage factor.
For this publication the expanded uncertainty is computed with $k = 1$.

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

If a value is given without an uncertainty, this means that this value is considered as questionable. It is provided for information and was often estimated from the decay scheme as to be "in the order of".

Information about evaluation procedures can be obtained from references [85Zi, 96He, 99In] or directly from the authors.
Information about meaning of physical data can be obtained from reference [99In].

NUMBERING

The nuclear levels are arbitrarily numbered from 0 for the ground state level to *n* for the *n*th excited level. All the transitions are designated by their initial and final level.
For transitions with weak probabilities which are not shown by an arrow in the decay scheme, the initial and final levels are noted (-1, *n*).
For the 511 keV gamma emission which follows the beta plus disintegration, the adopted numbering is (-1, -1).

UNITS

The recommended values are expressed :
- 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 ;

- for energies the values are expressed in keV.

CAUTION

This report was printed in 2004, new evaluations and updated issues will be available on :
http://www.nucleide.org/NucData.htm

TABELLE DER RADIONUKLIDE

EINLEITUNG

Die Evaluation der Zerfallsdaten für die Table de Radionucléides durch das BNM-LNHB/CEA begann im Jahre 1974, diese Arbeit wurde bis 1987 fortgesetzt, und es wurden vier Bände veröffentlicht [87Ta, 99Be]. Dieser neue Bericht kommt hinzu dem vorhergehend Arbeit.
Übrigens wurde ein Computerform der Table de Radionucléides im LNHB entwickelt. Diese Software 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 Umgebungsüberwachung, der Reaktorabschirmung usw. zur Verfügung zu stellen.
Die Datenbank umfaßt empfohlene Daten und ihre Unsicherheiten, die aus den verfügbaren Daten oder theoretischen Berechnungen gewonnen worden sind. Alle für die Evaluation benutzten Referenzen werden angegeben.
Um die schon 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) einen Vertrag 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 Institut (KRI, Rußland) an. Eine der ersten Arbeiten dieser Gruppe war es, die in diesen Evaluationen benutzte Methodologie zu diskutieren und festzulegen.

EMPFOHLENE WERTE UND UNSICHERHEITEN

Die Hauptschritte für die Evaluation der Daten und Unsicherheiten sind:
- Eine kritische Analyse aller verfügbaren Veröffentlichungen, um einen Wert und seine Unsicherheit - auf die kombinierte Standardunsicherheit zurückgeführt - zu berücksichtigen.
- 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 ein Gewicht, das größer ist als 50 %, auf 50 % reduziert. Die Unsicherheit, als *uc* bezeichnet, ist der größere Wert der inneren oder äußeren Unsicherheit. Für einen diskrepanten Datensatz ist sie so zu vergrößern, 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:
$U(y) = k \, . \, uc(y)$ 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.

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 durch einen Pfeil im Zerfallsschema gezeigt sind, werden das Ausgangs- und Endniveau notiert. (-1, *n*)

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:

	Symbol
. 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 2004 erstellt. Alle späteren Fassungen oder neueren Evaluationen können vom Leser unter
http://www.nucleide.org/NucData.htm
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]. Новое издание находится в русле предыдущей работы.
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 Radionucléides, и добавить новые оценки, Национальная лаборатория им. Анри Беккереля (LNHB, Франция) и Физико-Технический Институт (PTB, Германия) заключили кооперативное соглашение. К ним затем присоединились Национальная лаборатория прикладных и экологических исследований Айдахо (INEEL, США), Лоуренсовская Национальная Лаборатория Беркли (LBNL, США) и Радиевый институт им. В.Г. Хлопина (KRI, Россия). Это международное сотрудничество основано на неформальном соглашении. Первоначальная работа состояла в обсуждении и принятии согласованной методологии, которая должна быть использована в этих оценках. Данные и связанные с ними погрешности были оценены с использованием всех имеющихся в распоряжении результатов экспериментов и с учетом теоретических рассмотрений.

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 (*uc*) 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: $U(y)=k.uc(y)$, 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 ± 0,011 и
9,2(11)		9,2 ± 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 отчет подготовлен в 2004 г. Новые оценки и обновленные результаты можно найти на сайте:
http://www.nucleide.org/NucData.htm

TABLA DE RADIONUCLEIDOS

INTRODUCCION

El Laboratoire National Henri Becquerel (LNHB) comenzó el estudio de datos nucleares y atómicos que caracterizan la desintegración de radionucleidos en 1974. Esas evaluaciones han permitido la publicación de cuatro volúmenes de la Tabla de radionucleidos [87Ta,99Be]. Este nuevo volúmen es el siguiente en la continuación del estudio precedente.

Con la idea de facilitar, la corrección de nuevos datos y la comodidad de consulta para los utilisadores, el LNHB a creado una base de datos en computadora. El programa NUCLEIDE es el contenido de la Tabla en computadora, que permite el fácil acceso a diferentes informaciones, con la ayuda de menues en cascada accesibles con un simple « clic » sobre una « tecla ».

El objetivo de la Tabla es estudiar un número limitado de radionucleidos útiles en el campo de la metrología u otros campos de aplicación (medicina nuclear, medio ambiente, ciclo del combustible, etc.) y presentar un estudio completo.

Los datos recomendados comprenden : el período radioactivo, los modos de desintegración, las emisiones α, β, γ, X y electrónicas con las características de transiciones asociadas.

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. Luego se unieron a este acuerdo el *Idaho National Engineering and Environmental Laboratory* (INEEL, USA), *Lawrence Berkeley National Laboratory* LBNL, USA) y *Khlopin Radium Institute* (KRI, Rusia). El primer trabajo de esta colaboración internacional ha sido de establecer un méthodo y reglas comunes de evaluación. Las evaluaciones proponen valores recomendados e incertidumbres asociadas. Esos valores han sido evaluados a partir de datos experimentales disponibles. En ausencia de éstos últimos, esos valores han sido obtenidos por cálculos teóricos. Todas las referencias utilizadas para la evaluación de un radionucleido son listadas 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 obtenir o no un valor con su incertidumbre, considerada como incertidumbre tipo compuesta.
- La determinación de un valor recomendado que es, según el caso, una media simple o ponderada de valores obtenidos de publicaciones, ésto es decidido luego de examinar el chi al cuadrado reducido. En el caso de una media ponderada, el peso relativo de cada valor es limitado a 50 %. La incertidumbre, llamada *uc*, es el mayor de los valores de incertidumbres interna o externa ; en el caso de valores incompatibles, este valor puede ser extendido con el fin de recubrir el valor más preciso.

Par ciertas aplicaciones, es necesario definir una incertidumbre extendida, llamada *U*, la cual es :
$U(y) = k \cdot uc(y)$ donde *k* es el factor de extensión.
El valor de *k* retenido 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

Si un valor es dado sin incertidumbre, significa que ésta es considerada dudosa (es indicada aproximativamente y ha sido estimada a partir del esquema de desintegración).

NUMERACION

Los niveles de un núcleo son numerados de manera arbitraria, de 0 para el nivel fundamental, a *n* para el enésimo nivel excitado. Las diversas transiciones son así señaladas desde el nivel de partida al nivel de llegada.
En el caso de una transición de probabilidad pequeña que es imposible de indicar en el esquema de desintegración, los niveles de partida y de llegada son notificados : (-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 son expresados :
- para los períodos :

	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, les valores son dados por 100 desintegraciones ;

- para las energías los valores son expresados en keV.

ADVERTENCIA

Este documento ha sido imprimido en 2004, para obtener todas las nuevas evaluaciones actualizadas ulteriormente, el lector deberá referirse a los documentos disponibles en :
http://www.nucleide.org/NucData.htm

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

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

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

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

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$^{152}_{63}$**Eu** $_{89}$

1 Decay Scheme

Eu-152 disintegrates 72.1% by electron-capture and about 0.027% by emission of positrons to Sm-152 and by beta minus emission (27.9%) to Gd-152.
L'europium 152 se désintègre par capture électronique (72,1%) et par émission de positron (environ 0,027%) vers le samarium 152 et par émission bêta moins (27,9%) vers le gadolinium 152.

2 Nuclear Data

$T_{1/2}$(^{152}Eu)	:	13,522	(16)	a
Q^-(^{152}Eu)	:	1818,8	(11)	keV
Q^+(^{152}Eu)	:	1874,3	(7)	keV

2.1 Electron Capture Transitions

	Energy keV	Probability × 100	Nature	lg ft	P_K	P_L	P_M
$\epsilon_{0,19}$	105,2 (7)	0,068 (5)	1st Forbidden	10,3	0,6586 (33)	0,2591 (24)	0,0657 (12)
$\epsilon_{0,18}$	117,1 (7)	0,041 (3)	1st Forbidden	10,7	0,6903 (28)	0,2358 (20)	0,0591 (11)
$\epsilon_{0,17}$	144,1 (7)	0,0422 (12)	(Allowed)	10,9	0,7339 (23)	0,2036 (16)	0,0499 (9)
$\epsilon_{0,16}$	224,4 (7)	0,889 (14)	Allowed	10,1	0,7859 (19)	0,1651 (13)	0,0392 (7)
$\epsilon_{0,15}$	261,4 (7)	0,0208 (14)		11,9	0,7966 (18)	0,1571 (13)	0,0370 (7)
$\epsilon_{0,14}$	294,9 (7)	2,068 (12)	Allowed	10	0,8036 (17)	0,1519 (12)	0,0356 (7)
$\epsilon_{0,13}$	344,5 (7)	24,72 (11)	Allowed	9,1	0,8109 (17)	0,1465 (12)	0,0341 (7)
$\epsilon_{0,12}$	502,6 (7)	0,869 (24)	1st Forbidden	10,9	0,8236 (16)	0,1370 (11)	0,0316 (6)
$\epsilon_{0,11}$	581,5 (7)	0,644 (10)	(1st Forbidden)	11,2	0,8271 (16)	0,1344 (11)	0,0309 (6)
$\epsilon_{0,10}$	640,4 (7)	17,16 (8)	1st Forbidden	9,8	0,8291 (16)	0,1329 (11)	0,0305 (6)
$\epsilon_{0,9}$	788,5 (7)	21,35 (11)	1st Forbidden	9,9	0,8327 (15)	0,1302 (11)	0,0297 (6)
$\epsilon_{0,8}$	833,2 (7)	0,086 (7)	Allowed	12,4	0,8335 (15)	0,1296 (11)	0,0296 (6)
$\epsilon_{0,7}$	851,3 (7)	0,238 (5)	1st Forbidden	11,9	0,8338 (15)	0,1294 (11)	0,0295 (6)
$\epsilon_{0,5}$	1063,9 (7)	1,28 (3)	1st Forbidden	11,4	0,8366 (15)	0,1273 (11)	0,0290 (6)
$\epsilon_{0,2}$	1507,8 (7)	0,77 (5)	1st Forbidden	12	0,8398 (15)	0,1249 (11)	0,0283 (5)
$\epsilon_{0,1}$	1752,5 (7)	1,7 (10)	1st Forbidden	11,8	0,8408 (15)	0,1241 (10)	0,0281 (5)

USP, LBNL /V.R. Vanin,
R.M. de Castro, E. Browne

2.2 β^+ Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^+_{0,2}$	485,8 (7)	0,0024 (2)	1st Forbidden	
$\beta^+_{0,1}$	730,5 (7)	0,025 (15)	1st Forbidden	

2.3 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,15}$	126,4 (11)	0,0203 (11)	1st Forbidden	11,1
$\beta^-_{0,14}$	175,4 (11)	1,826 (21)	Allowed	9,6
$\beta^-_{0,13}$	213,5 (11)	0,101 (3)	1st Forbidden	11,1
$\beta^-_{0,12}$	268,6 (11)	0,0536 (18)	1st Forbidden	11,7
$\beta^-_{0,11}$	384,8 (11)	2,44 (3)	1st Forbidden	10,5
$\beta^-_{0,10}$	500,3 (11)	0,0267 (17)	1st Forbidden	12,9
$\beta^-_{0,9}$	504,1 (11)	0,0048 (7)	2nd Forbidden	13,6
$\beta^-_{0,8}$	536,5 (11)	0,037 (8)	1st Forbidden	12,8
$\beta^-_{0,7}$	695,6 (11)	13,80 (15)	Allowed	10,6
$\beta^-_{0,6}$	709,7 (11)	0,245 (8)	1st Forbidden	12,4
$\beta^-_{0,4}$	888,2 (11)	0,303 (7)	1st Forbidden	12,7
$\beta^-_{0,3}$	1063,4 (11)	0,904 (14)	1st Forbidden	12,5
$\beta^-_{0,1}$	1474,5 (11)	8,17 (11)	1st Forbidden	12,1

2.4 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L (10^{-3})	α_M (10^{-3})	α_T
$\gamma_{1,0}$(Sm)	121,7818 (3)	61,5 (10)	E2	0,676 (20)	378 (11)	87,5 (26)	1,165 (35)
$\gamma_{5,3}$(Sm)	125,69 (13)	0,038 (13)	(E2)	0,616 (18)	329 (10)	76,0 (23)	1,042 (31)
$\gamma_{10,9}$(Sm)	148,010 (17)	0,055 (8)	(M1+50%E2)	0,430 (13)	115,0 (34)	26,0 (8)	0,578 (17)
$\gamma_{7,4}$(Gd)	192,6 (4)	0,00714 (22)	(E1)	0,0426 (13)	6,09 (18)	1,32 (4)	0,0504 (15)
$\gamma_{14,12}$(Sm)	207,6 (3)	0,0062 (4)	(E1)	0,0327 (10)	4,55 (14)	0,975 (29)	0,0385 (12)
$\gamma_{14,11}$(Gd)	209,41 (13)	0,0058 (5)	(E1)	0,0342 (10)	4,86 (15)	1,050 (32)	0,0404 (12)
$\gamma_{7,5}$(Sm)	212,568 (15)	0,0229 (8)	E2	0,1244 (37)	36,4 (11)	8,25 (25)	0,171 (5)
$\gamma_{(-1,0)}$(Sm)	237,3 (1)	0,0026 (9)	(E1)	0,0231 (7)	3,18 (10)	0,681 (20)	0,0272 (8)
$\gamma_{19,13}$(Sm)	239,42 (17)	0,008 (3)	(E1)	0,0225 (7)	3,11 (9)	0,665 (20)	0,0265 (8)
$\gamma_{2,1}$(Sm)	244,6976 (8)	8,37 (5)	E2	0,0809 (24)	21,1 (6)	4,75 (14)	0,1080 (32)
$\gamma_{11,8}$(Sm)	251,633 (7)	0,0687 (15)	(E1)	0,0198 (6)	2,72 (8)	0,583 (17)	0,0233 (7)
$\gamma_{11,7}$(Sm)	269,86 (6)	0,006 (3)	(E2)	0,0602 (18)	14,60 (44)	3,27 (10)	0,0789 (24)
$\gamma_{2,1}$(Gd)	271,131 (8)	0,084 (3)	E2	0,0621 (19)	16,20 (49)	3,70 (11)	0,0831 (25)
$\gamma_{9,5}$(Sm)	275,449 (15)	0,0357 (19)	(M1)	0,0887 (27)	12,30 (37)	2,65 (8)	0,1044 (31)
$\gamma_{12,9}$(Sm)	285,98 (3)	0,0107 (7)	(E2)	0,0506 (15)	11,80 (35)	2,63 (8)	0,0657 (20)

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L (10^{-3})	α_M (10^{-3})	α_T
$\gamma_{13,10}$(Sm)	295,9390 (17)	0,449 (3)	E1	0,01310 (39)	1,78 (5)	0,381 (11)	0,01530 (46)
$\gamma_{4,2}$(Gd)	315,174 (17)	0,052 (2)	(E2)	0,0400 (12)	9,38 (28)	2,12 (6)	0,0521 (16)
$\gamma_{7,4}$(Sm)	316,2 (2)	0,0032 (10)	(E2)	0,0376 (11)	8,19 (25)	1,83 (5)	0,0481 (14)
$\gamma_{(-1,1)}$(Sm)	320,03 (15)	0,0017 (6)					
$\gamma_{11,6}$(Gd)	324,83 (3)	0,0785 (16)	M1+50%E2	0,0521 (16)	8,97 (27)	1,99 (6)	0,0636 (19)
$\gamma_{11,6}$(Sm)	329,425 (21)	0,131 (6)	(E1)	0,0100 (3)	1,360 (41)	0,290 (9)	0,01170 (35)
$\gamma_{12,8}$(Sm)	330,54 (10)	0,0061 (17)	(E1)	0,0099 (3)	1,34 (4)	0,288 (9)	0,01160 (35)
$\gamma_{4,2}$(Sm)	340,40 (14)	0,033 (3)	E2	0,0304 (9)	6,32 (19)	1,410 (42)	0,0385 (12)
$\gamma_{1,0}$(Gd)	344,2789 (12)	27,65 (13)	E2	0,0311 (9)	6,87 (21)	1,550 (46)	0,0399 (12)
$\gamma_{8,4}$(Gd)	351,66 (4)	0,0145 (24)	E2	0,0293 (9)	6,39 (19)	1,440 (43)	0,0375 (11)
$\gamma_{16,11}$(Sm)	357,26 (5)	0,0041 (5)	(E1)	0,00820 (25)	1,110 (33)	0,237 (7)	0,00960 (29)
$\gamma_{7,3}$(Gd)	367,7896 (20)	0,870 (5)	E1	0,00830 (25)	1,130 (34)	0,245 (7)	0,00970 (29)
$\gamma_{(-1,2)}$(Sm)	379,37 (6)	0,00083 (21)					
$\gamma_{18,12}$(Sm)	385,69 (20)	0,0052 (7)	(M1+50%E2)	0,0290 (9)	4,59 (14)	0,999 (30)	0,0348 (10)
$\gamma_{10,4}$(Gd)	387,90 (8)	0,00429 (45)	(M1+E2+E0)	0,38 (9)			0,45 (11)
$\gamma_{(-1,3)}$(Sm)	391,32 (14)	0,00125 (22)					
$\gamma_{(-1,4)}$(Sm)	406,74 (15)	0,00083 (21)					
$\gamma_{3,1}$(Gd)	411,1171 (12)	2,292 (11)	E2	0,0190 (6)	3,79 (11)	0,849 (25)	0,0239 (7)
$\gamma_{16,10}$(Sm)	416,049 (8)	0,1097 (17)	(E1)	0,00570 (17)	0,762 (23)	0,1630 (49)	0,0067 (2)
$\gamma_{10,5}$(Sm)	423,45 (4)	0,0033 (5)	(M1+50%E2)	0,0226 (7)	3,5 (1)	0,761 (23)	0,0271 (8)
$\gamma_{12,6}$(Gd)	440,86 (10)	0,0136 (11)	(E2)	0,01580 (47)	3,03 (9)	0,677 (20)	0,0197 (6)
$\gamma_{5,2}$(Sm)	443,966 (3)	0,325 (18)	(E2)	0,01450 (44)	2,63 (8)	0,579 (17)	0,0178 (5)
$\gamma_{13,9}$(Sm)	443,966 (3)	2,821 (22)	E1(+M2)	0,00520 (16)	0,635 (19)	0,1390 (42)	0,00600 (18)
$\gamma_{13,7}$(Gd)	482,31 (3)	0,0014 (6)	(E1)	0,00440 (13)	0,594 (18)	0,1280 (38)	0,00510 (15)
$\gamma_{11,5}$(Sm)	482,31 (3)	0,0285 (16)	(M1+50%E2)	0,01610 (48)	2,43 (7)	0,526 (16)	0,0192 (6)
$\gamma_{13,8}$(Sm)	488,680 (2)	0,4197 (24)	M1+E2	0,01150 (34)	1,96 (6)	0,429 (13)	0,01400 (42)
$\gamma_{14,9}$(Sm)	493,508 (20)	0,028 (3)	(E1)	0,00380 (11)	0,509 (15)	0,1090 (33)	0,00450 (14)
$\gamma_{6,2}$(Gd)	493,509 (20)	0,0093 (21)	(E2)	0,01180 (35)	2,14 (6)	0,476 (14)	0,01450 (44)
$\gamma_{13,6}$(Gd)	496,39 (3)	0,00461 (44)	M1+E2+E0	0,082 (9)			0,097 (11)
$\gamma_{17,10}$(Sm)	496,39 (3)	0,0049 (8)	(E1)	0,00380 (11)	0,502 (15)	0,1070 (32)	0,00440 (13)
$\gamma_{11,4}$(Gd)	503,475 (5)	0,1554 (18)	(E2)	0,01120 (34)	2,02 (6)	0,448 (13)	0,01380 (41)
$\gamma_{14,7}$(Gd)	520,228 (5)	0,0545 (12)	(M1+50%E2)	0,01520 (46)	2,30 (7)	0,504 (15)	0,0181 (5)
$\gamma_{18,10}$(Sm)	523,13 (5)	0,0114 (21)	(M1+50%E2)	0,01310 (39)	1,94 (6)	0,421 (13)	0,01560 (47)
$\gamma_{8,3}$(Gd)	526,882 (20)	0,0141 (7)	M1+E2+E0	0,084 (9)			0,094 (8)
$\gamma_{14,6}$(Gd)	534,246 (7)	0,0369 (19)	(E1)	0,0035 (1)	0,470 (14)	0,101 (3)	0,00410 (12)
$\gamma_{(-1,5)}$(Sm)	535,4 (4)	0,0060 (16)	(M1+50%E2)	0,01240 (37)	1,83 (5)	0,395 (12)	0,01470 (44)
$\gamma_{14,8}$(Sm)	538,29 (6)	0,0042 (6)	(M1+50%E2)	0,01220 (37)	1,80 (5)	0,389 (12)	0,01450 (44)
$\gamma_{14,7}$(Sm)	556,56 (3)	0,0178 (11)	(E1)	0,00290 (9)	0,387 (12)	0,0826 (25)	0,0034 (1)
$\gamma_{13,5}$(Gd)	557,91 (17)	0,0044 (7)	(E2)	0,00870 (26)	1,490 (45)	0,331 (10)	0,01060 (32)
$\gamma_{12,5}$(Sm)	561,2 (5)	0,00109 (21)	(E2)	0,00790 (24)	1,300 (39)	0,285 (9)	0,00960 (29)
$\gamma_{3,1}$(Sm)	562,93 (2)	0,038 (13)	E2	0,00780 (23)	1,290 (39)	0,282 (8)	0,00950 (28)
$\gamma_{16,9}$(Sm)	563,991 (7)	0,458 (14)	E1	0,00280 (8)	0,376 (11)	0,0802 (24)	0,0033 (1)
$\gamma_{13,6}$(Sm)	566,442 (5)	0,133 (4)	M1+35,4%E2	0,01170 (35)	1,66 (5)	0,357 (11)	0,01380 (41)
$\gamma_{15,8}$(Sm)	571,83 (8)	0,0048 (8)					
$\gamma_{4,1}$(Gd)	586,266 (3)	0,4732 (41)	E2+4%M1+E0	0,0202 (16)			0,0243 (9)
$\gamma_{(-1,6)}$(Sm)	595,61 (1)	0,0031 (17)					
$\gamma_{14,6}$(Sm)	616,05 (3)	0,0092 (6)	(E2)	0,00630 (19)	1,00 (3)	0,219 (7)	0,00760 (23)
$\gamma_{17,9}$(Sm)	644,37 (5)	0,0063 (6)	(E1)	0,00210 (6)	0,280 (8)	0,0598 (18)	0,00250 (8)
$\gamma_{7,2}$(Sm)	656,490 (5)	0,1519 (19)	E2+18%M1+E0	0,0497 (16)			0,0568 (20)
$\gamma_{12,4}$(Sm)	664,78 (5)	0,010 (3)	(E2)	0,00520 (16)	0,818 (25)	0,178 (5)	0,00630 (19)
$\gamma_{18,9}$(Sm)	671,157 (17)	0,0196 (13)	M1+1,9%E2	0,00900 (27)	1,220 (37)	0,260 (8)	0,01050 (32)
$\gamma_{13,4}$(Gd)	674,677 (7)	0,0172 (18)	E2+17%M1	0,00630 (19)	0,980 (29)	0,215 (6)	0,00760 (23)
$\gamma_{8,2}$(Sm)	674,677 (3)	0,170 (4)	E1	0,00190 (6)	0,254 (8)	0,0542 (16)	0,00230 (7)
$\gamma_{11,3}$(Gd)	678,625 (5)	0,473 (4)	E2+6%M1	0,00570 (17)	0,900 (27)	0,198 (6)	0,00690 (21)
$\gamma_{(-1,7)}$(Sm)	683,32 (11)	0,0031 (8)					
$\gamma_{16,6}$(Sm)	686,61 (5)	0,0201 (17)	(M1+50%E2)	0,0067 (2)	0,954 (29)	0,205 (6)	0,00790 (24)
$\gamma_{5,1}$(Sm)	688,672 (5)	0,877 (6)	E2+M1+E0	0,0359 (13)			0,0434 (13)
$\gamma_{(-1,8)}$(Sm)	696,87 (19)	0,0029 (10)					
$\gamma_{5,1}$(Gd)	703,25 (6)	0,0018 (9)	(E2)	0,00500 (15)	0,796 (24)	0,175 (5)	0,00600 (18)

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L (10^{-3})	α_M (10^{-3})	α_T
$\gamma_{10,2}$(Gd)	703,25 (6)	0,0035 (9)	(E2)	0,00500 (15)	0,796 (24)	0,175 (5)	0,00600 (18)
$\gamma_{14,4}$(Gd)	712,845 (6)	0,0963 (19)	(E1)	0,00190 (6)	0,251 (8)	0,0541 (16)	0,00220 (7)
$\gamma_{13,5}$(Sm)	719,351 (4)	0,059 (7)	(E1)	0,00170 (5)	0,222 (7)	0,0473 (14)	0,00200 (6)
$\gamma_{9,2}$(Sm)	719,351 (4)	0,270 (13)	(E2)	0,00440 (13)	0,666 (20)	0,1440 (43)	0,00520 (16)
$\gamma_{19,8}$(Sm)	727,99 (14)	0,0106 (13)	(E1)	0,00166 (5)	0,216 (6)	0,0461 (14)	0,00193 (6)
$\gamma_{(-1,9)}$(Sm)	735,4 (1)	0,0058 (10)					
$\gamma_{(-1,10)}$(Sm)	756,12 (9)	0,0054 (8)					
$\gamma_{6,1}$(Gd)	764,902 (9)	0,191 (4)	E2+6,5%M1	0,00440 (13)	0,669 (20)	0,1460 (44)	0,00520 (16)
$\gamma_{14,5}$(Sm)	768,946 (9)	0,089 (3)	(E1)	0,001500 (45)	0,193 (6)	0,0412 (12)	0,00170 (5)
$\gamma_{7,1}$(Gd)	778,9066 (24)	12,99 (6)	E1	0,001600 (48)	0,209 (6)	0,0450 (14)	0,00190 (6)
$\gamma_{12,3}$(Gd)	794,81 (3)	0,0265 (11)	M1(+13,8%E2)	0,0065 (2)	0,905 (27)	0,196 (6)	0,00770 (23)
$\gamma_{19,6}$(Sm)	805,70 (7)	0,0125 (8)	(E1)	0,001400 (42)	0,176 (5)	0,0374 (11)	0,001600 (48)
$\gamma_{5,0}$(Sm)	810,453 (5)	0,318 (3)	(E2)	0,0033 (1)	0,493 (15)	0,1070 (32)	0,00400 (12)
$\gamma_{16,5}$(Sm)	839,36 (4)	0,0161 (8)	(E1)	0,001200 (36)	0,1620 (49)	0,0345 (10)	0,001500 (45)
$\gamma_{6,1}$(Sm)	841,576 (5)	0,163 (2)	E1	0,001200 (36)	0,1610 (48)	0,0343 (10)	0,001500 (45)
$\gamma_{10,2}$(Sm)	867,383 (3)	4,258 (23)	E2+2%M1	0,00290 (9)	0,423 (13)	0,0913 (27)	0,0035 (1)
$\gamma_{(-1,11)}$(Sm)	896,58 (9)	0,0669 (21)					
$\gamma_{7,1}$(Sm)	901,184 (11)	0,084 (3)	E2	0,00260 (8)	0,382 (11)	0,0824 (25)	0,00310 (9)
$\gamma_{15,4}$(Sm)	906,01 (6)	0,016 (1)					
$\gamma_{8,1}$(Sm)	919,340 (4)	0,430 (4)	E1	0,00100 (3)	0,135 (4)	0,0288 (9)	0,001200 (36)
$\gamma_{11,2}$(Sm)	926,320 (15)	0,274 (4)	(E2)	0,00250 (8)	0,358 (11)	0,0772 (23)	0,00290 (9)
$\gamma_{4,0}$(Gd)	930,58 (15)	0,0731 (19)	(E2)	0,00270 (8)	0,400 (12)	0,0872 (26)	0,0032 (1)
$\gamma_{15,3}$(Gd)	937,053 (15)	0,0027 (6)	(M1+50%E2)	0,00370 (11)	0,516 (15)	0,1120 (34)	0,00430 (13)
$\gamma_{19,5}$(Sm)	958,63 (5)	0,0211 (19)	(M1+E2)	0,00310 (9)			0,00360 (11)
$\gamma_{6,0}$(Sm)	963,393 (12)	0,1342 (20)	E1	0,00100 (3)	0,1230 (37)	0,0263 (8)	0,001100 (33)
$\gamma_{9,1}$(Sm)	964,082 (18)	14,54 (7)	E2(+M1)	0,00230 (7)	0,327 (10)	0,0703 (21)	0,00270 (8)
$\gamma_{10,1}$(Gd)	974,09 (4)	0,0139 (8)	M1+50%E2+E0	0,0048 (5)			0,0056 (6)
$\gamma_{13,2}$(Gd)	990,19 (3)	0,0315 (13)	(E2)	0,00240 (7)	0,347 (10)	0,0755 (23)	0,00300 (9)
$\gamma_{(-1,12)}$(Sm)	1001,1 (3)	0,0046 (10)					
$\gamma_{12,2}$(Sm)	1005,276 (17)	0,667 (23)		0,00220 (7)	0,311 (9)	0,0669 (20)	0,00260 (8)
$\gamma_{(-1,15)}$(Sm)	1084 (1)	0,244 (8)					
$\gamma_{9,0}$(Sm)	1085,841 (10)	10,15 (6)	E2	0,00180 (5)	0,250 (8)	0,0536 (16)	0,00210 (6)
$\gamma_{11,1}$(Gd)	1089,741 (5)	1,735 (10)	(M1)+E2	0,00200 (6)			0,00230 (7)
$\gamma_{6,0}$(Gd)	1109,178 (12)	0,186 (4)	E2	0,00190 (6)	0,269 (8)	0,0584 (18)	0,00220 (7)
$\gamma_{10,1}$(Sm)	1112,080 (3)	13,44 (6)	E2(+1%M1)	0,00170 (5)	0,238 (7)	0,0511 (15)	0,00200 (6)
$\gamma_{(-1,13)}$(Sm)	1139 (1)	0,0013 (3)					
$\gamma_{11,1}$(Sm)	1170,93 (11)	0,0366 (13)	(M1+50%E2)	0,00200 (6)	0,265 (8)	0,0567 (17)	0,00230 (7)
$\gamma_{12,1}$(Gd)	1206,11 (15)	0,0138 (8)	(E2)	0,001600 (48)	0,225 (7)	0,0487 (15)	0,00190 (6)
$\gamma_{14,2}$(Sm)	1212,953 (11)	1,417 (9)	E1	0,000600 (18)	0,0802 (24)	0,0170 (5)	0,000700 (21)
$\gamma_{12,1}$(Sm)	1249,944 (13)	0,187 (3)	E2	0,001400 (42)	0,184 (6)	0,0395 (12)	0,001600 (48)
$\gamma_{13,1}$(Gd)	1261,349 (23)	0,0337 (11)	M1	0,00230 (7)	0,313 (9)	0,0676 (20)	0,00270 (8)
$\gamma_{11,0}$(Sm)	1292,784 (19)	0,104 (3)	(E2)	0,001300 (39)	0,172 (5)	0,0368 (11)	0,001500 (45)
$\gamma_{14,1}$(Gd)	1299,148 (8)	1,634 (9)	E1(+0,2%M2)	0,000600 (18)	0,0803 (24)	0,0172 (5)	0,000700 (21)
$\gamma_{9,0}$(Gd)	1314,7 (2)	0,0048 (6)	E1	0,000600 (18)	0,0773 (23)	0,0166 (5)	0,000700 (21)
$\gamma_{15,1}$(Gd)	1348,10 (7)	0,0175 (8)	E2+(0,6%M1)	0,001300 (39)	0,179 (5)	0,0387 (12)	0,001600 (48)
$\gamma_{17,2}$(Sm)	1363,77 (5)	0,0257 (8)	M1(+E2)	0,00170 (5)	0,222 (7)	0,0474 (14)	0,00200 (6)
$\gamma_{18,2}$(Sm)	1390,36 (16)	0,0048 (6)	(M1+50%E2)	0,001400 (42)	0,180 (5)	0,0385 (12)	0,001600 (48)
$\gamma_{13,1}$(Sm)	1408,013 (3)	20,86 (9)	E1(+M2)	0,000500 (15)	0,0615 (18)	0,01310 (39)	0,000600 (18)
$\gamma_{14,1}$(Sm)	1457,651 (11)	0,498 (4)	E1	0,000500 (15)	0,0580 (17)	0,01230 (37)	0,000500 (15)
$\gamma_{16,1}$(Sm)	1528,111 (18)	0,281 (5)	E1	0,000400 (12)			0,000500 (15)
$\gamma_{13,0}$(Gd)	1605,61 (7)	0,0081 (4)	(E2)	0,000900 (27)			0,000900 (27)
$\gamma_{17,1}$(Sm)	1608,36 (8)	0,0053 (3)	(E1)	0,000400 (12)			0,000400 (12)
$\gamma_{18,1}$(Sm)	1635,2 (5)	0,00015 (5)	(M1+50%E2)	0,00100 (3)			0,00100 (3)
$\gamma_{14,0}$(Gd)	1643,6 (1)	0,0015 (4)	(M2)	0,00280 (8)			0,0032 (1)
$\gamma_{19,1}$(Sm)	1647,41 (14)	0,0064 (4)	(E2)	0,000800 (24)			0,000800 (24)
$\gamma_{(-1,14)}$(Sm)	1674,30 (6)	0,0060 (8)					
$\gamma_{19,0}$(Sm)	1769,09 (5)	0,0092 (3)	(E2)	0,000700 (21)			0,000700 (21)

3 Atomic Data

3.1 Sm

ω_K	:	0,926	(4)
$\bar{\omega}_L$	:	0,158	(6)
n_{KL}	:	0,857	(4)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	39,5229		55,25
	$K\alpha_1$	40,1186		100
	$K\beta_3$	45,289	}	
	$K\beta_1$	45,413	}	
	$K\beta_5''$	45,731	}	31,23
	$K\beta_2$	46,575	}	
	$K\beta_4$	46,705	}	8,06
	$KO_{2,3}$	46,813	}	
X_L				
	$L\alpha$	5,61 – 5,64		
	$L\gamma$	– 7,18		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	31,190 – 33,218	100
KLX	37,302 – 40,097	50,7
KXY	43,39 – 46,79	6,42
Auger L	0,08 – 7,69	1815

3.2 Gd

ω_K	:	0,932	(4)
$\bar{\omega}_L$	:	0,176	(6)
n_{KL}	:	0,850	(4)

3.2.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	42,3093		55,59
	$K\alpha_1$	42,9967		100
	$K\beta_3$	48,556	}	
	$K\beta_1$	48,697	}	
	$K\beta_5''$	49,053	}	31,6
	$K\beta_2$	49,961	}	
	$K\beta_4$	50,099	}	8,31
	$KO_{2,3}$	50,219	}	
X_L				
	$L\alpha$	6,025 – 6,057		
	$L\gamma$	– 7,78		

3.2.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	33,310 – 35,562	100
KLX	39,907 – 42,976	51,3
KXY	46,48 – 50,20	6,58
Auger L	0,07 – 8,33	

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Sm)	0,08 - 7,69		67,7 (7)
e_{AK}	(Sm)			5,9 (4)
	KLL	31,190 - 33,218	}	
	KLX	37,302 - 40,097	}	
	KXY	43,39 - 46,79	}	
e_{AL}	(Gd)	0,07 - 8,33		0,800 (14)
e_{AK}	(Gd)			0,062 (4)
	KLL	33,310 - 35,562	}	
	KLX	39,907 - 42,976	}	
	KXY	46,48 - 50,20	}	
$ec_{1,0\ K}$	(Sm)	74,9475 (20)		19,2 (6)
$ec_{1,0\ L}$	(Sm)	114,045 - 115,066		10,7 (3)
$ec_{1,0\ M}$	(Sm)	120,059 - 120,702		2,48 (7)
$ec_{1,0\ N}$	(Sm)	121,436 - 121,776		0,57 (2)
$ec_{2,1\ K}$	(Sm)	197,8632 (20)		0,611 (19)
$ec_{2,1\ L}$	(Sm)	236,961 - 237,981		0,159 (5)
$ec_{1,0\ K}$	(Gd)	294,0394 (20)		0,86 (3)
$ec_{1,0\ L}$	(Gd)	335,903 - 337,036		0,190 (6)
$\beta^+_{0,1}$	max:	730,5 (7)		0,025 (15)
$\beta^+_{0,1}$	avg:	338,1 (3)		
$\beta^+_{0,2}$	max:	485,8 (7)		0,0024 (2)
$\beta^+_{0,2}$	avg:	230,7 (3)		
$\beta^-_{0,15}$	max:	126,4 (11)		0,0203 (11)
$\beta^-_{0,15}$	avg:	33,4 (3)		
$\beta^-_{0,14}$	max:	175,4 (11)		1,826 (21)
$\beta^-_{0,14}$	avg:	47,4 (4)		
$\beta^-_{0,13}$	max:	213,5 (11)		0,101 (3)
$\beta^-_{0,13}$	avg:	58,6 (4)		
$\beta^-_{0,12}$	max:	268,6 (11)		0,0536 (18)
$\beta^-_{0,12}$	avg:	75,2 (4)		
$\beta^-_{0,11}$	max:	384,8 (11)		2,44 (3)
$\beta^-_{0,11}$	avg:	112,3 (4)		
$\beta^-_{0,10}$	max:	500,3 (11)		0,0267 (17)
$\beta^-_{0,10}$	avg:	151,4 (4)		
$\beta^-_{0,9}$	max:	504,1 (11)		0,0048 (7)
$\beta^-_{0,9}$	avg:	152,7 (4)		
$\beta^-_{0,8}$	max:	536,5 (11)		0,037 (8)
$\beta^-_{0,8}$	avg:	164,1 (4)		

		Energy keV		Electrons per 100 disint.
$\beta^-_{0,7}$	max:	695,6	(11)	13,80 (15)
$\beta^-_{0,7}$	avg:	221,7	(4)	
$\beta^-_{0,6}$	max:	709,7	(11)	0,245 (8)
$\beta^-_{0,6}$	avg:	226,9	(5)	
$\beta^-_{0,4}$	max:	888,2	(11)	0,303 (7)
$\beta^-_{0,4}$	avg:	295,1	(5)	
$\beta^-_{0,3}$	max:	1063,4	(11)	0,904 (14)
$\beta^-_{0,3}$	avg:	364,6	(5)	
$\beta^-_{0,1}$	max:	1474,5	(11)	8,17 (11)
$\beta^-_{0,1}$	avg:	535,4	(5)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Sm)	5,61 — 7,18		13,0 (4)	
XKα_2	(Sm)	39,5229		20,8 (3)	} Kα
XKα_1	(Sm)	40,1186		37,7 (5)	}
XKβ_3	(Sm)	45,289	}		
XKβ_1	(Sm)	45,413	}	11,78 (19)	K$'\beta_1$
XKβ_5''	(Sm)	45,731	}		
XKβ_2	(Sm)	46,575	}		
XKβ_4	(Sm)	46,705	}	3,04 (8)	K$'\beta_2$
XKO$_{2,3}$	(Sm)	46,813	}		
XL	(Gd)	6,025 — 7,78		0,177 (5)	
XKα_2	(Gd)	42,3093		0,243 (7)	} Kα
XKα_1	(Gd)	42,9967		0,437 (12)	}
XKβ_3	(Gd)	48,556	}		
XKβ_1	(Gd)	48,697	}	0,138 (4)	K$'\beta_1$
XKβ_5''	(Gd)	49,053	}		
XKβ_2	(Gd)	49,961	}		
XKβ_4	(Gd)	50,099	}	0,0363 (13)	K$'\beta_2$
XKO$_{2,3}$	(Gd)	50,219	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Sm)	121,7817 (3)	28,41 (13)
$\gamma_{5,3}$(Sm)	125,69 (13)	0,019 (6)
$\gamma_{10,9}$(Sm)	148,010 (17)	0,035 (5)
$\gamma_{7,4}$(Gd)	192,6 (4)	0,0068 (2)
$\gamma_{14,12}$(Sm)	207,6 (3)	0,0059 (4)
$\gamma_{14,11}$(Gd)	209,41 (13)	0,0055 (5)
$\gamma_{7,5}$(Sm)	212,568 (15)	0,0196 (6)
$\gamma_{(-1,0)}$(Sm)	237,31 (5)	0,0025 (8)
$\gamma_{19,13}$(Sm)	239,42 (17)	0,008 (3)
$\gamma_{2,1}$(Sm)	244,6974 (8)	7,55 (4)
$\gamma_{11,8}$(Sm)	251,633 (10)	0,0671 (15)
$\gamma_{11,7}$(Sm)	269,86 (6)	0,0060 (24)
$\gamma_{2,1}$(Gd)	271,131 (8)	0,078 (3)
$\gamma_{9,5}$(Sm)	275,449 (15)	0,0323 (17)
$\gamma_{12,9}$(Sm)	285,98 (3)	0,0100 (6)
$\gamma_{13,10}$(Sm)	295,9387 (17)	0,442 (3)
$\gamma_{4,2}$(Gd)	315,174 (17)	0,0496 (17)
$\gamma_{7,4}$(Sm)	316,2 (2)	0,0031 (10)
$\gamma_{(-1,1)}$(Sm)	320,03 (15)	0,0017 (6)
$\gamma_{11,6}$(Gd)	324,83 (3)	0,0738 (15)
$\gamma_{11,6}$(Sm)	329,425 (21)	0,129 (6)
$\gamma_{12,8}$(Sm)	330,54 (10)	0,0060 (17)
$\gamma_{4,2}$(Sm)	340,40 (14)	0,031 (3)
$\gamma_{1,0}$(Gd)	344,2785 (12)	26,59 (12)
$\gamma_{8,4}$(Gd)	351,66 (4)	0,0140 (22)
$\gamma_{16,11}$(Sm)	357,26 (5)	0,0040 (5)
$\gamma_{7,3}$(Gd)	367,7891 (20)	0,862 (5)
$\gamma_{(-1,2)}$(Sm)	379,37 (6)	0,00083 (21)
$\gamma_{18,12}$(Sm)	385,69 (20)	0,0050 (6)
$\gamma_{10,4}$(Gd)	387,90 (8)	0,00296 (21)
$\gamma_{(-1,3)}$(Sm)	391,32 (14)	0,00125 (21)
$\gamma_{(-1,4)}$(Sm)	406,74 (15)	0,00083 (21)
$\gamma_{3,1}$(Gd)	411,1165 (12)	2,238 (10)
$\gamma_{16,10}$(Sm)	416,048 (8)	0,1090 (17)
$\gamma_{10,5}$(Sm)	423,45 (4)	0,0032 (5)
$\gamma_{12,6}$(Gd)	440,86 (10)	0,0133 (10)
$\gamma_{5,2}$(Sm)	443,965 (3)	0,32 (2)
$\gamma_{13,9}$(Sm)	443,965 (3)	2,80 (2)
$\gamma_{13,7}$(Gd)	482,31 (3)	0,00139 (6)
$\gamma_{11,5}$(Sm)	482,31 (3)	0,0279 (16)
$\gamma_{13,8}$(Sm)	488,6792 (20)	0,4139 (24)
$\gamma_{6,2}$(Gd)	493,508 (20)	0,009 (2)
$\gamma_{14,9}$(Sm)	493,508 (20)	0,0278 (30)
$\gamma_{13,6}$(Gd)	496,39 (3)	0,0042 (4)
$\gamma_{17,10}$(Sm)	496,39 (3)	0,0049 (5)

	Energy keV	Photons per 100 disint.
$\gamma_{11,4}$(Gd)	503,474 (5)	0,1533 (18)
$\gamma^{\pm}$	511	0,054 (30)
$\gamma_{14,7}$(Gd)	520,227 (5)	0,0536 (13)
$\gamma_{18,10}$(Sm)	523,13 (5)	0,0113 (21)
$\gamma_{8,3}$(Gd)	526,881 (20)	0,0129 (6)
$\gamma_{14,6}$(Gd)	534,245 (7)	0,0368 (19)
$\gamma_{(-1,5)}$(Sm)	535,4 (4)	0,0060 (16)
$\gamma_{14,8}$(Sm)	538,29 (6)	0,0042 (6)
$\gamma_{14,7}$(Sm)	556,56 (3)	0,0177 (11)
$\gamma_{13,5}$(Gd)	557,91 (17)	0,0044 (7)
$\gamma_{12,5}$(Sm)	561,2 (5)	0,00108 (21)
$\gamma_{3,1}$(Sm)	562,93 (2)	0,038 (13)
$\gamma_{16,9}$(Sm)	563,990 (7)	0,457 (13)
$\gamma_{13,6}$(Sm)	566,442 (5)	0,131 (4)
$\gamma_{15,8}$(Sm)	571,83 (8)	0,0048 (8)
$\gamma_{4,1}$(Gd)	586,265 (3)	0,462 (4)
$\gamma_{(-1,6)}$(Sm)	595,61 (1)	0,0031 (17)
$\gamma_{14,6}$(Sm)	616,05 (3)	0,0092 (6)
$\gamma_{17,9}$(Sm)	644,37 (5)	0,0063 (6)
$\gamma_{7,2}$(Sm)	656,489 (5)	0,1437 (18)
$\gamma_{12,4}$(Sm)	664,78 (5)	0,010 (3)
$\gamma_{18,9}$(Sm)	671,155 (17)	0,0194 (13)
$\gamma_{8,2}$(Sm)	674,675 (3)	0,170 (4)
$\gamma_{13,4}$(Gd)	674,677 (3)	0,0171 (18)
$\gamma_{11,3}$(Gd)	678,623 (5)	0,470 (4)
$\gamma_{(-1,7)}$(Sm)	683,32 (11)	0,0031 (8)
$\gamma_{16,6}$(Sm)	686,61 (5)	0,0200 (17)
$\gamma_{5,1}$(Sm)	688,670 (5)	0,841 (6)
$\gamma_{(-1,8)}$(Sm)	696,87 (19)	0,0029 (10)
$\gamma_{10,2}$(Gd)	703,25 (6)	0,0035 (9)
$\gamma_{5,1}$(Gd)	703,25 (6)	0,0018 (9)
$\gamma_{14,4}$(Gd)	712,843 (6)	0,0961 (19)
$\gamma_{13,5}$(Sm)	719,349 (4)	0,059 (7)
$\gamma_{9,2}$(Sm)	719,349 (4)	0,268 (13)
$\gamma_{19,8}$(Sm)	727,99 (14)	0,0106 (13)
$\gamma_{(-1,9)}$(Sm)	735,4 (1)	0,0058 (10)
$\gamma_{(-1,10)}$(Sm)	756,12 (9)	0,0054 (8)
$\gamma_{6,1}$(Gd)	764,900 (9)	0,190 (4)
$\gamma_{14,5}$(Sm)	768,944 (9)	0,088 (3)
$\gamma_{7,1}$(Gd)	778,9045 (24)	12,97 (6)
$\gamma_{12,3}$(Gd)	794,81 (3)	0,0263 (10)
$\gamma_{19,6}$(Sm)	805,70 (7)	0,0125 (8)
$\gamma_{5,0}$(Sm)	810,451 (5)	0,317 (3)
$\gamma_{16,5}$(Sm)	839,36 (4)	0,0160 (8)
$\gamma_{6,1}$(Sm)	841,574 (5)	0,163 (2)
$\gamma_{10,2}$(Sm)	867,380 (3)	4,243 (23)
$\gamma_{(-1,11)}$(Sm)	896,58 (9)	0,0669 (21)

	Energy keV	Photons per 100 disint.
$\gamma_{7,1}$(Sm)	901,181 (11)	0,084 (3)
$\gamma_{15,4}$(Sm)	906,01 (6)	0,016 (1)
$\gamma_{8,1}$(Sm)	919,337 (4)	0,429 (5)
$\gamma_{11,2}$(Sm)	926,317 (15)	0,273 (4)
$\gamma_{4,0}$(Gd)	930,58 (15)	0,0729 (19)
$\gamma_{15,3}$(Gd)	937,050 (15)	0,0027 (6)
$\gamma_{19,5}$(Sm)	958,63 (5)	0,0210 (19)
$\gamma_{6,0}$(Sm)	963,390 (12)	0,1341 (20)
$\gamma_{9,1}$(Sm)	964,079 (18)	14,50 (6)
$\gamma_{10,1}$(Gd)	974,09 (4)	0,0138 (8)
$\gamma_{13,2}$(Gd)	990,19 (3)	0,0315 (13)
$\gamma_{(-1,12)}$(Sm)	1001,1 (3)	0,0046 (10)
$\gamma_{12,2}$(Sm)	1005,272 (17)	0,665 (23)
$\gamma_{(-1,15)}$(Sm)	1084 (1)	0,244 (8)
$\gamma_{9,0}$(Sm)	1085,837 (10)	10,13 (6)
$\gamma_{11,1}$(Gd)	1089,737 (5)	1,73 (1)
$\gamma_{6,0}$(Gd)	1109,174 (12)	0,186 (4)
$\gamma_{10,1}$(Sm)	1112,076 (3)	13,41 (6)
$\gamma_{(-1,13)}$(Sm)	1139 (1)	0,0013 (3)
$\gamma_{11,1}$(Sm)	1170,93 (11)	0,0365 (13)
$\gamma_{12,1}$(Gd)	1206,11 (15)	0,0135 (8)
$\gamma_{14,2}$(Sm)	1212,948 (11)	1,416 (9)
$\gamma_{12,1}$(Sm)	1249,938 (13)	0,186 (3)
$\gamma_{13,1}$(Gd)	1261,343 (23)	0,0336 (11)
$\gamma_{11,0}$(Sm)	1292,778 (19)	0,104 (3)
$\gamma_{14,1}$(Gd)	1299,142 (8)	1,633 (9)
$\gamma_{9,0}$(Gd)	1314,7 (2)	0,0048 (6)
$\gamma_{15,1}$(Gd)	1348,10 (7)	0,0175 (8)
$\gamma_{17,2}$(Sm)	1363,77 (5)	0,0256 (8)
$\gamma_{18,2}$(Sm)	1390,36 (16)	0,0048 (6)
$\gamma_{13,1}$(Sm)	1408,013 (3)	20,85 (8)
$\gamma_{14,1}$(Sm)	1457,643 (11)	0,498 (4)
$\gamma_{16,1}$(Sm)	1528,103 (18)	0,281 (5)
$\gamma_{13,0}$(Gd)	1605,61 (7)	0,0081 (4)
$\gamma_{17,1}$(Sm)	1608,36 (8)	0,0053 (3)
$\gamma_{18,1}$(Sm)	1635,2 (5)	0,00015 (5)
$\gamma_{14,0}$(Gd)	1643,6 (1)	0,0015 (4)
$\gamma_{19,1}$(Sm)	1647,41 (14)	0,0064 (4)
$\gamma_{(-1,14)}$(Sm)	1674,30 (6)	0,0060 (8)
$\gamma_{19,0}$(Sm)	1769,09 (5)	0,0092 (3)

6 Main Production Modes

Eu – 151(n,γ)Eu – 152

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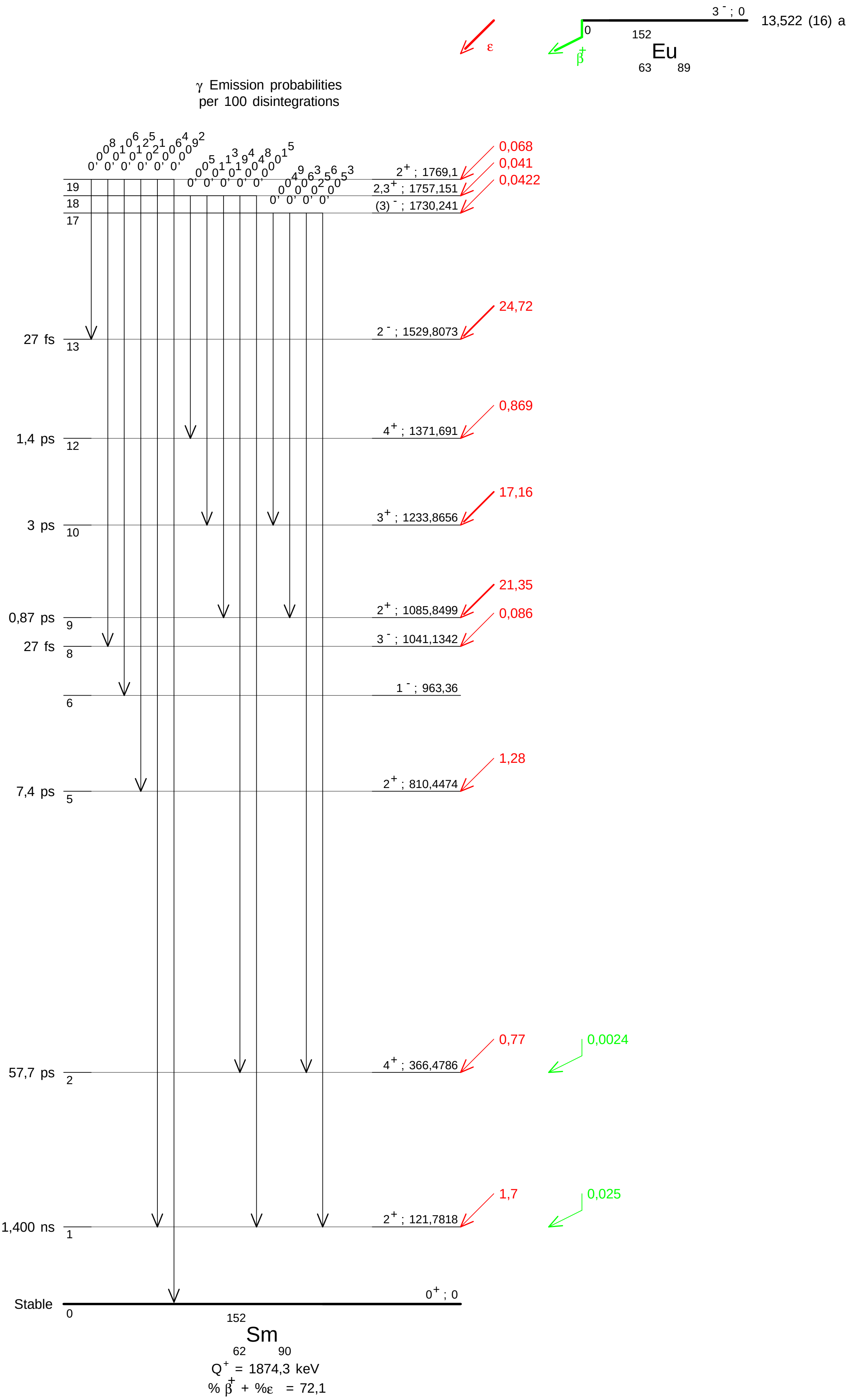

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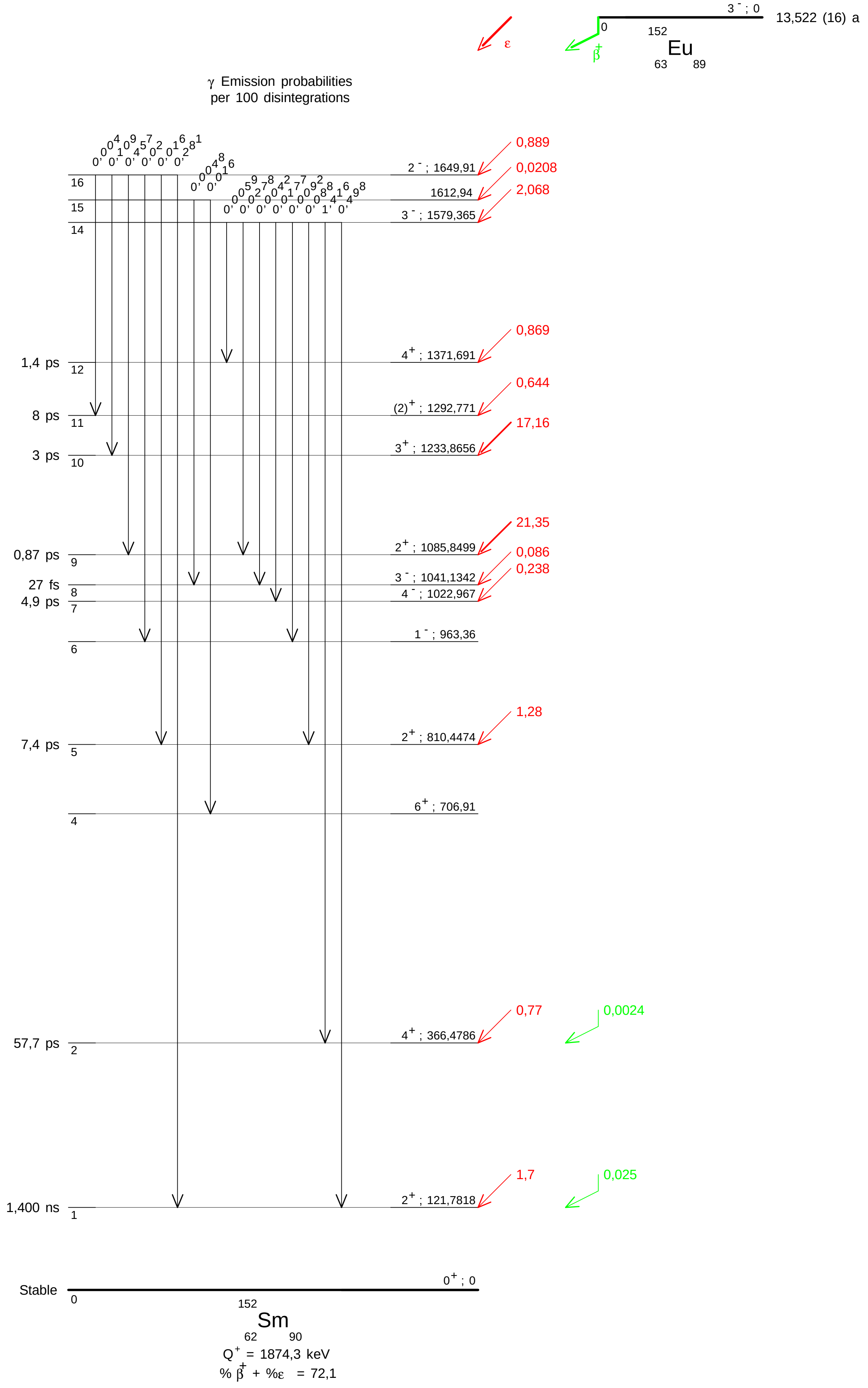

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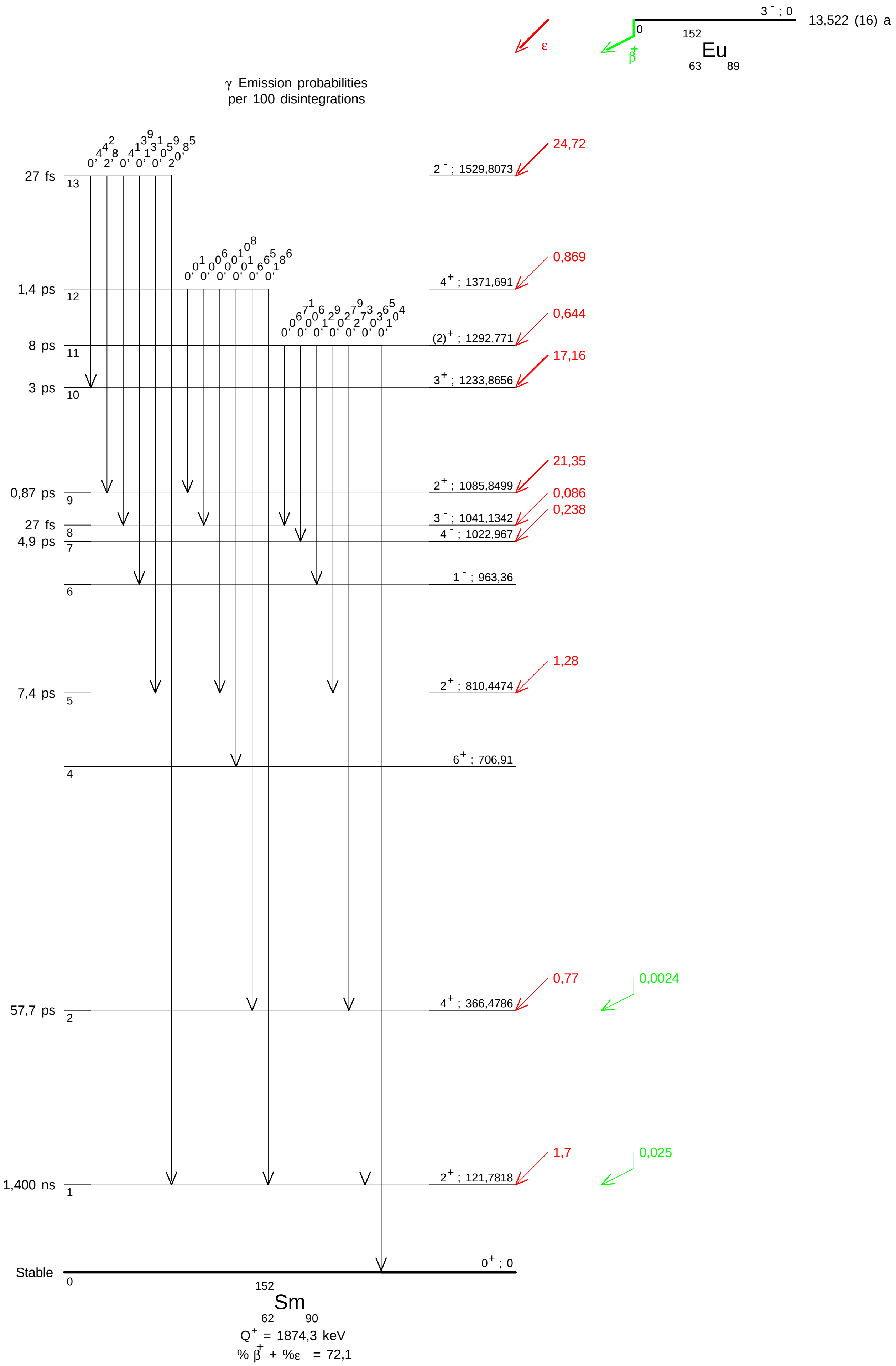
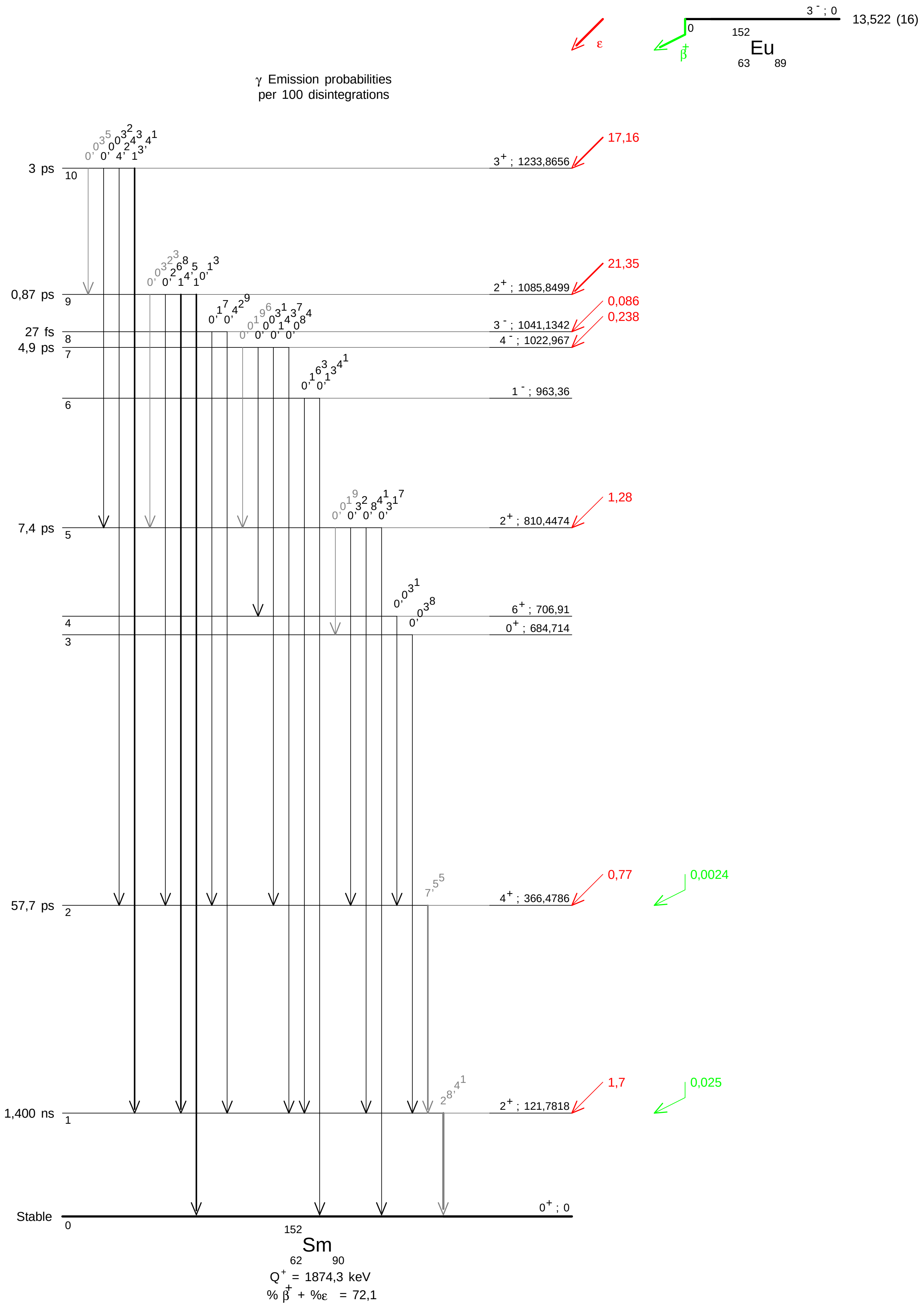

3 - ; 0
13,522 (16) a
152
Eu
63 89
ε
β+
γ Emission probabilities
per 100 disintegrations
27 fs 13
2 - ; 1529,8073
24,72
1,4 ps 12
4+ ; 1371,691
0,869
8 ps 11
(2)+ ; 1292,771
0,644
3 ps 10
3+ ; 1233,8656
17,16
0,87 ps 9
2+ ; 1085,8499
21,35
27 fs 8
3 - ; 1041,1342
0,086
4,9 ps 7
4 - ; 1022,967
0,238
6
1 - ; 963,36
7,4 ps 5
2+ ; 810,4474
1,28
4
6+ ; 706,91
57,7 ps 2
4+ ; 366,4786
0,77
0,0024
1,400 ns 1
2+ ; 121,7818
1,7
0,025
Stable 0
0+ ; 0
152
Sm
62 90
Q+ = 1874,3 keV
% β+ + %ε = 72,1



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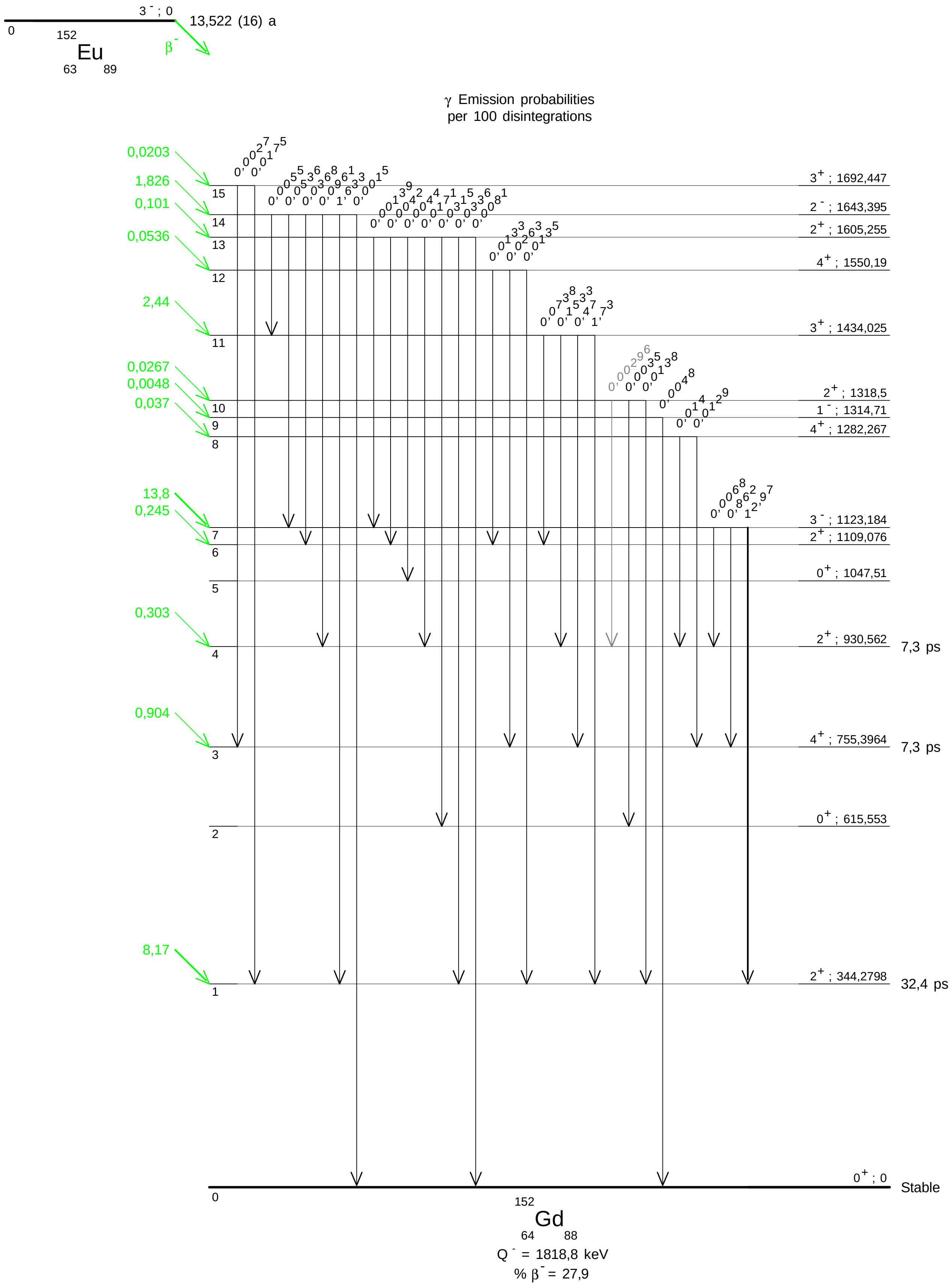
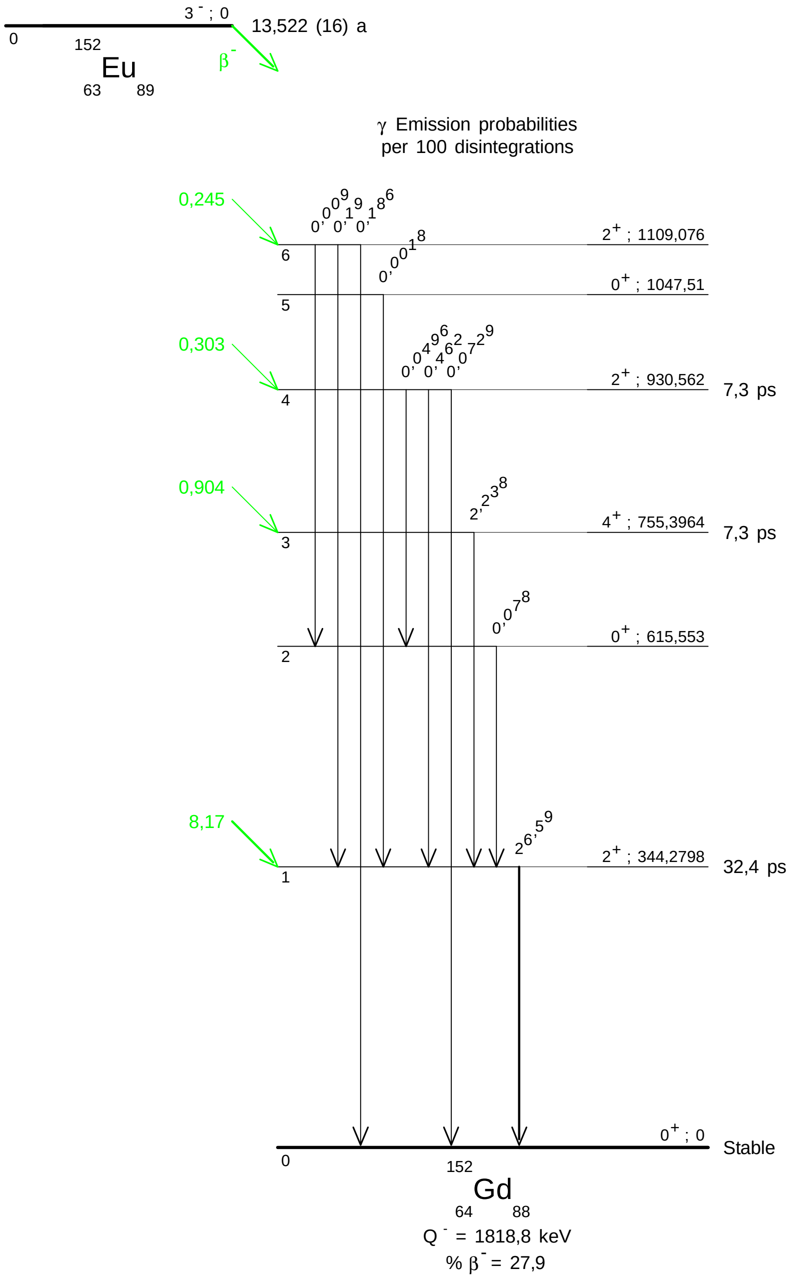
R.M. de Castro, E. Browne


3 - ; 0
13,522 (16) a
152 Eu 63 89
β -
γ Emission probabilities
per 100 disintegrations
3+ ; 1692,447
2 - ; 1643,395
2+ ; 1605,255
4+ ; 1550,19
3+ ; 1434,025
2+ ; 1318,5
1 - ; 1314,71
4+ ; 1282,267
3 - ; 1123,184
2+ ; 1109,076
0+ ; 1047,51
2+ ; 930,562
7,3 ps
4+ ; 755,3964
7,3 ps
0+ ; 615,553
2+ ; 344,2798
32,4 ps
0+ ; 0
Stable
0,0203
1,826
0,101
0,0536
2,44
0,0267
0,0048
0,037
13,8
0,245
0,303
0,904
8,17
152 Gd 64 88
Q - = 1818,8 keV
% β - = 27,9


3⁻ ; 0
13,522 (16) a
0
152
Eu
63 89
β⁻
γ Emission probabilities
per 100 disintegrations
0,245
0,303
0,904
8,17
2⁺ ; 1109,076
0⁺ ; 1047,51
2⁺ ; 930,562
7,3 ps
4⁺ ; 755,3964
7,3 ps
0⁺ ; 615,553
2⁺ ; 344,2798
32,4 ps
0⁺ ; 0
Stable
6
5
4
3
2
1
0
152
Gd
64 88
Q⁻ = 1818,8 keV
% β⁻ = 27,9

$^{153}_{64}$Gd $_{89}$

1 Decay Scheme

Gd-153 disintegrates by 100% electron capture to levels in Eu-153.
Le gadolinium 153 se désintègre à 100% par capture électronique vers des niveaux exités de l'europium 153.

2 Nuclear Data

$T_{1/2}$(^{153}Gd)	:	240,4	(10)	d
Q^{+}(^{153}Gd)	:	484,4	(11)	keV

2.1 Electron Capture Transitions

	Energy keV	Probability × 100	Nature	lg ft	P_K	P_L	P_M
$\epsilon_{0,4}$	311,5 (11)	15,9 (6)	1st forbidden	7,9	0,8019 (19)	0,1519 (4)	0,0359 (9)
$\epsilon_{0,3}$	381,2 (11)	42,4 (18)	1st forbidden	7,7	0,8111 (18)	0,1452 (16)	0,0341 (8)
$\epsilon_{0,2}$	387,0 (11)	38,0 (11)	Allowed	7,7	0,8116 (18)	0,1448 (16)	0,034 (8)
$\epsilon_{0,1}$	401,0 (11)	0,08 (7)	1st forbidden				
$\epsilon_{0,0}$	484,4 (11)	4 (3)	1st forbidden	8,9	0,8192 (17)	0,1392 (15)	0,0324 (8)

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{2,1}$(Eu)	14,06383 (20)	0,244 (61)	E1		8,70 (26)	1,92 (6)	11,2 (3)
$\gamma_{3,1}$(Eu)	19,81296 (19)	0,39 (1)	E2		2523 (76)	579 (17)	3290 (99)
$\gamma_{4,3}$(Eu)	69,67302 (13)	2,42 (7)	M1+1,8%E2	4,48 (14)	0,730 (23)	0,204 (6)	5,41 (16)
$\gamma_{4,2}$(Eu)	75,42215 (21)	0,138 (3)	E1+0,3%M2	0,63 (5)	0,113 (15)	0,032 (4)	0,77 (7)
$\gamma_{1,0}$(Eu)	83,36719 (17)	0,950 (7)	M1+65,6%E2	2,37 (7)	1,13 (5)	0,329 (12)	3,82 (12)
$\gamma_{4,1}$(Eu)	89,48598 (21)	0,252 (5)	M1+6,2%E2	2,15 (6)	0,39 (7)	0,110 (17)	2,65 (6)
$\gamma_{2,0}$(Eu)	97,43103 (17)	37,9 (8)	E1	0,258 (8)	0,0384 (12)	0,0105 (3)	0,307 (9)
$\gamma_{3,0}$(Eu)	103,18016 (13)	57,4 (6)	M1+1,4%E2	1,45 (5)	0,216 (7)	0,0603 (18)	1,72 (5)
$\gamma_{4,0}$(Eu)	172,85317 (13)	0,050 (2)	M1+65,6%E2	0,300 (5)	0,064 (2)	0,0184	0,382 (6)

3 Atomic Data

3.1 Eu

ω_K	:	0,929	(4)
$\bar{\omega}_L$	:	0,168	(7)
n_{KL}	:	0,853	(4)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	40,9024		55,42
	$K\alpha_1$	41,5427		100
	$K\beta_3$	46,9004	}	
	$K\beta_1$	47,0384	}	
	$K\beta_5''$	47,373	}	31,5
	$K\beta_2$	48,2566	}	
	$K\beta_4$	48,386	}	8,1
	$KO_{2,3}$	48,4979	}	
X_L				
	$L\alpha$	5,85 –		
	$L\gamma$	– 8,03		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	32,25 – 34,38	100
KLX	38,59 – 41,27	51
KXY	44,9 – 48,2	6,5
Auger L	3,4 – 7,8	18,9

4 Electron Emissions

		Energy keV	Electrons per 100 disint.
e_{AL}	(Eu)	3,4 - 7,8	111,5 (25)
e_{AK}	(Eu)		9,3 (6)
	KLL	32,25 - 34,38	}
	KLX	38,59 - 41,27	}
	KXY	44,9 - 48,2	}
$ec_{2,1\ L}$	(Eu)	6,012 - 7,097	0,174 (24)
$ec_{3,1\ L}$	(Eu)	11,761 - 12,836	0,30 (8)
$ec_{4,3\ K}$	(Eu)	21,1540 (5)	10,8 (5)
$ec_{1,0\ K}$	(Eu)	34,8482 (5)	0,47 (2)
$ec_{2,0\ K}$	(Eu)	48,9120 (5)	7,5 (3)
$ec_{3,0\ K}$	(Eu)	54,6611 (5)	30,6 (11)
$ec_{4,3\ L}$	(Eu)	61,621 - 62,896	1,77 (8)
$ec_{4,3\ M}$	(Eu)	67,873 - 68,742	0,49 (2)
$ec_{1,0\ L}$	(Eu)	75,315 - 76,390	0,22 (2)
$ec_{2,0\ L}$	(Eu)	89,379 - 90,454	1,10 (5)
$ec_{3,0\ L}$	(Eu)	95,128 - 96,203	4,6 (2)
$ec_{2,0\ M}$	(Eu)	95,631 - 96,300	0,30 (1)
$ec_{3,0\ M}$	(Eu)	101,38 - 102,10	1,30 (5)

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Eu)	5,85 — 8,03		22,5 (11)	
$XK\alpha_2$	(Eu)	40,9024		34,5 (9)	} $K\alpha$
$XK\alpha_1$	(Eu)	41,5427		62,2 (15)	}
$XK\beta_3$	(Eu)	46,9004	}		
$XK\beta_1$	(Eu)	47,0384	}	19,6 (6)	$K'\beta_1$
$XK\beta_5''$	(Eu)	47,373	}		
$XK\beta_2$	(Eu)	48,2566	}		
$XK\beta_4$	(Eu)	48,386	}	5,05 (17)	$K'\beta_2$
$XKO_{2,3}$	(Eu)	48,4979	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{2,1}$(Eu)	14,06383 (20)	0,020 (5)
$\gamma_{3,1}$(Eu)	19,81296 (19)	0,00012
$\gamma_{4,3}$(Eu)	69,67302 (13)	2,42 (7)
$\gamma_{4,2}$(Eu)	75,42213 (23)	0,078 (3)
$\gamma_{1,0}$(Eu)	83,36717 (21)	0,197 (7)
$\gamma_{4,1}$(Eu)	89,48595 (22)	0,069 (5)
$\gamma_{2,0}$(Eu)	97,43100 (21)	29,0 (8)
$\gamma_{3,0}$(Eu)	103,18012 (17)	21,1 (6)
$\gamma_{4,0}$(Eu)	172,85307 (21)	0,036 (2)

6 Main Production Modes

Gd – 152(n,γ)Gd – 153
Eu – 153(d,2n)Gd – 153

7 References

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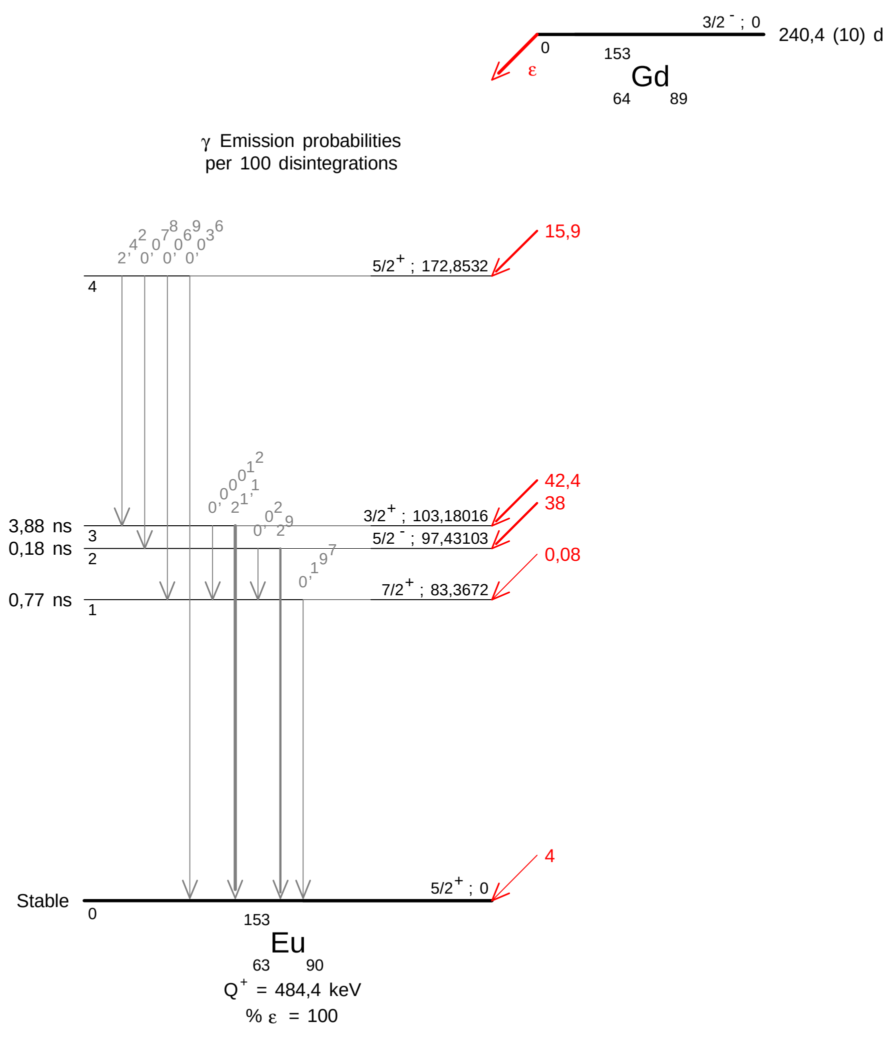

3/2 - ; 0
240,4 (10) d
0
ε
153
Gd
64
89
γ Emission probabilities
per 100 disintegrations
5/2+ ; 172,8532
15,9
4
3/2+ ; 103,18016
42,4
38
3,88 ns
3
5/2 - ; 97,43103
0,18 ns
2
0,08
7/2+ ; 83,3672
0,77 ns
1
Stable
0
5/2+ ; 0
4
153
Eu
63
90
Q+ = 484,4 keV
% ε = 100

$^{153}_{62}$Sm $_{91}$

1 Decay Scheme

Sm-153 disintegrates via 3 main branches and at least 10 others very weak branches by 100% beta-emission to levels in Eu-153.
Le samarium 153 se désintègre vers 3 branches principales et vers au moins 10 autres branches plus faibles de l'europium 153 par émission bêta moins.

2 Nuclear Data

$T_{1/2}$(^{153}Sm)	:	1,92849	(11)	d
Q^-(^{153}Sm)	:	808,2	(8)	keV

2.1 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,18}$	44,4 (8)	0,000025 (25)		8,9
$\beta^-_{0,17}$	47,8 (8)	0,00063 (7)		7,9
$\beta^-_{0,16}$	89,5 (8)	0,00134 (15)	Allowed	8,4
$\beta^-_{0,15}$	95,1 (8)	0,0135 (8)		7,4
$\beta^-_{0,14}$	101,6 (8)	0,0237 (8)	Allowed	7,3
$\beta^-_{0,13}$	106,7 (8)	0,00076 (15)		8,8
$\beta^-_{0,12}$	114,0 (8)	0,0242 (10)	Allowed	7,4
$\beta^-_{0,11}$	126,3 (8)	0,0102 (4)	1st forbidden	7,9
$\beta^-_{0,10}$	150,5 (8)	0,0005 (5)		9,3
$\beta^-_{0,9}$	171,7 (8)	0,0665 (13)	1st forbidden	7,5
$\beta^-_{0,8}$	173,5 (8)	0,0568 (11)	Allowed	7,6
$\beta^-_{0,7}$	223,2 (8)	0,00228 (6)		9,4
$\beta^-_{0,6}$	538,4 (8)	0,0012 (12)	2nd forbidden	11
$\beta^-_{0,5}$	635,3 (8)	31,1 (10)	Allowed	6,7
$\beta^-_{0,4}$	656,6 (8)	0,034 (12)	Unique 1st forbidden	10
$\beta^-_{0,3}$	705,0 (8)	49,6 (19)	Allowed	6,7

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,2}$	710,8 (8)	0,59 (6)	1st forbidden	8,6
$\beta^-_{0,0}$	808,2 (8)	18,4 (18)	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
$\gamma_{2,1}$(Eu)	14,06383 (24)		E1		8,7 (3)	1,92 (6)	11,2 (4)
$\gamma_{3,1}$(Eu)	19,81296 (21)	0,28	E2		2523 (76)	579 (18)	3290 (99)
$\gamma_{4,2}$(Eu)	54,1936 (12)	0,0304 (4)	M1+E2	7,9 (15)	5 (4)	1,5 (8)	15 (5)
$\gamma_{4,1}$(Eu)	68,2557 (12)	0,0023 (4)	E1	0,664 (20)	0,105 (3)	0,0285 (9)	0,797 (24)
$\gamma_{5,3}$(Eu)	69,67300 (13)	30,32 (3)	M1+1,82%E2	4,48 (13)	0,731 (23)	0,204 (6)	5,41 (16)
$\gamma_{5,2}$(Eu)	75,42213 (21)	0,342 (26)	E1+0,3%M2	0,63 (5)	0,113 (14)	0,032 (4)	0,77 (7)
$\gamma_{1,0}$(Eu)	83,36717 (17)	0,927 (7)	M1+40%E2	2,37 (8)	1,13 (6)	0,329 (12)	3,83 (12)
$\gamma_{5,1}$(Eu)	89,48595 (21)	0,577 (55)	M1+5,8%E2	2,15 (7)	0,39 (7)	0,111 (17)	2,65 (10)
$\gamma_{6,5}$(Eu)	96,8825 (7)	0,024	M1+E2	1,52 (23)	0,7 (5)	0,16 (9)	2,4 (4)
$\gamma_{2,0}$(Eu)	97,43100 (21)	1,009 (18)	E1	0,258 (8)	0,0384 (12)	0,0105 (3)	0,307 (9)
$\gamma_{3,0}$(Eu)	103,18012 (17)	79,7 (3)	M1+1,4%E2	1,45 (4)	0,216 (6)	0,061 (2)	1,72 (5)
$\gamma_{6,4}$(Eu)	118,1105 (10)	0,00027 (6)	[E1]	0,153 (5)	0,0223 (7)	0,0061 (2)	0,181 (5)
$\gamma_{4,0}$(Eu)	151,6245 (12)	0,0116 (4)	E1	0,0782 (23)	0,0111 (3)	0,00315 (9)	0,092 (3)
$\gamma_{6,3}$(Eu)	166,5548 (15)	0,00086 (6)	[E2]	0,268 (9)	0,104 (3)	0,0304 (9)	0,403 (12)
$\gamma_{6,2}$(Eu)	172,3035 (13)	0,0004	[E1]	0,0555 (16)	0,0078 (2)	0,00214 (6)	0,0655 (20)
$\gamma_{5,0}$(Eu)	172,85307 (21)	0,1019 (20)	M1+40%E2	0,301 (10)	0,064 (3)	0,0184 (8)	0,382 (11)
$\gamma_{7,5}$(Eu)	412,17 (10)	0,00192 (5)					
$\gamma_{12,6}$(Eu)	424,45 (11)	0,00189 (5)					
$\gamma_{14,6}$(Eu)	436,89 (9)	0,00170 (15)					
$\gamma_{15,6}$(Eu)	443,38 (20)	0,000088 (15)					
$\gamma_{8,5}$(Eu)	461,81 (12)	0,00158 (26)					
$\gamma_{9,5}$(Eu)	463,62 (10)	0,0136 (6)					
$\gamma_{10,5}$(Eu)	484,82 (14)	0,00038 (3)					
$\gamma_{7,2}$(Eu)	487,59 (15)	0,00036					
$\gamma_{11,5}$(Eu)	509,06 (10)	0,00199 (18)					
$\gamma_{12,5}$(Eu)	521,34 (11)	0,0069 (3)					
$\gamma_{8,3}$(Eu)	531,47 (12)	0,0547 (9)					
$\gamma_{9,3}$(Eu)	533,29 (10)	0,0299 (6)					
$\gamma_{9,2}$(Eu)	539,04 (10)	0,0211 (6)					
$\gamma_{12,4}$(Eu)	542,56 (11)	0,0032 (9)					
$\gamma_{16,5}$(Eu)	545,84 (14)	0,00076 (3)					
$\gamma_{14,4}$(Eu)	555,01 (9)	0,00474 (9)					
$\gamma_{10,1}$(Eu)	574,31 (14)	0,00016 (5)					
$\gamma_{11,3}$(Eu)	578,73 (10)	0,00328 (9)					
$\gamma_{11,2}$(Eu)	584,48 (10)	0,00106 (3)					
$\gamma_{17,5}$(Eu)	587,54 (17)	0,00050 (5)					
$\gamma_{12,3}$(Eu)	591,01 (11)	0,00118 (5)					
$\gamma_{12,2}$(Eu)	596,76 (11)	0,0109 (3)					
$\gamma_{13,3}$(Eu)	598,28 (24)	0,0018 (3)					
$\gamma_{11,1}$(Eu)	598,54 (10)	0,0018 (3)					
$\gamma_{14,3}$(Eu)	603,45 (9)	0,00448 (12)					
$\gamma_{13,2}$(Eu)	604,03 (24)	0,00448 (12)					
$\gamma_{14,2}$(Eu)	609,20 (9)	0,0128 (7)					
$\gamma_{15,3}$(Eu)	609,95 (20)	0,0128 (7)					
$\gamma_{16,3}$(Eu)	615,51 (14)	0,00056 (15)					
$\gamma_{15,2}$(Eu)	615,69 (20)	0,00056 (15)					
$\gamma_{13,1}$(Eu)	618,09 (24)	0,00073 (15)					

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{15,1}$(Eu)	629,75 (20)	0,000099 (15)					
$\gamma_{8,0}$(Eu)	634,66 (12)	0,00052 (6)					
$\gamma_{9,0}$(Eu)	636,47 (10)	0,00193 (12)					
$\gamma_{17,3}$(Eu)	657,21 (7)	0,00040 (2)					
$\gamma_{10,0}$(Eu)	657,67 (25)	0,00040 (2)					
$\gamma_{17,2}$(Eu)	662,96 (17)	0,00005 (4)					
$\gamma_{17,1}$(Eu)	677,02 (17)	0,000044 (15)					
$\gamma_{11,0}$(Eu)	681,91 (10)	0,00015 (12)					
$\gamma_{12,0}$(Eu)	694,19 (11)	0,000020 (6)					
$\gamma_{13,0}$(Eu)	701,46 (24)	0,000029 (6)					
$\gamma_{14,0}$(Eu)	706,63 (9)	0,000023 (12)					
$\gamma_{15,0}$(Eu)	713,12	0,000231 (20)					
$\gamma_{16,0}$(Eu)	718,69 (14)	0,000025 (5)					
$\gamma_{17,0}$(Eu)	760,39 (17)	0,000032 (5)					
$\gamma_{18,0}$(Eu)	763,8 (8)	0,000044 (12)					

3 Atomic Data

3.1 Eu

ω_K	:	0,929	(4)
$\bar{\omega}_L$	:	0,168	(7)
n_{KL}	:	0,853	(4)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	40,9024		55,42
	$K\alpha_1$	41,5427		100
	$K\beta_3$	46,904	}	
	$K\beta_1$	47,0384	}	
	$K\beta_5''$	47,373	}	31,5
	$K\beta_2$	48,266	}	
	$K\beta_4$	48,386	}	8,13
	$KO_{2,3}$	48,499	}	
X_L				
	$L\alpha$	5,18 – 8,03		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	32,24 – 34,38	100
KLX	38,59 – 41,52	51
KXY	44,9 – 48,5	6,5
Auger L	3,4 – 7,8	1870

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Eu)	3,4 - 7,8		56,1 (16)
e_{AK}	(Eu)			4,7 (3)
	KLL	32,24 - 34,38	}	
	KLX	38,59 - 41,52	}	
	KXY	44,9 - 48,5	}	
$ec_{3,1\ L}$	(Eu)	11,760 - 12,836		0,214
$ec_{5,3\ T}$	(Eu)	21,154 - 68,542		25,6 (11)
$ec_{5,3\ K}$	(Eu)	21,1541 (5)		21 (1)
$ec_{5,2\ K}$	(Eu)	26,9031 (5)		0,122 (17)
$ec_{1,0\ K}$	(Eu)	34,8482 (5)		0,46 (3)
$ec_{5,1\ K}$	(Eu)	40,9669 (5)		0,34 (3)
$ec_{2,0\ K}$	(Eu)	48,9121 (5)		0,199 (6)
$ec_{3,0\ T}$	(Eu)	54,661 - 102,049		50,3 (15)
$ec_{3,0\ K}$	(Eu)	54,6611 (5)		42,4 (13)
$ec_{5,3\ L}$	(Eu)	61,621 - 62,696		3,46 (17)
$ec_{5,3\ M}$	(Eu)	67,873 - 68,542		0,96 (5)
$ec_{1,0\ L}$	(Eu)	75,315 - 76,390		0,22 (1)
$ec_{5,1\ L}$	(Eu)	81,434 - 82,509		0,062 (6)
$ec_{1,0\ M}$	(Eu)	81,567 - 82,236		0,063 (3)
$ec_{3,0\ L}$	(Eu)	95,128 - 96,203		6,3 (2)
$ec_{3,0\ M}$	(Eu)	101,380 - 102,049		1,78 (6)
$\beta^-_{0,18}$	max:	44,4 (8)		0,000025 (25)
$\beta^-_{0,18}$	avg:	11,3 (3)		
$\beta^-_{0,17}$	max:	47,8 (8)		0,00063 (7)
$\beta^-_{0,17}$	avg:	12,19 (22)		
$\beta^-_{0,16}$	max:	89,5 (8)		0,00134 (15)
$\beta^-_{0,16}$	avg:	23,29 (22)		

		Energy keV		Electrons per 100 disint.
$\beta^-_{0,15}$	max:	95,1	(8)	0,0135 (8)
$\beta^-_{0,15}$	avg:	24,80	(23)	
$\beta^-_{0,14}$	max:	101,6	(8)	0,0237 (8)
$\beta^-_{0,14}$	avg:	26,57	(22)	
$\beta^-_{0,13}$	max:	106,7	(8)	0,00076 (15)
$\beta^-_{0,13}$	avg:	27,99	(25)	
$\beta^-_{0,12}$	max:	114,0	(8)	0,0242 (10)
$\beta^-_{0,12}$	avg:	29,99	(23)	
$\beta^-_{0,11}$	max:	126,3	(8)	0,0102 (4)
$\beta^-_{0,11}$	avg:	33,41	(23)	
$\beta^-_{0,10}$	max:	150,5	(8)	0,0005 (5)
$\beta^-_{0,10}$	avg:	40,24	(24)	
$\beta^-_{0,9}$	max:	171,7	(8)	0,0665 (13)
$\beta^-_{0,9}$	avg:	46,32	(24)	
$\beta^-_{0,8}$	max:	173,5	(8)	0,0568 (11)
$\beta^-_{0,8}$	avg:	46,84	(24)	
$\beta^-_{0,7}$	max:	223,2	(8)	0,00228 (6)
$\beta^-_{0,7}$	avg:	61,5	(3)	
$\beta^-_{0,6}$	max:	538,4	(8)	0,0012 (12)
$\beta^-_{0,6}$	avg:	164,9	(3)	
$\beta^-_{0,5}$	max:	635,3	(8)	31,1 (10)
$\beta^-_{0,5}$	avg:	199,7	(3)	
$\beta^-_{0,4}$	max:	656,6	(8)	0,034 (12)
$\beta^-_{0,4}$	avg:	221,2	(3)	
$\beta^-_{0,3}$	max:	705,0	(8)	49,6 (19)
$\beta^-_{0,3}$	avg:	225,3	(3)	
$\beta^-_{0,2}$	max:	710,8	(8)	0,59 (6)
$\beta^-_{0,2}$	avg:	227,6	(3)	
$\beta^-_{0,0}$	max:	808,2	(8)	18,4 (18)
$\beta^-_{0,0}$	avg:	264,5	(3)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV	Photons per 100 disint.	
XL	(Eu)	5,18 — 8,03	10,04 (15)	
XKα_2	(Eu)	40,9024	16,3 (3)	} Kα
XKα_1	(Eu)	41,5427	29,3 (4)	}

		Energy keV		Photons per 100 disint.	
$XK\beta_3$	(Eu)	46,904	}		
$XK\beta_1$	(Eu)	47,0384	}	9,20 (14)	$K'\beta_1$
$XK\beta_5''$	(Eu)	47,373	}		
$XK\beta_2$	(Eu)	48,266	}		
$XK\beta_4$	(Eu)	48,386	}	2,36 (11)	$K'\beta_2$
$XKO_{2,3}$	(Eu)	48,499	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{3,1}$(Eu)	19,81296 (21)	0,000085
$\gamma_{4,2}$(Eu)	54,1936 (12)	0,0019 (4)
$\gamma_{4,1}$(Eu)	68,2574 (12)	0,0013 (4)
$\gamma_{5,3}$(Eu)	69,67300 (13)	4,73 (3)
$\gamma_{5,2}$(Eu)	75,42213 (23)	0,193 (26)
$\gamma_{1,0}$(Eu)	83,36717 (21)	0,192 (7)
$\gamma_{5,1}$(Eu)	89,48595 (22)	0,158 (15)
$\gamma_{6,5}$(Eu)	96,8824 (7)	0,007
$\gamma_{2,0}$(Eu)	97,43100 (21)	0,772 (18)
$\gamma_{3,0}$(Eu)	103,18012 (17)	29,26 (32)
$\gamma_{6,4}$(Eu)	118,1105 (10)	0,00023 (6)
$\gamma_{4,0}$(Eu)	151,6244 (12)	0,0106 (4)
$\gamma_{6,3}$(Eu)	166,5546 (15)	0,00061 (6)
$\gamma_{6,2}$(Eu)	172,3032 (13)	0,0004
$\gamma_{5,0}$(Eu)	172,85307 (21)	0,0737 (20)
$\gamma_{7,5}$(Eu)	412,05 (20)	0,00192 (5)
$\gamma_{12,6}$(Eu)	424,4 (3)	0,00189 (5)
$\gamma_{14,6}$(Eu)	436,9 (3)	0,00170 (15)
$\gamma_{15,6}$(Eu)	443,2 (5)	0,000088 (15)
$\gamma_{8,5}$(Eu)	462,0 (3)	0,00158 (26)
$\gamma_{9,5}$(Eu)	463,6 (2)	0,0136 (6)
$\gamma_{10,5}$(Eu)	485,0 (2)	0,00038 (3)
$\gamma_{7,2}$(Eu)	487,75 (23)	0,00036
$\gamma_{11,5}$(Eu)	509,15 (20)	0,00199 (18)
$\gamma_{12,5}$(Eu)	521,30 (25)	0,0069 (3)
$\gamma_{8,3}$(Eu)	531,40 (15)	0,0547 (9)
$\gamma_{9,3}$(Eu)	533,2 (2)	0,0299 (6)
$\gamma_{9,2}$(Eu)	539,1 (2)	0,0211 (6)
$\gamma_{12,4}$(Eu)	542,7 (2)	0,0032 (9)
$\gamma_{16,5}$(Eu)	545,75 (15)	0,00076 (3)
$\gamma_{14,4}$(Eu)	554,94 (10)	0,00474 (9)
$\gamma_{10,1}$(Eu)	574,1 (3)	0,00016 (5)
$\gamma_{11,3}$(Eu)	578,75 (20)	0,00328 (9)

	Energy keV	Photons per 100 disint.
$\gamma_{11,2}$(Eu)	584,55 (20)	0,00106 (3)
$\gamma_{17,5}$(Eu)	587,60 (25)	0,00050 (5)
$\gamma_{12,3}$(Eu)	590,96 (20)	0,00118 (5)
$\gamma_{12,2}$(Eu)	596,7 (2)	0,0109 (3)
$\gamma_{13,3}$(Eu)	598,3 (3)	0,0018 (3)
$\gamma_{11,1}$(Eu)	598,54 (10)	0,0018 (3)
$\gamma_{14,3}$(Eu)	603,6 (4)	0,00448 (12)
$\gamma_{13,2}$(Eu)	604,03 (24)	0,00448 (12)
$\gamma_{14,2}$(Eu)	609,5 (3)	0,0128 (7)
$\gamma_{15,3}$(Eu)	609,95 (20)	0,0128 (7)
$\gamma_{16,3}$(Eu)	615,51 (14)	0,00056 (15)
$\gamma_{15,2}$(Eu)	615,8 (4)	0,00056 (15)
$\gamma_{13,1}$(Eu)	617,9 (3)	0,00073 (15)
$\gamma_{15,1}$(Eu)	630,5 (4)	0,000099 (15)
$\gamma_{8,0}$(Eu)	634,8 (3)	0,00052 (6)
$\gamma_{9,0}$(Eu)	636,5 (2)	0,00193 (12)
$\gamma_{17,3}$(Eu)	657,21 (7)	0,00040 (2)
$\gamma_{10,0}$(Eu)	657,55 (25)	0,00040 (2)
$\gamma_{17,2}$(Eu)	662,4 (6)	0,00005 (4)
$\gamma_{17,1}$(Eu)	677,0 (3)	0,000044 (15)
$\gamma_{11,0}$(Eu)	682,0 (6)	0,00015 (12)
$\gamma_{12,0}$(Eu)	694,1 (3)	0,000020 (6)
$\gamma_{13,0}$(Eu)	701,8 (4)	0,000029 (6)
$\gamma_{14,0}$(Eu)	706,8 (5)	0,000023 (12)
$\gamma_{15,0}$(Eu)	713,9 (3)	0,000231 (20)
$\gamma_{16,0}$(Eu)	719,0 (4)	0,000025 (5)
$\gamma_{17,0}$(Eu)	760,5 (4)	0,000032 (5)
$\gamma_{18,0}$(Eu)	763,8 (6)	0,000044 (12)

6 Main Production Modes

Sm – 152(n,γ)Sm – 153
Nd – 150(α,n)Sm – 153

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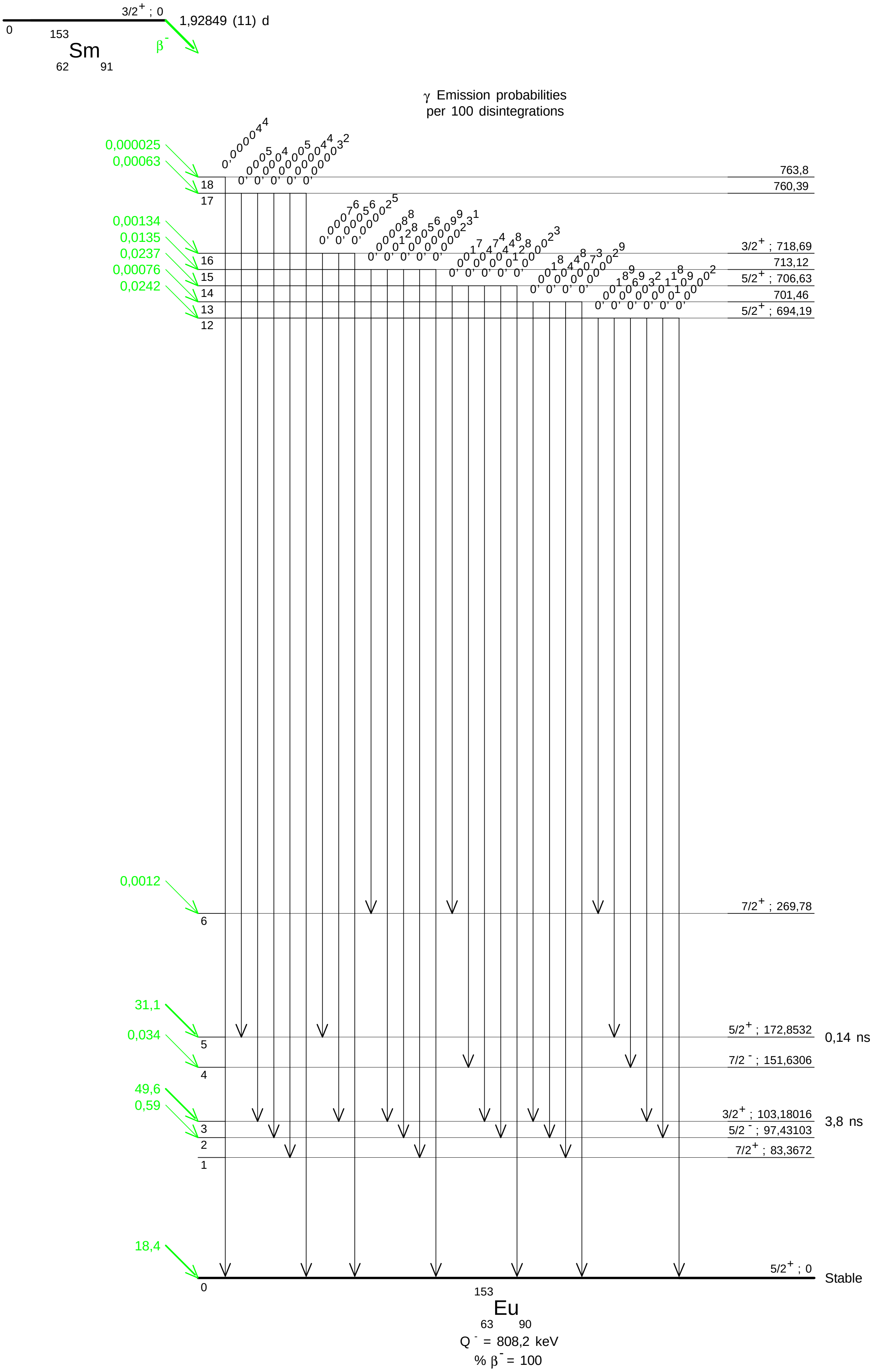
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1,92849 (11) d
0
153 Sm 62 91
β-
γ Emission probabilities
per 100 disintegrations
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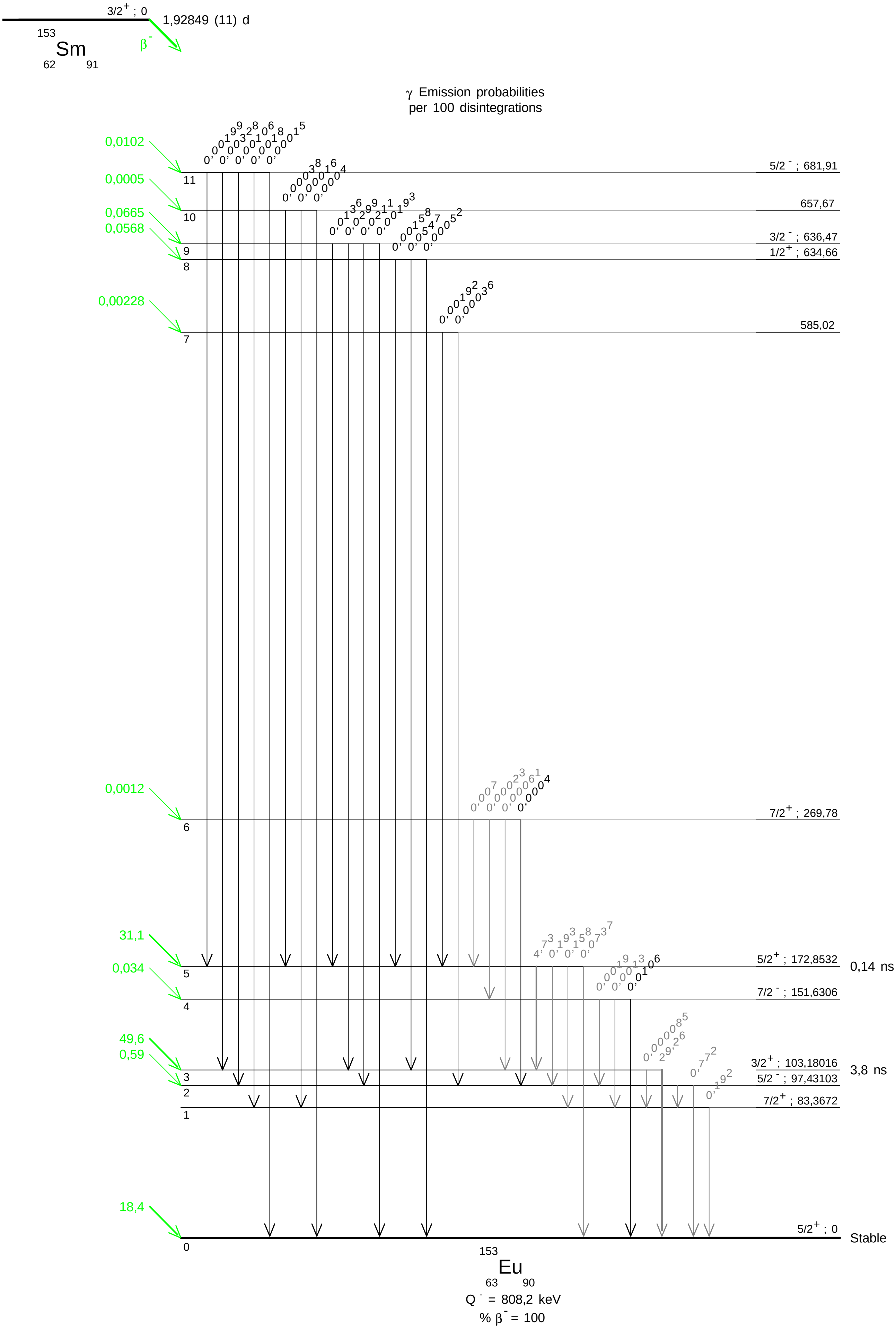
0,00063
0,00134
0,0135
0,0237
0,00076
0,0242
0,0012
31,1
0,034
49,6
0,59
18,4
763,8
760,39
3/2+ ; 718,69
713,12
5/2+ ; 706,63
701,46
5/2+ ; 694,19
7/2+ ; 269,78
5/2+ ; 172,8532
0,14 ns
7/2 - ; 151,6306
3/2+ ; 103,18016
3,8 ns
5/2 - ; 97,43103
7/2+ ; 83,3672
5/2+ ; 0
Stable
153 Eu 63 90
Q - = 808,2 keV
% β- = 100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1,92849 (11) d
153 Sm 62 91
β-
γ Emission probabilities
per 100 disintegrations
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0,0005
0,0665
0,0568
0,00228
0,0012
31,1
0,034
49,6
0,59
18,4
11
10
9
8
7
6
5
4
3
2
1
0
5/2 - ; 681,91
657,67
3/2 - ; 636,47
1/2+ ; 634,66
585,02
7/2+ ; 269,78
5/2+ ; 172,8532
0,14 ns
7/2 - ; 151,6306
3/2+ ; 103,18016
3,8 ns
5/2 - ; 97,43103
7/2+ ; 83,3672
5/2+ ; 0
Stable
153 Eu 63 90
Q - = 808,2 keV
% β- = 100

$^{154}_{63}$Eu $_{91}$

1 Decay Scheme

Eu-154 disintegrates by 99.982 % beta decay via excited levels of Gd-154 and by 0.018 % electron capture via excited levels of Sm-154. Transitions to the ground states of Gd-154 and Sm-154 have not been observed.
L'europium 154 se désintègre par émission bêta vers les niveaux excités de gadolinium 154 (99,982%) et par capture électronique vers les niveaux excités de samarium 154 (0,02%). Des transitions vers les niveaux fondamentaux du gadolinium 154 et du samarium 154 n'ont pas été observées.

2 Nuclear Data

$T_{1/2}(^{154}\text{Eu})$	:	8,601	(4)	a
$Q^{+}(^{154}\text{Eu})$	:	717,3	(11)	keV
$Q^{-}(^{154}\text{Eu})$	:	1968,4	(11)	keV

2.1 Electron Capture Transitions

	Energy keV	Probability × 100	Nature	lg ft	P_K	P_L	P_M
$\epsilon_{0,2}$	450,6 (11)	0,0047 (8)	1st forbidden	12,9	0,8205 (16)	0,1393 (11)	0,0322 (6)
$\epsilon_{0,1}$	635,3 (11)	0,013 (13)	1st forbidden	12,7	0,8289 (16)	0,1330 (11)	0,0305 (6)

2.2 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,33}$	73,7 (11)	0,0035 (6)	1 st forbidden	10,92
$\beta^-_{0,32}$	89,4 (11)	0,0042 (3)		
$\beta^-_{0,31}$	107,2 (11)	0,034 (3)	allowed	10,44
$\beta^-_{0,30}$	130,1 (12)	0,017 (5)	1 st forbidden	10,99
$\beta^-_{0,29}$	171,7 (12)	0,060 (6)	allowed	10,8

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,28}$	178,1 (11)	0,022 (1)	1 st forbidden	11,31
$\beta^-_{0,27}$	197,9 (11)	0,0022 (4)	1 st forbidden	12,46
$\beta^-_{0,26}$	248,8 (11)	28,32 (22)	allowed	8,66
$\beta^-_{0,25}$	270,2 (11)	0,0100 (4)	(1 st forbidden)	12,33
$\beta^-_{0,24}$	307,5 (11)	0,849 (9)	1 st forbidden	10,48
$\beta^-_{0,23}$	322,6 (11)	0,148 (4)	1 st forbidden	11,31
$\beta^-_{0,22}$	351,3 (11)	1,78 (3)	allowed	10,34
$\beta^-_{0,21}$	408,8 (12)	0,100 (4)	allowed	11,81
$\beta^-_{0,20}$	437,1 (11)	0,330 (13)	1 st forbidden	11,39
$\beta^-_{0,19}$	458,3 (11)	0,021 (2)	(2nd forbidden)	12,66
$\beta^-_{0,18}$	550,0 (11)	0,075 (2)	1 st forbidden	12,23
$\beta^-_{0,16}$	570,9 (11)	36,06 (35)	allowed	9,74
$\beta^-_{0,13}$	704,6 (11)	0,707 (7)	1 st forbidden	11,76
$\beta^-_{0,12}$	716,8 (11)	0,289 (6)	allowed	12,18
$\beta^-_{0,8}$	840,6 (11)	17,33 (18)	1 st forbidden	10,64
$\beta^-_{0,7}$	920,8 (11)	0,108 (18)	1 st forbidden	13
$\beta^-_{0,6}$	972,1 (11)	2,82 (18)	1 st forbidden	11,66
$\beta^-_{0,5}$	1152,9 (11)	0,33 (3)	1 st forbidden	12,8
$\beta^-_{0,2}$	1597,4 (11)	0,31 (7)	1 st forbidden	13,43
$\beta^-_{0,1}$	1845,3 (11)	10,3 (5)	1 st forbidden	12,4

2.3 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{26,24}$(Gd)	58,4	0,0087 (9)	(E1)				1,23 (3)
$\gamma_{8,7}$(Gd)	80,4	0,016 (13)	(M1,E2)				4,8 (10)
$\gamma_{1,0}$(Sm)	81,99 (2)	0,018 (13)	E2	1,98 (4)	2,28 (5)	0,532 (11)	4,93 (10)
$\gamma_{1,0}$(Gd)	123,0707 (9)	88,8 (13)	E2	0,653 (13)	0,418 (9)	0,096 (2)	1,197 (19)
$\gamma_{18,15}$(Gd)	125,39 (5)	0,007 (2)					
$\gamma_{24,20}$(Gd)	129,5	0,028 (4)	(M1,E2)				0,99 (3)
$\gamma_{8,6}$(Gd)	131,58 (5)	0,0216 (11)	M1+E2				0,95 (4)
$\gamma_{5,3}$(Gd)	134,84	0,0134 (8)	E2				0,868 (18)
$\gamma_{16,12}$(Gd)	146,05 (5)	0,044 (2)	(M1,E2)				0,68 (2)
$\gamma_{16,11}$(Gd)	156,2	0,0152 (6)	(M1,E2)				0,55 (3)
$\gamma_{(-1,1)}$(Gd)	159,9	0,0010 (5)					
$\gamma_{21,16}$(Gd)	162,09 (5)	0,0016 (6)	(E2)				0,457 (9)
$\gamma_{15,8}$(Gd)	165,90 (21)	0,0025 (5)					
$\gamma_{6,5}$(Gd)	180,7	0,0054 (7)	(M1,E2)				0,35 (4)
$\gamma_{2,1}$(Sm)	184,72	0,0047 (8)	E2	0,193 (4)	0,0642 (13)	0,0146 (3)	0,275 (6)
$\gamma_{26,20}$(Gd)	188,24 (2)	0,252 (6)	E1	0,0453 (90)	0,0065 (2)		0,0536 (11)
$\gamma_{(-1,2)}$(Gd)	195,5 (5)	0,002 (1)					
$\gamma_{(-1,3)}$(Gd)	197	0,0016 (2)					
$\gamma_{22,17}$(Gd)	202,50 (16)	0,03 (1)					
$\gamma_{26,19}$(Gd)	209,4 (4)	0,0025 (6)					

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{22,16}$(Gd)	219,4	0,0028 (6)	(M1,E2)				0,20 (4)
$\gamma_{14,7}$(Gd)	229,01 (13)	0,0024 (8)					
$\gamma_{7,5}$(Gd)	232,01 (5)	0,0270 (11)	E2				0,137 (3)
$\gamma_{20,15}$(Gd)	237	0,006 (3)					0,018 (7)
$\gamma_{2,1}$(Gd)	247,9290 (7)	7,65 (8)	E2	0,0810 (16)	0,0228 (5)		0,110 (2)
$\gamma_{16,9}$(Gd)	260,9	0,0022 (7)					
$\gamma_{20,13}$(Gd)	267,44	0,0148 (8)	(E2)				0,087 (2)
$\gamma_{(-1,4)}$(Gd)	269,8	0,0071 (11)	(E1)				0,0209 (4)
$\gamma_{(-1,5)}$(Gd)	274,0 (5)	0,0039 (2)					
$\gamma_{20,12}$(Gd)	279,9	0,0030 (2)	(E1)				0,0190 (4)
$\gamma_{20,11}$(Gd)	290	0,0033 (2)	(E1)				0,0174 (3)
$\gamma_{21,13}$(Gd)	295,7	0,0024 (2)	(E1)				0,0166 (3)
$\gamma_{16,8}$(Gd)	296 (1)	0,0014 (9)	(E1)				0,0166 (3)
$\gamma_{26,18}$(Gd)	301,25	0,0102 (4)	(E2)				0,0158 (3)
$\gamma_{26,17}$(Gd)	305,1	0,0187 (8)	(M1,E2)				0,075 (18)
$\gamma_{(-1,6)}$(Gd)	308,2	0,0024 (6)					
$\gamma_{8,5}$(Gd)	312,3	0,019 (2)	(M1,E2)				0,07 (2)
$\gamma_{6,3}$(Gd)	315,4	0,007 (2)	(E2)				0,052 (1)
$\gamma_{(-1,7)}$(Gd)	320 (1)	0,0010 (7)					
$\gamma_{26,16}$(Gd)	322,02 (5)	0,070 (3)	(M1,E2)				0,065 (17)
$\gamma_{7,4}$(Gd)	329,9 (7)	0,0095 (5)	E2				0,0454 (9)
$\gamma_{4,2}$(Gd)	346,72 (5)	0,030 (1)	E2				0,0391 (8)
$\gamma_{23,14}$(Gd)	368,21	0,0030 (2)					
$\gamma_{18,7}$(Gd)	370,71	0,0058 (14)	E2				0,0321 (7)
$\gamma_{22,11}$(Gd)	375,2 (5)	0,0021 (8)	(E2)				0,0310 (6)
$\gamma_{23,13}$(Gd)	382,00 (5)	0,0100 (4)	(E2,M1)				0,034 (11)
$\gamma_{24,13}$(Gd)	397,1	0,030 (1)	(M1,E2)				0,036 (10)
$\gamma_{16,6}$(Gd)	401,260 (14)	0,202 (4)	(E1,M2,E3)				0,07 (2)
$\gamma_{20,8}$(Gd)	403,55 (5)	0,027 (1)	(M1,E2)				0,035 (10)
$\gamma_{(-1,8)}$(Gd)	414,3	0,0049 (6)					
$\gamma_{24,11}$(Gd)	419,4	0,0039 (23)	M2				0,140 (3)
$\gamma_{(-1,9)}$(Gd)	422,1	0,0022 (9)					
$\gamma_{(-1,10)}$(Gd)	435,9	0,0038 (10)					
$\gamma_{5,2}$(Gd)	444,4931 (19)	0,570 (6)	E2	0,0154 (3)	0,00295 (6)		0,0192 (4)
$\gamma_{32,17}$(Gd)	463,9	0,0042 (3)					
$\gamma_{26,12}$(Gd)	467,84 (5)	0,0618 (24)	(M1,E2)				0,024 (7)
$\gamma_{26,11}$(Gd)	478,27 (5)	0,230 (2)	M1	0,0245 (5)	0,00341 (7)		0,0287 (6)
$\gamma_{22,9}$(Gd)	480,61	0,0048 (3)					
$\gamma_{20,7}$(Gd)	483,74	0,0051 (3)	(E2)				0,0153 (3)
$\gamma_{(-1,11)}$(Gd)	484,64	0,0039 (2)					
$\gamma_{22,8}$(Gd)	488,26	0,007 (3)	(E1)				0,00498 (10)
$\gamma_{27,13}$(Gd)	506,4	0,0064 (14)	E2				0,0136 (3)
$\gamma_{(-1,12)}$(Gd)	510	0,059 (7)					
$\gamma_{(-1,13)}$(Gd)	512	0,032 (7)					
$\gamma_{23,8}$(Gd)	518,00 (5)	0,047 (2)	(E2,M1)				0,013 (1)
$\gamma_{24,8}$(Gd)	533,1	0,007 (2)					
$\gamma_{29,13}$(Gd)	533,1	0,004 (3)	E1				0,00412 (8)
$\gamma_{13,4}$(Gd)	545,6	0,014 (2)	(E2)				0,0112 (2)
$\gamma_{3,1}$(Gd)	557,58 (5)	0,270 (5)	E2	0,0087 (2)	0,0015 (3)		0,0106 (2)
$\gamma_{21,6}$(Gd)	563,4	0,0030 (7)	(M2)				0,058 (1)
$\gamma_{22,7}$(Gd)	569,23	0,0100 (8)	(E1)				0,0036 (1)
$\gamma_{16,5}$(Gd)	582,01 (5)	0,889 (11)	E1	0,00288 (6)	0,000385 (8)		0,00339 (7)
$\gamma_{26,8}$(Gd)	591,755 (3)	4,97 (5)	E1+(M2)	0,0028 (6)	0,000374 (8)		0,00329 (10)
$\gamma_{31,13}$(Gd)	597,5	0,0055 (3)	(E1)				0,00321 (7)
$\gamma_{23,7}$(Gd)	598,3	0,0062 (7)	M1+2,8%E2				0,014 (1)
$\gamma_{17,5}$(Gd)	600,0 (5)	0,006 (4)	(E1)				0,00318 (7)
$\gamma_{18,5}$(Gd)	602,81 (5)	0,0035 (2)	E0+M1+E2				0,048 (6)
$\gamma_{24,7}$(Gd)	613,26 (5)	0,094 (4)	(E2,M1)				0,012 (4)
$\gamma_{22,6}$(Gd)	620,52	0,091 (5)	(E1)				0,00296 (6)

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{6,2}$(Gd)	625,2570 (24)	0,319 (5)	E2	0,00658 (13)	0,00109 (2)		0,00797 (16)
$\gamma_{27,8}$(Gd)	642,4	0,0044 (17)	(M1,E2)				0,011 (4)
$\gamma_{23,6}$(Gd)	649,44 (5)	0,079 (3)	E2				0,0073 (2)
$\gamma_{25,7}$(Gd)	650,6	0,0100 (4)	(E0,M1,E2)				0,026 (8)
$\gamma_{24,6}$(Gd)	664,68 (5)	0,029 (1)	(M1,E2)				0,010 (3)
$\gamma_{29,8}$(Gd)	668,9	0,013 (2)	E1				0,00253 (5)
$\gamma_{7,2}$(Gd)	676,598 (12)	0,166 (11)	E0+M1+E2	0,049 (5)	0,0080 (8)		0,059 (6)
$\gamma_{3,0}$(Gd)	680,72 (10)	0,0052 (7)	E0				
$\gamma_{5,1}$(Gd)	692,4222 (18)	1,88 (3)	E0+M1+E2	0,040 (4)	0,0070 (7)		0,049 (6)
$\gamma_{20,5}$(Gd)	715,77 (3)	0,19 (1)	(E0,M1,E2)				0,013 (4)
$\gamma_{26,6}$(Gd)	723,3032 (22)	20,09 (21)	E1+0,05%M2	0,00184 (4)	0,000244 (5)		0,00215 (5)
$\gamma_{(-1,14)}$(Gd)	737,6	0,0063 (24)					
$\gamma_{8,2}$(Gd)	756,8040 (23)	4,55 (5)	E1+2,8%M2	0,00431 (9)	0,00067 (2)		0,0051 (12)
$\gamma_{27,6}$(Gd)	774,4	0,008 (4)	(M3)				0,053 (2)
$\gamma_{30,7}$(Gd)	790,2	0,010 (3)	(E2)				0,00462 (9)
$\gamma_{29,6}$(Gd)	800,2	0,032 (5)	E1				0,00175 (4)
$\gamma_{22,5}$(Gd)	801,21 (4)	0,012 (3)	(E1)				0,00175 (4)
$\gamma_{5,0}$(Gd)	815,53 (5)	0,514 (7)	E2	0,00360 (7)	0,000548 (11)		0,00430 (9)
$\gamma_{(-1,15)}$(Gd)	830,3	0,008 (3)					
$\gamma_{24,5}$(Gd)	845,418 (7)	0,588 (9)	E2	0,00333 (7)	0,000502 (10)		0,00397 (8)
$\gamma_{20,3}$(Gd)	850,64 (3)	0,242 (4)	E2				0,00392 (8)
$\gamma_{6,1}$(Gd)	873,1860 (23)	12,22 (12)	E2+1,55%M1+E0	0,00313 (6)	0,00047 (1)		0,00373 (8)
$\gamma_{12,2}$(Gd)	880,60 (3)	0,081 (4)	E1+0,05%M2				0,00153 (8)
$\gamma_{13,2}$(Gd)	892,778 (6)	0,516 (7)	E0+E2+M1				0,00369 (8)
$\gamma_{33,6}$(Gd)	898,36	0,0020 (5)	(M1,E2)				0,0048 (13)
$\gamma_{26,5}$(Gd)	904,067 (3)	0,891 (11)	E1(+M2)	0,00118 (4)	0,000156 (3)		0,00138 (3)
$\gamma_{14,2}$(Gd)	906,1	0,0118 (6)					
$\gamma_{(-1,16)}$(Gd)	919,24	0,012 (1)					
$\gamma_{7,1}$(Gd)	924,63 (5)	0,062 (2)	E2				0,00327 (7)
$\gamma_{(-1,17)}$(Gd)	928,4	0,0045 (21)					
$\gamma_{29,5}$(Gd)	981,3 (5)	0,0084 (17)	(E1)				0,00118 (3)
$\gamma_{(-1,18)}$(Gd)	984,5	0,0094 (21)					
$\gamma_{6,0}$(Gd)	996,25 (5)	10,53 (10)	E2	0,00236 (5)	0,000342 (7)		0,00279 (6)
$\gamma_{8,1}$(Gd)	1004,722 (7)	17,91 (18)	E1+1,35%M2	0,00232 (5)	0,000336 (7)		0,00276 (6)
$\gamma_{9,1}$(Gd)	1012,8 (2)	0,003 (1)					
$\gamma_{30,5}$(Gd)	1023 (1)	0,0066 (25)	(M1,E2)				
$\gamma_{(-1,19)}$(Gd)	1033,4	0,0117 (8)					
$\gamma_{18,2}$(Gd)	1047,4 (1)	0,049 (3)	E2				0,00251 (5)
$\gamma_{(-1,20)}$(Gd)	1049,4 (1)	0,0172 (8)					
$\gamma_{(-1,21)}$(Gd)	1072,2	0,0035 (14)					
$\gamma_{10,1}$(Gd)	1110	0,003 (2)					
$\gamma_{11,1}$(Gd)	1118,53 (6)	0,108 (14)	E1	0,000798 (16)	0,000103 (20)		0,00093 (2)
$\gamma_{(-1,22)}$(Gd)	1124,2	0,0069 (10)					
$\gamma_{12,1}$(Gd)	1128,556 (7)	0,317 (5)	E1	0,000785 (16)	0,000101 (2)		0,000915 (18)
$\gamma_{9,0}$(Gd)	1136,1	0,007 (1)					
$\gamma_{13,1}$(Gd)	1140,707 (6)	0,235 (4)	E2				0,00211 (4)
$\gamma_{(-1,23)}$(Gd)	1153,1 (5)	0,011 (4)					
$\gamma_{20,2}$(Gd)	1160,37 (8)	0,0437 (21)	(E2)				0,00204 (4)
$\gamma_{15,1}$(Gd)	1170,7 (5)	0,0036 (10)					
$\gamma_{21,2}$(Gd)	1188,35 (17)	0,093 (7)	(E1)				0,00083 (2)
$\gamma_{(-1,25)}$(Gd)	1216,8	0,0035 (10)					
$\gamma_{(-1,24)}$(Gd)	1232,1 (5)	0,008 (5)					
$\gamma_{11,0}$(Gd)	1241,44 (10)	0,133 (6)	E1+(M2)	0,000662 (13)			0,000771 (15)
$\gamma_{22,2}$(Gd)	1246,126 (4)	0,863 (11)	E1	0,000658 (13)			0,000766 (15)
$\gamma_{16,1}$(Gd)	1274,435 (4)	34,9 (3)	E1+0,1%M2	0,000632 (13)			0,000737 (15)
$\gamma_{24,2}$(Gd)	1290,51 (10)	0,025 (3)	(M1,E2)				0,0021 (5)
$\gamma_{17,1}$(Gd)	1292,0 (2)	0,0127 (5)	E1				0,00072 (2)
$\gamma_{18,1}$(Gd)	1295,5 (2)	0,0091 (10)					
$\gamma_{(-1,26)}$(Gd)	1316,4 (3)	0,017 (4)					

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{19,1}$(Gd)	1387,0 (5)	0,019 (2)	(E1)				0,00063 (2)
$\gamma_{27,2}$(Gd)	1397,35 (5)	0,0031 (8)	(M1,E2)				0,0018 (4)
$\gamma_{20,1}$(Gd)	1408,5 (2)	0,023 (3)	(E0,M1,E2)				0,0037 (14)
$\gamma_{17,0}$(Gd)	1415,0 (5)	0,040 (2)	E1				0,00061 (1)
$\gamma_{18,0}$(Gd)	1418,6 (2)	0,011 (2)	E2				0,00138 (3)
$\gamma_{28,2}$(Gd)	1419,0 (2)	0,0020 (1)	(M1,E2)				0,0017 (4)
$\gamma_{29,2}$(Gd)	1425,9 (5)	0,0012 (7)	(E1)				0,00060 (1)
$\gamma_{31,2}$(Gd)	1489,6 (2)	0,0029 (4)	(E1)				0,00056 (1)
$\gamma_{22,1}$(Gd)	1494,056 (4)	0,699 (9)	E1	0,000481 (10)			0,00056 (1)
$\gamma_{19,0}$(Gd)	1510,0 (5)	0,0048 (10)	(E1)				0,00047 (1)
$\gamma_{33,2}$(Gd)	1522 (1)	0,0006 (3)	(E2)				0,00102 (2)
$\gamma_{20,0}$(Gd)	1531,5 (2)	0,0060 (4)	(E2)				0,00101 (2)
$\gamma_{24,1}$(Gd)	1537,82 (4)	0,053 (2)	(M1,E2)				0,0012 (3)
$\gamma_{(-1,27)}$(Gd)	1554	0,0011 (5)					
$\gamma_{26,1}$(Gd)	1596,4892 (28)	1,784 (17)	E1(+M2)	0,000430 (9)			0,00049 (1)
$\gamma_{28,1}$(Gd)	1667,3 (2)	0,0019 (3)	(E2)				
$\gamma_{29,1}$(Gd)	1674,0 (5)	0,0017 (4)	(E1)				
$\gamma_{30,1}$(Gd)	1716,9 (5)	0,0006 (3)	(M1,E2)				
$\gamma_{33,1}$(Gd)	1773 (1)	0,00035 (21)	(M1,E2)				
$\gamma_{30,0}$(Gd)	1838,0 (5)	0,0008 (2)	(E2)				
$\gamma_{33,0}$(Gd)	1895 (1)	0,0006 (2)	(E2)				

3 Atomic Data

3.1 Sm

ω_K : 0,926 (4)
$\bar{\omega}_L$: 0,158 (6)
n_{KL} : 0,857 (4)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	39,5229		55,25
	$K\alpha_1$	40,1186		100
	$K\beta_3$	45,289	}	
	$K\beta_1$	45,413	}	
	$K\beta_5''$	45,731	}	31,26
	$K\beta_2$	46,575	}	
	$K\beta_4$	46,705	}	8,06
	$KO_{2,3}$	46,813	}	
X_L				
	$L\ell$	4,99		
	$L\gamma$	– 7,49		

3.1.2 Auger Electrons

	Energy keV	Relative probability
KLL	31,19 – 33,22	100
KLX	37,30 – 40,18	50,7
KXY	45,30 – 46,23	6,42
Auger L	3,2 – 7,6	2277

3.2 Gd

ω_K : 0,932 (4)
$\bar{\omega}_L$: 0,176 (6)
n_{KL} : 0,850 (4)

3.2.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	42,3093		55,59
	$K\alpha_1$	42,9967		100
	$K\beta_3$	48,556	}	
	$K\beta_1$	48,697	}	
	$K\beta_5''$	49,053	}	31,66
	$K\beta_2$	49,961	}	
	$K\beta_4$	50,099	}	8,32
	$KO_{2,3}$	50,219	}	
X_L				
	$L\ell$	5,36		
	$L\gamma$	– 8,1		

3.2.2 Auger Electrons

	Energy keV	Relative probability
KLL	33,32 – 35,58	100
KLX	39,98 – 42,86	51,3
KXY	47,98 – 48,91	6,58
Auger L	3,4 – 8,3	2814

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Sm)	3,2 - 7,6		0,023 (13)
e_{AK}	(Sm)			0,0016 (13)
	KLL	31,19 - 33,22	}	
	KLX	37,30 - 40,18	}	
	KXY	45,30 - 46,23	}	
e_{AL}	(Gd)	3,4 - 8,3		33,2 (6)
e_{AK}	(Gd)			1,86 (12)
	KLL	33,32 - 35,58	}	
	KLX	39,98 - 42,86	}	
	KXY	47,98 - 48,91	}	
$ec_{1,0\ K}$	(Gd)	72,832 (1)		26,4 (4)
$ec_{1,0\ L}$	(Gd)	114,70 - 115,83		16,9 (4)
$ec_{1,0\ M}$	(Gd)	121,19 - 121,89		3,88 (9)
$ec_{2,1\ K}$	(Gd)	197,6898 (7)		0,558 (12)
$ec_{2,1\ L}$	(Gd)	239,56 - 240,69		0,157 (4)
$ec_{5,1\ K}$	(Gd)	642,180 (2)		0,072 (7)
$\beta^-_{0,33}$	max:	73,7 (11)		0,0035 (6)
$\beta^-_{0,33}$	avg:	19,0 (3)		
$\beta^-_{0,32}$	max:	89,4 (11)		0,0042 (3)
$\beta^-_{0,32}$	avg:	23,3 (3)		
$\beta^-_{0,31}$	max:	107,2 (11)		0,034 (3)
$\beta^-_{0,31}$	avg:	28,1 (3)		
$\beta^-_{0,30}$	max:	130,1 (12)		0,017 (5)
$\beta^-_{0,30}$	avg:	34,5 (3)		
$\beta^-_{0,29}$	max:	171,7 (12)		0,060 (6)
$\beta^-_{0,29}$	avg:	46,3 (3)		
$\beta^-_{0,28}$	max:	178,1 (11)		0,022 (1)
$\beta^-_{0,28}$	avg:	48,1 (3)		
$\beta^-_{0,27}$	max:	197,9 (11)		0,0022 (4)
$\beta^-_{0,27}$	avg:	53,9 (3)		
$\beta^-_{0,26}$	max:	248,8 (11)		28,32 (22)
$\beta^-_{0,26}$	avg:	69,2 (3)		
$\beta^-_{0,25}$	max:	270,2 (11)		0,0100 (4)
$\beta^-_{0,25}$	avg:	75,7 (3)		
$\beta^-_{0,24}$	max:	307,5 (11)		0,849 (9)
$\beta^-_{0,24}$	avg:	87,4 (3)		
$\beta^-_{0,23}$	max:	322,6 (11)		0,148 (4)
$\beta^-_{0,23}$	avg:	92,2 (4)		

		Energy keV		Electrons per 100 disint.
$\beta^-_{0,22}$	max:	351,3	(11)	1,78 (3)
$\beta^-_{0,22}$	avg:	101,4	(4)	
$\beta^-_{0,21}$	max:	408,8	(12)	0,100 (4)
$\beta^-_{0,21}$	avg:	120,3	(4)	
$\beta^-_{0,20}$	max:	437,1	(11)	0,330 (13)
$\beta^-_{0,20}$	avg:	129,8	(4)	
$\beta^-_{0,19}$	max:	458,3	(11)	0,021 (2)
$\beta^-_{0,19}$	avg:	136,9	(4)	
$\beta^-_{0,18}$	max:	550,0	(11)	0,075 (2)
$\beta^-_{0,18}$	avg:	168,8	(4)	
$\beta^-_{0,16}$	max:	570,9	(11)	36,06 (35)
$\beta^-_{0,16}$	avg:	176,2	(4)	
$\beta^-_{0,13}$	max:	704,6	(11)	0,707 (7)
$\beta^-_{0,13}$	avg:	225,0	(4)	
$\beta^-_{0,12}$	max:	716,8	(11)	0,289 (6)
$\beta^-_{0,12}$	avg:	229,5	(4)	
$\beta^-_{0,8}$	max:	840,6	(11)	17,33 (18)
$\beta^-_{0,8}$	avg:	276,6	(4)	
$\beta^-_{0,7}$	max:	920,8	(11)	0,108 (18)
$\beta^-_{0,7}$	avg:	307,8	(4)	
$\beta^-_{0,6}$	max:	972,1	(11)	2,82 (18)
$\beta^-_{0,6}$	avg:	328,1	(4)	
$\beta^-_{0,5}$	max:	1152,9	(11)	0,33 (3)
$\beta^-_{0,5}$	avg:	401,0	(5)	
$\beta^-_{0,2}$	max:	1597,4	(11)	0,31 (7)
$\beta^-_{0,2}$	avg:	588,0	(5)	
$\beta^-_{0,1}$	max:	1845,3	(11)	10,3 (5)
$\beta^-_{0,1}$	avg:	695,6	(5)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Sm)	4,99 — 7,49		0,0044 (20)	
$XK\alpha_2$	(Sm)	39,5229		0,006 (4)	} $K\alpha$
$XK\alpha_1$	(Sm)	40,1186		0,010 (8)	}
$XK\beta_3$	(Sm)	45,289	}		
$XK\beta_1$	(Sm)	45,413	}	0,003 (2)	$K'\beta_1$
$XK\beta_5''$	(Sm)	45,731	}		
$XK\beta_2$	(Sm)	46,575	}		
$XK\beta_4$	(Sm)	46,705	}	0,001	$K'\beta_2$
$XKO_{2,3}$	(Sm)	46,813	}		
XL	(Gd)	5,36 — 8,1		7,1 (3)	
$XK\alpha_2$	(Gd)	42,3093		7,2 (2)	} $K\alpha$
$XK\alpha_1$	(Gd)	42,9967		13,0 (3)	}
$XK\beta_3$	(Gd)	48,556	}		
$XK\beta_1$	(Gd)	48,697	}	4,1 (1)	$K'\beta_1$
$XK\beta_5''$	(Gd)	49,053	}		
$XK\beta_2$	(Gd)	49,961	}		
$XK\beta_4$	(Gd)	50,099	}	1,08 (3)	$K'\beta_2$
$XKO_{2,3}$	(Gd)	50,219	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{26,24}$(Gd)	58,4	0,0039 (4)
$\gamma_{8,7}$(Gd)	80,4	0,0028 (14)
$\gamma_{1,0}$(Sm)	81,99 (2)	0,0031 (21)
$\gamma_{1,0}$(Gd)	123,0706 (9)	40,4 (5)
$\gamma_{18,15}$(Gd)	125,39 (5)	0,007 (2)
$\gamma_{24,20}$(Gd)	129,5	0,014 (2)
$\gamma_{8,6}$(Gd)	131,58 (5)	0,0111 (5)
$\gamma_{5,3}$(Gd)	134,84	0,0072 (4)
$\gamma_{16,12}$(Gd)	146,05 (5)	0,026 (1)
$\gamma_{16,11}$(Gd)	156,2	0,0098 (4)
$\gamma_{(-1,1)}$(Gd)	159,9	0,0010 (5)

	Energy keV	Photons per 100 disint.
$\gamma_{21,16}$(Gd)	162,09 (5)	0,0011 (4)
$\gamma_{15,8}$(Gd)	165,90 (21)	0,0025 (5)
$\gamma_{6,5}$(Gd)	180,7	0,0040 (5)
$\gamma_{2,1}$(Sm)	184,72	0,0037 (7)
$\gamma_{26,20}$(Gd)	188,24 (2)	0,239 (6)
$\gamma_{(-1,2)}$(Gd)	195,5 (5)	0,002 (1)
$\gamma_{(-1,3)}$(Gd)	197	0,0016 (2)
$\gamma_{22,17}$(Gd)	202,50 (16)	0,03 (1)
$\gamma_{26,19}$(Gd)	209,4 (4)	0,0025 (6)
$\gamma_{22,16}$(Gd)	219,4	0,0023 (5)
$\gamma_{14,7}$(Gd)	229,01 (13)	0,0024 (8)
$\gamma_{7,5}$(Gd)	232,01 (5)	0,024 (1)
$\gamma_{20,15}$(Gd)	237	0,006 (3)
$\gamma_{2,1}$(Gd)	247,9288 (7)	6,89 (7)
$\gamma_{16,9}$(Gd)	260,9	0,0022 (7)
$\gamma_{20,13}$(Gd)	267,44	0,0136 (7)
$\gamma_{(-1,4)}$(Gd)	269,8	0,0070 (11)
$\gamma_{(-1,5)}$(Gd)	274,0 (5)	0,0039 (2)
$\gamma_{20,12}$(Gd)	279,9	0,0030 (2)
$\gamma_{20,11}$(Gd)	290	0,0033 (2)
$\gamma_{21,13}$(Gd)	295,7	0,0024 (2)
$\gamma_{16,8}$(Gd)	296 (1)	0,0014 (9)
$\gamma_{26,18}$(Gd)	301,25	0,0102 (4)
$\gamma_{26,17}$(Gd)	305,1	0,0174 (7)
$\gamma_{(-1,6)}$(Gd)	308,2	0,0024 (6)
$\gamma_{8,5}$(Gd)	312,3	0,018 (2)
$\gamma_{6,3}$(Gd)	315,4	0,007 (2)
$\gamma_{(-1,7)}$(Gd)	320 (1)	0,0010 (7)
$\gamma_{26,16}$(Gd)	322,02 (5)	0,066 (3)
$\gamma_{7,4}$(Gd)	329,9 (7)	0,0091 (5)
$\gamma_{4,2}$(Gd)	346,72 (5)	0,029 (1)
$\gamma_{23,14}$(Gd)	368,21	0,0030 (2)
$\gamma_{18,7}$(Gd)	370,71	0,0056 (14)
$\gamma_{22,11}$(Gd)	375,2 (5)	0,0020 (8)
$\gamma_{23,13}$(Gd)	382,00 (5)	0,0099 (4)
$\gamma_{24,13}$(Gd)	397,1	0,029 (1)
$\gamma_{16,6}$(Gd)	401,259 (14)	0,189 (3)
$\gamma_{20,8}$(Gd)	403,55 (5)	0,026 (1)
$\gamma_{(-1,8)}$(Gd)	414,3	0,0049 (6)
$\gamma_{24,11}$(Gd)	419,4	0,0034 (20)
$\gamma_{(-1,9)}$(Gd)	422,1	0,0022 (9)
$\gamma_{(-1,10)}$(Gd)	435,9	0,0038 (10)
$\gamma_{5,2}$(Gd)	444,4924 (19)	0,560 (8)
$\gamma_{32,17}$(Gd)	463,9	0,0042 (3)
$\gamma_{26,12}$(Gd)	467,84 (5)	0,0604 (24)
$\gamma_{26,11}$(Gd)	478,27 (5)	0,224 (3)
$\gamma_{22,9}$(Gd)	480,61	0,0048 (3)

	Energy keV	Photons per 100 disint.
$\gamma_{20,7}$(Gd)	483,74	0,0050 (3)
$\gamma_{(-1,11)}$(Gd)	484,64	0,0039 (2)
$\gamma_{22,8}$(Gd)	488,26	0,007 (3)
$\gamma_{27,13}$(Gd)	506,4	0,0063 (14)
$\gamma_{(-1,12)}$(Gd)	510	0,059 (7)
$\gamma^{\pm}$	511	
$\gamma_{(-1,13)}$(Gd)	512	0,032 (7)
$\gamma_{23,8}$(Gd)	518,00 (5)	0,047 (2)
$\gamma_{24,8}$(Gd)	533,1	0,007 (2)
$\gamma_{29,13}$(Gd)	533,1	0,004 (3)
$\gamma_{13,4}$(Gd)	545,6	0,014 (2)
$\gamma_{3,1}$(Gd)	557,58 (5)	0,267 (5)
$\gamma_{21,6}$(Gd)	563,4	0,0028 (7)
$\gamma_{22,7}$(Gd)	569,23	0,0100 (8)
$\gamma_{16,5}$(Gd)	582,01 (5)	0,886 (11)
$\gamma_{26,8}$(Gd)	591,755 (3)	4,95 (5)
$\gamma_{31,13}$(Gd)	597,5	0,0055 (3)
$\gamma_{23,7}$(Gd)	598,3	0,0062 (7)
$\gamma_{17,5}$(Gd)	600	0,006 (4)
$\gamma_{18,5}$(Gd)	602,81 (5)	0,0033 (2)
$\gamma_{24,7}$(Gd)	613,26 (5)	0,093 (4)
$\gamma_{22,6}$(Gd)	620,52	0,091 (5)
$\gamma_{6,2}$(Gd)	625,2556 (24)	0,317 (5)
$\gamma_{27,8}$(Gd)	642,4	0,0044 (17)
$\gamma_{23,6}$(Gd)	649,44 (5)	0,078 (3)
$\gamma_{25,7}$(Gd)	650,6	0,0098 (4)
$\gamma_{24,6}$(Gd)	664,68 (5)	0,029 (1)
$\gamma_{29,8}$(Gd)	668,9	0,013 (2)
$\gamma_{7,2}$(Gd)	676,596 (12)	0,157 (11)
$\gamma_{5,1}$(Gd)	692,4205 (18)	1,79 (3)
$\gamma_{20,5}$(Gd)	715,77 (3)	0,19 (1)
$\gamma_{26,6}$(Gd)	723,3014 (22)	20,05 (21)
$\gamma_{(-1,14)}$(Gd)	737,6	0,0063 (24)
$\gamma_{8,2}$(Gd)	756,8020 (23)	4,53 (5)
$\gamma_{27,6}$(Gd)	774,4	0,008 (4)
$\gamma_{30,7}$(Gd)	790,2	0,010 (3)
$\gamma_{29,6}$(Gd)	800,2	0,032 (5)
$\gamma_{22,5}$(Gd)	801,21 (4)	0,012 (3)
$\gamma_{5,0}$(Gd)	815,53 (5)	0,512 (7)
$\gamma_{(-1,15)}$(Gd)	830,3	0,008 (3)
$\gamma_{24,5}$(Gd)	845,416 (7)	0,586 (9)
$\gamma_{20,3}$(Gd)	850,64 (3)	0,241 (4)
$\gamma_{6,1}$(Gd)	873,1834 (23)	12,17 (12)
$\gamma_{12,2}$(Gd)	880,60 (3)	0,081 (4)
$\gamma_{13,2}$(Gd)	892,775 (6)	0,514 (7)
$\gamma_{33,6}$(Gd)	898,36	0,0020 (5)
$\gamma_{26,5}$(Gd)	904,064 (3)	0,890 (11)

	Energy keV	Photons per 100 disint.
$\gamma_{14,2}$(Gd)	906,1	0,0118 (6)
$\gamma_{(-1,16)}$(Gd)	919,24	0,012 (1)
$\gamma_{7,1}$(Gd)	924,63 (5)	0,062 (2)
$\gamma_{(-1,17)}$(Gd)	928,4	0,0045 (21)
$\gamma_{29,5}$(Gd)	981,3 (5)	0,0084 (17)
$\gamma_{(-1,18)}$(Gd)	984,5	0,0094 (21)
$\gamma_{6,0}$(Gd)	996,25 (5)	10,5 (1)
$\gamma_{8,1}$(Gd)	1004,718 (7)	17,86 (18)
$\gamma_{9,1}$(Gd)	1012,8 (2)	0,003 (1)
$\gamma_{30,5}$(Gd)	1023 (1)	0,0066 (25)
$\gamma_{(-1,19)}$(Gd)	1033,4	0,0119 (7)
$\gamma_{18,2}$(Gd)	1047,4 (1)	0,049 (3)
$\gamma_{(-1,20)}$(Gd)	1049,4 (1)	0,0172 (8)
$\gamma_{(-1,21)}$(Gd)	1072,2	0,0035 (14)
$\gamma_{10,1}$(Gd)	1110	0,003 (2)
$\gamma_{11,1}$(Gd)	1118,52 (6)	0,108 (14)
$\gamma_{(-1,22)}$(Gd)	1124,2	0,0069 (10)
$\gamma_{12,1}$(Gd)	1128,552 (7)	0,317 (5)
$\gamma_{9,0}$(Gd)	1136,1	0,007 (1)
$\gamma_{13,1}$(Gd)	1140,702 (6)	0,235 (4)
$\gamma_{(-1,23)}$(Gd)	1153,1 (5)	0,011 (4)
$\gamma_{20,2}$(Gd)	1160,36 (8)	0,0436 (21)
$\gamma_{15,1}$(Gd)	1170,7 (5)	0,0036 (10)
$\gamma_{21,2}$(Gd)	1188,34 (17)	0,093 (7)
$\gamma_{(-1,25)}$(Gd)	1216,8	0,0033 (10)
$\gamma_{(-1,24)}$(Gd)	1232,1 (5)	0,008 (5)
$\gamma_{11,0}$(Gd)	1241,43 (10)	0,133 (6)
$\gamma_{22,2}$(Gd)	1246,121 (4)	0,862 (11)
$\gamma_{16,1}$(Gd)	1274,429 (4)	34,9 (3)
$\gamma_{24,2}$(Gd)	1290,5 (1)	0,025 (3)
$\gamma_{17,1}$(Gd)	1292,0 (2)	0,0127 (5)
$\gamma_{18,1}$(Gd)	1295,5 (2)	0,0091 (10)
$\gamma_{(-1,26)}$(Gd)	1316,4 (3)	0,017 (4)
$\gamma_{19,1}$(Gd)	1387,0 (5)	0,019 (2)
$\gamma_{27,2}$(Gd)	1397,34 (5)	0,0031 (8)
$\gamma_{20,1}$(Gd)	1408,5 (2)	0,023 (3)
$\gamma_{17,0}$(Gd)	1415,0 (5)	0,040 (2)
$\gamma_{18,0}$(Gd)	1418,6 (2)	0,011 (2)
$\gamma_{28,2}$(Gd)	1419,0 (2)	0,0020 (1)
$\gamma_{29,2}$(Gd)	1425,9 (5)	0,0012 (7)
$\gamma_{31,2}$(Gd)	1489,6 (2)	0,0029 (4)
$\gamma_{22,1}$(Gd)	1494,048 (4)	0,698 (9)
$\gamma_{19,0}$(Gd)	1510,0 (5)	0,0048 (10)
$\gamma_{33,2}$(Gd)	1522 (1)	0,0006 (3)
$\gamma_{20,0}$(Gd)	1531,4 (2)	0,0060 (4)
$\gamma_{24,1}$(Gd)	1537,81 (4)	0,053 (2)
$\gamma_{(-1,27)}$(Gd)	1554	0,0011 (5)

	Energy keV	Photons per 100 disint.
$\gamma_{26,1}$(Gd)	1596,4804 (28)	1,783 (17)
$\gamma_{28,1}$(Gd)	1667,3 (2)	0,0019 (3)
$\gamma_{29,1}$(Gd)	1674,0 (5)	0,0017 (4)
$\gamma_{30,1}$(Gd)	1716,9 (5)	0,0006 (3)
$\gamma_{33,1}$(Gd)	1773 (1)	0,00035 (21)
$\gamma_{30,0}$(Gd)	1838,0 (5)	0,0008 (2)
$\gamma_{33,0}$(Gd)	1895 (1)	0,0006 (2)

6 Main Production Modes

$\left\{ \begin{array}{l} \text{Eu} - 153(\text{n},\gamma)\text{Eu} - 154 \\ \text{Possible impurities : Eu} - 152,\text{Eu} - 155 \end{array} \right.$

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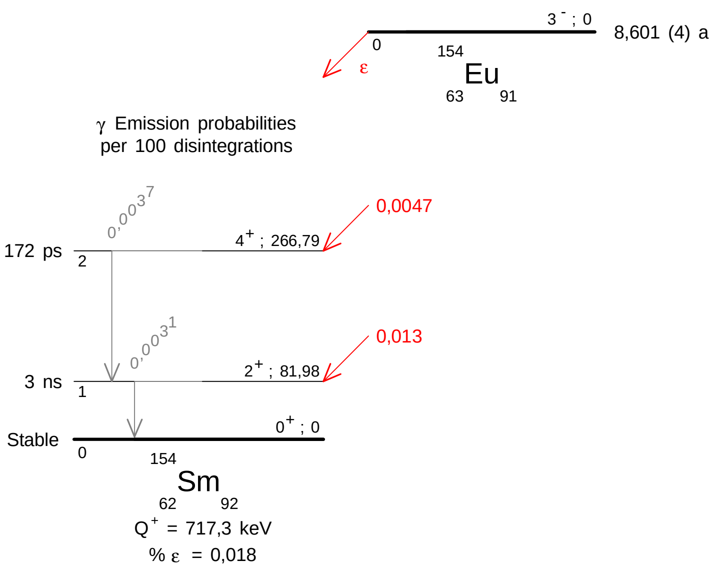
3 - ; 0
8,601 (4) a
0
154
Eu
63
91
ε
γ Emission probabilities
per 100 disintegrations
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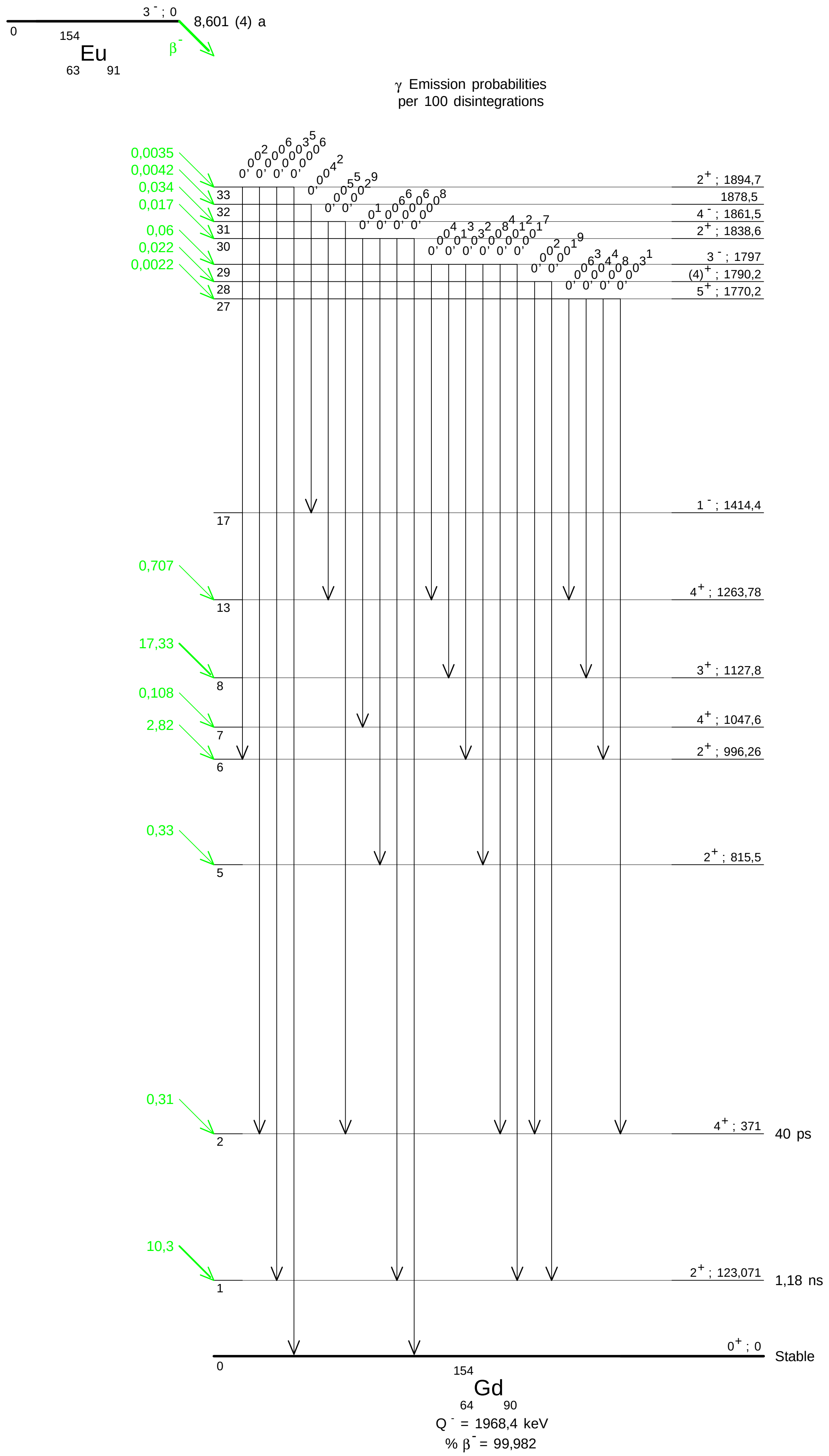
0,0047
4+ ; 266,79
172 ps
2
0,0031
0,013
2+ ; 81,98
3 ns
1
0+ ; 0
Stable
0
154
Sm
62
92
Q+ = 717,3 keV
% ε = 0,018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8,601 (4) a
154 Eu 63 91
β-
γ Emission probabilities
per 100 disintegrations
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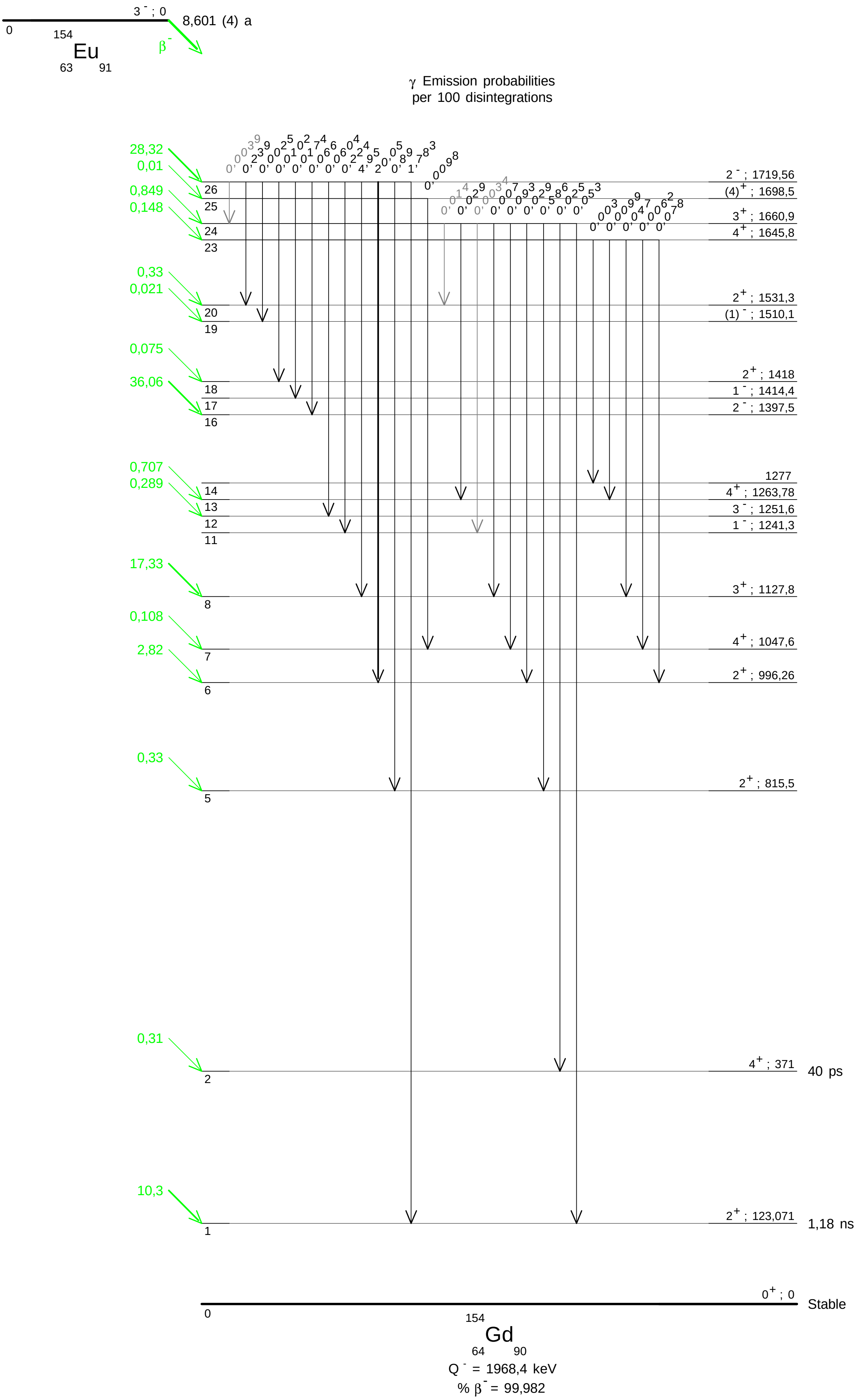
0,0042
0,034
0,017
0,06
0,022
0,0022
0,707
17,33
0,108
2,82
0,33
0,31
10,3
2+ ; 1894,7
1878,5
4 - ; 1861,5
2+ ; 1838,6
3 - ; 1797
(4)+ ; 1790,2
5+ ; 1770,2
1 - ; 1414,4
4+ ; 1263,78
3+ ; 1127,8
4+ ; 1047,6
2+ ; 996,26
2+ ; 815,5
4+ ; 371
40 ps
2+ ; 123,071
1,18 ns
0+ ; 0
Stable
154 Gd 64 90
Q - = 1968,4 keV
% β- = 99,982


3 ⁻ ; 0
8,601 (4) a
154 Eu 63 91
β⁻
γ Emission probabilities
per 100 disintegrations
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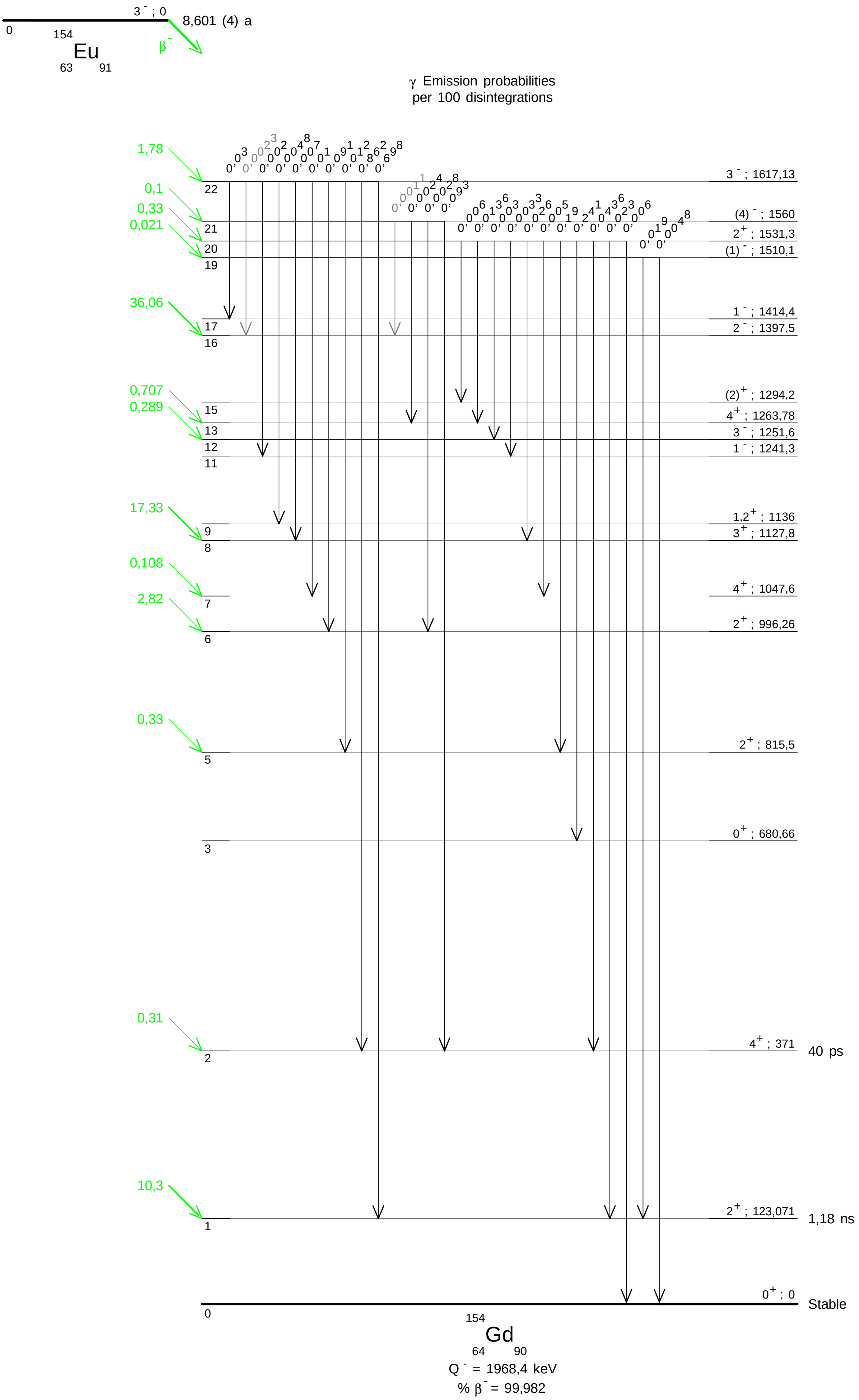
(4)⁺ ; 1698,5
3⁺ ; 1660,9
4⁺ ; 1645,8
2⁺ ; 1531,3
(1) ⁻ ; 1510,1
2⁺ ; 1418
1 ⁻ ; 1414,4
2 ⁻ ; 1397,5
1277
4⁺ ; 1263,78
3 ⁻ ; 1251,6
1 ⁻ ; 1241,3
3⁺ ; 1127,8
4⁺ ; 1047,6
2⁺ ; 996,26
2⁺ ; 815,5
4⁺ ; 371
40 ps
2⁺ ; 123,071
1,18 ns
0⁺ ; 0
Stable
28,32
0,01
0,849
0,148
0,33
0,021
0,075
36,06
0,707
0,289
17,33
0,108
2,82
0,33
0,31
10,3
154 Gd 64 90
Q ⁻ = 1968,4 keV
% β⁻ = 99,982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0
154
Eu
63 91
β-
γ Emission probabilities
per 100 disintegrations
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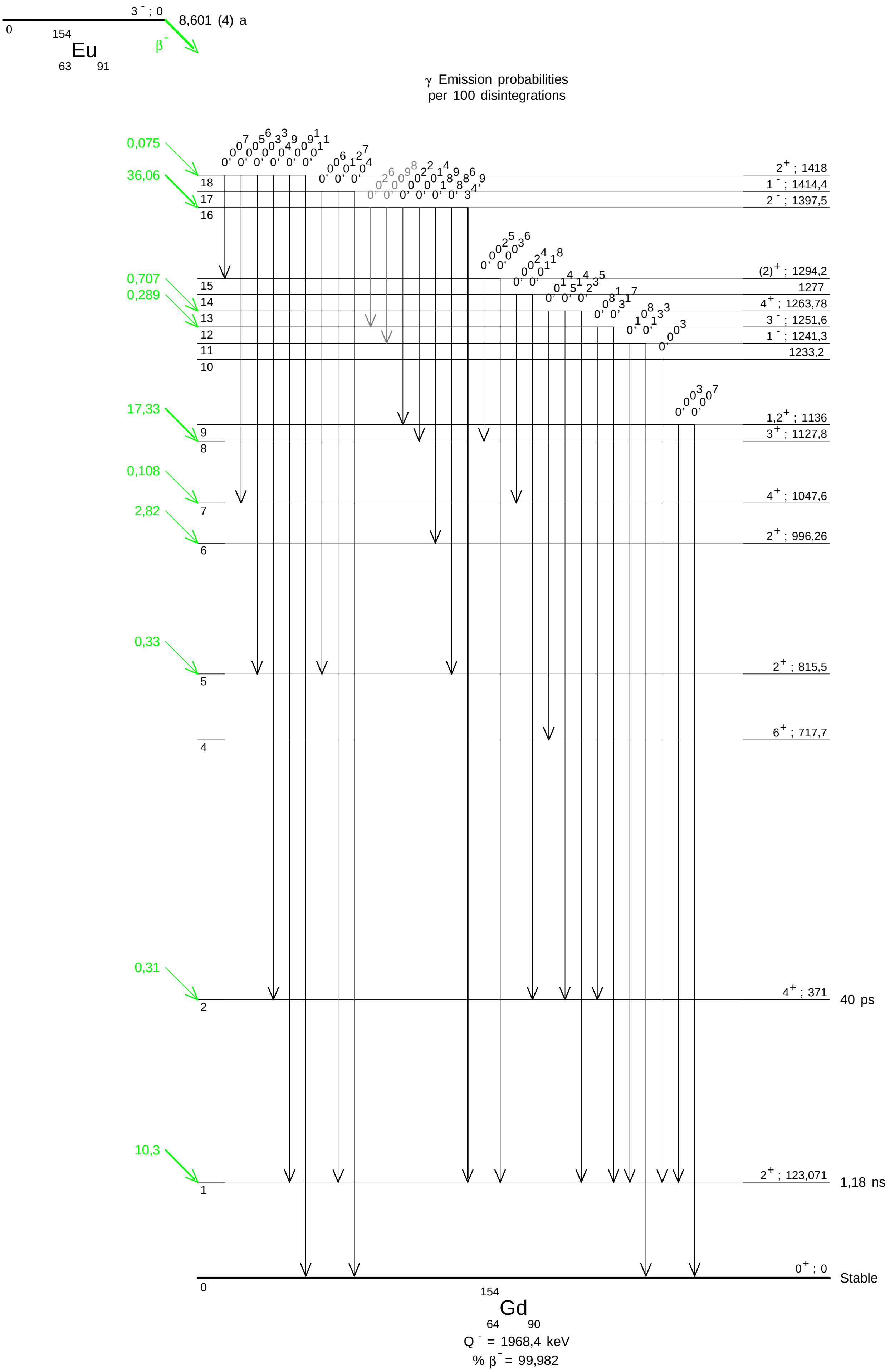
0,1
0,33
0,021
36,06
0,707
0,289
17,33
0,108
2,82
0,33
0,31
10,3
22
21
20
19
17
16
15
13
12
11
9
8
7
6
5
3
2
1
0
3 - ; 1617,13
(4) - ; 1560
2+ ; 1531,3
(1) - ; 1510,1
1 - ; 1414,4
2 - ; 1397,5
(2)+ ; 1294,2
4+ ; 1263,78
3 - ; 1251,6
1 - ; 1241,3
1,2+ ; 1136
3+ ; 1127,8
4+ ; 1047,6
2+ ; 996,26
2+ ; 815,5
0+ ; 680,66
4+ ; 371
40 ps
2+ ; 123,071
1,18 ns
0+ ; 0
Stable
154
Gd
64 90
Q - = 1968,4 keV
% β- = 99,982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8,601 (4) a
154 Eu 63 91
β-
γ Emission probabilities
per 100 disintegrations
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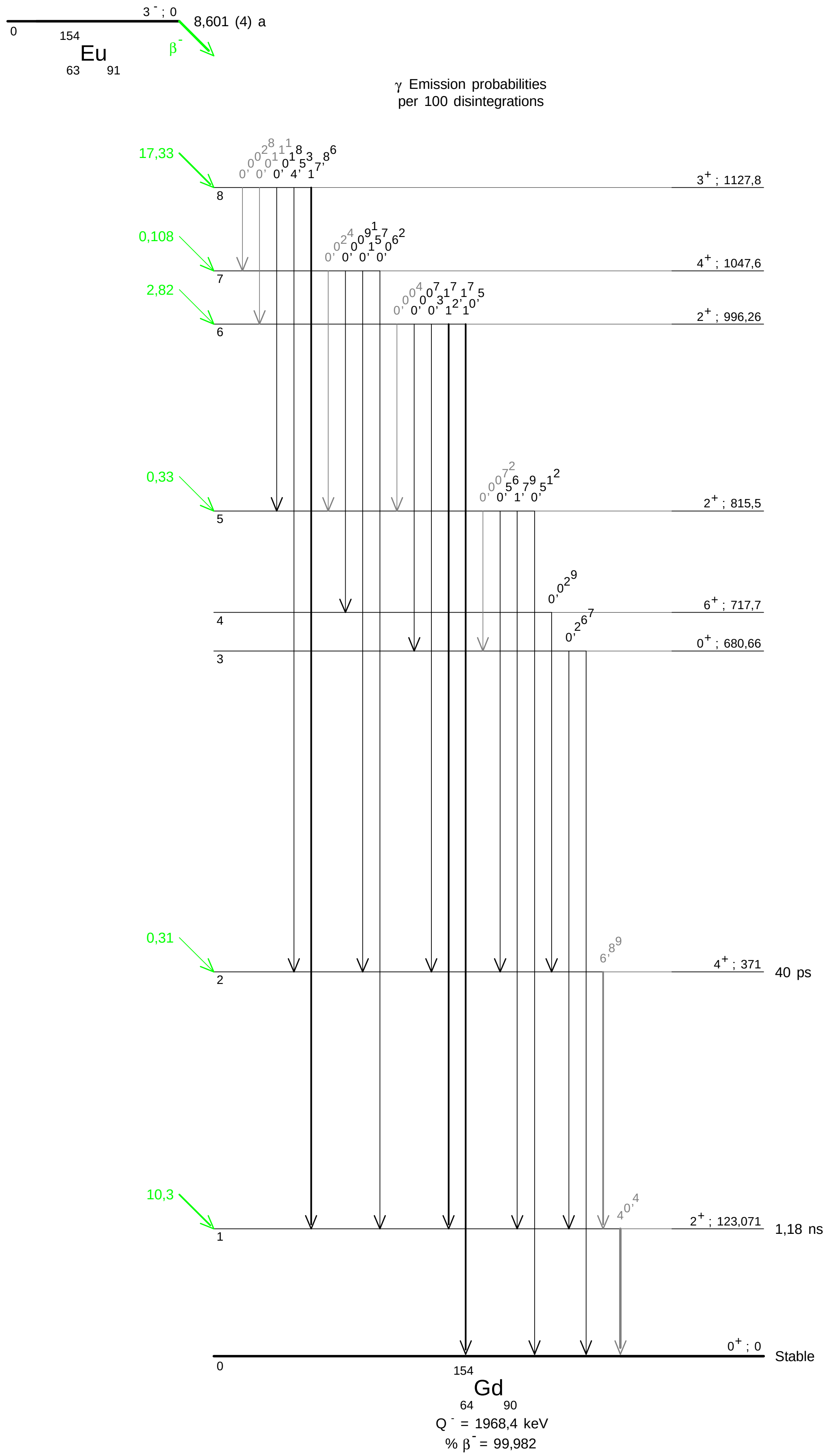
36,06
0,707
0,289
17,33
0,108
2,82
0,33
0,31
10,3
2+ ; 1418
1 - ; 1414,4
2 - ; 1397,5
(2)+ ; 1294,2
1277
4+ ; 1263,78
3 - ; 1251,6
1 - ; 1241,3
1233,2
1,2+ ; 1136
3+ ; 1127,8
4+ ; 1047,6
2+ ; 996,26
2+ ; 815,5
6+ ; 717,7
4+ ; 371
40 ps
2+ ; 123,071
1,18 ns
0+ ; 0
Stable
154 Gd 64 90
Q - = 1968,4 keV
% β- = 99,982


3⁻ ; 0
8,601 (4) a
0
154
Eu
63 91
β⁻
γ Emission probabilities
per 100 disintegrations
17,33
0,108
2,82
0,33
0,31
10,3
3⁺ ; 1127,8
4⁺ ; 1047,6
2⁺ ; 996,26
2⁺ ; 815,5
6⁺ ; 717,7
0⁺ ; 680,66
4⁺ ; 371
40 ps
2⁺ ; 123,071
1,18 ns
0⁺ ; 0
Stable
8
7
6
5
4
3
2
1
0
154
Gd
64 90
Q⁻ = 1968,4 keV
% β⁻ = 99,982

$^{155}_{63}$Eu $_{92}$

1 Decay Scheme

Eu-155 disintegrates 100 % via beta minus disintegration to excited levels and to the ground state in Gd-155.
L'europium 155 se désintègre par émission bêta moins vers des niveaux excités et le niveau fondamental de gadolinium 155.

2 Nuclear Data

$T_{1/2}$(^{155}Eu)	:	4,753	(14)	a
Q^-(^{155}Eu)	:	252,1	(11)	keV

2.1 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,6}$	106,1 (11)	0,73 (7)	1st Forbidden	8,83
$\beta^-_{0,5}$	134,2 (11)	1,85 (23)	Allowed	8,75
$\beta^-_{0,4}$	144,6 (11)	<0,01	2nd Forbidden	>11,1
$\beta^-_{0,3}$	146,9 (11)	46,1 (29)	Allowed	7,47
$\beta^-_{0,2}$	165,7 (11)	25,5 (29)	Allowed	7,89
$\beta^-_{0,1}$	192,2 (11)	9,2 (4)	1st Forbidden	8,54
$\beta^-_{0,0}$	252,2 (11)	16,6 (11)	Allowed	8,65

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{5,4}$(Gd)	10,4183 (13)	1,2 (1)	M1+0,11%E2		265 (22)	59 (5)	340 (23)
$\gamma_{3,2}$(Gd)	18,763 (2)	17,7 (28)	M1+7,1%E2		284 (22)	65,9 (30)	367 (22)

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{4,2}$(Gd)	21,035 (4)	1,2 (1)	E2		2013 (60)	471 (14)	2600 (70)
$\gamma_{2,1}$(Gd)	26,531 (21)	0,94 (7)	E1		1,55 (5)	0,342 (11)	1,98 (6)
$\gamma_{5,2}$(Gd)	31,444 (7)	0,50 (15)	M1+17%E2		53 (13)	12,5 (30)	69 (14)
$\gamma_{3,1}$(Gd)	45,299 (1)	1,89 (7)	E1		0,347 (10)	0,0758 (23)	0,443 (11)
$\gamma_{5,1}$(Gd)	57,989 (1)	0,150 (14)	E1	1,021 (10)	0,173 (5)	0,0377 (11)	1,243 (11)
$\gamma_{1,0}$(Gd)	60,0086 (10)	12,8 (6)	M1+4,1%E2	7,48 (9)	1,55 (6)	0,347 (14)	9,48 (11)
$\gamma_{6,1}$(Gd)	86,0591 (10)	0,65 (7)	M1+3,0%E2	2,66 (3)	0,443 (17)	0,098 (4)	3,23 (4)
$\gamma_{2,0}$(Gd)	86,5479 (10)	44,0 (5)	E1	0,360 (4)	0,0561 (17)	0,0122 (4)	0,432 (7)
$\gamma_{3,0}$(Gd)	105,3083 (10)	26,5 (8)	E1	0,214 (2)	0,0323 (10)	0,00701 (21)	0,255 (3)
$\gamma_{6,0}$(Gd)	146,071 (1)	0,084 (7)	E2	0,397 (4)	0,198 (6)	0,0462 (14)	0,653 (8)

3 Atomic Data

3.1 Gd

ω_K	:	0,932	(4)
$\bar{\omega}_L$	:	0,176	(6)
n_{KL}	:	0,850	(4)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	42,3093		55,59
	$K\alpha_1$	42,9967		100
	$K\beta_3$	48,556	}	
	$K\beta_1$	48,697	}	
	$K\beta_5''$	49,053	}	31,8
	$K\beta_2$	49,961	}	
	$K\beta_4$	50,099	}	8,1
	$KO_{2,3}$	50,219	}	
X_L				
	$L\ell$	5,36		
	$L\gamma$	– 8,35		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	33,49 – 35,75	100
KLX	39,98 – 42,86	51,3
KXY	47,98 – 48,95	6,58
Auger L	3,4 – 8,3	

4 Electron Emissions

		Energy keV	Electrons per 100 disint.
e_{AL}	(Gd)	3,4 - 8,3	35,1 (20)
e_{AK}	(Gd)		1,71 (11)
	KLL	33,49 - 35,75	}
	KLX	39,98 - 42,86	}
	KXY	47,98 - 48,95	}
$ec_{5,4\ L}$	(Gd)	2,043 - 3,175	0,93 (13)
$ec_{5,1\ K}$	(Gd)	7,75 (3)	0,068 (7)
$ec_{5,4\ M}$	(Gd)	8,538 - 9,233	0,21 (3)
$ec_{1,0\ K}$	(Gd)	9,770 (3)	9,1 (4)
$ec_{3,2\ L}$	(Gd)	10,387 - 11,520	13,6 (23)
$ec_{4,2\ L}$	(Gd)	12,659 - 13,792	0,93 (18)
$ec_{3,2\ M}$	(Gd)	16,882 - 17,578	3,2 (5)
$ec_{2,1\ L}$	(Gd)	18,155 - 19,288	0,49 (4)
$ec_{4,2\ M}$	(Gd)	19,154 - 19,850	0,22 (4)
$ec_{5,2\ L}$	(Gd)	23,068 - 24,201	0,38 (4)
$ec_{2,1\ M}$	(Gd)	24,650 - 25,346	0,108 (8)
$ec_{5,2\ M}$	(Gd)	29,563 - 30,259	0,09 (3)
$ec_{6,1\ K}$	(Gd)	35,820 (3)	0,41 (5)
$ec_{2,0\ K}$	(Gd)	36,309 (3)	11,05 (16)
$ec_{3,1\ L}$	(Gd)	36,923 - 38,056	0,45 (2)
$ec_{3,1\ M}$	(Gd)	43,418 - 44,114	0,100 (5)
$ec_{5,1\ L}$	(Gd)	49,613 - 50,746	0,012 (1)
$ec_{1,0\ L}$	(Gd)	51,633 - 52,766	1,89 (11)
$ec_{3,0\ K}$	(Gd)	55,069 (3)	4,52 (14)
$ec_{5,1\ M}$	(Gd)	56,108 - 56,804	0,0030 (3)
$ec_{1,0\ M}$	(Gd)	58,128 - 58,823	0,42 (3)
$ec_{6,1\ L}$	(Gd)	77,683 - 78,816	0,068 (8)
$ec_{2,0\ L}$	(Gd)	78,172 - 79,305	1,72 (5)
$ec_{6,1\ M}$	(Gd)	84,178 - 84,874	0,015 (2)
$ec_{2,0\ M}$	(Gd)	84,667 - 85,363	0,375 (13)

		Energy keV		Electrons per 100 disint.
$ec_{6,0\ K}$	(Gd)	95,832	(3)	0,0202 (16)
$ec_{3,0\ L}$	(Gd)	96,933 - 98,066		0,68 (3)
$ec_{3,0\ M}$	(Gd)	103,428 - 104,123		0,148 (8)
$ec_{6,0\ L}$	(Gd)	137,696 - 138,829		0,0101 (8)
$ec_{6,0\ M}$	(Gd)	144,190 - 144,886		0,0024 (2)
$\beta^-_{0,6}$	max:	106,1	(11)	0,73 (7)
$\beta^-_{0,6}$	avg:	27,8	(3)	
$\beta^-_{0,5}$	max:	134,2	(11)	1,85 (23)
$\beta^-_{0,5}$	avg:	35,6	(3)	
$\beta^-_{0,4}$	max:	144,6	(11)	0,01
$\beta^-_{0,4}$	avg:			
$\beta^-_{0,3}$	max:	146,9	(11)	46,1 (29)
$\beta^-_{0,3}$	avg:	39,2	(3)	
$\beta^-_{0,2}$	max:	165,7	(11)	25,5 (29)
$\beta^-_{0,2}$	avg:	44,6	(3)	
$\beta^-_{0,1}$	max:	192,2	(11)	9,2 (4)
$\beta^-_{0,1}$	avg:	52,3	(3)	
$\beta^-_{0,0}$	max:	252,2	(11)	16,6 (11)
$\beta^-_{0,0}$	avg:	70,2	(3)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Gd)	5,36 — 8,35		7,5 (5)	
XKα_2	(Gd)	42,3093		6,70 (13)	} Kα
XKα_1	(Gd)	42,9967		12,05 (23)	}
XKβ_3	(Gd)	48,556	}		
XKβ_1	(Gd)	48,697	}	3,84 (11)	K$'\beta_1$
XKβ_5''	(Gd)	49,053	}		
XKβ_2	(Gd)	49,961	}		
XKβ_4	(Gd)	50,099	}	0,977 (26)	K$'\beta_2$
XKO$_{2,3}$	(Gd)	50,219	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{5,4}$(Gd)	10,4183 (13)	0,0035 (4)
$\gamma_{3,2}$(Gd)	18,763 (2)	0,048 (7)
$\gamma_{4,2}$(Gd)	21,035 (4)	0,00046 (3)
$\gamma_{2,1}$(Gd)	26,531 (21)	0,316 (22)
$\gamma_{5,2}$(Gd)	31,444 (7)	0,0071 (15)
$\gamma_{3,1}$(Gd)	45,299 (1)	1,31 (5)
$\gamma_{5,1}$(Gd)	57,989 (1)	0,067 (6)
$\gamma_{1,0}$(Gd)	60,0086 (10)	1,22 (5)
$\gamma_{6,1}$(Gd)	86,0591 (10)	0,154 (17)
$\gamma_{2,0}$(Gd)	86,5479 (10)	30,7 (3)
$\gamma_{3,0}$(Gd)	105,3083 (10)	21,1 (6)
$\gamma_{6,0}$(Gd)	146,071 (1)	0,051 (4)

6 Main Production Modes

Sm – 154(n,γ)Sm – 155
Possible impurities : Eu – 152, Eu – 154

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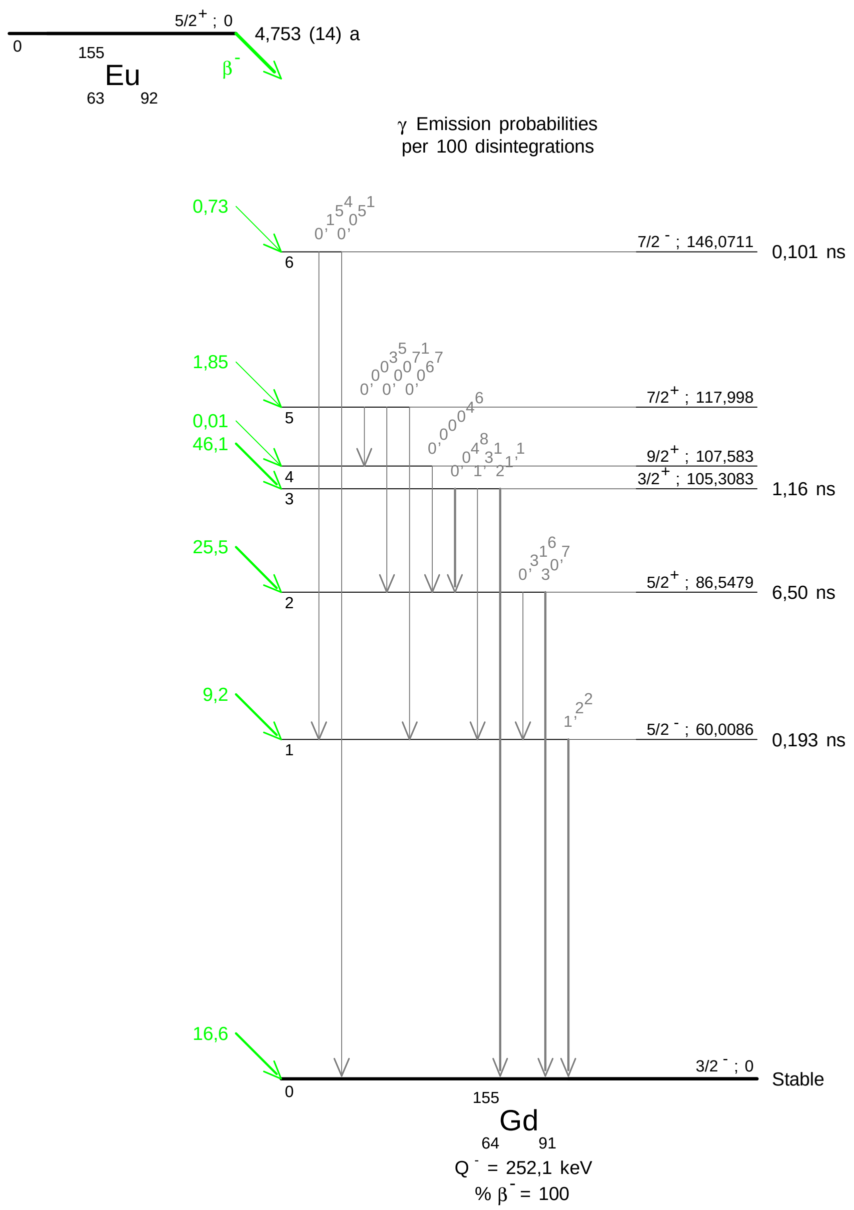
5/2+ ; 0
0
155
Eu
63 92
4,753 (14) a
β-
γ Emission probabilities
per 100 disintegrations
0,73
1,85
0,01
46,1
25,5
9,2
16,6
7/2 - ; 146,0711
0,101 ns
7/2+ ; 117,998
9/2+ ; 107,583
3/2+ ; 105,3083
1,16 ns
5/2+ ; 86,5479
6,50 ns
5/2 - ; 60,0086
0,193 ns
3/2 - ; 0
Stable
155
Gd
64 91
Q - = 252,1 keV
% β- = 100

$^{166}_{67}$Ho $_{99}$

1 Decay Scheme

Ho-166 decays by beta minus emission to excited states of Er-166.
L'holmium 166 se désintègre uniquement par émission bêta moins vers les états excités d'erbium 166.

2 Nuclear Data

$T_{1/2}$(^{166}Ho)	:	26,795	(29)	h
Q^-(^{166}Ho)	:	1854,5	(9)	keV

2.1 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,8}$	24,1 (9)	0,0353 (11)		5
$\beta^-_{0,7}$	41,7 (9)	0,00010 (3)	1st forbidden	12,1
$\beta^-_{0,6}$	192,0 (9)	0,304 (7)	Allowed	6,9
$\beta^-_{0,5}$	326,2 (9)	0,00276 (22)	Unique 1st forbidden	9,5
$\beta^-_{0,4}$	394,5 (9)	0,955 (16)	1st forbidden	7,4
$\beta^-_{0,3}$	1068,6 (9)	0,0072 (21)	Unique 1st forbidden	11,6
$\beta^-_{0,1}$	1773,9 (9)	50,5 (15)	Unique 1st forbidden	9
$\beta^-_{0,0}$	1854,5 (9)	48,2 (15)	1st forbidden	8,1

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L (10^{-2})	α_M (10^{-2})	α_T
$\gamma_{1,0}$(Er)	80,5725 (13)	51,7 (11)	E2	1,65 (5)	401 (8)	97,8 (20)	6,90 (14)
$\gamma_{2,1}$(Er)	184,4107 (21)	0,0020 (9)	E2	0,205 (6)	9,84 (30)	2,36 (7)	0,333 (10)
$\gamma_{3,2}$(Er)	520,80 (7)	0,00036 (2)	E2	0,01192 (36)	0,234 (7)	0,0535 (16)	0,0149 (5)
$\gamma_{4,3}$(Er)	674,25 (7)	0,0200 (17)	E2	0,00653 (20)	0,1138 (34)	0,0257 (8)	0,00799 (24)

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L (10^{-2})	α_M (10^{-2})	α_T
$\gamma_{3,1}$(Er)	705,21 (7)	0,0147 (12)	E2+M1	0,00591 (18)	0,1012 (30)	0,0228 (7)	0,00721 (22)
$\gamma_{3,0}$(Er)	785,78 (7)	0,0121 (3)	E2	0,00467 (14)	0,0769 (23)	0,0173 (5)	0,00566 (17)
$\gamma_{5,2}$(Er)	1263,25 (15)	0,0155 (9)	E2(+M3)	0,0018 (2)	0,03 (1)	0,0058 (2)	0,0021 (2)
$\gamma_{4,1}$(Er)	1379,452 (10)	0,935 (35)	E2	0,00151 (5)	0,022 (1)	0,0048 (2)	0,00179 (5)
$\gamma_{5,1}$(Er)	1447,66 (15)	0,00105 (10)	E2(+E0)	0,00138 (4)	0,0198 (6)	0,0044 (2)	0,00163 (5)
$\gamma_{4,0}$(Er)	1460,025 (10)	0,0003	E0	0,3			
$\gamma_{5,0}$(Er)	1528,23 (15)	0,00014 (5)	E2	0,00125 (4)	0,0178 (5)		0,00147 (4)
$\gamma_{6,1}$(Er)	1581,860 (15)	0,186 (4)	E1+(M2)	0,0006 (1)			
$\gamma_{6,0}$(Er)	1662,433 (15)	0,118 (5)	E1	0,000484 (15)			
$\gamma_{7,1}$(Er)	1732,2 (5)	0,000046 (20)	M1(+E2)	0,0015 (2)			
$\gamma_{8,1}$(Er)	1749,846 (24)	0,0272 (10)	E1(+M2)	0,0005 (2)			
$\gamma_{7,0}$(Er)	1812,8 (5)	0,000056 (19)	E1(+M2)	0,0004 (2)			
$\gamma_{8,0}$(Er)	1830,419 (24)	0,0081 (2)	E1	0,000413 (12)			

3 Atomic Data

3.1 Er

ω_K	:	0,942	(4)
$\bar{\omega}_L$	:	0,216	(9)
n_{KL}	:	0,838	(4)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	48,2215		56,34
	$K\alpha_1$	49,1282		100
	$K\beta_3$	55,495	}	
	$K\beta_1$	55,682	}	
	$K\beta_5''$	56,04	}	32,5
	$K\beta_2$	57,21	}	
	$K\beta_4$	57,313	}	8,45
	$KO_{2,3}$	57,456	}	
X_L				
	$L\ell$	6,14		
	$L\alpha$	6,9 – 6,95		
	$L\eta$	7,05		
	$L\beta$	7,75 – 8,34		
	$L\gamma$	8,81 – 9,43		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	37,78 – 40,55	100
KLX	45,52 – 49,10	52,4
KXY	53,07 – 57,84	6,86
Auger L	3,9 – 7,6	

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Er)	3,9 - 7,6		28,0 (6)
e_{AK}	(Er)			0,63 (5)
	KLL	37,78 - 40,55	}	
	KLX	45,52 - 49,10	}	
	KXY	53,07 - 57,84	}	
$ec_{1,0\ T}$	(Er)	23,09 - 80,54		45,2 (15)
$ec_{1,0\ K}$	(Er)	23,090 (2)		10,81 (35)
$ec_{1,0\ L}$	(Er)	70,82 - 72,22		26,3 (8)
$ec_{1,0\ M}$	(Er)	78,37 - 79,16		6,41 (21)
$ec_{1,0\ N}$	(Er)	80,12 - 80,57		1,493 (49)
$\beta^-_{0,8}$	max:	24,1 (9)		0,0353 (11)
$\beta^-_{0,8}$	avg:	7,1 (10)		
$\beta^-_{0,7}$	max:	41,7 (9)		0,00010 (3)
$\beta^-_{0,7}$	avg:	13 (2)		
$\beta^-_{0,6}$	max:	192,0 (9)		0,304 (7)
$\beta^-_{0,6}$	avg:	52 (1)		
$\beta^-_{0,5}$	max:	326,2 (9)		0,00276 (22)
$\beta^-_{0,5}$	avg:	93 (3)		
$\beta^-_{0,4}$	max:	394,5 (9)		0,955 (16)
$\beta^-_{0,4}$	avg:	115 (3)		
$\beta^-_{0,3}$	max:	1068,6 (9)		0,0072 (21)
$\beta^-_{0,3}$	avg:	356 (9)		
$\beta^-_{0,1}$	max:	1773,9 (9)		50,5 (15)
$\beta^-_{0,1}$	avg:	651,1 (6)		
$\beta^-_{0,0}$	max:	1854,5 (9)		48,2 (15)
$\beta^-_{0,0}$	avg:	693,8 (6)		

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Er)	6,14 — 9,43		7,91 (18)	
XKα_2	(Er)	48,2215		2,91 (10)	} Kα
XKα_1	(Er)	49,1282		5,16 (17)	}
XKβ_3	(Er)	55,495	}		
XKβ_1	(Er)	55,682	}	1,68 (6)	K$'\beta_1$
XKβ_5''	(Er)	56,04	}		
XKβ_2	(Er)	57,21	}		
XKβ_4	(Er)	57,313	}	0,436 (18)	K$'\beta_2$
XKO$_{2,3}$	(Er)	57,456	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Er)	80,5725 (13)	6,55 (8)
$\gamma_{2,1}$(Er)	184,4107 (11)	0,0015 (7)
$\gamma_{3,2}$(Er)	520,80 (7)	0,00035 (2)
$\gamma_{4,3}$(Er)	674,24 (7)	0,0198 (17)
$\gamma_{3,1}$(Er)	705,21 (7)	0,0146 (12)
$\gamma_{3,0}$(Er)	785,78 (7)	0,0120 (3)
$\gamma_{5,2}$(Er)	1263,24 (15)	0,0155 (9)
$\gamma_{4,1}$(Er)	1379,446 (10)	0,933 (35)
$\gamma_{5,1}$(Er)	1447,66 (15)	0,00105 (10)
$\gamma_{4,0}$(Er)	1460,018 (10)	0,0002
$\gamma_{5,0}$(Er)	1528,23 (15)	0,00014 (5)
$\gamma_{6,1}$(Er)	1581,852 (15)	0,186 (4)
$\gamma_{6,0}$(Er)	1662,424 (15)	0,118 (5)
$\gamma_{7,1}$(Er)	1732,2 (5)	0,000046 (20)
$\gamma_{8,1}$(Er)	1749,837 (14)	0,0272 (10)
$\gamma_{7,0}$(Er)	1812,8 (5)	0,000056 (19)
$\gamma_{8,0}$(Er)	1830,408 (24)	0,0081 (2)

6 Main Production Modes

Ho – 165 (E = thermal)(n,γ)Ho – 166

Ho – 165(d,p)Ho – 166

Ho – 165(d,pg)Ho – 166

Er – 167(t)Ho – 166

Dy – 166 decay, $T_{1/2}$ = 81,6 h

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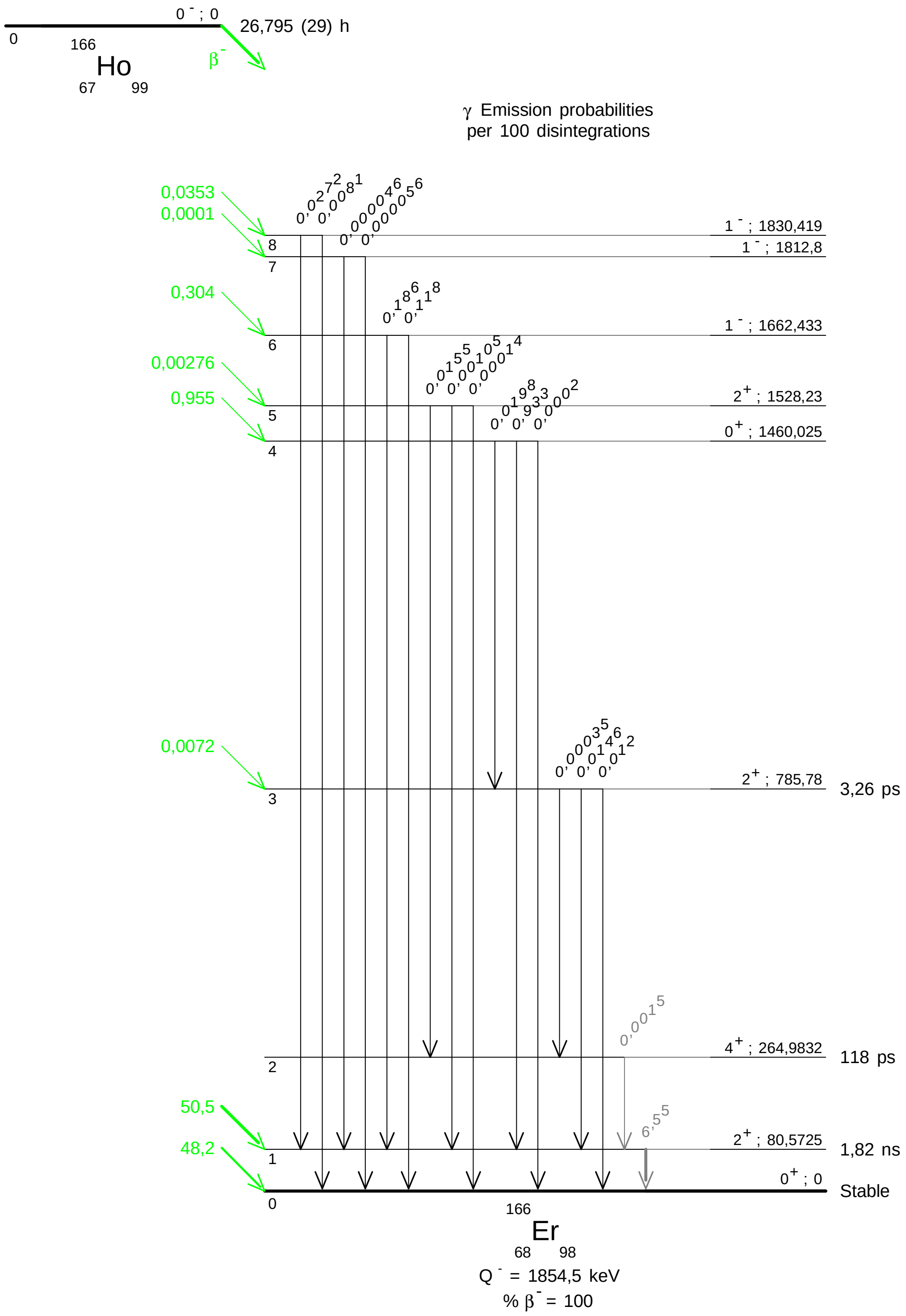
0 ⁻ ; 0
26,795 (29) h
0
166
Ho
67 99
β⁻
γ Emission probabilities
per 100 disintegrations
0,0353
0,0001
0,304
0,00276
0,955
0,0072
50,5
48,2
1 ⁻ ; 1830,419
1 ⁻ ; 1812,8
1 ⁻ ; 1662,433
2⁺ ; 1528,23
0⁺ ; 1460,025
2⁺ ; 785,78
3,26 ps
4⁺ ; 264,9832
118 ps
2⁺ ; 80,5725
1,82 ns
0⁺ ; 0
Stable
166
Er
68 98
Q⁻ = 1854,5 keV
% β⁻ = 100

$^{166}_{67}$ Ho $^{m}_{99}$

1 Decay Scheme

Ho-166m disintegrates by β^- emission mainly to the 1827 keV and to the 1786 keV levels of Er-166.
L'holmium 166 métastable se désintègre par émission bêta moins, principalement vers les deux niveaux de 1827 keV et 1786 keV de l'erbium 166.

2 Nuclear Data

$T_{1/2}(^{166}\mathrm{Ho}^{m})$	:	1200	(180)	a
$Q^-(^{166}\mathrm{Ho}^{m})$	:	1860,5	(9)	keV

2.1 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,17}$	32,9 (9)	17,2 (4)	Allowed	8,4
$\beta^-_{0,16}$	73,5 (9)	74,8 (12)	Allowed	8,8
$\beta^-_{0,11}$	304,6 (9)	0,394 (5)	1st forbidden	12,9
$\beta^-_{0,10}$	484,5 (9)	0,81 (26)	1st forbidden	13
$\beta^-_{0,9}$	644,5 (9)	2,31 (29)	1st forbidden	13,4
$\beta^-_{0,6}$	949,3 (9)	1,12 (6)	1st forbidden	14,2
$\beta^-_{0,3}$	1315,1 (9)	3,4 (6)	1st forbidden	14,3

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{5,4}$(Er)	73,62 (7)	0,212 (14)	M1+E2	5,98 (18)	0,902 (27)	0,201 (6)	7,14 (21)
$\gamma_{1,0}$(Er)	80,580 (3)	99,981 (4)	E2	1,65 (3)	4,01 (8)	0,978 (29)	6,90 (14)
$\gamma_{16,15}$(Er)	94,675 (14)	0,650 (23)	M1+E2	2,89 (9)	0,435 (13)	0,0967 (29)	3,45 (10)
$\gamma_{8,7}$(Er)	119,033 (9)	0,452 (11)	E2+M1	0,888 (27)	0,556 (17)	0,1339 (40)	1,614 (48)
$\gamma_{16,14}$(Er)	121,176 (31)	0,593 (20)	E2	0,663 (20)	0,610 (18)	0,1480 (44)	1,460 (44)
$\gamma_{17,15}$(Er)	135,260 (14)	0,194 (4)	E2	0,493 (15)	0,373 (11)	0,0904 (27)	0,981 (29)
$\gamma_{9,8}$(Er)	140,703 (7)	0,0829 (44)	M1+E2	0,604 (18)	0,256 (8)	0,0611 (18)	0,938 (28)
$\gamma_{10,9}$(Er)	160,039 (7)	0,157 (8)	M1+E2	0,417 (13)	0,1530 (46)	0,0363 (11)	0,616 (18)
$\gamma_{17,14}$(Er)	161,76 (3)	0,166 (6)	E2 (+M1)	0,299 (9)	0,171 (5)	0,0412 (12)	0,522 (16)
$\gamma_{2,1}$(Er)	184,4107 (11)	96,7 (7)	E2	0,205 (6)	0,0984 (30)	0,0236 (7)	0,334 (7)
$\gamma_{16,13}$(Er)	190,86 (7)	0,279 (7)	E2	0,186 (6)	0,0853 (26)	0,0204 (6)	0,297 (9)
$\gamma_{16,12}$(Er)	214,75 (6)	0,534 (13)	E2	0,1318 (40)	0,0526 (16)	0,01254 (38)	0,200 (4)
$\gamma_{8,5}$(Er)	215,869 (8)	3,18 (20)	E2	0,1299 (26)	0,0516 (10)	0,01229 (37)	0,197 (4)
$\gamma_{17,13}$(Er)	231,45 (7)	0,253 (7)	E2	0,1062 (21)	0,0391 (8)	0,00928 (28)	0,157 (3)
$\gamma_{9,7}$(Er)	259,736 (9)	1,195 (11)	E2	0,0762 (15)	0,0249 (5)	0,00589 (18)	0,1087 (22)
$\gamma_{3,2}$(Er)	280,4630 (34)	32,07 (28)	E2	0,0613 (12)	0,0187 (4)	0,00439 (13)	0,0855 (17)
$\gamma_{10,8}$(Er)	300,742 (7)	3,99 (4)	E2	0,0503 (10)	0,0144 (3)	0,00338 (10)	0,0691 (14)
$\gamma_{9,6}$(Er)	304,758 (9)	0,0195 (13)	E2	0,0485 (10)	0,0137 (3)	0,00322 (10)	0,0662 (13)
$\gamma_{11,9}$(Er)	339,75 (5)	0,1694 (24)	E2	0,0359 (7)	0,00930 (19)	0,00217 (7)	0,048 (1)
$\gamma_{6,3}$(Er)	365,768 (8)	2,56 (4)	E2	0,0294 (6)	0,00721 (15)	0,00167 (5)	0,0388 (8)
$\gamma_{16,10}$(Er)	410,955 (9)	11,45 (18)	E1(+M2)	0,00743 (22)	0,001055 (32)	0,000233 (7)	0,00878 (26)
$\gamma_{17,10}$(Er)	451,540 (9)	2,936 (14)	E1(+M2)	0,00599 (18)	0,000846 (25)	0,000187 (6)	0,00707 (21)
$\gamma_{10,6}$(Er)	464,797 (9)	1,28 (4)	M1+E2	0,01579 (47)	0,0033 (1)	0,000758 (23)	0,0201 (6)
$\gamma_{15,9}$(Er)	476,319 (13)	0,0365 (13)	E1	0,00531 (16)	0,000748 (22)	0,000165 (5)	0,00627 (19)
$\gamma_{12,8}$(Er)	496,95 (6)	0,126 (3)	E1(+M2)	0,00483 (15)	0,000679 (20)	0,0001497 (45)	0,00571 (17)
$\gamma_{4,2}$(Er)	520,80 (7)	0,155 (6)	E2	0,01192 (36)	0,00234 (7)	0,000535 (16)	0,0149 (3)
$\gamma_{8,3}$(Er)	529,823 (6)	9,5 (4)	M1+E2	0,01145 (26)	0,00223 (5)	0,000508 (15)	0,0144 (3)
$\gamma_{16,9}$(Er)	570,994 (9)	5,45 (20)	E1(+M2)	0,00358 (11)	0,000498 (15)	0,0001097 (33)	0,00421 (13)
$\gamma_{5,2}$(Er)	594,417 (6)	0,59 (6)	E2+M1	0,00881 (26)	0,001613 (48)	0,000366 (11)	0,01089 (33)
$\gamma_{17,9}$(Er)	611,579 (9)	1,31 (21)	E1(+M2)	0,00309 (9)	0,000429 (13)	0,0000944 (28)	0,00364 (11)
$\gamma_{12,7}$(Er)	615,98 (6)	0,100 (31)	E4	0,0444 (13)	0,0185 (6)	0,00449 (13)	0,0687 (21)
$\gamma_{13,7}$(Er)	639,86 (7)	0,0946 (7)	E1	0,00282 (8)	0,000389 (12)	0,0000857 (26)	0,00331 (10)
$\gamma_{11,6}$(Er)	644,51 (5)	0,145 (4)	E2+M1	0,00810 (24)	0,001384 (42)	0,000312 (9)	0,00989 (30)
$\gamma_{9,3}$(Er)	670,526 (6)	5,38 (21)	E2+M1	0,00666 (20)	0,001161 (35)	0,000262 (8)	0,00816 (24)
$\gamma_{7,2}$(Er)	691,253 (8)	1,33 (7)	E2+M1	0,00620 (19)	0,001069 (32)	0,000241 (7)	0,00758 (23)
$\gamma_{4,1}$(Er)	705,21 (7)	0,014 (7)	E2(+M1)	0,00591 (18)	0,001012 (30)	0,000228 (7)	0,00721 (22)
$\gamma_{16,8}$(Er)	711,697 (9)	55,0 (9)	E1(+M2)	0,00227 (7)	0,000311 (9)	0,0000685 (21)	0,00266 (8)
$\gamma_{13,5}$(Er)	736,70 (7)	0,374 (6)	E1	0,00211 (6)	0,000290 (9)	0,0000637 (19)	0,00249 (7)
$\gamma_{17,8}$(Er)	752,282 (9)	12,2 (3)	E1(+M2)	0,00203 (6)	0,000278 (8)	0,0000611 (18)	0,00238 (7)
$\gamma_{5,1}$(Er)	778,828 (6)	3,03 (8)	E2+M1	0,00477 (14)	0,000788 (24)	0,000177 (5)	0,00579 (17)
$\gamma_{4,0}$(Er)	785,78 (7)	0,019 (4)	E2	0,00467 (14)	0,000769 (23)	0,000173 (5)	0,00566 (17)
$\gamma_{8,2}$(Er)	810,286 (5)	57,6 (11)	E2+M1	0,00438 (9)	0,00071 (2)	0,0001603 (48)	0,0053 (1)
$\gamma_{10,3}$(Er)	830,565 (6)	9,77 (18)	E2+M1	0,00416 (12)	0,000673 (20)	0,0001509 (45)	0,00503 (15)
$\gamma_{7,1}$(Er)	875,664 (8)	0,724 (9)	E2	0,00371 (11)	0,000592 (18)	0,0001324 (40)	0,00447 (13)
$\gamma_{9,2}$(Er)	950,989 (5)	2,754 (19)	E2	0,00313 (9)	0,000488 (15)	0,0001089 (33)	0,00376 (11)
$\gamma_{11,3}$(Er)	1010,27 (5)	0,0797 (16)	E2	0,00277 (8)	0,000425 (13)	0,0000947 (28)	0,00332 (10)
$\gamma_{14,3}$(Er)	1120,344 (30)	0,199 (4)	E1	0,000956 (29)	0,0001283 (38)	0,0000281 (8)	0,001121 (34)
$\gamma_{15,3}$(Er)	1146,845 (12)	0,2061 (26)	E1	0,000918 (28)	0,0001230 (37)	0,0000270 (8)	0,001075 (32)
$\gamma_{16,3}$(Er)	1241,520 (8)	0,85 (3)	E1(+M2)	0,000796 (24)	0,0001063 (32)	0,0000233 (7)	0,000932 (28)
$\gamma_{17,3}$(Er)	1282,105 (8)	0,183 (7)	E1(+M2)	0,000752 (23)	0,0001004 (30)	0,0000220 (7)	0,000881 (26)
$\gamma_{12,2}$(Er)	1307,24 (6)	0,0055 (11)	E1	0,000727 (22)	0,0000970 (29)	0,0000213 (6)	0,000852 (26)
$\gamma_{13,2}$(Er)	1331,12 (7)	0,0043 (12)	E1	0,000705 (21)	0,0000939 (28)	0,0000206 (6)	0,000825 (25)
$\gamma_{14,2}$(Er)	1400,79 (2)	0,508 (6)	E1	0,000645 (19)	0,0000859 (26)	0,0000188 (6)	0,000755 (23)
$\gamma_{15,2}$(Er)	1427,24 (2)	0,498 (6)	E1	0,000625 (19)	0,0000831 (25)	0,0000182 (5)	0,000732 (22)

3 Atomic Data

3.1 Er

ω_K	:	0,942	(4)
$\bar{\omega}_L$	:	0,216	(9)
n_{KL}	:	0,836	(4)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	48,2211		56,4
	$K\alpha_1$	49,1277		100
	$K\beta_3$	55,494	}	
	$K\beta_1$	55,681	}	
	$K\beta_5''$	56,04	}	31,9
	$K\beta_2$	57,21	}	
	$K\beta_4$	57,313	}	8,8
	$KO_{2,3}$	57,45	}	
X_L				
	$L\ell$	6,14		
	$L\alpha$	6,9 – 6,95		
	$L\eta$	7,05		
	$L\beta$	7,75 – 8,34		
	$L\gamma$	8,81 – 9,43		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	37,78 – 40,55	100
KLX	45,52 – 49,10	52,2
KXY	53,07 – 56,84	7,84
Auger L	3,9 – 7,6	

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Er)	3,9 - 7,6		72,0 (7)
e_{AK}	(Er)			2,33 (17)
	KLL	37,78 - 40,55	}	
	KLX	45,52 - 49,10	}	
	KXY	53,07 - 56,84	}	
$ec_{5,4\ K}$	(Er)	16,13	(7)	0,15 (10)
$ec_{1,0\ T}$	(Er)	23,095 - 80,550		87,4 (31)
$ec_{1,0\ K}$	(Er)	23,095	(3)	20,9 (7)
$ec_{16,15\ K}$	(Er)	37,189	(14)	0,422 (18)
$ec_{8,7\ K}$	(Er)	61,548	(9)	0,154 (5)
$ec_{16,14\ K}$	(Er)	63,69	(3)	0,160 (7)
$ec_{1,0\ L}$	(Er)	70,828 - 72,222		50,8 (18)
$ec_{1,0\ M}$	(Er)	78,374 - 79,171		12,38 (43)
$ec_{1,0\ N}$	(Er)	80,131 - 80,576		2,89 (10)
$ec_{16,15\ L}$	(Er)	84,924 - 86,317		0,0635 (26)
$ec_{10,9\ K}$	(Er)	102,554	(7)	0,0524 (31)
$ec_{8,7\ L}$	(Er)	109,282 - 110,675		0,0962 (34)
$ec_{16,14\ L}$	(Er)	111,424 - 112,818		0,147 (6)
$ec_{2,1\ T}$	(Er)	126,925 - 184,381		24,1 (7)
$ec_{2,1\ K}$	(Er)	126,925	(1)	14,86 (44)
$ec_{16,12\ K}$	(Er)	157,26	(6)	0,0587 (23)
$ec_{8,5\ K}$	(Er)	158,384	(8)	0,346 (24)
$ec_{2,1\ L}$	(Er)	174,659 - 176,053		7,13 (22)
$ec_{2,1\ M}$	(Er)	182,204 - 183,001		1,71 (5)
$ec_{2,1\ N}$	(Er)	183,962 - 184,406		0,402 (12)
$ec_{9,7\ K}$	(Er)	202,251	(9)	0,0821 (26)
$ec_{8,5\ L}$	(Er)	206,118 - 207,511		0,137 (10)
$ec_{3,2\ T}$	(Er)	222,978 - 280,433		2,5 (16)
$ec_{3,2\ K}$	(Er)	222,978	(4)	1,8 (12)
$ec_{10,8\ K}$	(Er)	243,257	(7)	0,188 (6)
$ec_{3,2\ L}$	(Er)	270,711 - 272,105		0,55 (36)
$ec_{3,2\ M}$	(Er)	278,256 - 279,053		0,13 (8)
$ec_{10,8\ L}$	(Er)	290,991 - 292,384		0,0537 (17)
$ec_{6,3\ K}$	(Er)	308,282	(8)	0,0723 (25)
$ec_{16,10\ K}$	(Er)	353,469	(9)	0,0843 (28)
$ec_{8,3\ K}$	(Er)	472,338	(6)	0,108 (6)
$ec_{16,8\ K}$	(Er)	654,211	(9)	0,1246 (47)
$ec_{8,2\ K}$	(Er)	752,80	(5)	0,251 (9)
$\beta^-_{0,17}$	max:	32,9	(9)	17,2 (4)
$\beta^-_{0,17}$	avg:	8,2	(2)	
$\beta^-_{0,16}$	max:	73,5	(9)	74,8 (12)
$\beta^-_{0,16}$	avg:	18,6	(4)	

		Energy keV		Electrons per 100 disint.
$\beta^-_{0,11}$	max:	304,6	(9)	0,394 (5)
$\beta^-_{0,11}$	avg:			
$\beta^-_{0,10}$	max:	484,5	(9)	0,81 (26)
$\beta^-_{0,10}$	avg:			
$\beta^-_{0,9}$	max:	644,5	(9)	2,31 (29)
$\beta^-_{0,9}$	avg:	201,2	(9)	
$\beta^-_{0,6}$	max:	949,3	(9)	1,12 (6)
$\beta^-_{0,6}$	avg:	294,3	(9)	
$\beta^-_{0,3}$	max:	1315,1	(9)	3,4 (6)
$\beta^-_{0,3}$	avg:	674,6	(9)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Er)	6,14 — 9,43		20,8 (4)	
$XK\alpha_2$	(Er)	48,2211		10,81 (21)	} $K\alpha$
$XK\alpha_1$	(Er)	49,1277		19,2 (4)	}
$XK\beta_3$	(Er)	55,494	}		
$XK\beta_1$	(Er)	55,681	}	6,24 (14)	$K'\beta_1$
$XK\beta_5''$	(Er)	56,04	}		
$XK\beta_2$	(Er)	57,21	}		
$XK\beta_4$	(Er)	57,313	}	1,62 (5)	$K'\beta_2$
$XKO_{2,3}$	(Er)	57,45	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{5,4}$(Er)	73,62 (7)	0,0260 (16)
$\gamma_{1,0}$(Er)	80,5725 (13)	12,66 (23)
$\gamma_{16,15}$(Er)	94,675 (14)	0,146 (4)
$\gamma_{8,7}$(Er)	119,033 (10)	0,173 (3)
$\gamma_{16,14}$(Er)	121,175 (10)	0,241 (7)
$\gamma_{17,15}$(Er)	135,260 (14)	0,0979 (19)
$\gamma_{9,8}$(Er)	140,703 (7)	0,0428 (22)
$\gamma_{10,9}$(Er)	160,039 (7)	0,097 (5)

	Energy keV	Photons per 100 disint.
$\gamma_{17,14}$(Er)	161,76 (3)	0,109 (4)
$\gamma_{2,1}$(Er)	184,4107 (11)	72,5 (3)
$\gamma_{16,13}$(Er)	190,86 (7)	0,215 (5)
$\gamma_{16,12}$(Er)	214,79 (3)	0,445 (11)
$\gamma_{8,5}$(Er)	215,871 (7)	2,66 (17)
$\gamma_{17,13}$(Er)	231,45 (7)	0,219 (6)
$\gamma_{9,7}$(Er)	259,736 (10)	1,078 (10)
$\gamma_{3,2}$(Er)	280,4630 (23)	29,54 (25)
$\gamma_{10,8}$(Er)	300,741 (3)	3,73 (3)
$\gamma_{9,6}$(Er)	304,758 (9)	0,0183 (12)
$\gamma_{11,9}$(Er)	339,75 (5)	0,1616 (23)
$\gamma_{6,3}$(Er)	365,768 (6)	2,46 (4)
$\gamma_{16,10}$(Er)	410,956 (3)	11,35 (17)
$\gamma_{17,10}$(Er)	451,540 (4)	2,915 (14)
$\gamma_{10,6}$(Er)	464,798 (6)	1,25 (4)
$\gamma_{15,9}$(Er)	476,25 (4)	0,0363 (13)
$\gamma_{12,8}$(Er)	496,90 (6)	0,125 (3)
$\gamma_{4,2}$(Er)	520,80 (7)	0,153 (6)
$\gamma_{8,3}$(Er)	529,825 (4)	9,4 (4)
$\gamma_{16,9}$(Er)	570,995 (5)	5,43 (20)
$\gamma_{5,2}$(Er)	594,417 (6)	0,58 (6)
$\gamma_{17,9}$(Er)	611,579 (6)	1,31 (21)
$\gamma_{12,7}$(Er)	615,93 (6)	0,094 (29)
$\gamma_{13,7}$(Er)	639,86 (6)	0,0943 (7)
$\gamma_{11,6}$(Er)	644,51 (7)	0,144 (4)
$\gamma_{9,3}$(Er)	670,526 (4)	5,34 (21)
$\gamma_{7,2}$(Er)	691,253 (7)	1,32 (7)
$\gamma_{4,1}$(Er)	705,21 (7)	0,014 (7)
$\gamma_{16,8}$(Er)	711,697 (3)	54,9 (9)
$\gamma_{13,5}$(Er)	736,70 (7)	0,373 (6)
$\gamma_{17,8}$(Er)	752,280 (4)	12,2 (3)
$\gamma_{5,1}$(Er)	778,827 (6)	3,01 (8)
$\gamma_{4,0}$(Er)	785,78 (7)	0,019 (4)
$\gamma_{8,2}$(Er)	810,286 (4)	57,3 (11)
$\gamma_{10,3}$(Er)	830,565 (4)	9,72 (18)
$\gamma_{7,1}$(Er)	875,663 (7)	0,721 (9)
$\gamma_{9,2}$(Er)	950,988 (4)	2,744 (19)
$\gamma_{11,3}$(Er)	1010,27 (6)	0,0794 (16)
$\gamma_{14,3}$(Er)	1120,32 (3)	0,199 (4)
$\gamma_{15,3}$(Er)	1146,77 (3)	0,2059 (26)
$\gamma_{16,3}$(Er)	1241,519 (4)	0,85 (3)
$\gamma_{17,3}$(Er)	1282,102 (5)	0,183 (7)
$\gamma_{12,2}$(Er)	1307,19 (6)	0,0055 (11)
$\gamma_{13,2}$(Er)	1331,12 (7)	0,0043 (12)
$\gamma_{14,2}$(Er)	1400,79 (2)	0,508 (6)
$\gamma_{15,2}$(Er)	1427,24 (2)	0,498 (6)

6 Main Production Modes

$$\begin{cases} Ho - 165(n,\gamma)Ho - 166m \quad \sigma : 1 \ \text{barns} \\ \text{Possible impurities : } Ho - 166 \end{cases}$$

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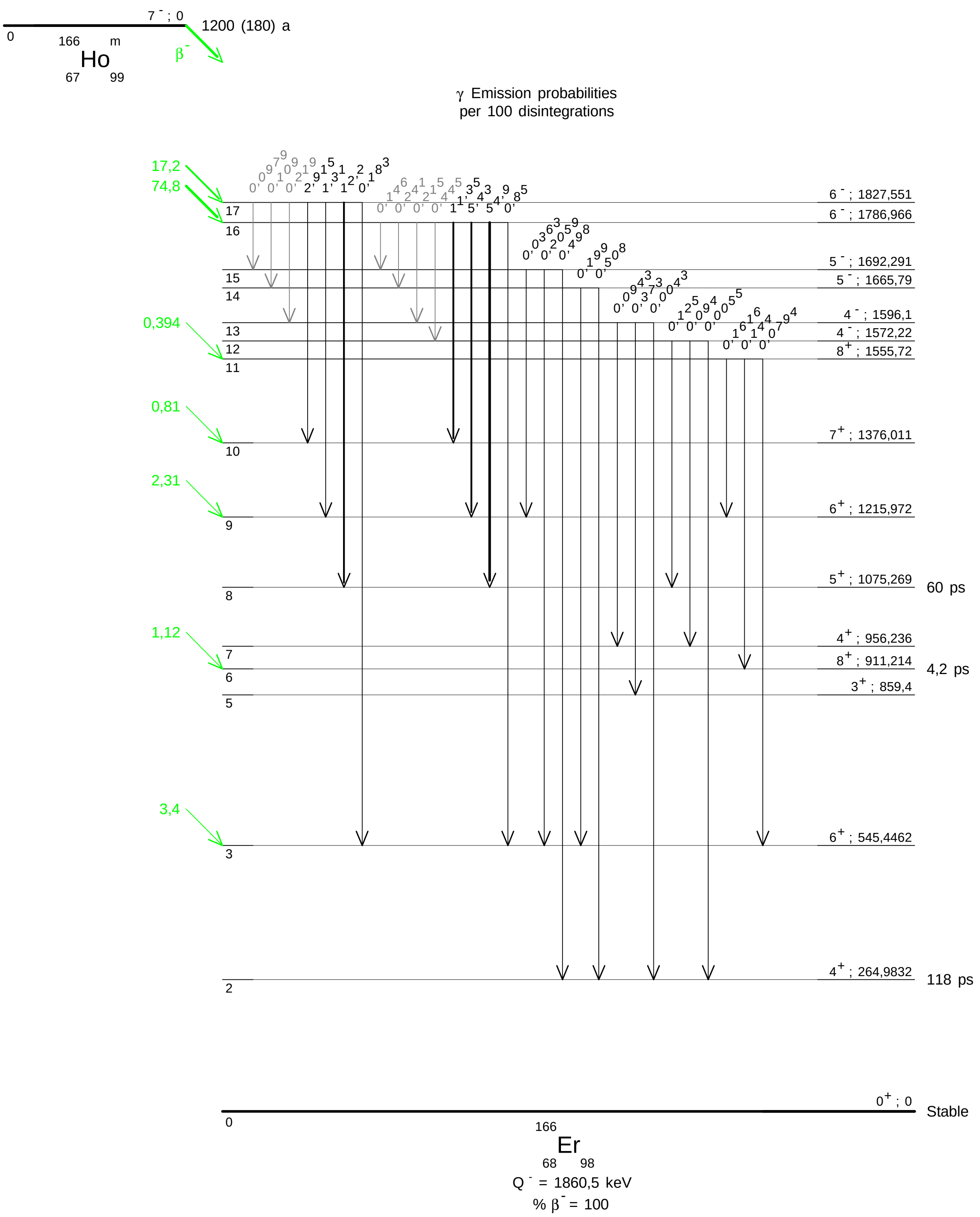
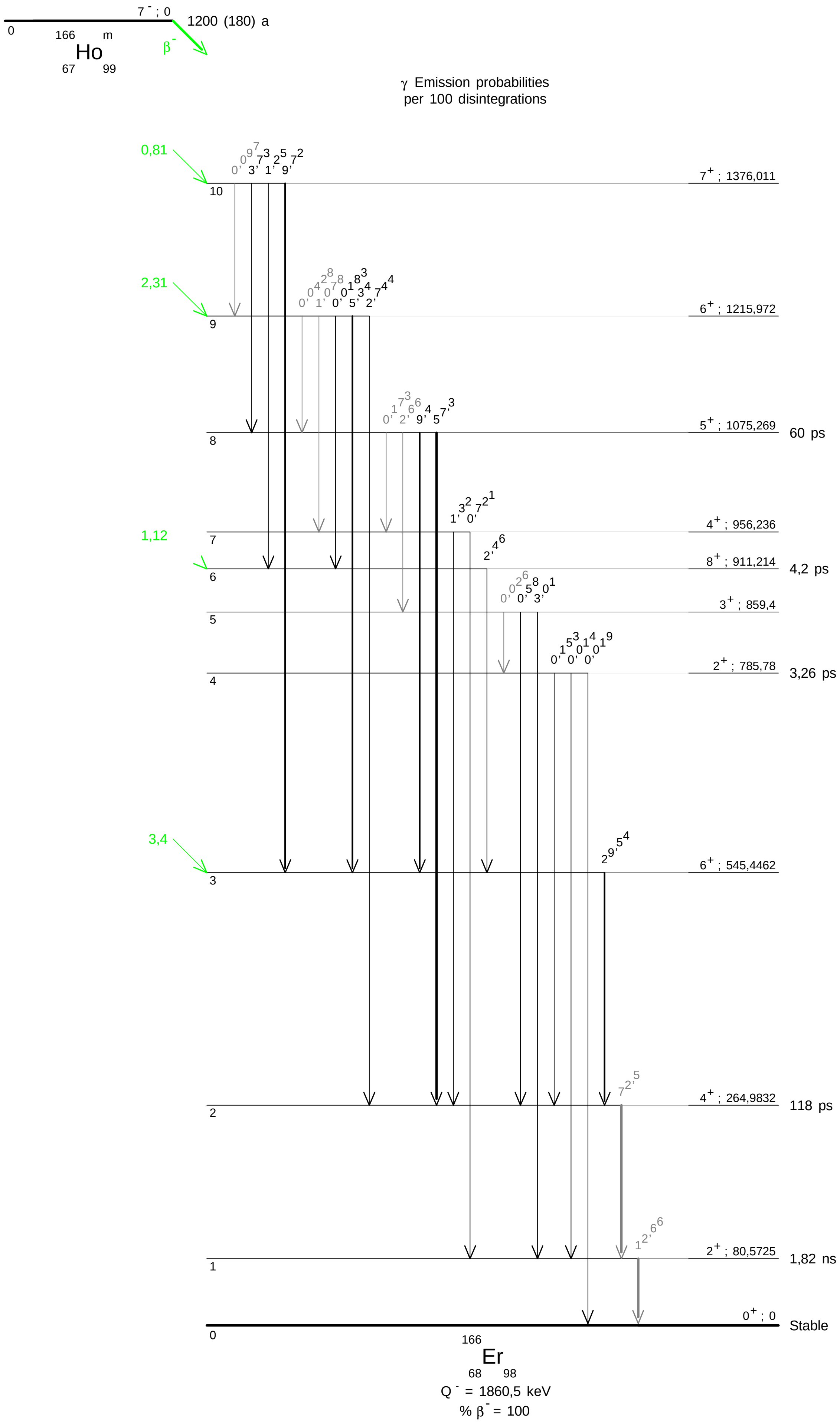

7 - ; 0
1200 (180) a
0
166 m
Ho
67 99
β -
γ Emission probabilities
per 100 disintegrations
17,2
74,8
0,394
0,81
2,31
1,12
3,4
17
16
15
14
13
12
11
10
9
8
7
6
5
3
2
0
6 - ; 1827,551
6 - ; 1786,966
5 - ; 1692,291
5 - ; 1665,79
4 - ; 1596,1
4 - ; 1572,22
8+ ; 1555,72
7+ ; 1376,011
6+ ; 1215,972
5+ ; 1075,269
60 ps
4+ ; 956,236
8+ ; 911,214
4,2 ps
3+ ; 859,4
6+ ; 545,4462
4+ ; 264,9832
118 ps
0+ ; 0
Stable
166
Er
68 98
Q - = 1860,5 keV
% β - = 100


7 - ; 0
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1200 (180) a
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γ Emission probabilities
per 100 disintegrations
0,81
2,31
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7 + ; 1376,011
6 + ; 1215,972
5 + ; 1075,269
60 ps
4 + ; 956,236
8 + ; 911,214
4,2 ps
3 + ; 859,4
2 + ; 785,78
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6 + ; 545,4462
4 + ; 264,9832
118 ps
2 + ; 80,5725
1,82 ns
0 + ; 0
Stable
166 Er 68 98
Q - = 1860,5 keV
% β - = 100

$^{169}_{70}$Yb $_{99}$

1 Decay Scheme

The Yb-169 disintegrates 100 % by electron capture to excited levels of Tm-169.
L'ytterbium 169 se désintègre à 100 % par capture électronique vers des niveaux excités du thulium 169.

2 Nuclear Data

$T_{1/2}$(^{169}Yb)	:	32,018	(5)	d
Q^{+}(^{169}Yb)	:	909	(5)	keV

2.1 Electron Capture Transitions

	Energy keV	Probability × 100	Nature	lg ft	P_K	P_L	P_M
$\epsilon_{0,19}$	31 (5)	0,000004 (1)	Allowed	10,8			
$\epsilon_{0,18}$	77 (5)	0,0000175 (5)	Allowed	11,2			
$\epsilon_{0,17}$	127 (5)	0,0045 (3)	Allowed	10,5	0,623 (15)	0,280 (11)	0,0743 (32)
$\epsilon_{0,16}$	190 (5)	0,0037 (2)	Allowed	10,3	0,725 (5)	0,2073 (35)	0,0526 (13)
$\epsilon_{0,15}$	262 (5)	0,00013 (7)	1st forbidden	12			
$\epsilon_{0,14}$	276 (5)	0,0109 (4)	Allowed	10,3	0,7692 (25)	0,1750 (18)	0,0432 (9)
$\epsilon_{0,13}$	338 (5)	0,00030 (6)	(2nd Forbidden)	12			
$\epsilon_{0,12}$	434 (5)	0,000344 (7)	Unique 1st forbidden	12			
$\epsilon_{0,11}$	436 (5)	12,6 (3)	1st forbidden	7,6	0,7980 (19)	0,1540 (13)	0,0372 (7)
$\epsilon_{0,10}$	474 (5)	0,121 (14)	Allowed	9,9	0,8017 (18)	0,1513 (13)	0,0365 (7)
$\epsilon_{0,9}$	479 (5)	0,0044 (1)	1st forbidden	11,2	0,8020 (18)	0,1511 (13)	0,0364 (7)
$\epsilon_{0,8}$	530 (5)	82,2 (18)	1st forbidden	7	0,8057 (18)	0,1484 (12)	0,0356 (7)
$\epsilon_{0,6}$	564 (5)	0,0138 (13)	1st forbidden	11	0,8078 (18)	0,1469 (12)	0,0352 (7)
$\epsilon_{0,5}$	577 (5)	0,0142 (16)	Allowed	10,9	0,8085 (18)	0,1463 (12)	0,0350 (7)
$\epsilon_{0,4}$	593 (5)	5,1 (19)	Allowed	8,33	0,8093 (17)	0,1457 (12)	0,0349 (7)

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{1,0}$(Tm)	8,41016 (15)	95,1 (8)	M1+0,108%E2			218 (11)	273 (13)
$\gamma_{3,2}$(Tm)	20,74370 (21)	11,2 (4)	M1+0,085%E2		44,5 (13)	10,0 (3)	57,3 (17)
$\gamma_{7,4}$(Tm)	51,51 (40)	0,1686 (1)	E2		37,1 (15)	9,1 (4)	48,6 (22)
$\gamma_{8,4}$(Tm)	63,12044 (4)	92,9 (18)	E1+0,01%M2	0,899 (27)	0,163 (6)	0,0366 (12)	1,11 (4)
$\gamma_{11,8}$(Tm)	93,61450 (8)	12,6 (3)	M1+3,25%E2	3,18 (10)	0,55 (2)	0,124 (4)	3,89 (12)
$\gamma_{11,7}$(Tm)	105,19 (10)	0,0034 (10)	[E1]	0,24 (1)	0,039 (3)		0,293 (15)
$\gamma_{2,1}$(Tm)	109,77928 (4)	59,9 (7)	M1+2,17%E2	2,03 (3)	0,327 (5)	0,0730 (11)	2,45 (4)
$\gamma_{10,4}$(Tm)	117,377 (18)	0,121 (14)	(M1+E2)	1,70 (17)	0,257 (26)	0,057 (6)	2,03 (20)
$\gamma_{2,0}$(Tm)	118,18944 (14)	4,97 (9)	E2	0,697 (21)	0,734 (22)	0,179 (6)	1,66 (5)
$\gamma_{3,1}$(Tm)	130,52293 (6)	24,5 (5)	E2	0,538 (17)	0,470 (15)	0,115 (4)	1,15 (4)
$\gamma_{11,4}$(Tm)	156,73495 (9)	0,0109 (3)	(E1)	0,0853 (26)	0,0132 (4)	0,0029 (1)	0,102 (3)
$\gamma_{4,3}$(Tm)	177,21317 (6)	35,49 (26)	M1+15,8%E2	0,484 (7)	0,0868 (13)	0,0197 (3)	0,590 (9)
$\gamma_{5,3}$(Tm)	193,15 (5)	0,0111 (16)	M1+1,1%E2	0,42 (2)	0,063 (5)		0,50 (3)
$\gamma_{4,2}$(Tm)	197,95687 (7)	52,03 (31)	M1+9%E2	0,370 (6)	0,0603 (9)	0,0136 (2)	0,448 (7)
$\gamma_{6,3}$(Tm)	205,99 (6)	0,0036 (8)	(E1)	0,042 (2)	0,0020 (2)		0,050 (2)
$\gamma_{5,2}$(Tm)	213,936 (17)	0,0035 (3)	E2	0,135 (7)	0,072 (6)		0,21 (1)
$\gamma_{6,2}$(Tm)	226,3 (7)	0,00025 (18)					
$\gamma_{8,3}$(Tm)	240,33362 (12)	0,120 (6)	E1+0,9%M2	0,037 (4)	0,0065 (7)	0,0009 (1)	0,045 (5)
$\gamma_{8,2}$(Tm)	261,07734 (9)	1,735 (9)	E1+0,1%M2	0,0237 (7)	0,00355 (11)	0,00079 (3)	0,0283 (9)
$\gamma_{9,3}$(Tm)	291,1909	0,0044 (1)	[E1]	0,018 (1)	0,0026 (2)		0,021 (2)
$\gamma_{10,3}$(Tm)	294,54 (11)	0,0011 (5)					
$\gamma_{4,1}$(Tm)	307,73616 (9)	10,72 (5)	E2	0,0482 (15)	0,0141 (4)	0,00333 (10)	0,0666 (20)
$\gamma_{4,0}$(Tm)	316,1463	0,0033 (3)	M3+E4				
$\gamma_{(-1,20)}$(Tm)	328 (2)	0,00672 (43)					
$\gamma_{11,3}$(Tm)	333,94777 (27)	0,00174 (9)	E1	0,0126 (13)	0,00182 (19)	0,00040 (4)	0,0149 (15)
$\gamma_{6,1}$(Tm)	336,621 (3)	0,0099 (9)	(E1)	0,0123 (13)	0,00179 (18)	0,00040 (4)	0,0146 (15)
$\gamma_{12,2}$(Tm)	356,74 (5)	0,000141 (6)					
$\gamma_{8,1}$(Tm)	370,85660 (29)	0,00111 (15)	[M2]	0,249 (8)	0,0460 (14)	0,0106 (3)	0,308 (9)
$\gamma_{8,0}$(Tm)	379,26676 (25)	0,00034 (14)	[E3]	0,0757 (23)	0,0401 (12)	0,0098 (3)	0,128 (4)
$\gamma_{16,5}$(Tm)	386,673 (13)	0,00038 (4)	[M1,E2]				
$\gamma_{10,1}$(Tm)	425,1138	0,00162 (29)					
$\gamma_{13,2}$(Tm)	452,62 (8)	0,000035 (19)	(M1+E2)				
$\gamma_{17,4}$(Tm)	465,657 (6)	0,000231 (24)					
$\gamma_{12,0}$(Tm)	474,973 (9)	0,000203 (9)					
$\gamma_{14,3}$(Tm)	494,360 (8)	0,00157 (12)					
$\gamma_{18,5}$(Tm)	500,35 (10)	0,0000088 (8)					
$\gamma_{15,3}$(Tm)	507,8 (3)	0,0000015 (8)					
$\gamma_{14,2}$(Tm)	515,108 (6)	0,00437 (16)	(M1)	0,0306 (30)	0,0045 (5)	0,00099 (10)	0,036 (4)
$\gamma_{15,2}$(Tm)	528,573 (10)	0,00013 (6)					
$\gamma_{19,5}$(Tm)	546,16 (22)	0,0000015 (4)					
$\gamma_{13,1}$(Tm)	562,414 (12)	0,00014 (4)	(M1+E2)				
$\gamma_{13,0}$(Tm)	570,89 (3)	0,000127 (26)	(M1+E2)				
$\gamma_{16,3}$(Tm)	579,855 (5)	0,00210 (17)	(M1)	0,023 (1)	0,0033 (3)		0,027 (2)
$\gamma_{16,2}$(Tm)	600,608 (8)	0,00114 (7)	(M1)				
$\gamma_{(-1,33)}$(Tm)	614,1 (5)	0,000097 (14)					
$\gamma_{14,1}$(Tm)	624,887 (4)	0,00495 (27)	(M1)	0,0187 (19)	0,0027 (3)	0,00060 (6)	0,0222 (22)
$\gamma_{14,0}$(Tm)	633,32 (10)	0,0000070 (5)					
$\gamma_{17,3}$(Tm)	642,878 (9)	0,000081 (5)					
$\gamma_{17,2}$(Tm)	663,604 (7)	0,00203 (15)					
$\gamma_{18,3}$(Tm)	693,46 (8)	0,0000087 (4)					
$\gamma_{16,1}$(Tm)	710,360 (15)	0,0000313 (22)					
$\gamma_{19,3}$(Tm)	739,42 (11)	0,00000183 (22)					
$\gamma_{19,2}$(Tm)	760,24 (24)	0,00000083 (22)					
$\gamma_{17,1}$(Tm)	773,390 (14)	0,00219 (11)					
$\gamma_{17,0}$(Tm)	781,64 (8)	0,0000030 (3)					

3 Atomic Data

3.1 Tm

ω_K	:	0,945	(4)
$\bar{\omega}_L$	:	0,227	(9)
n_{KL}	:	0,835	(4)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	49,7731		56,64
	$K\alpha_1$	50,7417		100
	$K\beta_3$	57,304	}	
	$K\beta_1$	57,516	}	
	$K\beta_5''$	57,925	}	32,7
	$K\beta_2$	59,1	}	
	$K\beta_4$	59,21	}	8,5
	$KO_{2,3}$	59,357	}	
X_L				
	$L\ell$	6,34		
	$L\alpha$	7,13 – 7,18		
	$L\eta$	7,31		
	$L\beta$	8,18 – 8,64		
	$L\gamma$	9,15 – 9,78		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	38,96 – 41,88	100
KLX	46,88 – 50,71	52,6
KXY	54,78 – 59,32	6,92
Auger L	3,85 – 7,18	2450

4 Electron Emissions

		Energy keV	Electrons per 100 disint.
e_{AL}	(Tm)	3,85 - 7,18	168,2 (18)
e_{AK}	(Tm)		10,8 (8)
	KLL	38,96 - 41,88	}
	KLX	46,88 - 50,71	}
	KXY	54,78 - 59,32	}
$ec_{8,4\ T}$	(Tm)	3,7308 - 63,0881	48,9 (18)
$ec_{8,4\ K}$	(Tm)	3,7308 (4)	39,6 (12)
$ec_{1,0\ T}$	(Tm)	6,10 - 8,38	95 (6)
$ec_{1,0\ M}$	(Tm)	6,103 - 6,942	76 (5)
$ec_{3,2\ T}$	(Tm)	10,628 - 20,711	11,0 (4)
$ec_{3,2\ L}$	(Tm)	10,628 - 12,096	8,6 (3)
$ec_{3,2\ M}$	(Tm)	18,437 - 19,276	1,93 (7)
$ec_{11,8\ K}$	(Tm)	34,2249 (8)	8,18 (27)
$ec_{11,8\ T}$	(Tm)	34,225 - 93,582	10,0 (3)
$ec_{2,1\ K}$	(Tm)	50,3897 (4)	35,2 (6)
$ec_{2,1\ T}$	(Tm)	50,3897 - 109,7470	42,5 (7)
$ec_{8,4\ L}$	(Tm)	53,0047 - 54,4720	7,18 (27)
$ec_{10,4\ K}$	(Tm)	57,987 (18)	0,068 (9)
$ec_{2,0\ T}$	(Tm)	58,79 - 118,16	3,1 (1)
$ec_{2,0\ K}$	(Tm)	58,7998 (2)	1,30 (4)
$ec_{8,4\ M}$	(Tm)	60,8136 - 61,6527	1,61 (5)
$ec_{3,1\ T}$	(Tm)	71,133 - 130,491	13,1 (5)
$ec_{3,1\ K}$	(Tm)	71,1333 (1)	6,1 (2)
$ec_{11,8\ L}$	(Tm)	83,499 - 84,967	1,4 (5)
$ec_{11,8\ M}$	(Tm)	91,308 - 92,147	0,32 (1)
$ec_{2,1\ L}$	(Tm)	99,6636 - 101,1310	5,68 (9)
$ec_{2,1\ M}$	(Tm)	107,4725 - 108,3116	1,267 (20)
$ec_{2,0\ L}$	(Tm)	108,074 - 109,541	1,37 (4)
$ec_{2,0\ M}$	(Tm)	115,883 - 116,723	0,33 (1)
$ec_{4,3\ T}$	(Tm)	117,823 - 177,181	13,2 (2)
$ec_{4,3\ K}$	(Tm)	117,8235 (1)	10,8 (2)
$ec_{3,1\ L}$	(Tm)	120,407 - 121,875	5,3 (2)
$ec_{3,1\ M}$	(Tm)	128,216 - 129,055	1,31 (5)
$ec_{4,2\ T}$	(Tm)	138,567 - 197,924	16,1 (3)
$ec_{4,2\ K}$	(Tm)	138,5671 (1)	13,29 (22)
$ec_{4,3\ L}$	(Tm)	167,097 - 168,565	1,94 (3)
$ec_{4,3\ M}$	(Tm)	174,906 - 175,745	0,44 (1)
$ec_{4,2\ L}$	(Tm)	187,841 - 189,308	2,17 (3)
$ec_{4,2\ M}$	(Tm)	195,649 - 196,489	0,49 (1)
$ec_{4,1\ K}$	(Tm)	248,3479 (1)	0,484 (15)
$ec_{4,1\ L}$	(Tm)	297,621 - 299,089	0,142 (4)

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Tm)	6,34 — 9,78		49,4 (8)	
XKα_2	(Tm)	49,7731		52,9 (8)	} Kα
XKα_1	(Tm)	50,7417		93,5 (13)	}
XKβ_3	(Tm)	57,304	}		
XKβ_1	(Tm)	57,516	}	30,6 (6)	Kβ_1'
XKβ_5''	(Tm)	57,925	}		
XKβ_2	(Tm)	59,1	}		
XKβ_4	(Tm)	59,21	}	7,95 (21)	Kβ_2'
XKO$_{2,3}$	(Tm)	59,357	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Tm)	8,41016 (15)	0,347 (17)
$\gamma_{3,2}$(Tm)	20,74370 (21)	0,1925 (43)
$\gamma_{7,4}$(Tm)	51,51 (40)	0,0034 (1)
$\gamma_{8,4}$(Tm)	63,12044 (4)	44,05 (24)
$\gamma_{11,8}$(Tm)	93,61447 (8)	2,571 (17)
$\gamma_{11,7}$(Tm)	105,19 (10)	0,0026 (8)
$\gamma_{2,1}$(Tm)	109,77924 (4)	17,36 (9)
$\gamma_{10,4}$(Tm)	117,377 (18)	0,0398 (36)
$\gamma_{2,0}$(Tm)	118,18940 (14)	1,87 (1)
$\gamma_{3,1}$(Tm)	130,52293 (6)	11,38 (5)
$\gamma_{11,4}$(Tm)	156,73487 (9)	0,00990 (25)
$\gamma_{4,3}$(Tm)	177,21307 (6)	22,32 (10)
$\gamma_{5,3}$(Tm)	193,15 (5)	0,0074 (10)
$\gamma_{4,2}$(Tm)	197,95675 (7)	35,93 (12)
$\gamma_{6,3}$(Tm)	205,99 (6)	0,0034 (8)
$\gamma_{5,2}$(Tm)	213,936 (17)	0,00291 (22)
$\gamma_{6,2}$(Tm)	226,3 (7)	0,00025 (18)
$\gamma_{8,3}$(Tm)	240,33344 (12)	0,115 (5)
$\gamma_{8,2}$(Tm)	261,07712 (9)	1,687 (8)
$\gamma_{9,3}$(Tm)	291,190 (11)	0,00431 (14)
$\gamma_{10,3}$(Tm)	294,54 (11)	0,0011 (5)
$\gamma_{4,1}$(Tm)	307,73757 (9)	10,046 (45)
$\gamma_{4,0}$(Tm)	316,2 (7)	0,0033 (3)

	Energy keV	Photons per 100 disint.
$\gamma_{(-1,20)}$(Tm)	328 (2)	0,00672 (43)
$\gamma_{11,3}$(Tm)	333,94777 (27)	0,00171 (9)
$\gamma_{6,1}$(Tm)	336,621 (3)	0,0098 (9)
$\gamma_{12,2}$(Tm)	356,74 (5)	0,000141 (6)
$\gamma_{8,1}$(Tm)	370,85616 (29)	0,00085 (11)
$\gamma_{8,0}$(Tm)	379,26630 (25)	0,00030 (12)
$\gamma_{16,5}$(Tm)	386,673 (13)	0,00038 (4)
$\gamma_{10,1}$(Tm)	425,0 (2)	0,00162 (29)
$\gamma_{13,2}$(Tm)	452,62 (8)	0,000035 (19)
$\gamma_{17,4}$(Tm)	465,657 (6)	0,000231 (24)
$\gamma_{12,0}$(Tm)	474,973 (9)	0,000203 (9)
$\gamma_{14,3}$(Tm)	494,360 (8)	0,00157 (12)
$\gamma_{18,5}$(Tm)	500,35 (10)	0,0000088 (8)
$\gamma_{15,3}$(Tm)	507,8 (3)	0,0000015 (8)
$\gamma_{14,2}$(Tm)	515,107 (6)	0,00422 (16)
$\gamma_{15,2}$(Tm)	528,572 (10)	0,00013 (6)
$\gamma_{19,5}$(Tm)	546,16 (22)	0,0000015 (4)
$\gamma_{13,1}$(Tm)	562,413 (12)	0,00014 (4)
$\gamma_{13,0}$(Tm)	570,89 (3)	0,000127 (26)
$\gamma_{16,3}$(Tm)	579,854 (5)	0,00204 (16)
$\gamma_{16,2}$(Tm)	600,607 (8)	0,00114 (7)
$\gamma_{(-1,33)}$(Tm)	614,1 (5)	0,000097 (14)
$\gamma_{14,1}$(Tm)	624,886 (4)	0,00484 (27)
$\gamma_{14,0}$(Tm)	633,32 (10)	0,0000070 (5)
$\gamma_{17,3}$(Tm)	642,877 (9)	0,000081 (5)
$\gamma_{17,2}$(Tm)	663,603 (7)	0,00203 (15)
$\gamma_{18,3}$(Tm)	693,46 (8)	0,0000087 (4)
$\gamma_{16,1}$(Tm)	710,358 (15)	0,0000313 (22)
$\gamma_{19,3}$(Tm)	739,42 (11)	0,00000183 (22)
$\gamma_{19,2}$(Tm)	760,24 (24)	0,00000083 (22)
$\gamma_{17,1}$(Tm)	773,390 (14)	0,00219 (11)
$\gamma_{17,0}$(Tm)	781,64 (8)	0,0000030 (3)

6 Main Production Modes

$\left\{ \begin{array}{l} \text{Yb} - 169\text{m(I.T.)Yb} - 169 \\ T_{1/2} = 46\ s \end{array} \right.$

$\left\{ \begin{array}{l} \text{Lu} - 169\text{(E.C.,)Yb} - 169 \\ T_{1/2} = 34,06\ h \end{array} \right.$

Er – 167(α,2nγ)Yb – 169

Yb – 168(n,γ)Yb – 169

Yb – 168(d,p)Yb – 169

Yb – 170(d,t)Yb – 169

Yb – 171(p,t)Yb – 169

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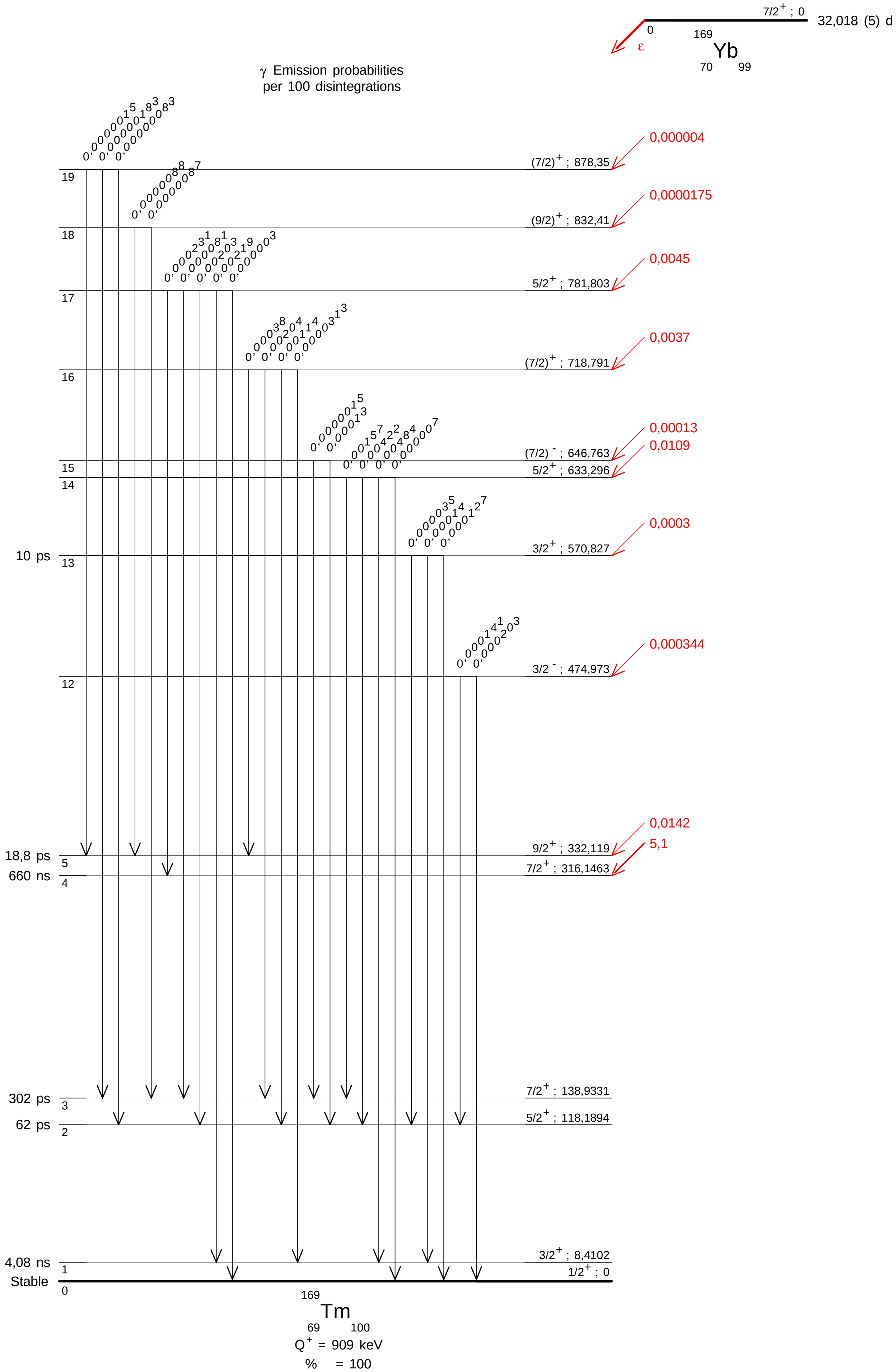
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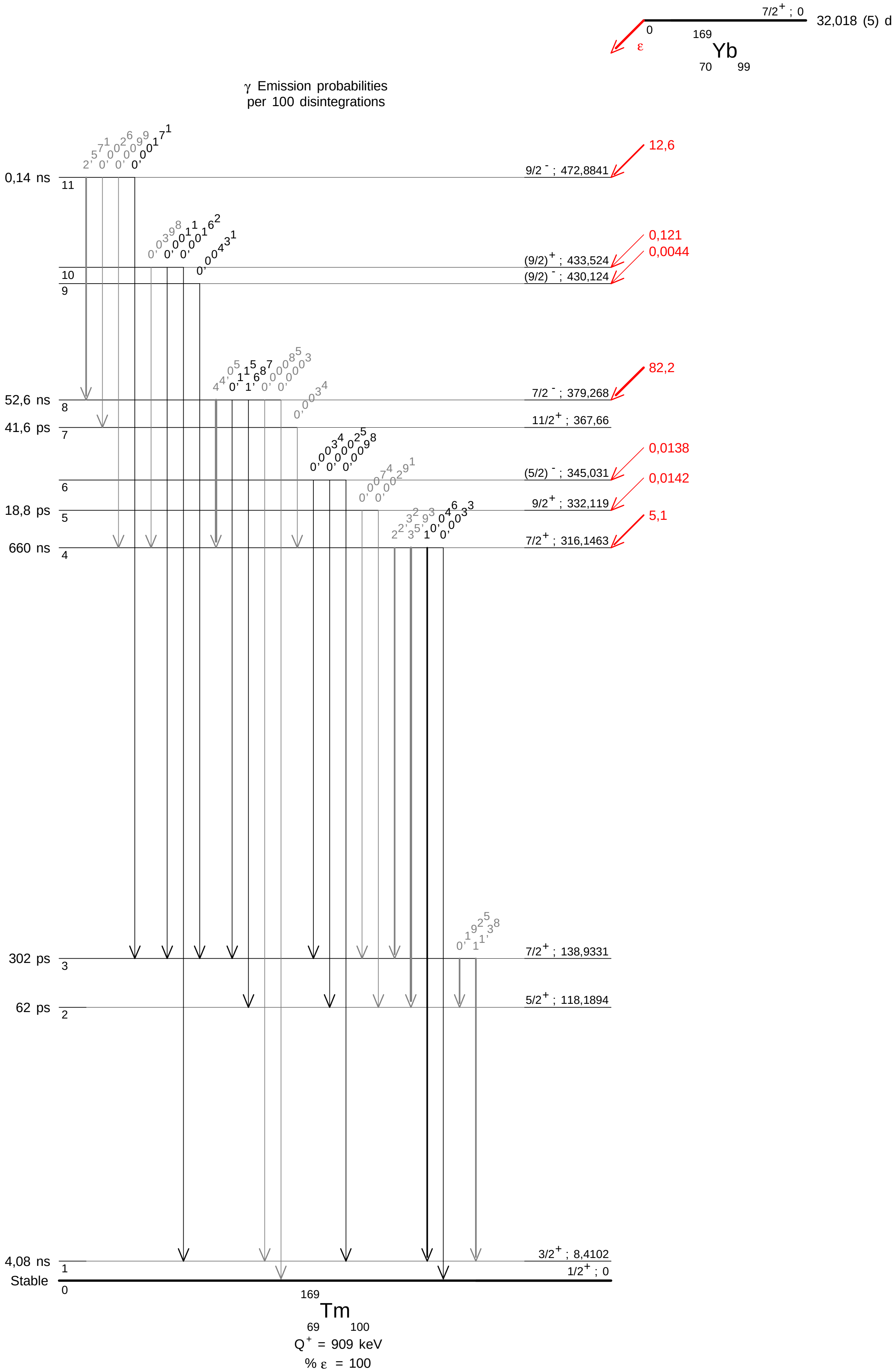
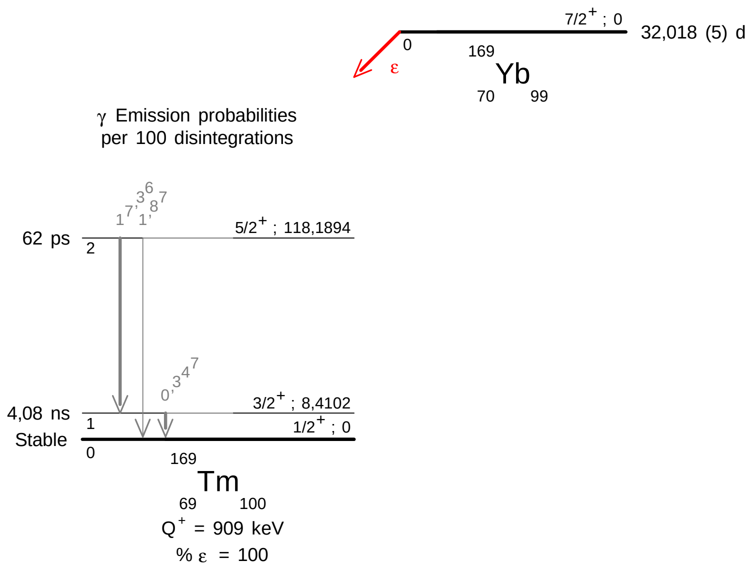
32,018 (5) d
ε
169 Yb 70 99
γ Emission probabilities per 100 disintegrations
(7/2)+ ; 878,35
0,000004
(9/2)+ ; 832,41
0,0000175
5/2+ ; 781,803
0,0045
(7/2)+ ; 718,791
0,0037
(7/2) - ; 646,763
0,00013
5/2+ ; 633,296
0,0109
3/2+ ; 570,827
0,0003
3/2 - ; 474,973
0,000344
9/2+ ; 332,119
0,0142
7/2+ ; 316,1463
5,1
7/2+ ; 138,9331
5/2+ ; 118,1894
3/2+ ; 8,4102
1/2+ ; 0
10 ps
18,8 ps
660 ns
302 ps
62 ps
4,08 ns
Stable
169 Tm 69 100
Q+ = 909 keV
% = 100


7/2+ ; 0
32,018 (5) d
ε
169 Yb 70 99
γ Emission probabilities
per 100 disintegrations
0,14 ns
52,6 ns
41,6 ps
18,8 ps
660 ns
302 ps
62 ps
4,08 ns
Stable
9/2 - ; 472,8841
(9/2)+ ; 433,524
(9/2) - ; 430,124
7/2 - ; 379,268
11/2+ ; 367,66
(5/2) - ; 345,031
9/2+ ; 332,119
7/2+ ; 316,1463
7/2+ ; 138,9331
5/2+ ; 118,1894
3/2+ ; 8,4102
1/2+ ; 0
12,6
0,121
0,0044
82,2
0,0138
0,0142
5,1
169 Tm 69 100
Q+ = 909 keV
% ε = 100


7/2+ ; 0
32,018 (5) d
0
ε
169
Yb
70
99
γ Emission probabilities
per 100 disintegrations
62 ps
2
5/2+ ; 118,1894
4,08 ns
1
3/2+ ; 8,4102
Stable
0
1/2+ ; 0
169
Tm
69
100
Q+ = 909 keV
% ε = 100

$^{\mathbf{170}}_{69}\mathrm{Tm}_{101}$

1 Decay Scheme

Tm-170 disintegrates by both beta minus decay and electron capture, respectively, to the first excited level of 84.25 keV (18.3 %) and the ground state (81 %) in Yb-170, and to the first excited level of 78.6 keV (0.03 %) and the ground state (0.12 %) in Er-170.
Le thulium 170 se désintègre par émission bêta moins et par capture électronique vers le premier niveau à 84,25 keV (18,3%), le niveau fondamental (81,6 %) de l'ytterbium 170, et le premier niveau à 78,6 keV (0,03 %) et le niveau fondamental (0,12 %) de l'erbium 170.

2 Nuclear Data

$T_{1/2}(^{170}\mathrm{Tm})$	:	127,8	(6)	d
$Q^-(^{170}\mathrm{Tm})$	:	968,0	(8)	keV
$Q^+(^{170}\mathrm{Tm})$	:	314,4	(18)	keV

2.1 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,1}$	883,7 (8)	18,3 (7)	1st forbidden	8,924
$\beta^-_{0,0}$	968,0 (8)	81,6 (7)	1st forbidden	9,432

2.2 Electron Capture Transitions

	Energy keV	Probability × 100	Nature	lg ft	P_K	P_L	P_M
$\epsilon_{0,1}$	235,8 (18)	0,029 (3)	1st forbidden	10,21	0,7595 (22)	0,1822 (15)	0,0451 (9)
$\epsilon_{0,0}$	314,4 (18)	0,118 (7)	1st forbidden	9,906	0,7838 (19)	0,1645 (13)	0,0401 (8)

2.3 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{(-1,0)}$(Er)							
$\gamma_{1,0}$(Er)	78,59 (2)	0,029 (3)	E2	1,72 (11)	4,51 (30)	1,10 (7)	7,62 (50)
$\gamma_{1,0}$(Yb)	84,25474 (8)	18,3 (7)	E2	1,39 (2)	3,81 (6)	0,94 (1)	6,39 (10)

3 Atomic Data

3.1 Er

ω_K : 0,942 (4)
$\bar{\omega}_L$: 0,216 (9)
n_{KL} : 0,838 (4)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	48,2212		56,34
	$K\alpha_1$	49,1276		100
	$K\beta_3$	55,4797	}	
	$K\beta_1$	55,6737	}	
	$K\beta_5''$	56,0322	}	32,5
	$K\beta_5'$	56,0762	}	
	$K\beta_2$	57,142	}	
	$K\beta_4$	57,313	}	8,45
	$KO_{2,3}$	57,456	}	
X_L				
	$L\ell$	6,15		
	$L\gamma$	– 9,43		

3.1.2 Auger Electrons

		Energy keV	Relative probability
Auger K			
	KLL	37,79 – 40,56	100
	KLX	45,47 – 49,10	52,4
	KXY	53,02 – 57,43	6,9

3.2 Yb

ω_K	:	0,947	(4)
$\bar{\omega}_L$	:	0,238	(10)
n_{KL}	:	0,833	(4)

3.2.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	51,3541		56,73
	$K\alpha_1$	52,3887		100
	$K\beta_3$	59,1593	}	
	$K\beta_1$	59,3825	}	
	$K\beta_5''$	59,756	}	32,83
	$K\beta_5'$	59,8045	}	
	$K\beta_2$	60,962	}	
	$K\beta_4$	61,141	}	8,57
	$KO_{2,3}$	61,309	}	
X_L				
	$L\ell$	6,548		
	$L\alpha$	7,369 – 7,416		
	$L\eta$	7,583		
	$L\beta$	8,026 – 8,756		
	$L\gamma$	9,736 – 10,142		

3.2.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	40,16 – 43,23	100
KLX	48,36 – 52,36	52,8
KXY	56,48 – 61,29	7

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AK}	(Er)			0,0072 (6)
	KLL	37,79 - 40,56	}	
	KLX	45,47 - 49,10	}	
	KXY	53,02 - 57,43	}	
e_{AK}	(Yb)			0,182 (14)
	KLL	40,16 - 43,23	}	
	KLX	48,36 - 52,36	}	
	KXY	56,48 - 61,29	}	
$ec_{1,0\ K}$	(Er)	21,10 (2)		0,0058 (5)
$ec_{1,0\ K}$	(Yb)	22,9224 (1)		3,45 (13)
$ec_{1,0\ L}$	(Er)	68,84 - 70,23		0,015 (1)
$ec_{1,0\ L}$	(Yb)	73,77 - 75,31		9,4 (4)
$ec_{1,0\ M}$	(Er)	76,38 - 77,18		0,0037 (3)
$ec_{1,0\ M}$	(Yb)	81,86 - 82,73		2,3 (1)
$\beta^-_{0,1}$	max:	883,7 (8)		18,3 (7)
$\beta^-_{0,1}$	avg:	290,5 (3)		
$\beta^-_{0,0}$	max:	968,0 (8)		81,6 (7)
$\beta^-_{0,0}$	avg:	323,1 (3)		

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Er)	6,15 — 9,43		0,0306 (19)	
XKα_2	(Er)	48,2212		0,332 (16)	} Kα
XKα_1	(Er)	49,1276		0,0590 (24)	}
XKβ_3	(Er)	55,4797	}		
XKβ_1	(Er)	55,6737	}	0,0191 (10)	K$'\beta_1$
XKβ_5''	(Er)	56,0322	}		
XKβ_5'	(Er)	56,0762	}		
XKβ_2	(Er)	57,142	}		
XKβ_4	(Er)	57,313	}	0,0050 (3)	K$'\beta_2$
XKO$_{2,3}$	(Er)	57,456	}		

		Energy keV		Photons per 100 disint.	
XL	(Yb)	6,548 — 10,142		3,22 (13)	
XKα_2	(Yb)	51,3541		0,95 (4)	} Kα
XKα_1	(Yb)	52,3887		1,67 (7)	}
XKβ_3	(Yb)	59,1593	}		
XKβ_1	(Yb)	59,3825	}	0,55 (3)	K$'\beta_1$
XKβ_5''	(Yb)	59,756	}		
XKβ_5'	(Yb)	59,8045	}		
XKβ_2	(Yb)	60,962	}		
XKβ_4	(Yb)	61,141	}	0,144 (7)	K$'\beta_2$
XKO$_{2,3}$	(Yb)	61,309	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Er)	78,59 (2)	0,0034 (3)
$\gamma_{1,0}$(Yb)	84,25474 (8)	2,48 (9)

6 Main Production Modes

Tm – 169(n,γ)Tm – 170

{ Er – 170(p,n)Tm – 170
  Possible impurities : Tm – 168

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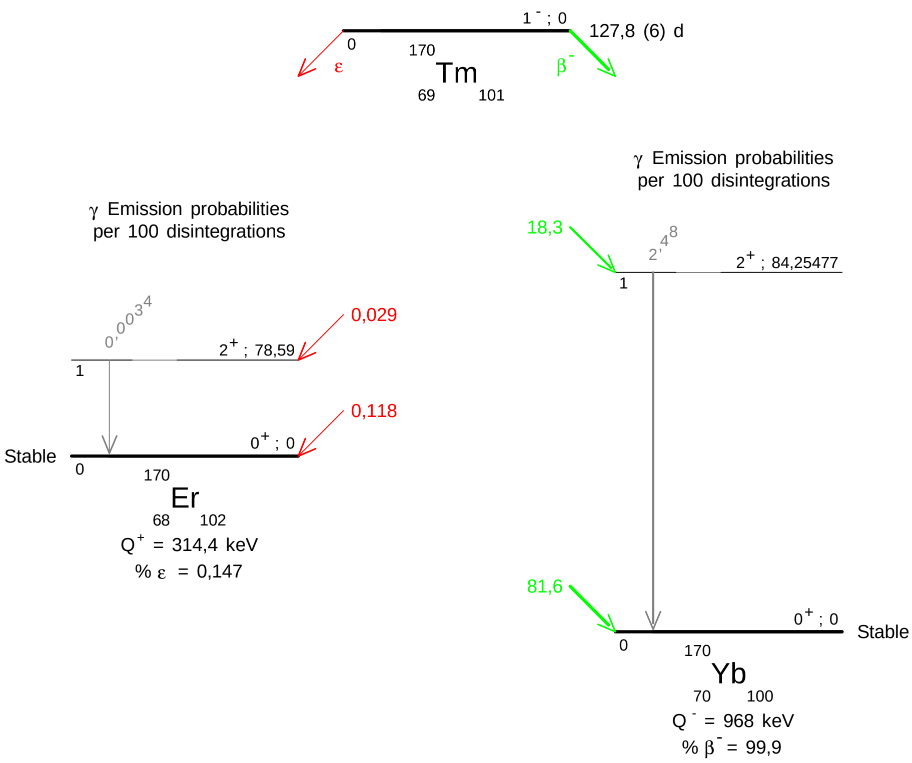
1 - ; 0
127,8 (6) d
0
170
Tm
69 101
ε
β -
γ Emission probabilities
per 100 disintegrations
0,0034
2 + ; 78,59
1
0,029
0,118
0 + ; 0
Stable
0
170
Er
68 102
Q + = 314,4 keV
% ε = 0,147
γ Emission probabilities
per 100 disintegrations
18,3
2,48
2 + ; 84,25477
1
81,6
0 + ; 0
Stable
0
170
Yb
70 100
Q - = 968 keV
% β - = 99,9

$^{177}_{71}$Lu $_{106}$

1 Decay Scheme

The Lu-177 ground state (JPI=7/2+) disintegrates by beta- emission (PB-=100%) to the ground state (JPI=7/2-) and to three excited levels (JPI=9/2-,11/2- and 9/2+) of Hf-177.
Le lutécium 177 se désintègre par émission bêta moins vers le niveau fondamental d' hafnium 177 via trois niveaux excités.

2 Nuclear Data

$T_{1/2}$(^{177}Lu)	:	6,647	(4)	d
Q^-(^{177}Lu)	:	498,3	(8)	keV

2.1 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,3}$	177,0 (8)	11,64 (10)	Allowed	6,1
$\beta^-_{0,2}$	248,6 (8)	0,012 (8)	1st forbidden Unique	9,2
$\beta^-_{0,1}$	385,4 (8)	9,1 (5)	1st Forbidden	7,3
$\beta^-_{0,0}$	498,3 (8)	79,3 (5)	1st Forbidden	6,7

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{3,2}$(Hf)	71,6418 (6)	0,327 (6)	E1+M2	0,715 (14)	0,138 (6)	0,0317 (14)	0,894 (22)
$\gamma_{1,0}$(Hf)	112,9498 (4)	20,29 (7)	M1+95,1%E2	0,817 (12)	1,104 (6)	0,2755 (14)	2,272 (5)
$\gamma_{2,1}$(Hf)	136,7245 (5)	0,1014 (7)	M1+90%E2	0,559 (21)	0,456 (7)	0,1129 (21)	1,158 (18)
$\gamma_{3,1}$(Hf)	208,3662 (4)	11,09 (7)	E1+0,54%M2	0,055 (4)	0,0094 (10)	0,00216 (24)	0,068 (5)
$\gamma_{2,0}$(Hf)	249,6742 (6)	0,2296 (21)	E2	0,091	0,038	0,009	0,141
$\gamma_{3,0}$(Hf)	321,3159 (6)	0,233 (8)	E1+M2	0,06 (5)	0,012 (10)	0,0028 (22)	0,08 (6)

3 Atomic Data

3.1 Hf

ω_K	:	0,951	(4)
$\bar{\omega}_L$	:	0,26	(1)
n_{KL}	:	0,829	(4)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	54,612		57,2
	$K\alpha_1$	55,7909		100
	$K\beta_3$	62,985	}	
	$K\beta_1$	63,234	}	
	$K\beta_5''$	63,662	}	33
	$K\beta_2$	64,942	}	
	$K\beta_4$	65,132	}	8,8
	$KO_{2,3}$	65,316	}	
X_L				
	$L\ell$	6,96		
	$L\alpha$	7,844 – 7,899		
	$L\eta$	8,139		
	$L\beta$	8,905 – 9,342		
	$L\gamma$	10,516 – 10,89		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	42,601 – 46,007	100
KLX	51,391 – 55,784	53,4
KXY	60,15 – 65,34	7,08
Auger L	4,3 – 11,2	

4 Electron Emissions

		Energy keV			Electrons per 100 disint.
e_{AL}	(Hf)	4,3	-	11,2	8,75 (20)
e_{AK}	(Hf)				0,283 (90)
	KLL	42,601	-	46,007	}
	KLX	51,391	-	55,784	}
	KXY	60,15	-	65,34	}
$ec_{3,2\ K}$	(Hf)	6,2910		(9)	0,123 (5)
$ec_{1,0\ K}$	(Hf)	47,5990		(8)	5,07 (18)
$ec_{1,0\ L}$	(Hf)	101,678	-	101,679	6,84 (23)
$ec_{1,0\ M}$	(Hf)	110,348	-	110,349	1,71 (6)
$ec_{3,1\ K}$	(Hf)	143,0154		(8)	0,57 (5)
$ec_{3,1\ L}$	(Hf)	197,094	-	197,096	0,098 (11)
$\beta^-_{0,3}$	max:	177,0		(8)	11,64 (10)
$\beta^-_{0,3}$	avg:	47,66		(23)	
$\beta^-_{0,2}$	max:	248,6		(8)	0,012 (8)
$\beta^-_{0,2}$	avg:	78,6		(3)	
$\beta^-_{0,1}$	max:	385,4		(8)	9,1 (5)
$\beta^-_{0,1}$	avg:	111,7		(3)	
$\beta^-_{0,0}$	max:	498,3		(8)	79,3 (5)
$\beta^-_{0,0}$	avg:	149,4		(3)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Hf)	6,96 — 10,89		3,18 (6)	
$XK\alpha_2$	(Hf)	54,612		1,59 (3)	} $K\alpha$
$XK\alpha_1$	(Hf)	55,7909		2,78 (6)	}
$XK\beta_3$	(Hf)	62,985	}		
$XK\beta_1$	(Hf)	63,234	}	0,917 (23)	$K'\beta_1$
$XK\beta_5''$	(Hf)	63,662	}		
$XK\beta_2$	(Hf)	64,942	}		
$XK\beta_4$	(Hf)	65,132	}	0,245 (8)	$K'\beta_2$
$XKO_{2,3}$	(Hf)	65,316	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{3,2}$(Hf)	71,6418 (6)	0,1726 (23)
$\gamma_{1,0}$(Hf)	112,9498 (4)	6,20 (7)
$\gamma_{2,1}$(Hf)	136,7245 (5)	0,0470 (7)
$\gamma_{3,1}$(Hf)	208,3662 (4)	10,38 (7)
$\gamma_{2,0}$(Hf)	249,6742 (6)	0,2012 (21)
$\gamma_{3,0}$(Hf)	321,3159 (6)	0,216 (8)

6 Main Production Modes

Lu – 176(n,γ)Lu – 177 σ : 1778 (75) barns

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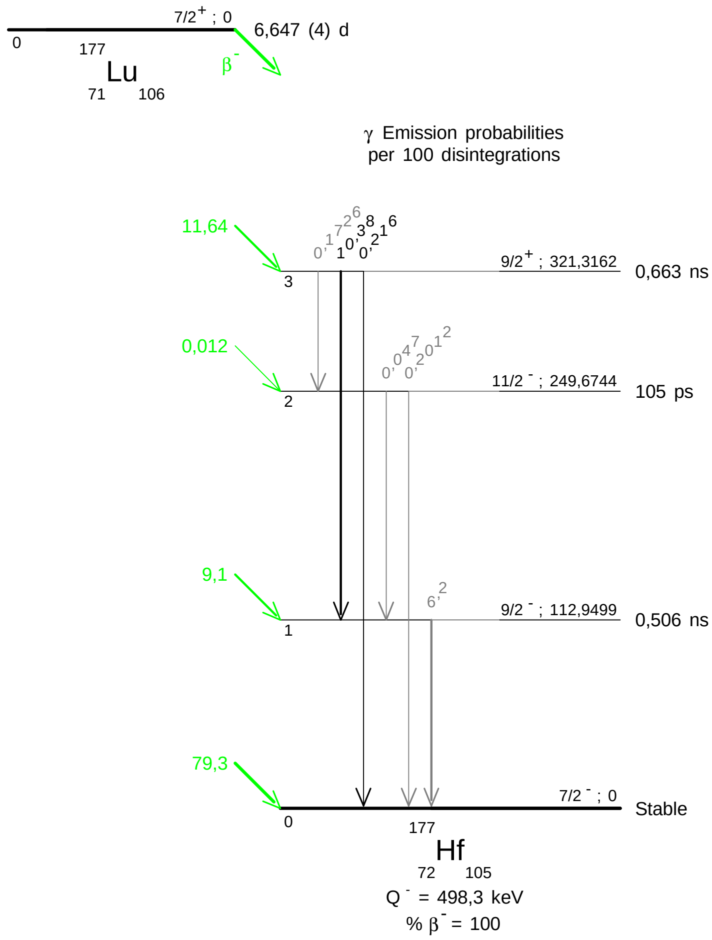
7/2+ ; 0
0
177
Lu
71 106
6,647 (4) d
β-
γ Emission probabilities
per 100 disintegrations
11,64
0,012
9,1
79,3
3
2
1
0
9/2+ ; 321,3162
0,663 ns
11/2 - ; 249,6744
105 ps
9/2 - ; 112,9499
0,506 ns
7/2 - ; 0
Stable
177
Hf
72 105
Q - = 498,3 keV
% β- = 100

$^{186}_{75}\mathrm{Re}_{111}$

1 Decay Scheme

Re-186 decays by beta minus emissions mainly to the fundamental and the 137 keV excited levels of Os-186 and by electron capture to the W-186.
Le rhénium 186 se désintègre par émission bêta moins principalement vers le niveau fondamental et le niveau excité de 137 keV de l'osmium 186 ; et par capture électronique vers le niveau fondamental et vers le niveau excité de 122 keV du tungstène 186.

2 Nuclear Data

$T_{1/2}(^{186}\mathrm{Re})$	:	3,7186	(17)	d
$Q^-(^{186}\mathrm{Re})$	:	1069,5	(9)	keV
$Q^+(^{186}\mathrm{Re})$	:	581,6	(17)	keV

2.1 Electron Capture Transitions

	Energy keV	Probability × 100	Nature	lg ft	P_K	P_L	P_M
$\epsilon_{0,1}$	459,3 (17)	1,69 (3)	1st Forbidden	7,8	0,7836 (19)	0,1638 (13)	0,0404 (8)
$\epsilon_{0,0}$	581,6 (17)	5,84 (12)	1st Forbidden	7,5	0,7943 (18)	0,1560 (12)	0,0382 (7)

2.2 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,4}$	159,0 (9)	0,000027 (9)	unique 1st forbidden	10,9
$\beta^-_{0,3}$	302,0 (9)	0,0627 (9)	1st Forbidden	8,9
$\beta^-_{0,1}$	932,3 (9)	21,5 (3)	1st Forbidden	8
$\beta^-_{0,0}$	1069,5 (9)	70,9 (3)	1st Forbidden	7,7

2.3 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{1,0}$(W)	122,33 (10)	1,694 (29)	E2	0,585 (12)	0,927 (19)	0,234 (7)	1,81 (4)
$\gamma_{1,0}$(Os)	137,157 (8)	21,57 (39)	E2	0,433 (13)	0,645 (19)	0,1648 (49)	1,290 (39)
$\gamma_{4,3}$(Os)	143,000 (42)	0,0000021 (7)	M1+E2	1,39 (8)	0,35 (2)	0,0842 (25)	1,85 (11)
$\gamma_{2,1}$(Os)	296,933 (31)	0,000058 (16)	E2	0,0609 (12)	0,0260 (6)	0,00645 (19)	0,095 (2)
$\gamma_{3,2}$(Os)	333,390 (42)	0,000066 (16)	[E2]	0,0454 (14)	0,0170 (5)	0,00418 (13)	0,0678 (20)
$\gamma_{4,2}$(Os)	476,390 (42)	0,0000015 (5)	E2+M1	0,0193 (6)	0,00512 (15)	0,001235 (37)	0,0259 (8)
$\gamma_{3,1}$(Os)	630,323 (31)	0,0297 (6)	M1+E2	0,0105 (6)	0,0023 (2)	0,000538 (16)	0,0134 (1)
$\gamma_{3,0}$(Os)	767,48 (3)	0,0330 (6)	E2	0,00690 (21)	0,001342 (40)	0,000315 (9)	0,00865 (26)
$\gamma_{4,1}$(Os)	773,323 (31)	0,000023 (7)	E2+M1	0,0189 (6)	0,00291 (9)		0,0266 (7)

3 Atomic Data

3.1 W

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

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	57,9823		57,57
	$K\alpha_1$	59,3189		100
	$K\beta_3$	66,952	}	
	$K\beta_1$	67,2451	}	
	$K\beta_5''$	67,664	}	33,15
	$K\beta_2$	69,033	}	
	$K\beta_4$	69,295	}	9,08
	$KO_{2,3}$	69,484	}	
X_L				
	$L\ell$	7,38		
	$L\gamma$	– 12,07		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	45,109 – 48,882	100
KLX	54,514 – 59,312	53,7
KXY	63,89 – 69,51	7,18
Auger L	4,5 – 12,1	27,6

3.2 Os

ω_K : 0,957 (4)
$\bar{\omega}_L$: 0,308 (12)
n_{KL} : 0,821 (4)

3.2.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	61,4873		58,03
	$K\alpha_1$	63,0011		100
	$K\beta_3$	71,078	}	
	$K\beta_1$	71,414	}	
	$K\beta_5''$	71,855	}	33,46
	$K\beta_2$	73,319	}	
	$K\beta_4$	73,615	}	9,37
	$KO_{2,3}$	73,819	}	
X_L				
	$L\ell$	7,82		
	$L\gamma$	– 12,92		

3.2.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	47,710 – 51,892	100
KLX	57,759 – 62,955	54,2
KXY	67,77 – 73,78	7,34
Auger L	4,7 – 12,9	60

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(W)	4,5 - 12,1		4,11 (4)
e_{AK}	(W)			0,291 (26)
	KLL	45,109 - 48,882	}	
	KLX	54,514 - 59,312	}	
	KXY	63,89 - 69,51	}	
e_{AL}	(Os)	4,7 - 12,9		6,43 (8)
e_{AK}	(Os)			0,175 (18)
	KLL	47,710 - 51,892	}	
	KLX	57,759 - 62,955	}	
	KXY	67,77 - 73,78	}	
$ec_{1,0\ K}$	(W)	52,8 (1)		0,353 (8)
$ec_{1,0\ T}$	(Os)	63,29 - 137,11		12,15 (38)
$ec_{1,0\ K}$	(Os)	63,29 (1)		4,08 (13)
$ec_{1,0\ L}$	(W)	110,23 - 112,12		0,559 (13)
$ec_{1,0\ M}$	(W)	119,51 - 120,52		0,1411 (44)
$ec_{1,0\ L}$	(Os)	124,19 - 126,29		6,08 (18)
$ec_{1,0\ M}$	(Os)	134,11 - 135,20		1,552 (47)
$ec_{1,0\ N}$	(Os)	136,5 - 137,1		0,381 (12)
$\beta^-_{0,4}$	max:	159,0 (9)		0,000027 (9)
$\beta^-_{0,4}$	avg:	42,6 (7)		
$\beta^-_{0,3}$	max:	302,0 (9)		0,0627 (9)
$\beta^-_{0,3}$	avg:	84,7 (7)		
$\beta^-_{0,1}$	max:	932,3 (9)		21,5 (3)
$\beta^-_{0,1}$	avg:	306,7 (7)		
$\beta^-_{0,0}$	max:	1069,5 (9)		70,9 (3)
$\beta^-_{0,0}$	avg:	359,6 (7)		

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(W)	7,38 — 12,07		1,66 (4)	
XKα_2	(W)	57,9823		1,736 (30)	} Kα
XKα_1	(W)	59,3189		3,02 (5)	}
XKβ_3	(W)	66,952	}		
XKβ_1	(W)	67,2451	}	1,000 (23)	K$'\beta_1$
XKβ_5''	(W)	67,664	}		
XKβ_2	(W)	69,033	}		
XKβ_4	(W)	69,295	}	0,274 (8)	K$'\beta_2$
XKO$_{2,3}$	(W)	69,484	}		
XL	(Os)	7,82 — 12,92		2,99 (7)	
XKα_2	(Os)	61,4873		1,13 (4)	} Kα
XKα_1	(Os)	63,0011		1,94 (6)	}
XKβ_3	(Os)	71,078	}		
XKβ_1	(Os)	71,414	}	0,650 (23)	K$'\beta_1$
XKβ_5''	(Os)	71,855	}		
XKβ_2	(Os)	73,319	}		
XKβ_4	(Os)	73,615	}	0,182 (8)	K$'\beta_2$
XKO$_{2,3}$	(Os)	73,819	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(W)	122,33 (10)	0,603 (6)
$\gamma_{1,0}$(Os)	137,157 (8)	9,42 (6)
$\gamma_{4,3}$(Os)	143,00 (4)	0,00000074 (25)
$\gamma_{2,1}$(Os)	296,93 (3)	0,000053 (15)
$\gamma_{3,2}$(Os)	333,39 (4)	0,000062 (15)
$\gamma_{4,2}$(Os)	476,39 (4)	0,0000015 (5)
$\gamma_{3,1}$(Os)	630,32 (3)	0,0293 (6)
$\gamma_{3,0}$(Os)	767,478 (30)	0,0327 (6)
$\gamma_{4,1}$(Os)	773,32 (3)	0,000022 (7)

6 Main Production Modes

$\left\{ \begin{array}{l} \text{Re} - 185(\text{n},\gamma)\text{Re} - 186 \quad \sigma : 112\ (3)\ \text{barns} \\ \text{Possible impurities : Re} - 186\text{m, Re} - 188\text{, Re} - 188\text{m} \end{array} \right.$

7 References

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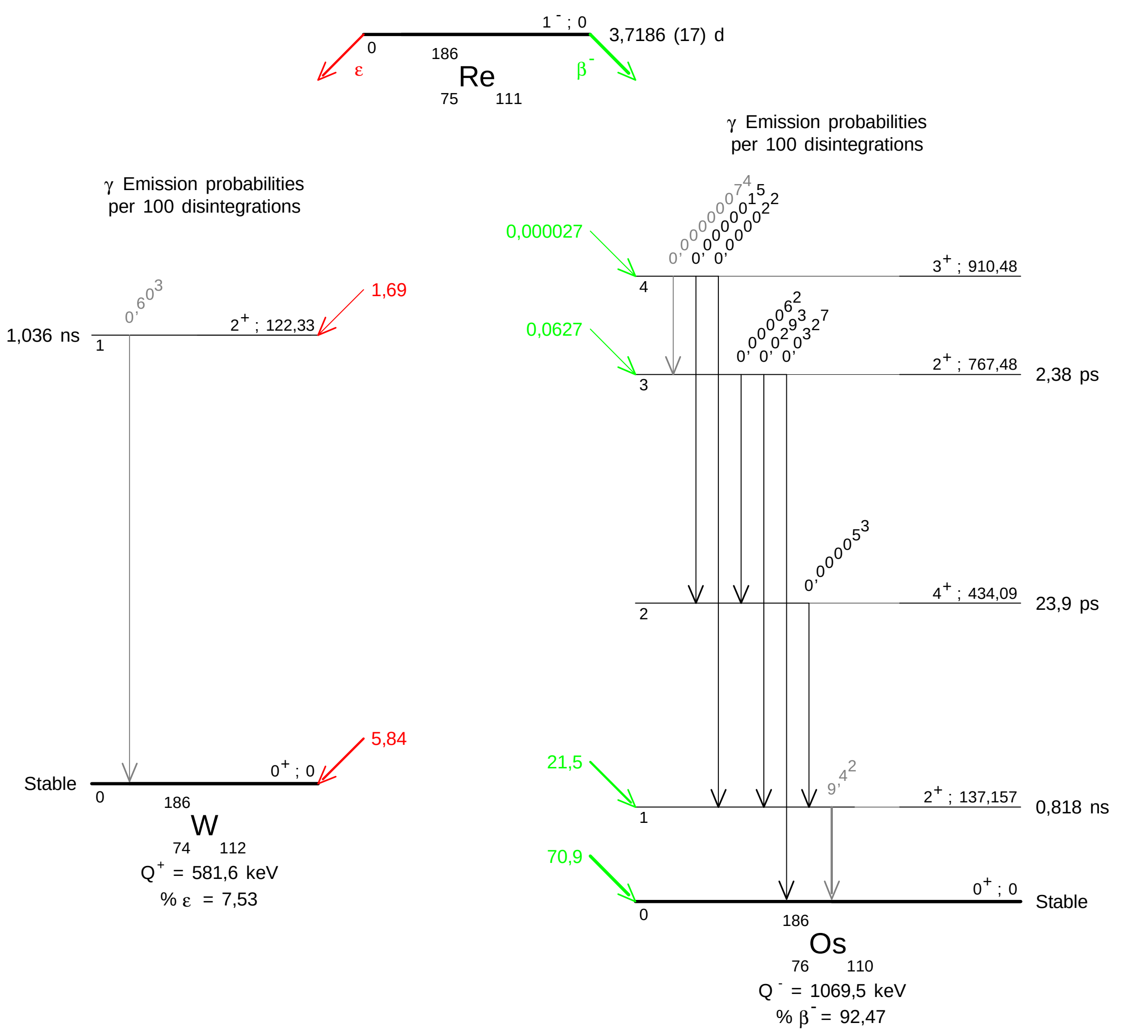
1 - ; 0
3,7186 (17) d
ε
β -
186 Re 75 111
γ Emission probabilities per 100 disintegrations
γ Emission probabilities per 100 disintegrations
1,69
2 + ; 122,33
1,036 ns
5,84
0 + ; 0
Stable
186 W 74 112
Q + = 581,6 keV
% ε = 7,53
0,000027
3 + ; 910,48
0,0627
2 + ; 767,48
2,38 ps
4 + ; 434,09
23,9 ps
21,5
2 + ; 137,157
0,818 ns
70,9
0 + ; 0
Stable
186 Os 76 110
Q - = 1069,5 keV
% β - = 92,47

$^{198}_{79}\mathrm{Au}_{119}$

1 Decay Scheme

The Au-198 disintegrates following three beta minus transitions, the main one is to the 411 keV level of Hg-198.
L'or 198 se désintègre selon trois transitions bêta moins, la principale vers le niveau de 411 keV du mercure 198, les deux autres de plus faible intensité vers le niveau de 1087 keV et le niveau fondamental.

2 Nuclear Data

$T_{1/2}(^{198}\mathrm{Au})$	:	2,6944	(8)	d
$Q^-(^{198}\mathrm{Au})$	:	1372,2	(10)	keV

2.1 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,2}$	284,5 (10)	0,989 (8)	1st Forbidden	7,6
$\beta^-_{0,1}$	960,4 (10)	98,986 (10)	1st Forbidden	7,36
$\beta^-_{0,0}$	1372,2 (10)	0,025 (5)	Unique 1st Forbidden	12,27

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{1,0}$(Hg)	411,80250 (17)	99,81 (9)	E2	0,0301 (2)	0,01091 (25)	0,0027 (2)	0,0447 (5)
$\gamma_{2,1}$(Hg)	675,8849 (7)	0,827 (7)	M1+56(5)%E2	0,0211 (15)	0,00380 (26)	0,00090 (7)	0,0261 (18)
$\gamma_{2,0}$(Hg)	1087,6874 (7)	0,1598 (30)	E2	0,00419 (13)	0,000761 (23)	0,000179 (5)	0,00519 (16)

3 Atomic Data

3.1 Hg

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

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	Kα_2	68,895		59
	Kα_1	70,819		100
	Kβ_3	79,822	}	
	Kβ_1	80,253	}	
	Kβ_5''	80,75	}	33,9
	Kβ_2	82,435	}	
	Kβ_4	82,776	}	9,94
	KO$_{2,3}$	83,028	}	
X_L				
	Lℓ	8,721		
	Lα	9,898 – 9,989		
	Lη	10,651		
	Lβ	11,358 – 12,56		
	Lγ	13,41 – 14,474		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	53,17 – 58,28	100
KLX	64,59 – 70,81	55,2
KXY	75,92 – 83,08	7,62
Auger L	5,1 – 14,8	32

4 Electron Emissions

		Energy keV			Electrons per 100 disint.
e_{AL}	(Hg)	5,1	-	14,8	2,170 (24)
e_{AK}	(Hg)				0,110 (12)
	KLL	53,17	-	58,28	}
	KLX	64,59	-	70,81	}
	KXY	75,92	-	83,08	}
$ec_{1,0\ K}$	(Hg)	328,7002		(5)	2,876 (19)
$ec_{1,0\ L}$	(Hg)	396,963	-	399,519	1,042 (24)
$ec_{1,0\ M}$	(Hg)	408,241	-	409,508	0,258 (19)
$\beta^-_{0,2}$	max:	284,5		(10)	0,989 (8)
$\beta^-_{0,2}$	avg:	79,4		(3)	
$\beta^-_{0,1}$	max:	960,4		(10)	98,986 (10)
$\beta^-_{0,1}$	avg:	314,5		(3)	
$\beta^-_{0,0}$	max:	1372,2		(10)	0,025 (5)
$\beta^-_{0,0}$	avg:	466		(1)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Hg)	8,721 — 14,474		1,21 (2)	
$XK\alpha_2$	(Hg)	68,895		0,809 (8)	} $K\alpha$
$XK\alpha_1$	(Hg)	70,819		1,372 (12)	}
$XK\beta_3$	(Hg)	79,822	}		
$XK\beta_1$	(Hg)	80,253	}	0,466 (8)	$K'\beta_1$
$XK\beta''_5$	(Hg)	80,75	}		
$XK\beta_2$	(Hg)	82,435	}		
$XK\beta_4$	(Hg)	82,776	}	0,136 (4)	$K'\beta_2$
$XKO_{2,3}$	(Hg)	83,028	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Hg)	411,80205 (17)	95,54 (7)
$\gamma_{2,1}$(Hg)	675,8836 (7)	0,806 (7)
$\gamma_{2,0}$(Hg)	1087,6842 (7)	0,159 (3)

6 Main Production Modes

Au – 197(n,γ)Au – 198 σ : 98,8 (3) barns
Possible impurities : Au – 199

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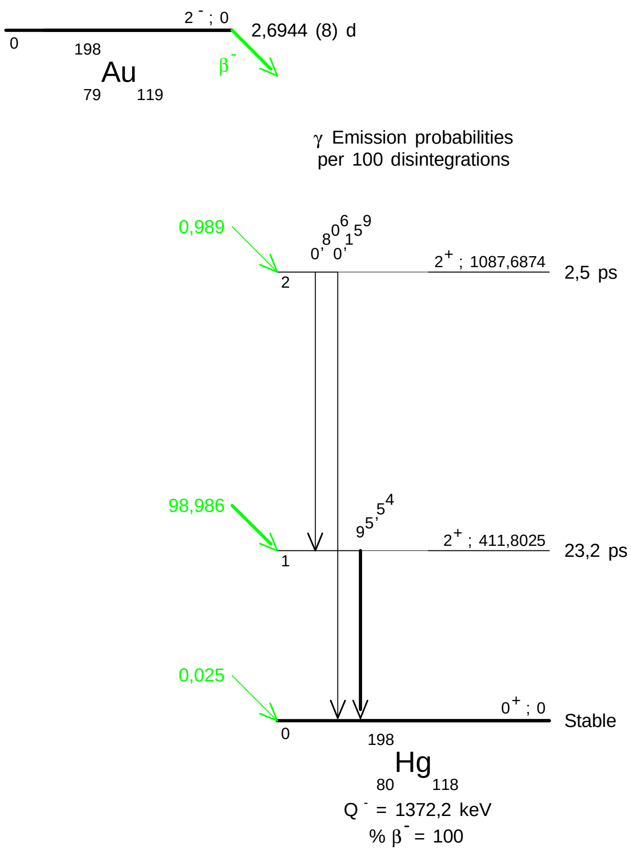
2 - ; 0
2,6944 (8) d
0
198
Au
79
119
β-
γ Emission probabilities
per 100 disintegrations
0,989
2
2+ ; 1087,6874
2,5 ps
98,986
1
2+ ; 411,8025
23,2 ps
0,025
0
0+ ; 0
Stable
198
Hg
80
118
Q - = 1372,2 keV
% β- = 100

$^{201}_{81}$Tl$_{120}$

1 Decay Scheme

Tl-201 decays by electron capture to the Hg-201.
Le thallium 201 se désintègre par capture électronique vers le mercure 201.

2 Nuclear Data

$T_{1/2}(^{201}$Tl)	:	3,0421	(17)	d
$Q^{+}(^{201}$Tl)	:	483	(15)	keV

2.1 Electron Capture Transitions

	Energy keV	Probability × 100	Nature	lg ft	P_K	P_L	P_M
$\epsilon_{0,4}$	316 (15)	40,9 (9)	1st Forbidden	6,1	0,724 (7)	0,206 (7)	0,054 (2)
$\epsilon_{0,3}$	451 (15)	13,0 (5)	1st Forbidden	6,9	0,758 (3)	0,181 (3)	0,0461 (12)
$\epsilon_{0,2}$	457 (15)	0,23	Unique 1st Forbidden	8,5			
$\epsilon_{0,1}$	482 (15)	25 (22)	1st Forbidden	6,5	0,763 (3)	0,178 (3)	0,0451 (12)
$\epsilon_{0,0}$	483 (15)	21 (21)	1st Forbidden	6,5	0,763 (3)	0,178 (3)	0,0451 (12)

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{1,0}$(Hg)	1,565 (6)	38 (22)	M1+E2				4,7 (7) 10^4
$\gamma_{3,2}$(Hg)	5,869 (26)	0,52 (14)	[M1+E2]				
$\gamma_{2,0}$(Hg)	26,269 (7)	0,64 (7)	M1(+E2)		58,8 (18)	13,74 (41)	76,9 (23)
$\gamma_{3,1}$(Hg)	30,573 (17)	12,77 (25)	M1+E2		36,9 (4)	8,79 (26)	48,5 (2)
$\gamma_{3,0}$(Hg)	32,138 (16)	11,28 (22)	M1+E2		32,0 (4)	7,62 (23)	41,9 (2)
$\gamma_{4,3}$(Hg)	135,312 (34)	11,59 (28)	M1+E2	2,83 (3)	0,48 (5)	0,1138 (34)	3,45 (10)

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{4,2}$(Hg)	141,18 (4)	< 0,02	[E2]	0,372 (11)	0,774 (23)	0,202 (6)	1,41 (4)
$\gamma_{4,1}$(Hg)	165,885 (31)	0,420 (13)	M1(+E2)	1,57 (3)	0,270 (5)	0,0634 (19)	1,86 (8)
$\gamma_{4,0}$(Hg)	167,45 (3)	28,9 (9)	M1+E2	1,55 (3)	0,262 (5)	0,0620 (19)	1,89 (8)

3 Atomic Data

3.1 Hg

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

3.1.1 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	}	10
	$KO_{2,3}$	83,028	}	
X_L				
	$L\ell$	8,72		
	$L\alpha$	9,898 – 9,989		
	$L\eta$	10,651		
	$L\beta$	11,563 – 12,56		
	$L\gamma$	13,41 – 14,85		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	53,178 – 58,277	100
KLX	64,594 – 68,430	55,2
KXY	75,98 – 83,09	7,62
Auger L	5,1 – 14,8	34

4 Electron Emissions

		Energy keV	Electrons per 100 disint.
e_{AL}	(Hg)	5,1 - 14,8	57,7 (7)
e_{AK}	(Hg)		3,7 (4)
	KLL	53,178 - 58,277	}
	KLX	64,594 - 68,430	}
	KXY	75,98 - 83,09	}
$ec_{2,0\ L}$	(Hg)	11,429 - 13,985	0,48 (5)
$ec_{3,1\ L}$	(Hg)	15,734 - 18,289	9,70 (34)
$ec_{3,0\ L}$	(Hg)	17,299 - 19,854	8,57 (31)
$ec_{2,0\ M}$	(Hg)	22,707 - 23,974	0,113 (13)
$ec_{3,1\ M}$	(Hg)	27,011 - 28,278	2,27 (8)
$ec_{3,0\ M}$	(Hg)	28,576 - 29,843	2,00 (7)
$ec_{3,1\ N}$	(Hg)	29,770 - 30,473	0,583 (21)
$ec_{3,0\ N}$	(Hg)	31,334 - 32,038	0,515 (19)
$ec_{4,3\ K}$	(Hg)	52,210 (34)	7,45 (24)
$ec_{4,1\ K}$	(Hg)	82,783 (31)	0,237 (8)
$ec_{4,0\ K}$	(Hg)	84,348 (30)	15,6 (5)
$ec_{4,3\ L}$	(Hg)	120,473 - 123,028	1,268 (41)
$ec_{4,3\ M}$	(Hg)	131,750 - 133,017	0,296 (9)
$ec_{4,3\ N}$	(Hg)	134,509 - 135,212	0,0760 (24)
$ec_{4,0\ L}$	(Hg)	152,611 - 155,166	2,65 (8)
$ec_{4,0\ M}$	(Hg)	163,888 - 165,155	0,62 (2)
$ec_{4,0\ N}$	(Hg)	166,647 - 167,350	0,159 (5)

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Hg)	8,72 — 14,85		42,7 (18)	
$XK\alpha_2$	(Hg)	68,895		27,3 (5)	} $K\alpha$
$XK\alpha_1$	(Hg)	70,82		46,4 (7)	}
$XK\beta_3$	(Hg)	79,823	}		
$XK\beta_1$	(Hg)	80,254	}	15,7 (4)	$K'\beta_1$
$XK\beta_5''$	(Hg)	80,762	}		
$XK\beta_2$	(Hg)	82,435	}		
$XK\beta_4$	(Hg)	82,776	}	4,61 (13)	$K'\beta_2$
$XKO_{2,3}$	(Hg)	83,028	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Hg)	1,565 (6)	0,00081 (47)
$\gamma_{3,2}$(Hg)	5,869 (26)	0,5
$\gamma_{2,0}$(Hg)	26,269 (7)	0,0082 (9)
$\gamma_{3,1}$(Hg)	30,573 (17)	0,258 (5)
$\gamma_{3,0}$(Hg)	32,138 (16)	0,263 (5)
$\gamma_{4,3}$(Hg)	135,312 (34)	2,604 (22)
$\gamma_{4,2}$(Hg)	141,18 (4)	< 0,008
$\gamma_{4,1}$(Hg)	165,885 (31)	0,147 (2)
$\gamma_{4,0}$(Hg)	167,45 (3)	10,0 (1)

6 Main Production Modes

{ Tl – 203(p,3n)Pb – 201
Possible impurities : Pb – 200, Pb – 202m, Pb – 203, Pb – 204m, Tl – 200

{ Tl – 205(p,5n)Pb – 201
Possible impurities : Pb – 200, Pb – 202m, Pb – 204m, Tl – 200, Tl – 202

{ Tl – 203(d,4n)Pb – 201
Possible impurities : Pb – 200, Pb – 202m, Pb – 203, Pb – 204m, Tl – 200, Tl – 202

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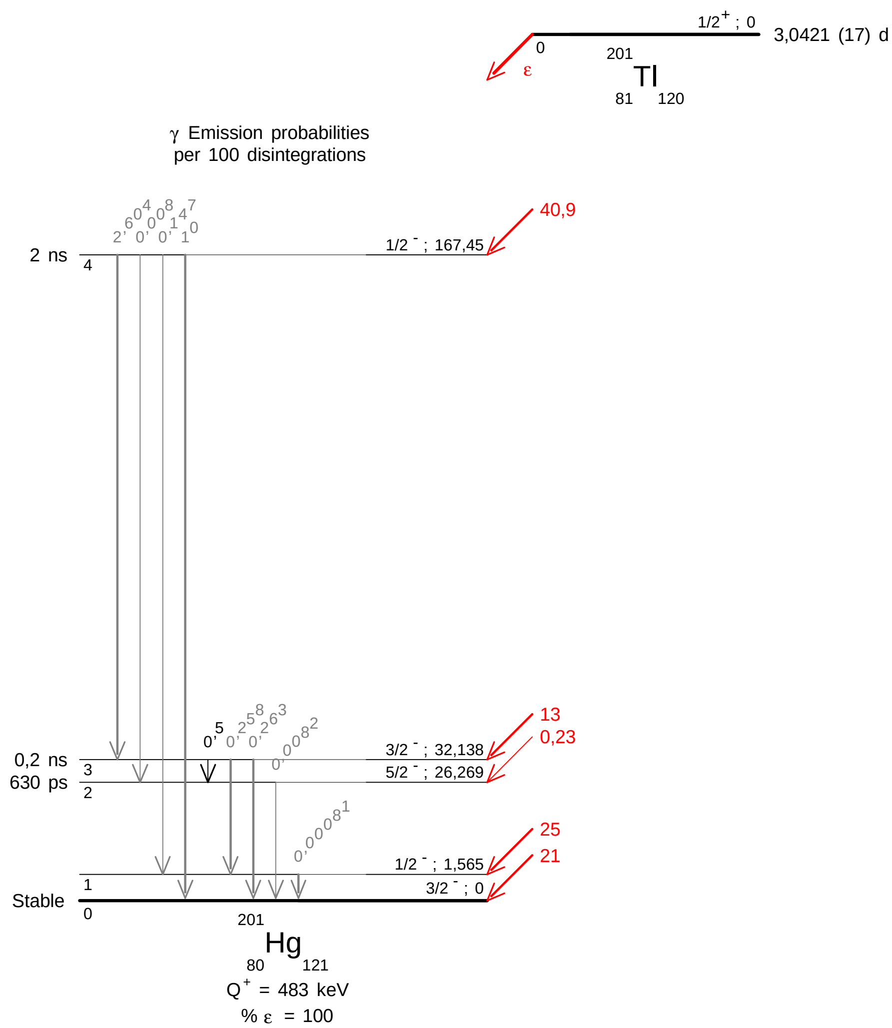
1/2+ ; 0
3,0421 (17) d
0
ε
201
Tl
81 120
γ Emission probabilities
per 100 disintegrations
40,9
1/2 - ; 167,45
2 ns
4
13
0,23
3/2 - ; 32,138
5/2 - ; 26,269
0,2 ns
630 ps
3
2
25
21
1/2 - ; 1,565
3/2 - ; 0
1
Stable
0
201
Hg
80 121
Q+ = 483 keV
% ε = 100

$^{203}_{80}$Hg$_{123}$

1 Decay Scheme

The simple and consistent decay scheme is dominated by beta decay to the first excited state of Tl-203, followed by a single gamma transition to the ground state.
Le mercure 203 se désintègre par émission bêta moins vers le niveau excités de 279 keV du thallium 203.

2 Nuclear Data

$T_{1/2}$(^{203}Hg)	:	46,594	(12)	d
Q^-(^{203}Hg)	:	491,8	(12)	keV

2.1 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,1}$	212,6 (12)	99,99 (1)	Allowed	6,455
$\beta^-_{0,0}$	491,8 (12)	0,01 (1)	1st Forbidden Unique	11,6

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{1,0}$(Tl)	279,1969 (12)	99,99 (1)	M1+75%E2	0,1640 (10)	0,0476 (2)	0,0155 (2)	0,2271 (12)

3 Atomic Data

3.1 Tl

ω_K	:	0,963	(4)
$\bar{\omega}_L$	:	0,367	(15)
n_{KL}	:	0,812	(5)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	70,8325		59,24
	$K\alpha_1$	72,8725		100
	$K\beta_3$	82,118	}	
	$K\beta_1$	82,577	}	
	$K\beta_5''$	83,115	}	34
	$K\beta_2$	84,838	}	
	$K\beta_4$	85,134	}	10,1
	$KO_{2,3}$	85,444	}	
X_L				
	$L\ell$	8,953		
	$L\alpha$	10,172 – 10,268		
	$L\eta$	10,994		
	$L\beta$	11,812 – 12,643		
	$L\gamma$	14,291 – 14,738		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	54,587 – 59,954	100
KLX	66,37 – 72,86	56
KXY	78,12 – 85,50	7,7
Auger L	5,18 – 10,13	3370

4 Electron Emissions

		Energy keV	Electrons per 100 disint.
e_{AL}	(Tl)	5,18 - 10,13	10,1 (1)
e_{AK}	(Tl)		0,49 (6)
	KLL	54,587 - 59,954	}
	KLX	66,37 - 72,86	}
	KXY	78,12 - 85,50	}
$ec_{1,0\ T}$	(Tl)	193,66 - 279,18	18,5 (1)
$ec_{1,0\ K}$	(Tl)	193,66 (1)	13,37 (6)
$ec_{1,0\ L}$	(Tl)	263,85 - 266,54	3,88 (2)
$ec_{1,0\ M}$	(Tl)	275,49 - 279,18	1,26 (1)
$\beta^-_{0,1}$	max:	212,6 (12)	99,99 (1)
$\beta^-_{0,1}$	avg:	57,8 (4)	
$\beta^-_{0,0}$	max:	491,8 (12)	0,01 (1)
$\beta^-_{0,0}$	avg:	154,4 (4)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Tl)	8,953 — 14,738		5,43 (9)	
$XK\alpha_2$	(Tl)	70,8325		3,75 (4)	} $K\alpha$
$XK\alpha_1$	(Tl)	72,8725		6,33 (6)	}
$XK\beta_3$	(Tl)	82,118	}		
$XK\beta_1$	(Tl)	82,577	}	2,15 (4)	$K'\beta_1$
$XK\beta_5''$	(Tl)	83,115	}		
$XK\beta_2$	(Tl)	84,838	}		
$XK\beta_4$	(Tl)	85,134	}	0,639 (16)	$K'\beta_2$
$XKO_{2,3}$	(Tl)	85,444	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Tl)	279,1952 (10)	81,48 (8)

6 Main Production Modes

Au – 203(β^-)Hg – 203

Tl – 204(γ,p)Hg – 203

Hg – 202(n,γ)Hg – 203

Hg – 202(d,p)Hg – 203

Hg – 204(d,t)Hg – 203

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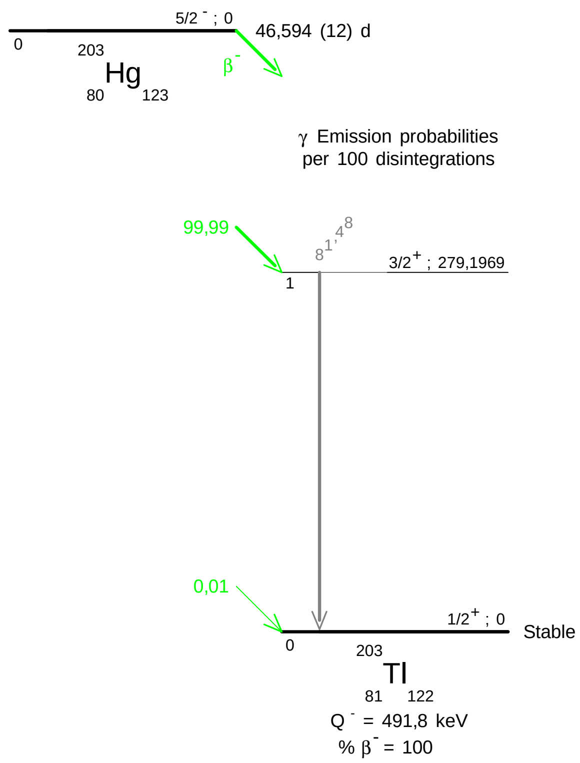
5/2 - ; 0
0
46,594 (12) d
203
Hg
80
123
β-
γ Emission probabilities
per 100 disintegrations
99,99
3/2+ ; 279,1969
1
0,01
1/2+ ; 0
Stable
0
203
Tl
81
122
Q - = 491,8 keV
% β- = 100

$^{204}_{81}$Tl $_{123}$

1 Decay Scheme

Le Tl-204 se désintègre par capture électronique (2,92 %) vers le niveau fondamental de Hg-204 et par émission bêta moins (97,08 %) vers le niveau fondamental de Pb-204.
Tl-204 disintegrates 97.08 (13)% by beta minus emission and 2.92 (13)% by electron capture transition to the ground states of Pb-204 and Hg-204, respectively.

2 Nuclear Data

$T_{1/2}$(^{204}Tl)	:	3,788	(15)	a
Q^-(^{204}Tl)	:	763,72	(18)	keV
Q^+(^{204}Tl)	:	345,0	(13)	keV

2.1 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,0}$	763,7 (2)	97,08 (13)	Unique 1st Forbidden	10,1

2.2 Electron Capture Transitions

	Energy keV	Probability × 100	Nature	lg ft	P_K	P_L	P_{M+}
$\epsilon_{0,0}$	347,5 (15)	2,92 (13)	Unique 1st Forbidden	9,6	0,5843 (14)	0,3024 (10)	0,1133 (5)

3 Atomic Data

3.1 Hg

ω_K	:	0,962	(4)
$\bar{\omega}_L$	:	0,355	(14)
$\bar{\omega}_M$	:	0,026	(3)
n_{KL}	:	0,815	(4)
$\bar{n}_{LM}$	:	1,34	(4)

3.1.1 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	}	34,3
	$K\beta_2$	82,435	}	
	$K\beta_4$	82,776	}	10,04
	$KO_{2,3}$	83,028	}	
X_L				
	$L\ell$	8,721		
	$L\alpha$	9,898 – 9,989		
	$L\eta$	10,647		
	$L\beta$	11,924 – 11,822		
	$L\gamma$	– 14,847		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	53,17 – 58,28	100
KLX	64,59 – 70,81	55,2
KXY	75,92 – 83,08	7,62
Auger L	5,1 – 14,8	

3.2 Pb

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

3.2.1 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	}	

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Hg)	5,1 - 14,8		1,48 (3)
e_{AK}	(Hg)			0,065 (8)
	KLL	53,17 - 58,28	}	
	KLX	64,59 - 70,81	}	
	KXY	75,92 - 83,08	}	
$\beta^-_{0,0}$	max:	763,7 (2)		97,08 (13)
$\beta^-_{0,0}$	avg:	243,9 (1)		

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Hg)	8,721 — 14,847		0,787 (20)	
XKα_2	(Hg)	68,895		0,474 (20)	} Kα
XKα_1	(Hg)	70,82		0,812 (34)	}
XKβ_3	(Hg)	79,823	}		
XKβ_1	(Hg)	80,254	}	0,273 (10)	K$'\beta_1$
XKβ_5''	(Hg)	80,762	}		
XKβ_2	(Hg)	82,435	}		
XKβ_4	(Hg)	82,776	}	0,081 (3)	K$'\beta_2$
XKO$_{2,3}$	(Hg)	83,028	}		
XKα_2	(Pb)	72,8049		0,0044 (3)	} Kα
XKα_1	(Pb)	74,97		0,0061 (3)	}
XKβ_3	(Pb)	84,451	}		
XKβ_1	(Pb)	84,937	}	0,0027 (2)	K$'\beta_1$
XKβ_5''	(Pb)	85,47	}		
XKβ_2	(Pb)	87,238	}		
XKβ_4	(Pb)	87,58	}	0,00073 (2)	K$'\beta_2$
XKO$_{2,3}$	(Pb)	87,911	}		

6 Main Production Modes

{ Tl – 203(n,γ)Tl – 204 σ : 11,0 (5) barns
Possible impurities : None

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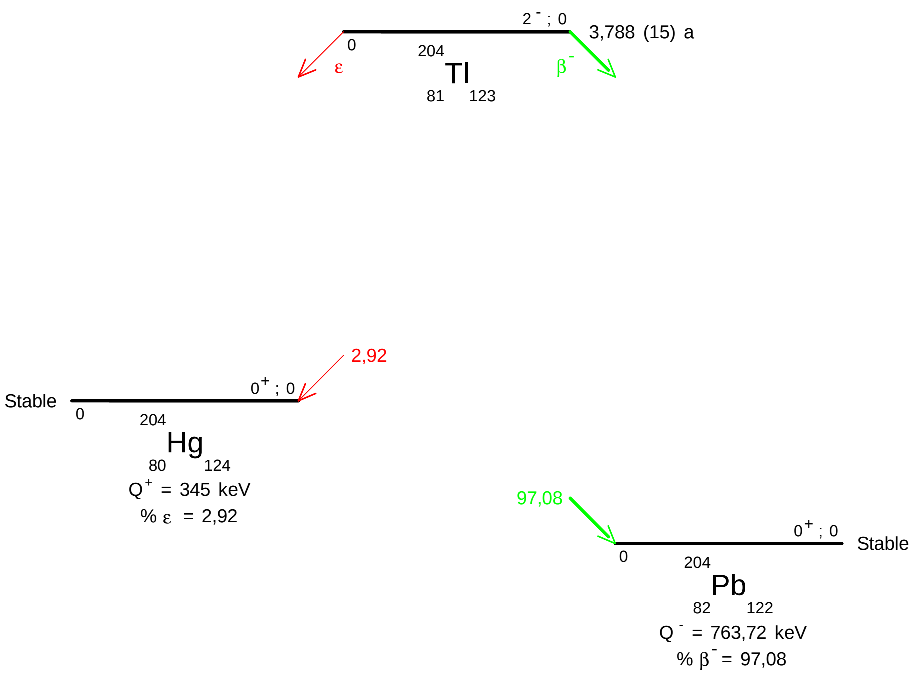
2 - ; 0
3,788 (15) a
0
204
Tl
81 123
ε
β-
2,92
Stable
0+ ; 0
0
204
Hg
80 124
Q+ = 345 keV
% ε = 2,92
97,08
0+ ; 0
Stable
0
204
Pb
82 122
Q - = 763,72 keV
% β- = 97,08

208 Tl
81 Tl 127

1 Decay Scheme

Tl-208 decays by beta minus emission to the Pb-208 excited levels.
Le thallium 208 se désintègre par émission bêta moins vers les niveaux excités du plomb 208.

2 Nuclear Data

$T_{1/2}$(^{208}Tl)	:	3,060	(8)	min
Q^-(^{208}Tl)	:	5001	(2)	keV

2.1 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,18}$	521 (2)	0,053 (5)	1st Forbidden	6,67
$\beta^-_{0,17}$	618 (2)	0,017 (5)	1st Forbidden	7,4
$\beta^-_{0,16}$	643 (2)	0,045 (7)	1st Forbidden	7,05
$\beta^-_{0,15}$	678 (2)	0,005 (2)	1st Forbidden	8,1
$\beta^-_{0,14}$	690 (2)	0,076 (11)	1st Forbidden	6,93
$\beta^-_{0,13}$	705 (2)	0,048 (6)	1st Forbidden	7,16
$\beta^-_{0,12}$	718 (2)	0,030 (7)	1st Forbidden	7,4
$\beta^-_{0,11}$	739 (2)	0,002 (1)	1st Forbidden	8,6
$\beta^-_{0,10}$	821 (2)	0,231 (9)	1st Forbidden	6,71
$\beta^-_{0,9}$	876 (2)	0,18 (2)	1st Forbidden	6,91
$\beta^-_{0,8}$	1005 (3)	0,007 (3)	1st Forbidden	8,5
$\beta^-_{0,7}$	1040 (2)	3,26 (7)	1st Forbidden	5,92
$\beta^-_{0,6}$	1055 (2)	0,048 (3)	1st Forbidden	7,77
$\beta^-_{0,5}$	1081 (2)	0,64 (6)	1st Forbidden	6,69
$\beta^-_{0,4}$	1293 (2)	24,1 (3)	1st Forbidden	5,39
$\beta^-_{0,3}$	1526 (2)	22,2 (7)	1st Forbidden	5,69
$\beta^-_{0,2}$	1803 (2)	49,0 (9)	1st Forbidden	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
$\gamma_{5,4}$(Pb)	211,4 (2)	0,39 (2)	[M1+2%E2]	0,952 (29)	0,166 (5)	0,052 (2)	1,17 (4)
$\gamma_{4,3}$(Pb)	233,3 (1)	0,59 (2)	[M1+2%E2]	0,724 (22)	0,125 (4)	0,039 (1)	0,888 (27)
$\gamma_{7,4}$(Pb)	252,5 (2)	1,34 (4)	[M1+2%E2]	0,582 (17)	0,100 (3)	0,0310 (9)	0,713 (21)
$\gamma_{3,2}$(Pb)	277,37 (3)	10,3 (5)	[M1]	0,457 (14)	0,078 (2)	0,0240 (7)	0,559 (17)
$\gamma_{7,3}$(Pb)	485,8 (1)	0,055 (4)	[M1]	0,101 (3)	0,0170 (5)	0,0050 (2)	0,123 (4)
$\gamma_{4,2}$(Pb)	510,7 (1)	25,0 (2)	[M1+0,27%E2]	0,089 (3)	0,0156 (5)	0,0040 (1)	0,108 (3)
$\gamma_{2,1}$(Pb)	583,187 (2)	86,8 (1)	E2	0,0152 (5)	0,0042 (1)	0,00130 (4)	0,0207 (6)
$\gamma_{13,4}$(Pb)	587,8 (2)	0,060 (21)	[M1]	0,0614 (18)	0,0102 (3)	0,0032 (1)	0,0748 (22)
$\gamma_{9,3}$(Pb)	650,2 (2)	0,05 (2)	[M1]	0,0472 (14)	0,0078 (2)	0,00250 (8)	0,0575 (17)
$\gamma_{10,3}$(Pb)	705,3 (2)	0,023 (4)	[M1]	0,0382 (11)	0,0063 (2)	0,00200 (6)	0,0465 (14)
$\gamma_{5,2}$(Pb)	722,0 (1)	0,25 (4)	[M1+8,8%E2]	0,0337 (10)	0,0056 (2)	0,00180 (5)	0,0411 (10)
$\gamma_{6,2}$(Pb)	748,7 (2)	0,0480 (31)	[M1]	0,0328 (10)	0,0054 (2)	0,00170 (5)	0,0399 (12)
$\gamma_{7,2}$(Pb)	763,2 (1)	1,86 (3)	[M1+0,01%E2]	0,0312 (10)	0,0052 (2)	0,00150 (5)	0,0379 (11)
$\gamma_{12,3}$(Pb)	808,3 (2)	0,030 (7)					
$\gamma_{13,3}$(Pb)	821,1 (2)	0,042 (4)	[M1]	0,0258 (8)	0,0043 (1)	0,00130 (4)	0,0314 (9)
$\gamma_{14,3}$(Pb)	835,9 (2)	0,076 (11)					
$\gamma_{3,1}$(Pb)	860,56 (3)	12,8 (1)	[M1+33,5%E2]	0,0176 (5)	0,0030 (1)	0,00100 (3)	0,0216 (6)
$\gamma_{16,3}$(Pb)	883,4 (2)	0,032 (3)	[M1]	0,0214 (7)	0,0035 (1)	0,00120 (4)	0,0261 (8)
$\gamma_{9,2}$(Pb)	927,6 (2)	0,128 (1)	[M1]	0,0189 (6)	0,0031 (1)	0,00100 (3)	0,0230 (7)
$\gamma_{10,2}$(Pb)	982,7 (2)	0,209 (8)	[M1]	0,0163 (5)	0,00270 (8)	0,00080 (2)	0,0198 (6)
$\gamma_{4,1}$(Pb)	1093,9 (1)	0,43 (2)	E2	0,00455 (14)	0,00084 (3)	0,000270 (8)	0,00566 (17)
$\gamma_{15,2}$(Pb)	1125,7 (4)	0,005 (2)					
$\gamma_{16,2}$(Pb)	1160,8 (2)	0,011 (3)	[M1]	0,0107 (3)	0,00160 (5)	0,00060 (2)	0,0129 (4)
$\gamma_{17,2}$(Pb)	1185,2 (3)	0,017 (5)	[M1]	0,0101 (3)	0,00160 (5)	0,00060 (2)	0,0123 (4)
$\gamma_{18,2}$(Pb)	1282,8 (3)	0,053 (5)	[M1]	0,00830 (25)	0,00127 (4)	0,00049 (2)	0,01006 (30)
$\gamma_{8,1}$(Pb)	1381,1 (5)	0,007 (3)	[E2]	0,00297 (9)	0,00051 (2)	0,000160 (5)	0,00364 (11)
$\gamma_{11,1}$(Pb)	1647,5 (7)	0,002 (1)					
$\gamma_{16,1}$(Pb)	1743,9 (2)	0,002 (1)	[M1]	0,00382 (11)	0,00057 (2)	0,000160 (5)	0,00455 (14)
$\gamma_{1,0}$(Pb)	2614,511 (10)	100,00 (1)	E3	0,00173 (5)	0,000290 (9)	0,000080 (2)	0,00210 (6)

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		59,6
	$K\alpha_1$	74,97		100
	$K\beta_3$	84,451	}	
	$K\beta_1$	84,937	}	
	$K\beta_5''$	85,47	}	34,1

		Energy keV		Relative probability
	$K\beta_2$	87,238	}	
	$K\beta_4$	87,58	}	10,3
	$KO_{2,3}$	87,911	}	
X_L				
	$L\ell$	9,184		
	$L\alpha$	10,45 – 10,551		
	$L\eta$	11,349		
	$L\beta$	12,142 – 13,015		
	$L\gamma$	14,765 – 15,216		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	56,03 – 61,67	100
KLX	68,18 – 74,97	56
KXY	80,3 – 88,0	7,8
Auger L	5,26 – 10,40	3020

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Pb)	5,26 - 10,40		5,23 (9)
e_{AK}	(Pb)			0,28 (4)
	KLL	56,03 - 61,67	}	
	KLX	68,18 - 74,97	}	
	KXY	80,3 - 88,0	}	
$ec_{3,2\ K}$	(Pb)	189,37 (3)		3,01 (9)
$ec_{3,2\ L}$	(Pb)	261,51 - 264,33		0,51 (2)
$ec_{3,2\ M}$	(Pb)	273,52 - 277,23		0,16 (1)
$ec_{4,2\ K}$	(Pb)	422,7 (1)		2,0 (1)
$ec_{4,2\ L}$	(Pb)	494,8 - 497,7		0,3
$ec_{2,1\ K}$	(Pb)	495,19 (3)		1,3 (1)
$ec_{4,2\ M}$	(Pb)	506,8 - 510,6		0,09
$ec_{2,1\ L}$	(Pb)	567,33 - 570,15		0,4
$ec_{2,1\ M}$	(Pb)	579,34 - 583,05		0,1

		Energy keV		Electrons per 100 disint.
$\beta^-_{0,18}$	max:	521	(2)	0,053 (5)
$\beta^-_{0,18}$	avg:	155,1	(7)	
$\beta^-_{0,17}$	max:	618	(2)	0,017 (5)
$\beta^-_{0,17}$	avg:	188,6	(7)	
$\beta^-_{0,16}$	max:	643	(2)	0,045 (7)
$\beta^-_{0,16}$	avg:	197,1	(7)	
$\beta^-_{0,15}$	max:	678	(2)	0,005 (2)
$\beta^-_{0,15}$	avg:	209,5	(7)	
$\beta^-_{0,14}$	max:	690	(2)	0,076 (11)
$\beta^-_{0,14}$	avg:	213,9	(7)	
$\beta^-_{0,13}$	max:	705	(2)	0,048 (6)
$\beta^-_{0,13}$	avg:	219,2	(7)	
$\beta^-_{0,12}$	max:	718	(2)	0,030 (7)
$\beta^-_{0,12}$	avg:	223,8	(7)	
$\beta^-_{0,11}$	max:	739	(2)	0,002 (1)
$\beta^-_{0,11}$	avg:	231,4	(8)	
$\beta^-_{0,10}$	max:	821	(2)	0,231 (9)
$\beta^-_{0,10}$	avg:	261,2	(7)	
$\beta^-_{0,9}$	max:	876	(2)	0,18 (2)
$\beta^-_{0,9}$	avg:	281,5	(7)	
$\beta^-_{0,8}$	max:	1005	(3)	0,007 (3)
$\beta^-_{0,8}$	avg:	330,4	(8)	
$\beta^-_{0,7}$	max:	1040	(2)	3,26 (7)
$\beta^-_{0,7}$	avg:	343,6	(8)	
$\beta^-_{0,6}$	max:	1055	(2)	0,048 (3)
$\beta^-_{0,6}$	avg:	349,2	(8)	
$\beta^-_{0,5}$	max:	1081	(2)	0,64 (6)
$\beta^-_{0,5}$	avg:	359,5	(8)	
$\beta^-_{0,4}$	max:	1293	(2)	24,1 (3)
$\beta^-_{0,4}$	avg:	442,3	(8)	
$\beta^-_{0,3}$	max:	1526	(2)	22,2 (7)
$\beta^-_{0,3}$	avg:	536,2	(8)	
$\beta^-_{0,2}$	max:	1803	(2)	49,0 (9)
$\beta^-_{0,2}$	avg:	650,3	(8)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Pb)	9,184 — 15,216		2,89 (6)	
$XK\alpha_2$	(Pb)	72,8049		2,15 (6)	} Kα
$XK\alpha_1$	(Pb)	74,97		3,61 (9)	}
$XK\beta_3$	(Pb)	84,451	}		
$XK\beta_1$	(Pb)	84,937	}	1,23 (4)	$K'\beta_1$
$XK\beta_5''$	(Pb)	85,47	}		
$XK\beta_2$	(Pb)	87,238	}		
$XK\beta_4$	(Pb)	87,58	}	0,373 (13)	$K'\beta_2$
$XKO_{2,3}$	(Pb)	87,911	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{5,4}$(Pb)	211,4 (2)	0,18 (1)
$\gamma_{4,3}$(Pb)	233,3 (1)	0,31 (1)
$\gamma_{7,4}$(Pb)	252,5 (2)	0,78 (2)
$\gamma_{3,2}$(Pb)	277,37 (3)	6,6 (3)
$\gamma_{7,3}$(Pb)	485,8 (1)	0,049 (4)
$\gamma_{4,2}$(Pb)	510,7 (1)	22,6 (2)
$\gamma_{2,1}$(Pb)	583,187 (2)	85,0 (3)
$\gamma_{13,4}$(Pb)	587,8 (2)	0,06 (2)
$\gamma_{9,3}$(Pb)	650,2 (2)	0,05 (2)
$\gamma_{10,3}$(Pb)	705,3 (2)	0,022 (4)
$\gamma_{5,2}$(Pb)	722,0 (1)	0,24 (4)
$\gamma_{6,2}$(Pb)	748,7 (2)	0,046 (3)
$\gamma_{7,2}$(Pb)	763,2 (1)	1,79 (3)
$\gamma_{12,3}$(Pb)	808,3 (2)	0,030 (7)
$\gamma_{13,3}$(Pb)	821,1 (2)	0,041 (4)
$\gamma_{14,3}$(Pb)	835,9 (2)	0,076 (11)
$\gamma_{3,1}$(Pb)	860,56 (3)	12,5 (1)
$\gamma_{16,3}$(Pb)	883,4 (2)	0,031 (3)
$\gamma_{9,2}$(Pb)	927,6 (2)	0,125 (1)
$\gamma_{10,2}$(Pb)	982,7 (2)	0,205 (8)
$\gamma_{4,1}$(Pb)	1093,9 (1)	0,43 (2)
$\gamma_{15,2}$(Pb)	1125,7 (4)	0,005 (2)
$\gamma_{16,2}$(Pb)	1160,8 (2)	0,011 (3)
$\gamma_{17,2}$(Pb)	1185,2 (3)	0,017 (5)
$\gamma_{18,2}$(Pb)	1282,8 (3)	0,052 (5)

	Energy keV	Photons per 100 disint.
$\gamma_{8,1}$(Pb)	1381,1 (5)	0,007 (3)
$\gamma_{11,1}$(Pb)	1647,5 (7)	0,002 (1)
$\gamma_{16,1}$(Pb)	1743,9 (2)	0,002 (1)
$\gamma_{1,0}$(Pb)	2614,511 (10)	99,79 (1)

6 Main Production Modes

Bi – 212 α decay

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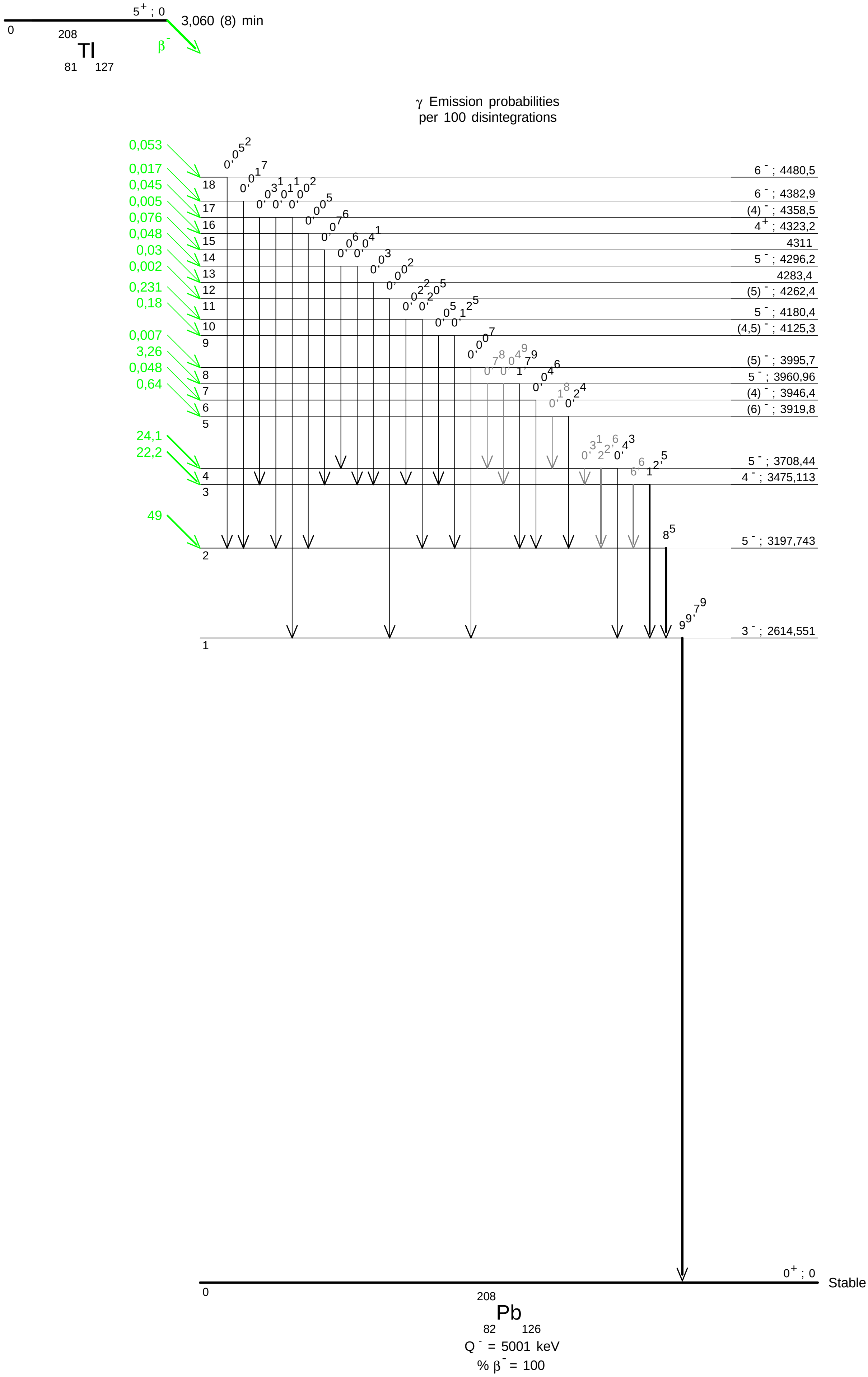
5+ ; 0
3,060 (8) min
208 Tl 81 127
β-
γ Emission probabilities
per 100 disintegrations
0,053
0,017
0,045
0,005
0,076
0,048
0,03
0,002
0,231
0,18
0,007
3,26
0,048
0,64
24,1
22,2
49
6 - ; 4480,5
6 - ; 4382,9
(4) - ; 4358,5
4+ ; 4323,2
4311
5 - ; 4296,2
4283,4
(5) - ; 4262,4
5 - ; 4180,4
(4,5) - ; 4125,3
(5) - ; 3995,7
5 - ; 3960,96
(4) - ; 3946,4
(6) - ; 3919,8
5 - ; 3708,44
4 - ; 3475,113
5 - ; 3197,743
3 - ; 2614,551
0+ ; 0
Stable
208 Pb 82 126
Q - = 5001 keV
% β- = 100

$^{212}_{83}$Bi $_{129}$

1 Decay Scheme

Bi-212 undergoes β^- decay to Po-212 (64.07(7)%), and α decay to Tl-208 (35.93(7)%).
Le bismuth 212 se désintègre à 64,07(7)% par émission β^- vers le polonium 212 et à 35,93(7)% par émission α vers le thallium 208.

2 Nuclear Data

$T_{1/2}$(^{212}Bi)	:	60,54	(6)	min
$T_{1/2}$(^{212}Po)	:	300	(2)	10^{-9} s
$T_{1/2}$(^{208}Tl)	:	3,060	(8)	min
Q^-(^{212}Bi)	:	2254	(2)	keV
Q^α(^{212}Bi)	:	6207,14	(4)	keV

2.1 α Transitions

	Energy keV	Probability × 100	F
$\alpha_{0,7}$	5400 (1)	0,000039 (4)	20800
$\alpha_{0,6}$	5448 (1)	0,00036 (18)	3810
$\alpha_{0,5}$	5586,7 (3)	0,0050 (7)	1370
$\alpha_{0,4}$	5714,45 (14)	0,43 (4)	66,9
$\alpha_{0,3}$	5733,6 (2)	0,06 (1)	594
$\alpha_{0,2}$	5879,2 (1)	0,63 (3)	269
$\alpha_{0,1}$	6167,28 (4)	25,1 (1)	126
$\alpha_{0,0}$	6207,14 (4)	9,7 (1)	480
*$\alpha_{1,0}$	9681,46 (12)	0,0024 (2)	
*$\alpha_{4,0}$	10633,58 (13)	0,0010 (1)	
*$\alpha_{5,0}$	10755,0 (3)	0,0106 (8)	

* Transitions α of long range.

2.2 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,6}$	448 (2)	0,68 (5)	1st Forbidden non-unique	6,69
$\beta^-_{0,5}$	453 (2)	0,029 (1)	1st Forbidden non-unique	8,08
$\beta^-_{0,4}$	575 (2)	0,21 (5)	1st Forbidden non-unique	7,56
$\beta^-_{0,3}$	633 (2)	1,90 (4)	1st Forbidden non-unique	6,74
$\beta^-_{0,2}$	741 (2)	1,45 (2)	1st Forbidden non-unique	7,1
$\beta^-_{0,1}$	1527 (2)	4,58 (21)	1st Forbidden non-unique	7,71
$\beta^-_{0,0}$	2254 (2)	55,23 (21)	1st Forbidden non-unique	7,269

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)	39,858 (4)	26 (1)	[M1]		18,6 (5)	6,00 (18)	24,6 (7)
$\gamma_{5,3}$(Po)	180,2 (2)	0,010 (3)	M1	1,79 (5)	0,32 (1)	0,100 (3)	2,21 (7)
$\gamma_{2,1}$(Tl)	288,08 (6)	0,47 (3)	[M1+E2]	0,378 (11)	0,064 (2)	0,0190 (6)	0,461 (14)
$\gamma_{2,0}$(Tl)	327,94 (6)	0,160 (4)	[M1]	0,267 (8)	0,0450 (13)	0,0130 (4)	0,325 (10)
$\gamma_{3,1}$(Tl)	433,7 (2)	0,011 (2)	[M1]	0,126 (4)	0,0210 (6)	0,0060 (2)	0,153 (5)
$\gamma_{4,1}$(Tl)	452,8 (1)	0,39 (3)	[M1]	0,112 (3)	0,0190 (6)	0,0060 (2)	0,137 (4)
$\gamma_{3,0}$(Tl)	473,6 (2)	0,049 (3)	[M1]	0,100 (3)	0,0160 (5)	0,00500 (15)	0,121 (4)
$\gamma_{4,0}$(Tl)	492,7 (1)	0,04 (1)	[M1]	0,090 (3)	0,0150 (5)	0,00400 (12)	0,109 (3)
$\gamma_{5,1}$(Tl)	580,5 (3)	0,0010 (2)	[E2]	0,0148 (5)	0,0039 (1)	0,00130 (4)	0,0200 (6)
$\gamma_{5,0}$(Tl)	620,4 (3)	0,0040 (6)	[M1]	0,0492 (15)	0,0081 (2)	0,00250 (8)	0,0598 (18)
$\gamma_{1,0}$(Po)	727,33 (1)	6,84 (12)	E2	0,0106 (3)	0,00260 (8)	0,00090 (3)	0,0141 (4)
$\gamma_{6,0}$(Tl)	759 (1)	0,00036 (18)					
$\gamma_{2,1}$(Po)	785,37 (9)	1,16 (1)	[M1+E2]	0,0338 (10)	0,0057 (2)	0,00180 (5)	0,0413 (12)
$\gamma_{7,0}$(Tl)	807 (1)	0,000039 (4)					
$\gamma_{3,1}$(Po)	893,41 (2)	0,39 (1)	[M1+E2]	0,0243 (7)	0,0041 (1)	0,00130 (4)	0,0297 (9)
$\gamma_{4,1}$(Po)	952,12 (2)	0,14 (4)	[M1+E2]	0,0164 (5)	0,00280 (8)	0,00100 (3)	0,0202 (6)
$\gamma_{5,1}$(Po)	1073,6 (2)	0,015 (5)	E2	0,00516 (15)	0,00100 (3)	0,00033 (1)	0,00649 (20)
$\gamma_{6,1}$(Po)	1078,63 (11)	0,56 (2)	[M1+E2]	0,0149 (4)	0,00230 (7)	0,00090 (3)	0,0181 (5)
$\gamma_{2,0}$(Po)	1512,70 (8)	0,29 (1)	E2	0,00278 (8)	0,00048 (2)	0,000160 (5)	0,00342 (10)
$\gamma_{3,0}$(Po)	1620,74 (1)	1,52 (3)	[M1+E2]	0,00504 (15)	0,00078 (2)	0,000030 (1)	0,00585 (18)
$\gamma_{4,0}$(Po)	1679,45 (1)	0,07 (1)	E2	0,00230 (7)	0,00039 (1)	0,000130 (4)	0,00282 (8)
$\gamma_{5,0}$(Po)	1800,9 (2)	0,004 (2)	E0				
$\gamma_{6,0}$(Po)	1805,96 (10)	0,12 (3)	E2	0,00202 (6)	0,00034 (1)	0,000110 (3)	0,00247 (7)

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		60,1
	$K\alpha_1$	79,293		100
	$K\beta_3$	89,256	}	
	$K\beta_1$	89,63	}	
	$K\beta_5''$	90,363	}	34,4
	$K\beta_2$	92,45	}	
	$K\beta_4$	92,62	}	10,7
	$KO_{2,3}$	92,98	}	
X_L				
	$L\ell$	9,66		
	$L\alpha$	11,016 – 11,13		
	$L\eta$	12,085		
	$L\beta$	12,823 – 13,778		
	$L\gamma$	15,742 – 16,21		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	58,98 – 65,21	100
KLX	71,90 – 79,29	57
KXY	84,8 – 93,1	8,1
Auger L	5,43 – 10,93	3190

3.2 Tl

ω_K	:	0,963	(4)
$\bar{\omega}_L$	:	0,367	(15)
n_{KL}	:	0,812	(5)

3.2.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	70,833		59
	$K\alpha_1$	72,873		100
	$K\beta_3$	82,118	}	
	$K\beta_1$	82,43	}	
	$K\beta_5''$	83,115	}	34
	$K\beta_2$	84,838	}	
	$K\beta_4$	85,134	}	10,1
	$KO_{2,3}$	85,444	}	
X_L				
	$L\ell$	8,953		
	$L\alpha$	10,172 – 10,268		
	$L\eta$	10,994		
	$L\beta$	11,812 – 12,643		
	$L\gamma$	14,291 – 14,738		

3.2.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	54,59 – 59,95	100
KLX	66,37 – 72,86	55
KXY	78,12 – 85,50	7,6
Auger L	5,18 – 10,13	363000

4 α Emissions

	Energy keV	Probability × 100
$\alpha_{0,7}$	5298 (1)	0,000039 (4)
$\alpha_{0,6}$	5345 (1)	0,00036 (18)
$\alpha_{0,5}$	5481,3 (3)	0,0050 (7)
$\alpha_{0,4}$	5606,63 (14)	0,43 (4)
$\alpha_{0,3}$	5625,4 (2)	0,06 (1)
$\alpha_{0,2}$	5768,27 (10)	0,63 (3)
$\alpha_{0,1}$	6050,92 (4)	25,1 (1)
$\alpha_{0,0}$	6090,02 (4)	9,7 (1)
$^*\alpha_{1,0}$	9498,79 (12)	0,0024 (2)
$^*\alpha_{4,0}$	10432,95 (13)	0,0010 (1)
$^*\alpha_{5,0}$	10552,1 (3)	0,0106 (8)

* α of long range.

5 Electron Emissions

		Energy keV	Electrons per 100 disint.
e_{AL}	(Po)	5,43 - 10,93	0,0958 (16)
e_{AK}	(Po)		0,0050 (6)
	KLL	58,98 - 65,21	}
	KLX	71,90 - 79,29	}
	KXY	84,8 - 93,1	}
e_{AL}	(Tl)	5,18 - 10,13	16,7 (7)
e_{AK}	(Tl)		0,0074 (9)
	KLL	54,59 - 59,95	}
	KLX	66,37 - 72,86	}
	KXY	78,12 - 85,50	}
$ec_{1,0\ L}$	(Tl)	24,51 - 27,20	19 (1)
$ec_{1,0\ M}$	(Tl)	36,15 - 39,85	6,1 (2)
$\beta^-_{0,6}$	max:	448 (2)	0,68 (5)
$\beta^-_{0,6}$	avg:	130,7 (7)	
$\beta^-_{0,5}$	max:	453 (2)	0,029 (1)
$\beta^-_{0,5}$	avg:	132,3 (7)	
$\beta^-_{0,4}$	max:	575 (2)	0,21 (5)
$\beta^-_{0,4}$	avg:	173,0 (7)	

		Energy keV		Electrons per 100 disint.
$\beta^-_{0,3}$	max:	633	(2)	1,90 (4)
$\beta^-_{0,3}$	avg:	193,3	(7)	
$\beta^-_{0,2}$	max:	741	(2)	1,45 (2)
$\beta^-_{0,2}$	avg:	231,5	(8)	
$\beta^-_{0,1}$	max:	1527	(2)	4,58 (21)
$\beta^-_{0,1}$	avg:	533,9	(8)	
$\beta^-_{0,0}$	max:	2254	(2)	55,23 (21)
$\beta^-_{0,0}$	avg:	835,0	(9)	

6 Photon Emissions

6.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Po)	9,66 — 16,21		0,0581 (12)	
XKα_2	(Po)	76,864		0,0404 (10)	} Kα
XKα_1	(Po)	79,293		0,0672 (17)	}
XKβ_3	(Po)	89,256	}		
XKβ_1	(Po)	89,63	}	0,0231 (7)	K$'\beta_1$
XKβ''_5	(Po)	90,363	}		
XKβ_2	(Po)	92,45	}		
XKβ_4	(Po)	92,62	}	0,00720 (24)	K$'\beta_2$
XKO$_{2,3}$	(Po)	92,98	}		
XL	(Tl)	8,953 — 14,738		6,73 (22)	
XKα_2	(Tl)	70,833		0,0563 (27)	} Kα
XKα_1	(Tl)	72,873		0,095 (5)	}
XKβ_3	(Tl)	82,118	}		
XKβ_1	(Tl)	82,43	}	0,0323 (16)	K$'\beta_1$
XKβ''_5	(Tl)	83,115	}		
XKβ_2	(Tl)	84,838	}		
XKβ_4	(Tl)	85,134	}	0,0096 (5)	K$'\beta_2$
XKO$_{2,3}$	(Tl)	85,444	}		

6.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Tl)	39,858 (4)	1,01 (3)
$\gamma_{5,3}$(Po)	180,2 (2)	0,003 (1)
$\gamma_{2,1}$(Tl)	288,08 (6)	0,32 (2)
$\gamma_{2,0}$(Tl)	327,94 (6)	0,121 (3)
$\gamma_{3,1}$(Tl)	433,7 (2)	0,0095 (20)
$\gamma_{4,1}$(Tl)	452,8 (1)	0,34 (3)
$\gamma_{3,0}$(Tl)	473,6 (2)	0,044 (3)
$\gamma_{4,0}$(Tl)	492,7 (1)	0,04 (1)
$\gamma_{5,1}$(Tl)	580,5 (3)	0,0010 (2)
$\gamma_{5,0}$(Tl)	620,4 (3)	0,0038 (6)
$\gamma_{1,0}$(Po)	727,33 (1)	6,74 (12)
$\gamma_{6,0}$(Tl)	759 (1)	0,00036 (18)
$\gamma_{2,1}$(Po)	785,37 (9)	1,11 (1)
$\gamma_{7,0}$(Tl)	807 (1)	0,000039 (4)
$\gamma_{3,1}$(Po)	893,41 (2)	0,38 (1)
$\gamma_{4,1}$(Po)	952,12 (2)	0,14 (4)
$\gamma_{5,1}$(Po)	1073,6 (2)	0,015 (5)
$\gamma_{6,1}$(Po)	1078,63 (11)	0,55 (2)
$\gamma_{2,0}$(Po)	1512,70 (8)	0,29 (1)
$\gamma_{3,0}$(Po)	1620,74 (1)	1,51 (3)
$\gamma_{4,0}$(Po)	1679,45 (1)	0,07 (1)
$\gamma_{5,0}$(Po)	1800,9 (2)	0,004 (2)
$\gamma_{6,0}$(Po)	1805,96 (10)	0,12 (3)

7 Main Production Modes

Pb – 212 β^- decay

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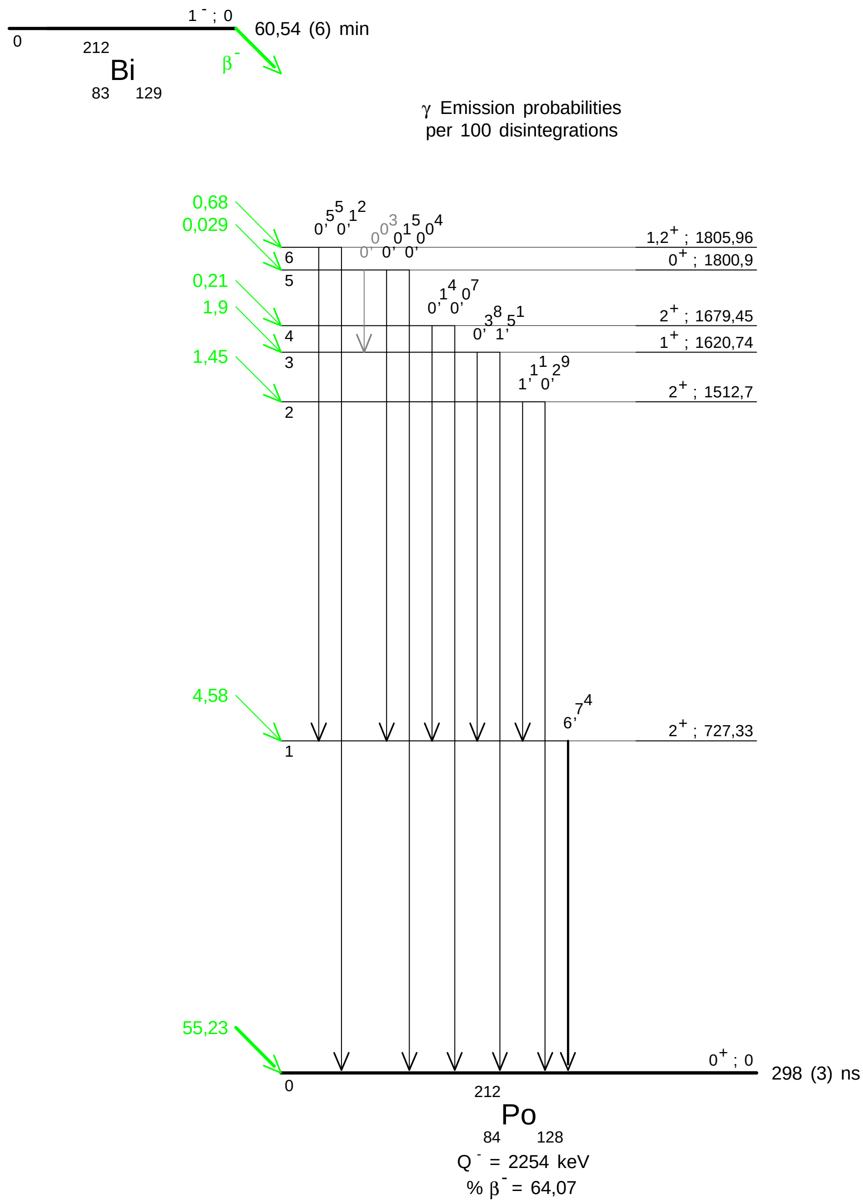
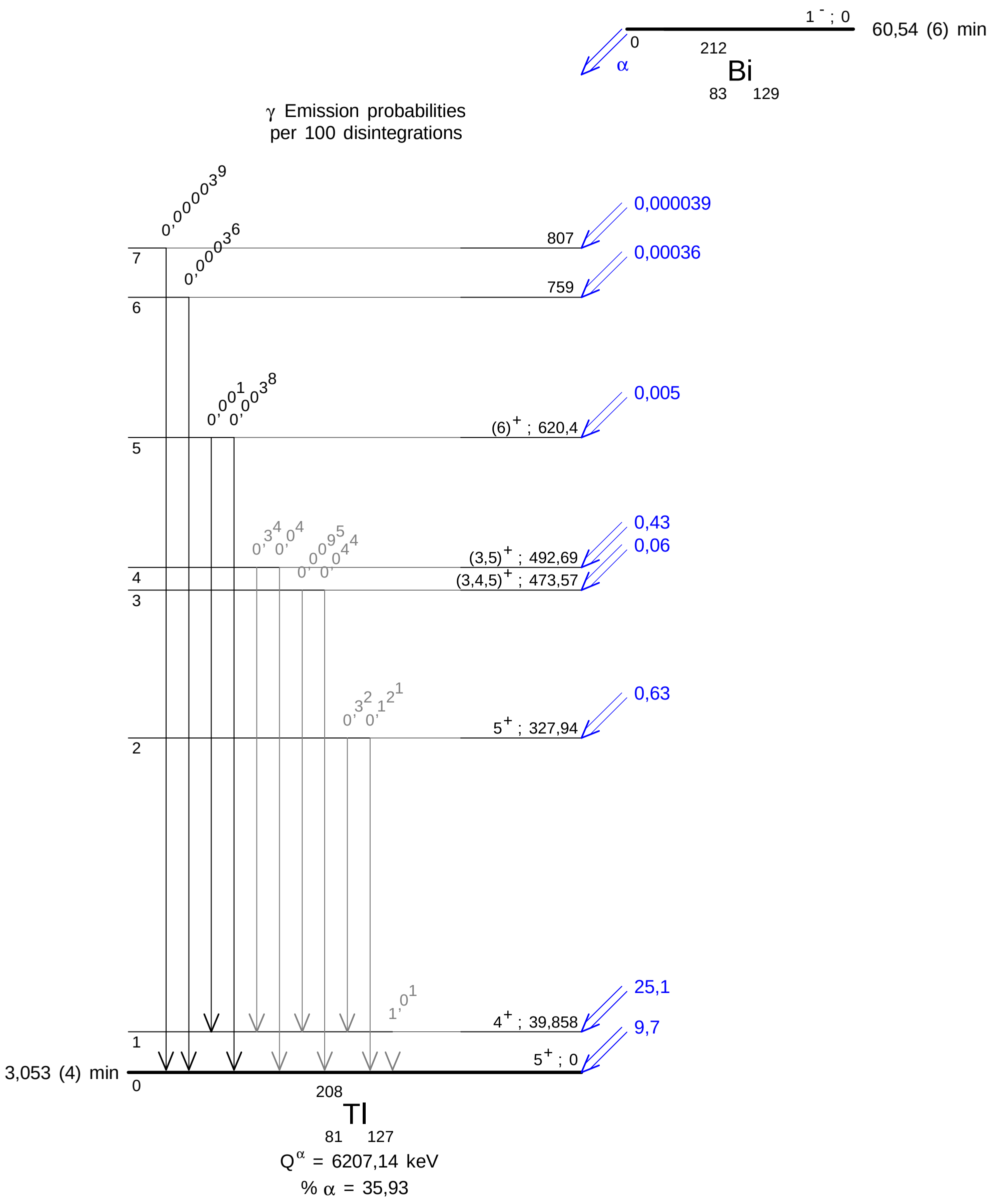

1⁻ ; 0
60,54 (6) min
212 Bi 83 129
β⁻
γ Emission probabilities
per 100 disintegrations
0,68
0,029
0,21
1,9
1,45
4,58
55,23
1,2⁺ ; 1805,96
0⁺ ; 1800,9
2⁺ ; 1679,45
1⁺ ; 1620,74
2⁺ ; 1512,7
2⁺ ; 727,33
0⁺ ; 0
298 (3) ns
212 Po 84 128
Q⁻ = 2254 keV
% β⁻ = 64,07



1 - ; 0
60,54 (6) min
α
212
Bi
83 129
γ Emission probabilities
per 100 disintegrations
0,000039
0,00036
0,0013
0,0038
0,34
0,04
0,095
0,044
0,32
1,21
1,01
807
759
(6)+ ; 620,4
(3,5)+ ; 492,69
(3,4,5)+ ; 473,57
5+ ; 327,94
4+ ; 39,858
5+ ; 0
0,000039
0,00036
0,005
0,43
0,06
0,63
25,1
9,7
7
6
5
4
3
2
1
0
3,053 (4) min
208
Tl
81 127
Qα = 6207,14 keV
% α = 35,93

$^{212}_{82}$Pb $_{130}$

1 Decay Scheme

Pb-212 disintegrates by beta minus emission to excited and fundamental levels of Bi-212.
Le plomb 212 se désintègre par émission bêta moins vers des niveaux excités et fondamental du bismuth 212.

2 Nuclear Data

$T_{1/2}$(^{212}Pb)	:	10,64	(1)	h
$T_{1/2}$(^{212}Bi)	:	60,54	(6)	min
Q^-(^{212}Pb)	:	574	(2)	keV

2.1 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,3}$	159 (2)	5,1 (2)	1st Forbidden	5,38
$\beta^-_{0,2}$	335 (2)	84,0 (14)	1st Forbidden	5,19
$\beta^-_{0,0}$	574 (2)	10,9 (14)	1st Forbidden	6,84

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)	115,183 (5)	5,12 (21)	[M1]	5,87 (18)	1,027 (30)	0,323 (10)	7,22 (22)
$\gamma_{2,1}$(Bi)	123,45 (1)	0,37 (1)	[E2]	0,418 (8)	1,802 (36)	0,630 (13)	2,85 (6)
$\gamma_{3,2}$(Bi)	176,64 (1)	0,16 (2)	[M1]	1,742 (50)	0,303 (10)	0,095 (3)	2,14 (6)
$\gamma_{2,0}$(Bi)	238,632 (2)	83,8 (11)	[M1]	0,753 (23)	0,130 (4)	0,040 (1)	0,923 (30)
$\gamma_{3,1}$(Bi)	300,09 (1)	4,74 (20)	[M1]	0,401 (12)	0,069 (2)	0,0210 (6)	0,491 (15)
$\gamma_{3,0}$(Bi)	415,27 (1)	0,17 (3)	[M1]	0,167 (5)	0,028 (1)	0,0090 (3)	0,204 (6)

3 Atomic Data

3.1 Bi

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

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	74,8157		59,8
	$K\alpha_1$	77,1088		100
	$K\beta_3$	86,835	}	
	$K\beta_1$	87,344	}	
	$K\beta_5''$	87,862	}	34,2
	$K\beta_2$	89,91	}	
	$K\beta_4$	90,074	}	10,4
	$KO_{2,3}$	90,421	}	
X_L				
	$L\ell$	9,42		
	$L\alpha$	10,731 – 10,839		
	$L\eta$	11,712		
	$L\beta$	12,48 – 13,393		
	$L\gamma$	15,248 – 15,709		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	57,49 – 63,42	100
KLX	70,03 – 77,11	57
KXY	82,53 – 90,52	7,8
Auger L	5,35 – 10,66	3040

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Bi)	5,35 - 10,66		25,2 (5)
e_{AK}	(Bi)			1,37 (16)
	KLL	57,49 - 63,42	}	
	KLX	70,03 - 77,11	}	
	KXY	82,53 - 90,52	}	
$ec_{1,0\ K}$	(Bi)	24,657 (5)		3,66 (13)
$ec_{1,0\ L}$	(Bi)	98,80 - 101,76		0,64 (2)
$ec_{1,0\ M}$	(Bi)	111,18 - 115,03		0,20 (1)
$ec_{2,0\ K}$	(Bi)	148,106 (2)		33 (1)
$ec_{3,1\ K}$	(Bi)	209,56 (2)		1,27 (4)
$ec_{2,0\ L}$	(Bi)	222,24 - 225,21		5,7 (2)
$ec_{2,0\ M}$	(Bi)	234,63 - 238,47		1,7 (1)
$ec_{3,1\ L}$	(Bi)	283,70 - 286,67		0,22 (1)
$ec_{3,1\ M}$	(Bi)	296,09 - 299,93		0,07
$\beta^-_{0,3}$	max:	159 (2)		5,1 (2)
$\beta^-_{0,3}$	avg:	42,3 (6)		
$\beta^-_{0,2}$	max:	335 (2)		84,0 (14)
$\beta^-_{0,2}$	avg:	94,8 (7)		
$\beta^-_{0,0}$	max:	574 (2)		10,9 (14)
$\beta^-_{0,0}$	avg:	173,1 (7)		

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Bi)	9,42 — 15,709		14,5 (4)	
$XK\alpha_2$	(Bi)	74,8157		10,7 (3)	} $K\alpha$
$XK\alpha_1$	(Bi)	77,1088		17,9 (5)	}
$XK\beta_3$	(Bi)	86,835	}		
$XK\beta_1$	(Bi)	87,344	}	6,12 (20)	$K'\beta_1$
$XK\beta_5''$	(Bi)	87,862	}		
$XK\beta_2$	(Bi)	89,91	}		
$XK\beta_4$	(Bi)	90,074	}	1,87 (7)	$K'\beta_2$
$XKO_{2,3}$	(Bi)	90,421	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Bi)	115,183 (5)	0,623 (22)
$\gamma_{2,1}$(Bi)	123,45 (1)	0,096 (4)
$\gamma_{3,2}$(Bi)	176,64 (1)	0,052 (4)
$\gamma_{2,0}$(Bi)	238,632 (2)	43,6 (3)
$\gamma_{3,1}$(Bi)	300,09 (1)	3,18 (13)
$\gamma_{3,0}$(Bi)	415,27 (1)	0,144 (22)

6 Main Production Modes

Po – 210(t,p)Pb – 212
Po – 216 α decay

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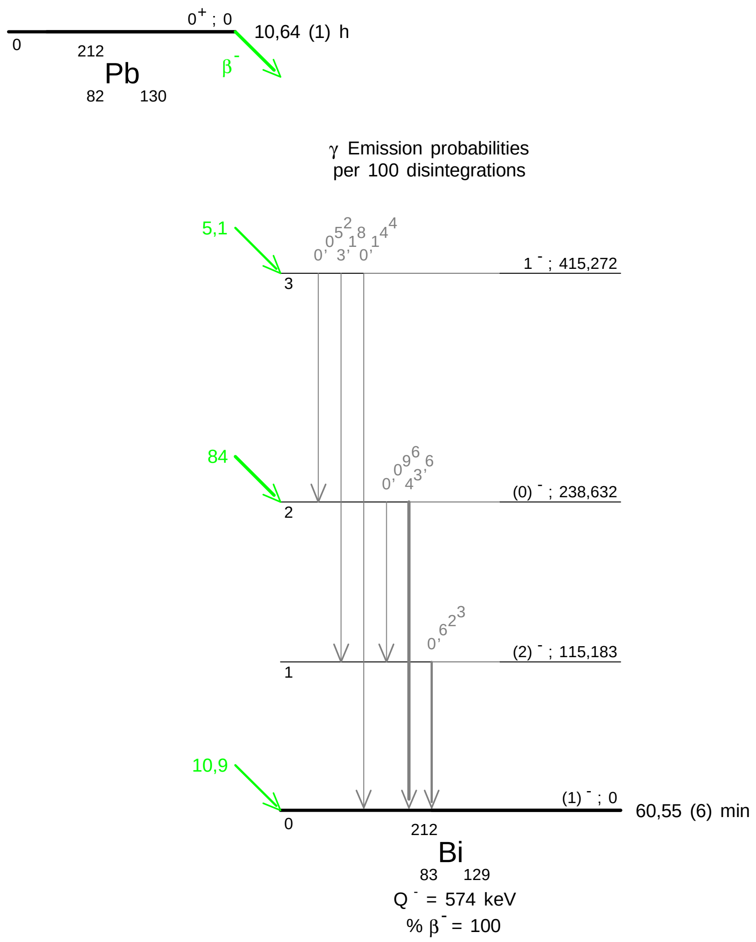
0+ ; 0
10,64 (1) h
0
212
Pb
82 130
β-
γ Emission probabilities
per 100 disintegrations
5,1
1 - ; 415,272
3
84
(0) - ; 238,632
2
(2) - ; 115,183
1
10,9
(1) - ; 0
60,55 (6) min
0
212
Bi
83 129
Q - = 574 keV
% β- = 100

$^{212}_{84}$Po $_{128}$

1 Decay Scheme

Po-212 is an extremely short-lived radionuclide populated via the beta decay of Bi-212 and the alpha decay of Rn-216. Alpha decay of Po-212 occurs directly to the ground state of Pb-208.
Le polonium 212 se désintègre par émission alpha vers le niveau fondamental du plomb 208.

2 Nuclear Data

$T_{1/2}(^{212}\text{Po})$	:	300	(2)	10^{-9} s
$Q^{\alpha}(^{212}\text{Po})$	:	8954,13	(11)	keV

2.1 α Transitions

	Energy keV	Probability × 100	F
$\alpha_{0,0}$	8954,13 (11)	100	1

3 α Emissions

	Energy keV	Probability × 100
$\alpha_{0,0}$	8785,18 (11)	100

4 Main Production Modes

Bi – 212(β^-)Po – 212
Rn – 216(α)Po – 212
Bi – 209(α,p)Po – 212
Pb – 210(α,2nγ)Po – 212

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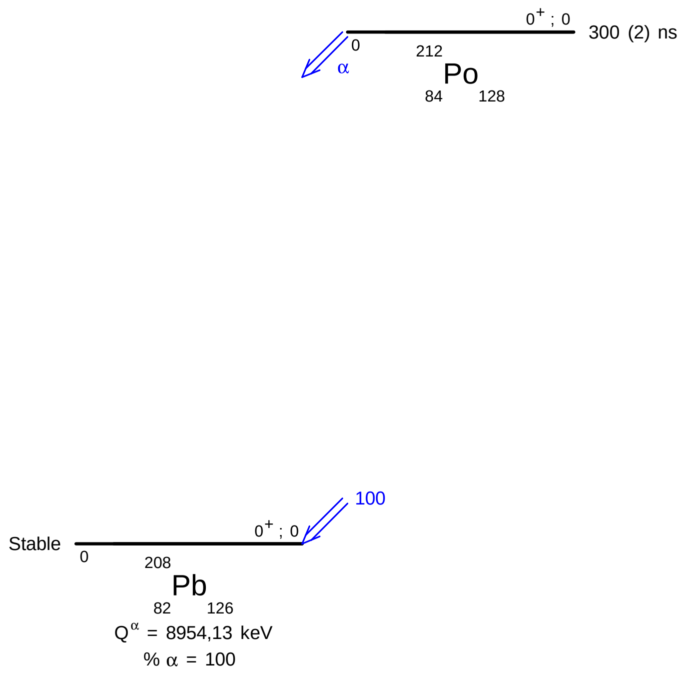
0+ ; 0
300 (2) ns
0
α
212
Po
84
128
100
Stable
0+ ; 0
0
208
Pb
82
126
Qα = 8954,13 keV
% α = 100

216 Po
$^{216}_{84}\mathrm{Po}_{132}$

1 Decay Scheme

Po-216 decays (100%) by alpha emission to the Pb-212 fundamental level.
Le polonium 216 se désintègre (100%) par émission alpha vers le niveau fondamental de plomb 212.

2 Nuclear Data

$T_{1/2}(^{216}\mathrm{Po})$	:	0,150	(5)	s
$T_{1/2}(^{212}\mathrm{Pb})$	:	10,64	(1)	h
$Q^{\alpha}(^{216}\mathrm{Po})$	:	6906,52	(51)	keV

2.1 α Transitions

	Energy keV	Probability × 100	F
$\alpha_{0,1}$	6101,6 (10)	0,0019 (3)	34,7
$\alpha_{0,0}$	6906,52 (50)	99,9981 (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
$\gamma_{1,0}$(Pb)	804,9 (5)	0,0019 (3)	[E2]	0,0081 (2)	0,00180 (4)	0,00050 (1)	0,0104 (2)

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
	$K\alpha_1$	74,97		100
	$K\beta_3$	84,451	}	
	$K\beta_1$	84,937	}	
	$K\beta_5''$	85,47	}	34
	$K\beta_2$	87,238	}	
	$K\beta_4$	87,58	}	10,3
	$KO_{2,3}$	87,911	}	
X_L				
	$L\ell$	9,184		
	$L\alpha$	10,45 – 10,551		
	$L\eta$	11,349		
	$L\beta$	12,142 – 13,015		
	$L\gamma$	14,765 – 15,216		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	56,03 – 61,67	100
KLX	68,18 – 74,97	54
KXY	80,3 – 88,0	7,7
Auger L	5,26 – 10,40	3060

4 α Emissions

	Energy keV	Probability × 100
$\alpha_{0,1}$	5988,6 (10)	0,0019 (3)
$\alpha_{0,0}$	6778,6 (5)	99,9981 (3)

5 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Pb)	5,26 - 10,40		0,0000107 (10)
e_{AK}	(Pb)			0,00000057 (11)
	KLL	56,03 - 61,67	}	
	KLX	68,18 - 74,97	}	
	KXY	80,3 - 88,0	}	

6 Photon Emissions

6.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Pb)	9,184 — 15,216		0,0000060 (6)	
$XK\alpha_2$	(Pb)	72,8049		0,0000043 (7)	} $K\alpha$
$XK\alpha_1$	(Pb)	74,97		0,0000073 (12)	}
$XK\beta_3$	(Pb)	84,451	}		
$XK\beta_1$	(Pb)	84,937	}	0,0000025 (4)	$K'\beta_1$
$XK\beta_5''$	(Pb)	85,47	}		
$XK\beta_2$	(Pb)	87,238	}		
$XK\beta_4$	(Pb)	87,58	}	0,00000075 (13)	$K'\beta_2$
$XKO_{2,3}$	(Pb)	87,911	}		

6.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Pb)	804,9 (5)	0,0019 (3)

7 Main Production Modes

Bi – 216(β^-)Po – 216
Th – 228 α decays

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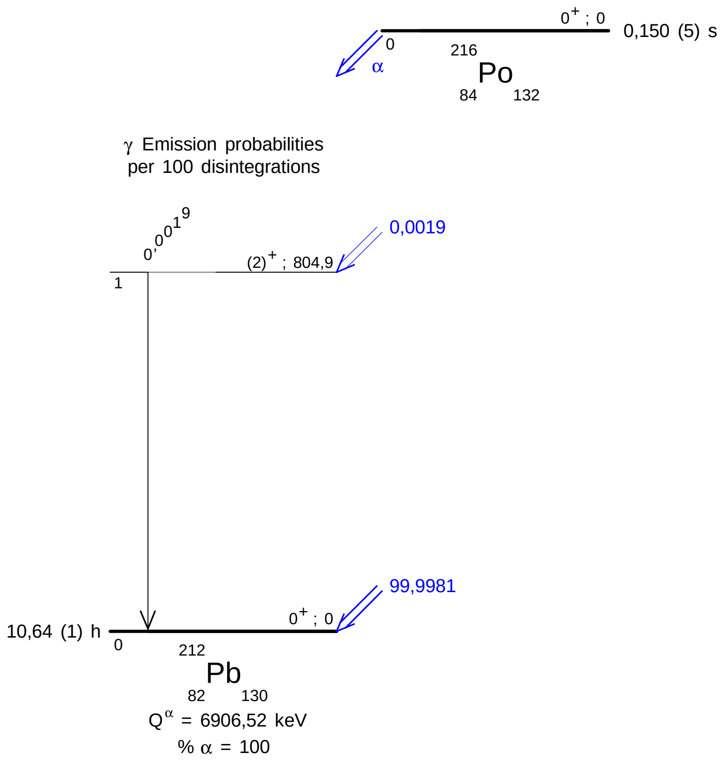
0+ ; 0
0,150 (5) s
0
α
216
Po
84
132
γ Emission probabilities
per 100 disintegrations
0,0019
0,0019
(2)+ ; 804,9
1
99,9981
10,64 (1) h
0+ ; 0
0
212
Pb
82
130
Qα = 6906,52 keV
% α = 100

$^{220}_{86}$Rn $_{134}$

1 Decay Scheme

Rn-220 mainly decays by alpha emission to the Po-216 fundamental level.
Le radon 220 se désintègre par émission alpha principalement vers le niveau fondamental du polonium 216.

2 Nuclear Data

$T_{1/2}(^{220}\text{Rn})$	:	55,8	(3)	s
$T_{1/2}(^{216}\text{Po})$	:	0,150	(5)	s
$Q^{\alpha}(^{220}\text{Rn})$	:	6404,67	(10)	keV

2.1 α Transitions

	Energy keV	Probability × 100	F
$\alpha_{0,1}$	5854,91 (14)	0,118 (15)	3,08
$\alpha_{0,0}$	6404,67 (10)	99,882 (15)	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)	549,76 (4)	0,118 (15)	E2	0,0184 (6)	0,0057 (2)	0,00190 (6)	0,0260 (8)

3 Atomic Data

3.1 Po

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

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	76,864		60
	$K\alpha_1$	79,293		100
	$K\beta_3$	89,256	}	
	$K\beta_1$	89,807	}	
	$K\beta_5''$	90,363	}	34,43
	$K\beta_2$	92,263	}	
	$K\beta_4$	92,618	}	10,71
	$KO_{2,3}$	92,983	}	
X_L				
	$L\ell$	9,658		
	$L\alpha$	11,016 – 11,13		
	$L\eta$	12,085		
	$L\beta$	12,823 – 13,778		
	$L\gamma$	15,742 – 16,213		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	58,98 – 65,21	100
KLX	71,90 – 79,29	55
KXY	84,8 – 93,1	8
Auger L	5,43 – 10,93	3400

4 α Emissions

	Energy keV	Probability × 100
$\alpha_{0,1}$	5748,46 (14)	0,118 (15)
$\alpha_{0,0}$	6288,22 (10)	99,882 (15)

5 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Po)	5,43 - 10,93		0,00155 (12)
e_{AK}	(Po)			0,000074 (13)
	KLL	58,98 - 65,21	}	
	KLX	71,90 - 79,29	}	
	KXY	84,8 - 93,1	}	

6 Photon Emissions

6.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Po)	9,658 — 16,213		0,00096 (7)	
XKα_2	(Po)	76,864		0,00060 (8)	} Kα
XKα_1	(Po)	79,293		0,00100 (14)	}
XKβ_3	(Po)	89,256	}		
XKβ_1	(Po)	89,807	}	0,00034 (5)	K$'\beta_1$
XKβ_5''	(Po)	90,363	}		
XKβ_2	(Po)	92,263	}		
XKβ_4	(Po)	92,618	}	0,000107 (15)	K$'\beta_2$
XKO$_{2,3}$	(Po)	92,983	}		

6.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Po)	549,76 (4)	0,115 (15)

7 Main Production Modes

Th – 228 α decays()

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  (K-x ray, L-x ray, Auger electrons)
- A. ARTNA-COHEN. Nucl. Data Sheets 80 (1997) 157
  (Nuclear structure, energies)
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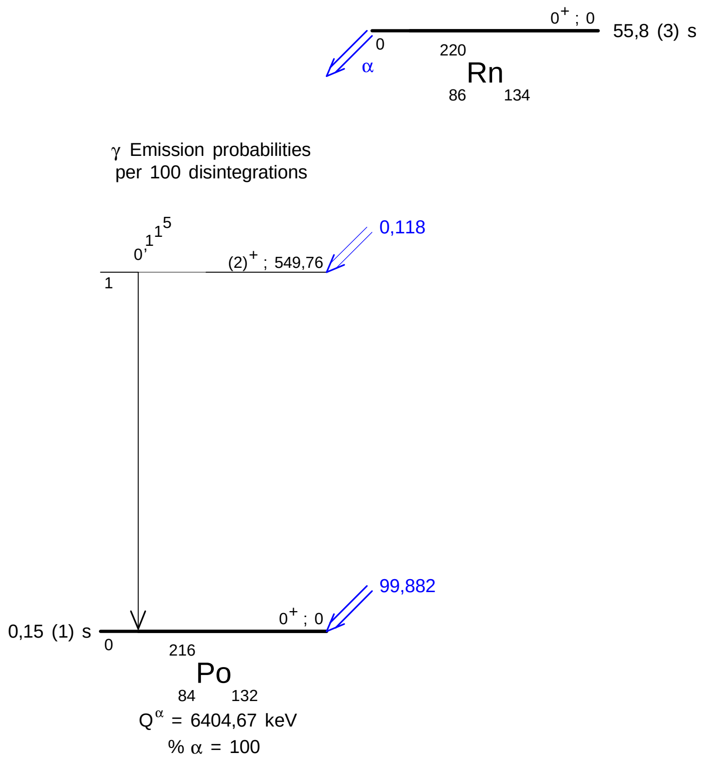
  (Auger electrons)
- E. SCHÖNFELD, G. RODLOFF. PTB Report 6.11-1999-1 (1999)
  (K-x ray)


0+ ; 0
55,8 (3) s
0
α
220
Rn
86
134
γ Emission probabilities
per 100 disintegrations
0,118
(2)+ ; 549,76
1
99,882
0,15 (1) s
0+ ; 0
0
216
Po
84
132
Qα = 6404,67 keV
% α = 100

$^{224}_{88}$Ra $_{136}$

1 Decay Scheme

Ra-224 mainly decays by alpha emission to the fundamental and the 241 keV levels of Rn-220.
Le radium 224 se désintègre par émission alpha principalement vers le niveau fondamental et le niveau excité de 241 keV du radon 220.

2 Nuclear Data

$T_{1/2}(^{224}$Ra)	:	3,627	(7)	d
$T_{1/2}(^{220}$Rn)	:	55,8	(3)	s
$Q^{\alpha}(^{224}$Ra)	:	5788,87	(15)	keV

2.1 α Transitions

	Energy keV	Probability × 100	F
$\alpha_{0,4}$	5125,84 (25)	0,0030 (5)	7,42
$\alpha_{0,3}$	5143,43 (24)	0,0076 (14)	3,73
$\alpha_{0,2}$	5255,18 (25)	0,0074 (8)	17,4
$\alpha_{0,1}$	5547,88 (16)	5,26 (7)	1,03
$\alpha_{0,0}$	5788,87 (15)	94,72 (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
$\gamma_{1,0}$(Rn)	240,986 (6)	5,27 (7)	E2	0,111 (2)	0,124 (3)	0,045 (1)	0,280 (6)
$\gamma_{2,1}$(Rn)	292,70 (11)	0,0073 (8)	E2	0,0730 (15)	0,057 (1)	0,0210 (4)	0,151 (3)
$\gamma_{3,1}$(Rn)	404,5 (1)	0,0022 (5)	E1	0,0141 (3)	0,00240 (5)	0,00080 (2)	0,0173 (4)
$\gamma_{4,1}$(Rn)	422,04 (11)	0,0030 (5)	[E1]	0,0129 (3)	0,00220 (4)	0,00070 (1)	0,0158 (3)
$\gamma_{3,0}$(Rn)	645,44 (9)	0,0054 (9)	E1	0,0055 (1)	0,00090 (2)	0,00030 (1)	0,0067 (1)

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		60,5
	$K\alpha_1$	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
	$KO_{2,3}$	98,357	}	
X_L				
	$L\ell$	10,137		
	$L\alpha$	11,598 – 11,726		
	$L\eta$	12,855		
	$L\beta$	14,565 – 13,52		
	$L\gamma$	16,77 – 17,28		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	62,02 – 68,89	100
KLX	75,74 – 83,79	56
KXY	89,45 – 98,39	8
Auger L	5,58 – 11,48	5840

4 α Emissions

	Energy keV	Probability × 100
$\alpha_{0,4}$	5034,31 (25)	0,0030 (5)
$\alpha_{0,3}$	5051,58 (24)	0,0076 (14)
$\alpha_{0,2}$	5161,34 (25)	0,0074 (8)
$\alpha_{0,1}$	5448,81 (16)	5,26 (7)
$\alpha_{0,0}$	5685,50 (15)	94,72 (7)

5 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Rn)	5,58 - 11,48		0,537 (9)
e_{AK}	(Rn)			0,0151 (19)
	KLL	62,02 - 68,89	}	
	KLX	75,74 - 83,79	}	
	KXY	89,45 - 98,39	}	
$ec_{1,0\ K}$	(Rn)	142,590 (12)		0,46 (2)
$ec_{1,0\ L}$	(Rn)	222,94 - 226,38		0,51 (2)
$ec_{1,0\ M}$	(Rn)	236,51 - 240,76		0,18 (1)

6 Photon Emissions

6.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Rn)	10,137 — 17,28		0,387 (8)	
$XK\alpha_2$	(Rn)	81,07		0,130 (4)	} $K\alpha$
$XK\alpha_1$	(Rn)	83,78		0,215 (7)	}
$XK\beta_3$	(Rn)	94,247	}		
$XK\beta_1$	(Rn)	94,868	}	0,0744 (24)	$K'\beta_1$
$XK\beta_5''$	(Rn)	95,449	}		
$XK\beta_2$	(Rn)	97,48	}		
$XK\beta_4$	(Rn)	97,853	}	0,0238 (9)	$K'\beta_2$
$XKO_{2,3}$	(Rn)	98,357	}		

6.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Rn)	240,986 (6)	4,12 (4)
$\gamma_{2,1}$(Rn)	292,70 (11)	0,0063 (7)
$\gamma_{3,1}$(Rn)	404,5 (1)	0,0022 (5)
$\gamma_{4,1}$(Rn)	422,04 (11)	0,0030 (5)
$\gamma_{3,0}$(Rn)	645,44 (9)	0,0054 (9)

7 Main Production Modes

Ra – 226(p,t)Ra – 224
Th – 228 α decays

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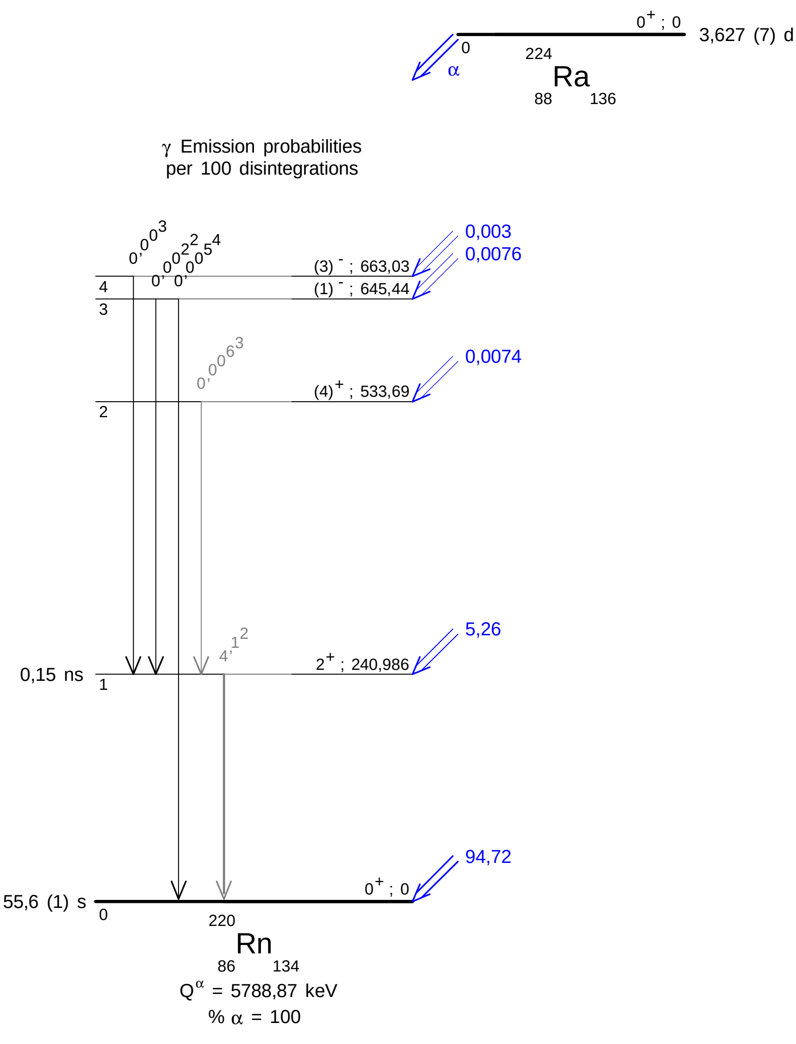
0+ ; 0
3,627 (7) d
0
α
224
Ra
88
136
γ Emission probabilities
per 100 disintegrations
0,003
0,0022
0,0054
0,003
0,0076
(3)- ; 663,03
(1)- ; 645,44
4
3
0,0063
0,0074
(4)+ ; 533,69
2
4,12
5,26
2+ ; 240,986
0,15 ns
1
94,72
0+ ; 0
55,6 (1) s
0
220
Rn
86
134
Qα = 5788,87 keV
% α = 100

$^{\mathbf{226}}_{88}\mathrm{Ra}_{138}$

1 Decay Scheme

Le Ra-226 se désintègre par émission alpha principalement vers le niveau excité de 186 keV et le niveau fondamental de Rn-222.
Ra-226 disintegrates by alpha emission mainly to the 186 keV level and to the ground state level of Rn-222.

2 Nuclear Data

$T_{1/2}(^{226}\mathrm{Ra})$	:	1600	(7)	a
$T_{1/2}(^{222}\mathrm{Rn})$	:	3,8235	(4)	d
$Q^{\alpha}(^{226}\mathrm{Ra})$	:	4870,63	(25)	keV

2.1 α Transitions

	Energy keV	Probability × 100	F
$\alpha_{0,4}$	4235 (2)	0,0002	8,65
$\alpha_{0,3}$	4270 (2)	0,0008	4,5
$\alpha_{0,2}$	4422 (1)	0,0065 (16)	10,4
$\alpha_{0,1}$	4684 (1)	5,96 (8)	0,96
$\alpha_{0,0}$	4870,54 (25)	94,03 (8)	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)	5,97 (8)	E2	0,190 (6)	0,367 (11)	0,0986 (30)	0,689 (21)
$\gamma_{2,1}$(Rn)	262,27 (5)	0,0065 (16)	(E2)				0,212 (2)
$\gamma_{3,1}$(Rn)	414,60 (5)	0,0003	(E1)				0,0165 (3)
$\gamma_{4,1}$(Rn)	449,37 (10)	0,0002	[E1]				
$\gamma_{3,0}$(Rn)	600,66 (5)	0,0005	(E1)				0,0077 (2)

BNM/LNHB, INEEL /MM. Bé,
V. Chisté, R.G. Helmer

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				
	$L\ell$	10,137		
	$L\alpha$	11,59 – 11,72		
	$L\eta$	12,855		
	$L\beta$	14,31 – 14,51		
	$L\gamma$	16,24 – 17,2		

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)	0,0065 (16)
$\alpha_{0,1}$	4601 (1)	5,96 (8)
$\alpha_{0,0}$	4784,34 (25)	94,03 (8)

5 Electron Emissions

		Energy keV	Electrons per 100 disint.
$ec_{1,0\ T}$	(Rn)	87,814 - 186,168	2,43 (7)
$ec_{1,0\ K}$	(Rn)	87,814 (13)	0,67 (2)
$ec_{1,0\ L}$	(Rn)	168,163 - 171,601	1,30 (4)
$ec_{1,0\ M}$	(Rn)	181,738 - 183,327	0,35 (1)
$ec_{1,0\ N}$	(Rn)	185,121 - 185,989	0,092 (3)

6 Photon Emissions

6.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Rn)	10,137 — 17,2		0,813 (17)	
$XK\alpha_2$	(Rn)	81,07		0,191 (7)	} $K\alpha$
$XK\alpha_1$	(Rn)	83,78		0,315 (11)	}
$XK\beta_3$	(Rn)	94,247	}		
$XK\beta_1$	(Rn)	94,868	}	0,109 (4)	$K'\beta_1$
$XK\beta_5''$	(Rn)	95,449	}		
$XK\beta_2$	(Rn)	97,48	}		
$XK\beta_4$	(Rn)	97,853	}	0,0349 (14)	$K'\beta_2$
$XKO_{2,3}$	(Rn)	98,357	}		

6.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Rn)	186,211 (13)	3,533 (21)
$\gamma_{2,1}$(Rn)	262,27 (5)	0,0054 (13)
$\gamma_{3,1}$(Rn)	414,60 (5)	0,0003
$\gamma_{4,1}$(Rn)	449,37 (10)	0,0002
$\gamma_{3,0}$(Rn)	600,66 (5)	0,0005

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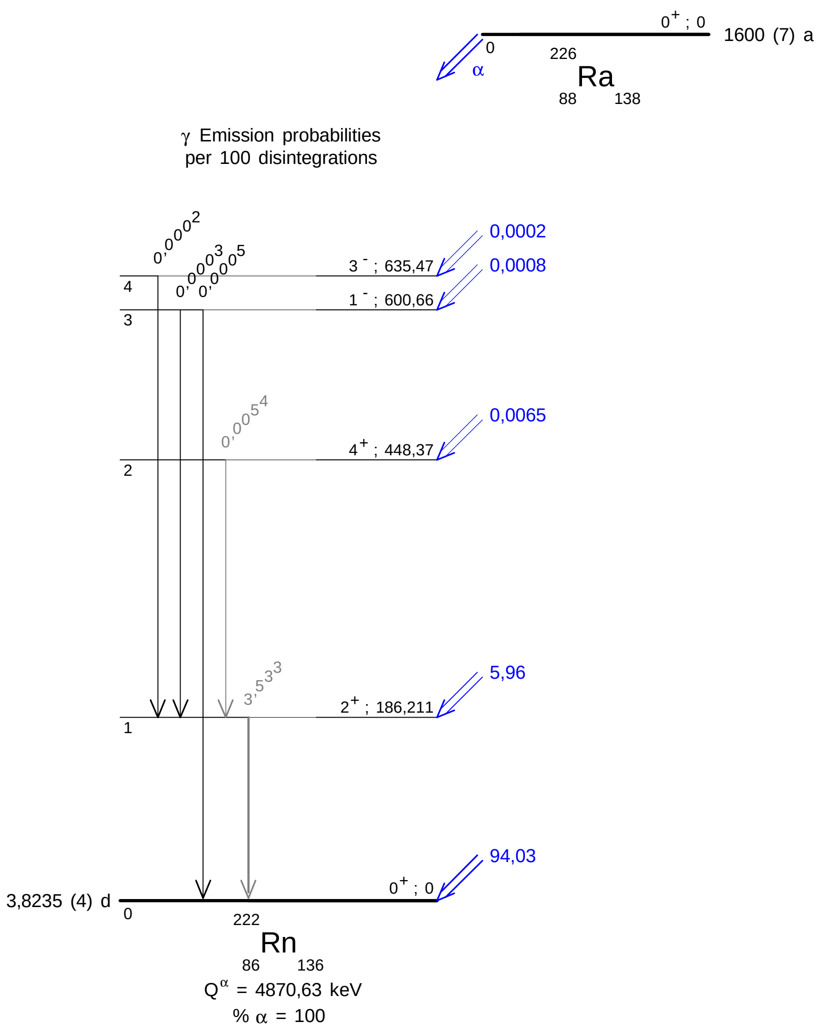

0+ ; 0
1600 (7) a
0
α
226
Ra
88
138
γ Emission probabilities
per 100 disintegrations
0,0002
0,0003
0,0005
0,0054
3,533
3 - ; 635,47
1 - ; 600,66
4+ ; 448,37
2+ ; 186,211
0+ ; 0
0,0002
0,0008
0,0065
5,96
94,03
4
3
2
1
0
3,8235 (4) d
222
Rn
86
136
Qα = 4870,63 keV
% α = 100

$^{227}_{90}$Th$_{137}$

1 Decay Scheme

Th-227 is member of the natural U-235 radioactive decay chain. Th-227 disintegrates entirely by alpha decay to Ra-223.
Le thorium 227 appartient à la chaine naturelle de l'uranium 235, il se désintègre à 100 % par émission alpha vers le radium 223.

2 Nuclear Data

$T_{1/2}(^{227}$Th)	:	18,718	(5)	d
$T_{1/2}(^{223}$Ra)	:	11,43	(5)	d
$Q^{\alpha}(^{227}$Th)	:	6146,43	(15)	keV

2.1 α Transitions

	Energy keV	Probability × 100	F
$\alpha_{0,56}$	5123,8 (40)	0,00031 (2)	30
$\alpha_{0,53}$	5146,8 (40)	0,00023 (2)	58
$\alpha_{0,52}$	5174,7 (40)	0,000150 (15)	133
$\alpha_{0,51}$	5202,2 (40)	0,00028 (2)	106
$\alpha_{0,50}$	5220,7 (30)	0,00062 (5)	60
$\alpha_{0,49}$	5238,8 (20)	0,00410 (8)	12
$\alpha_{0,46}$	5264 (3)	0,00170 (17)	39
$\alpha_{0,45}$	5273,5 (40)	0,00120 (24)	60
$\alpha_{0,43}$	5286,9 (25)	0,0038 (3)	25
$\alpha_{0,42}$	5303,7 (20)	0,0070 (3)	17
$\alpha_{0,40}$	5323 (2)	0,0098 (3)	16
$\alpha_{0,38}$	5342,4 (20)	0,00320 (16)	61
$\alpha_{0,36}$	5358,7 (20)	0,0026 (2)	94
$\alpha_{0,34}$	5417,3 (40)	0,00024 (10)	2190
$\alpha_{0,33}$	5431,6 (50)	0,0002 (1)	3240
$\alpha_{0,32}$	5461,0 (25)	0,00066 (3)	1410
$\alpha_{0,31}$	5505,7 (30)	0,00044 (7)	3700
$\alpha_{0,30}$	5556,5 (20)	0,00270 (5)	1140
$\alpha_{0,29}$	5578,7 (22)	0,0012 (1)	3400
$\alpha_{0,28}$	5608,7 (20)	0,0166 (3)	362
$\alpha_{0,27}$	5630,9 (18)	0,021 (2)	377

	Energy keV	Probability × 100	F
$\alpha_{0,26}$	5686,1 (16)	0,176 (6)	87
$\alpha_{0,25}$	5701,1 (18)	0,170 (17)	108
$\alpha_{0,23}$	5714,0 (16)	0,216 (8)	99
$\alpha_{0,22}$	5723,0 (17)	0,0070 (4)	3380
$\alpha_{0,21}$	5741,4 (15)	0,0179 (15)	1660
$\alpha_{0,20}$	5770,0 (15)	2,06 (12)	20
$\alpha_{0,19}$	5776,1 (16)	0,057 (4)	791
$\alpha_{0,18}$	5795,0 (16)	1,5 (1)	38
$\alpha_{0,16}$	5803,1 (16)	3,63 (20)	17
$\alpha_{0,15}$	5811,2 (16)	8,3 (3)	8,2
$\alpha_{0,14}$	5815,7 (16)	4,89 (20)	15
$\alpha_{0,13}$	5830,8 (16)	0,0342 (25)	2490
$\alpha_{0,12}$	5860,13 (15)	20,4 (9)	5,9
$\alpha_{0,11}$	5865,7 (15)	0,228 (10)	561
$\alpha_{0,10}$	5899,5 (15)	0,311 (5)	599
$\alpha_{0,9}$	5911,7 (15)	1,27 (2)	169
$\alpha_{0,7}$	5971,8	2,42 (10)	175
$\alpha_{0,6}$	6015,9 (15)	0,174 (8)	4000
$\alpha_{0,5}$	6022,0 (15)	0,775 (30)	963
$\alpha_{0,4}$	6066,6 (15)	3,00 (15)	404
$\alpha_{0,3}$	6084,94 (10)	23,5 (9)	63
$\alpha_{0,2}$	6096,8 (20)	<0,005	835000
$\alpha_{0,1}$	6116,6 (15)	2,90 (15)	717
$\alpha_{0,0}$	6146,32 (15)	24,2 (9)	118

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{6,5}$(Ra)	6,5 (3)	3,7 (11)	[E1]				41,2 (12)
$\gamma_{17,16}$(Ra)	8,15 (20)	0,008 (3)					
$\gamma_{2,1}$(Ra)	20,25 (5)	1,90 (23)	[E1]		2,83 (8)	1,51 (5)	7,2 (2)
$\gamma_{25,22}$(Ra)	20,94 (5)	0,006 (3)					
$\gamma_{(-1,1)}$(Ra)	22,0 (2)	0,009 (9)					
$\gamma_{(-1,2)}$(Ra)	24,13 (5)	0,086 (8)					
$\gamma_{(-1,3)}$(Ra)	27,41 (9)	0,029 (5)					
$\gamma_{4,2}$(Ra)	29,60 (3)	13,0 (7)	[M1+62,8%E2]		1653 (50)	444 (13)	2246 (67)
$\gamma_{1,0}$(Ra)	29,86 (1)	43 (6)	M1+14,4%E2		429 (13)	113 (3)	581 (17)
$\gamma_{3,1}$(Ra)	31,58 (1)	19 (3)	M1+7,3%E2		205 (6)	53,2 (16)	276 (8)
$\gamma_{20,17}$(Ra)	33,39 (8)	0,023 (8)	[E1]		1,57 (5)	0,395 (12)	2,09 (6)
$\gamma_{25,21}$(Ra)	40,20 (3)	0,015 (4)					
$\gamma_{20,15}$(Ra)	41,93 (5)	0,06 (3)	[E1]		0,86 (3)	0,214 (6)	1,14 (3)
$\gamma_{14,12}$(Ra)	43,77 (5)	0,42 (3)	E1		0,767 (23)	0,191 (6)	1,02 (3)
$\gamma_{(-1,4)}$(Ra)	43,8 (5)	0,054 (22)					
$\gamma_{5,4}$(Ra)	44,22 (12)	6,9 (17)	M1+21,3%E2		98 (3)	25,8 (8)	132 (4)
$\gamma_{8,6}$(Ra)	44,40 (5)	0,6 (4)	M1		27,1 (8)	6,55 (20)	35,8 (11)
$\gamma_{15,12}$(Ra)	48,30 (3)	4,4 (16)	E2		232 (7)	63,1 (19)	317 (10)
$\gamma_{4,1}$(Ra)	49,82 (5)	0,72 (16)	E1		0,542 (16)	0,133 (4)	0,72 (2)
$\gamma_{2,0}$(Ra)	50,13 (1)	14,0 (9)	E1		0,533 (16)	0,131 (4)	0,708 (21)
$\gamma_{7,5}$(Ra)	50,85 (5)	0,8 (4)	M1+13,8%E2		40,6 (12)	10,5 (3)	54,7 (16)
$\gamma_{15,11}$(Ra)	54,19 (4)	0,13 (3)	(M1)		15,0 (5)	3,60 (11)	19,9 (6)
$\gamma_{23,20}$(Ra)	56,00 (6)	0,091 (5)	M1		13,6 (4)	3,27 (10)	18,1 (5)
$\gamma_{16,12}$(Ra)	56,42 (7)	0,4 (3)	M1+18,1%E2		30,7 (9)	8,00 (24)	41,5 (12)

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{(-1,8)}$(Ra)	59,6 (5)	0,010 (4)					
$\gamma_{3,0}$(Ra)	61,44 (2)	8,8 (11)	E2		72,4 (22)	19,7 (6)	99 (3)
$\gamma_{17,11}$(Ra)	62,45 (5)	4,0 (6)	M1+7,8%E2		14,4 (4)	3,61 (11)	19,2 (6)
$\gamma_{21,17}$(Ra)	62,68 (3)	0,010 (4)	[E1]		0,294 (9)	0,0719 (22)	0,39 (1)
$\gamma_{18,12}$(Ra)	64,35 (10)	0,034 (5)	[E1]		0,274 (8)	0,067 (2)	0,363 (11)
$\gamma_{(-1,9)}$(Ra)	66,2 (5)	0,006 (4)					
$\gamma_{(-1,10)}$(Ra)	66,4 (5)	0,008 (4)					
$\gamma_{(-1,11)}$(Ra)	68,7 (1)	0,202 (11)	M1+50%E2		24,9 (7)	6,7 (2)	33,8 (10)
$\gamma_{6,3}$(Ra)	68,74 (3)	1,07 (20)	M1+16,8%E2		13,3 (4)	3,43 (10)	17,9 (5)
$\gamma_{(-1,12)}$(Ra)	69,8 (3)	0,010 (4)					
$\gamma_{10,7}$(Ra)	72,85 (5)	0,024 (19)					
$\gamma_{5,2}$(Ra)	73,63 (5)	0,59 (22)	E2		30,4 (9)	8,29 (25)	41,5 (12)
$\gamma_{(-1,0)}$(Ra)	75,01 (5)	0,026 (10)					
$\gamma_{(-1,13)}$(Ra)	77,4 (4)	0,0101 (5)					
$\gamma_{4,0}$(Ra)	79,69 (2)	2,30 (13)	E1		0,155 (5)	0,0377 (11)	0,205 (6)
$\gamma_{23,17}$(Ra)	89,6 (4)	0,0038 (13)					
$\gamma_{5,1}$(Ra)	93,88 (5)	1,67 (9)	E1		0,100 (3)	0,0243 (7)	0,133 (4)
$\gamma_{7,4}$(Ra)	94,97 (5)	0,32 (19)	E2		9,1 (3)	2,48 (7)	12,4 (4)
$\gamma_{20,11}$(Ra)	96,03 (5)	0,077 (15)	(E1)		0,094 (3)	0,0229 (7)	0,125 (4)
$\gamma_{15,9}$(Ra)	99,58 (10)	0,025 (6)					
$\gamma_{24,17}$(Ra)	99,6 (2)	0,0126 (6)					
$\gamma_{6,1}$(Ra)	100,27 (3)	0,87 (17)	E2		7,06 (21)	1,93 (6)	9,6 (3)
$\gamma_{23,14}$(Ra)	102,5 (1)	0,00113 (5)					
$\gamma_{11,7}$(Ra)	105,2 (1)	0,0097 (5)					
$\gamma_{16,9}$(Ra)	107,76 (7)	0,09 (3)	(M1), [E2]	5,6 (2)	3,53 (11)	0,93 (3)	10,4 (3)
$\gamma_{22,1}$(Ra)	109,2 (4)	0,0052 (15)					
$\gamma_{25,15}$(Ra)	110,65 (5)	0,023 (15)	E2	0,286 (9)	4,46 (13)	1,22 (4)	6,38 (19)
$\gamma_{(-1,14)}$(Ra)	112,6 (5)	0,009 (4)					
$\gamma_{8,3}$(Ra)	113,11 (5)	0,75 (14)	E1	0,279 (8)	0,0613 (18)	0,0148 (4)	0,360 (11)
$\gamma_{7,3}$(Ra)	113,11	1,3 (6)	E2	0,294 (9)	4,03 (12)	1,10 (3)	5,80 (17)
$\gamma_{10,6}$(Ra)	117,20 (5)	0,258 (22)	E1	0,256 (8)	0,0558 (17)	0,0135 (4)	0,33 (1)
$\gamma_{(-1,61)}$(Ra)	117,5 (5)	0,012 (4)					
$\gamma_{10,5}$(Ra)	123,58 (10)	0,014 (5)					
$\gamma_{21,11}$(Ra)	124,44 (20)	0,0040 (22)					
$\gamma_{(-1,15)}$(Ra)	128,02 (2)	0,0032 (5)					
$\gamma_{(-1,19)}$(Ra)	129,4 (2)	0,0013 (6)					
$\gamma_{19,9}$(Ra)	134,6 (1)	0,040 (8)	[E1]	0,185 (6)	0,0389 (12)	0,0094 (3)	0,236 (7)
$\gamma_{(-1,23)}$(Ra)	138,4 (1)	0,014 (3)					
$\gamma_{(-1,24)}$(Ra)	140,6 (3)	0,021 (3)					
$\gamma_{20,9}$(Ra)	141,42 (5)	0,140 (28)	E1	0,164 (5)	0,0342 (10)	0,00820 (25)	0,210 (6)
$\gamma_{11,6}$(Ra)	150,14 (20)	0,011 (3)					
$\gamma_{24,11}$(Ra)	162,19 (10)	0,008 (3)					
$\gamma_{(-1,25)}$(Ra)	164,52 (10)	0,014 (3)					
$\gamma_{17,7}$(Ra)	168,36 (10)	0,014 (3)					
$\gamma_{21,9}$(Ra)	169,95 (10)	0,0054 (22)					
$\gamma_{(-1,27)}$(Ra)	171,5 (2)	0,0038 (13)					
$\gamma_{9,3}$(Ra)	173,45 (3)	0,055 (1)	M1,E2	1,51 (5)	0,553 (17)	0,142 (4)	2,26 (7)
$\gamma_{(-1,30)}$(Ra)	175,8 (3)	0,020 (5)					
$\gamma_{(-1,33)}$(Ra)	181,1 (3)	0,0025 (13)					
$\gamma_{(-1,35)}$(Ra)	182,3 (2)	0,0038 (13)					
$\gamma_{9,2}$(Ra)	184,65 (5)	0,039 (5)	E1	0,0874 (30)	0,0172 (5)	0,00410 (12)	0,110 (3)
$\gamma_{25,10}$(Ra)	197,56 (10)	0,013 (4)					
$\gamma_{11,4}$(Ra)	200,5 (1)	0,013 (9)					
$\gamma_{20,7}$(Ra)	201,64 (10)	0,048 (6)	M1+71,7%E2	0,636 (20)	0,316 (9)	0,0825 (25)	1,06 (3)
$\gamma_{(-1,37)}$(Ra)	202,5 (5)	0,006 (3)					
$\gamma_{15,6}$(Ra)	204,14 (10)	0,340 (47)	E2	0,156 (5)	0,291 (9)	0,0787 (24)	0,552 (17)
$\gamma_{9,1}$(Ra)	204,98 (10)	0,51 (8)	M1+1,4%E2	1,74 (5)	0,322 (10)	0,0774 (23)	2,17 (7)
$\gamma_{14,5}$(Ra)	206,08 (5)	0,38 (4)	E2	0,153 (5)	0,280 (8)	0,0756 (23)	0,534 (16)
$\gamma_{15,5}$(Ra)	210,62 (5)	1,32 (11)	E1	0,0642 (19)	0,0124 (4)	0,00297 (9)	0,0805 (24)

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{17,6}$(Ra)	212,70 (4)	0,21 (3)	M1+13,8%E2	1,39 (4)	0,285 (9)	0,0692 (21)	1,77 (5)
$\gamma_{26,10}$(Ra)	212,7 (3)	0,019 (5)					
$\gamma_{(-1,40)}$(Ra)	216,0 (1)	0,00025 (13)					
$\gamma_{11,3}$(Ra)	218,90 (5)	0,30 (3)	M1	1,47 (4)	0,268 (8)	0,0643 (19)	1,82 (5)
$\gamma_{(-1,43)}$(Ra)	219,0 (2)	0,049 (12)					
$\gamma_{(-1,45)}$(Ra)	223,2 (4)	0,0050 (13)					
$\gamma_{26,9}$(Ra)	225,5 (3)	0,009 (3)					
$\gamma_{21,7}$(Ra)	229,9 (5)	0,0038 (13)					
$\gamma_{9,0}$(Ra)	234,76 (10)	1,10 (14)	M1(+0,5%E2)	1,20 (4)	0,220 (7)	0,0528 (16)	1,49 (4)
$\gamma_{12,2}$(Ra)	235,96 (2)	13,4 (6)	E1	0,0493 (15)	0,0093 (3)	0,00224 (7)	0,0617 (19)
$\gamma_{20,6}$(Ra)	246,12 (10)	0,0120 (22)					
$\gamma_{(-1,63)}$(Ra)	248,1 (1)	0,024 (5)					
$\gamma_{22,8}$(Ra)	249,6 (5)	0,0076 (25)					
$\gamma_{11,1}$(Ra)	250,15 (5)	0,020 (4)	M1	1,01 (3)	0,185 (6)	0,0443 (13)	1,26 (4)
$\gamma_{14,4}$(Ra)	250,27 (8)	0,64 (6)	M1+81,5%E2	0,271 (8)	0,136 (4)	0,0355 (11)	0,455 (14)
$\gamma_{20,5}$(Ra)	252,50 (5)	0,24 (4)	M1	0,99 (3)	0,180 (5)	0,0431 (13)	1,22 (4)
$\gamma_{15,4}$(Ra)	254,63 (3)	0,73 (14)	E1	0,041 (1)	0,00776 (23)	0,00186 (6)	0,0517 (16)
$\gamma_{12,1}$(Ra)	256,23 (2)	8,5 (4)	E2	0,099 (3)	0,114 (3)	0,0305 (9)	0,253 (8)
$\gamma_{(-1,47)}$(Ra)	260,6 (2)	0,0051 (13)					
$\gamma_{16,4}$(Ra)	262,87 (5)	0,110 (9)	E1	0,0385 (10)	0,00719 (22)	0,00172 (5)	0,0480 (14)
$\gamma_{(-1,50)}$(Ra)	265,3 (2)	0,0050 (13)					
$\gamma_{27,10}$(Ra)	267,05 (20)	0,010 (3)					
$\gamma_{24,8}$(Ra)	267,86 (20)	0,0069 (25)					
$\gamma_{25,7}$(Ra)	270,56 (20)	0,028 (9)					
$\gamma_{15,3}$(Ra)	272,91 (5)	0,80 (6)	M1+50%E2	0,441 (13)	0,117 (4)	0,0292 (9)	0,597 (18)
$\gamma_{14,2}$(Ra)	279,80 (5)	0,101 (25)	M1+1,4%E2	0,773 (23)	0,135 (4)	0,0323 (10)	0,91 (3)
$\gamma_{21,5}$(Ra)	280,7 (3)	0,0025 (13)					
$\gamma_{17,3}$(Ra)	281,42 (5)	0,304 (25)	M1+21,9%E2	0,588 (18)	0,121 (4)	0,0294 (9)	0,749 (22)
$\gamma_{15,10}$(Ra)	284,24 (10)	0,039 (13)					
$\gamma_{26,7}$(Ra)	285,52 (10)	0,066 (18)	M1+50%E2	0,390 (12)	0,101 (3)	0,0252 (8)	0,526 (16)
$\gamma_{12,0}$(Ra)	286,09 (2)	2,6 (3)	M1+50%E2	0,390 (12)	0,101 (3)	0,0252 (8)	0,526 (16)
$\gamma_{19,4}$(Ra)	289,59 (10)	1,9 (4)					
$\gamma_{28,10}$(Ra)	289,77 (10)	0,019 (4)					
$\gamma_{16,2}$(Ra)	292,41 (5)	0,066 (8)	E1	0,0303 (10)	0,00557 (17)	0,00133 (4)	0,0377 (11)
$\gamma_{20,4}$(Ra)	296,50 (5)	0,76 (8)	M1+1,7%E2	0,624 (19)	0,114 (3)	0,0274 (8)	0,775 (23)
$\gamma_{14,1}$(Ra)	299,98 (3)	2,24 (12)	E1	0,0286 (10)	0,00525 (16)	0,00125 (4)	0,0356 (11)
$\gamma_{18,2}$(Ra)	300,50 (16)	0,0200 (44)	(M1+50%E2)	0,34 (1)	0,086 (3)	0,0214 (6)	0,455 (14)
$\gamma_{15,1}$(Ra)	304,50 (2)	2,4 (3)	M1+6,3%E2(+E0)	0,95 (12)	0,161 (22)	0,024 (8)	1,1 (1)
$\gamma_{(-1,53)}$(Ra)	306,1 (3)	0,010 (4)					
$\gamma_{23,5}$(Ra)	308,40 (3)	0,024 (4)	M1+50%E2	0,318 (10)	0,0792 (24)	0,0197 (6)	0,424 (13)
$\gamma_{16,1}$(Ra)	312,69 (3)	0,83 (8)	M1+2,5%E2	0,535 (16)	0,098 (3)	0,0236 (7)	0,665 (20)
$\gamma_{(-1,55)}$(Ra)	314,75 (10)	0,034 (2)					
$\gamma_{20,3}$(Ra)	314,85 (48)	0,48 (4)	E1 or M1				
$\gamma_{24,5}$(Ra)	318,46 (20)	0,0066 (22)					
$\gamma_{19,2}$(Ra)	319,24 (5)	0,050 (11)	M1+3,1%E2	0,503 (15)	0,093 (3)	0,0222 (7)	0,626 (19)
$\gamma_{21,4}$(Ra)	324,88 (20)	0,014 (4)	M1+50%E2	0,277 (8)	0,0674 (20)	0,0167 (5)	0,367 (11)
$\gamma_{20,2}$(Ra)	325,99 (18)	0,006 (3)					
$\gamma_{14,0}$(Ra)	329,85 (2)	3,0 (2)	(E1)	0,0232 (10)	0,0042 (1)	0,00100 (3)	0,0288 (9)
$\gamma_{(-1,57)}$(Ra)	332,2 (2)	0,0016 (5)					
$\gamma_{15,0}$(Ra)	334,37 (2)	1,60 (13)	M1+27,1%E2	0,348 (10)	0,0714 (21)	0,0174 (5)	0,442 (13)
$\gamma_{27,8}$(Ra)	339,76 (10)	0,0038 (13)					
$\gamma_{16,0}$(Ra)	342,55 (4)	0,43 (11)	M1+62,5%E2	0,194 (6)	0,0523 (16)	0,0131 (4)	0,264 (8)
$\gamma_{20,1}$(Ra)	346,45 (1)	0,0117 (14)					
$\gamma_{(-1,60)}$(Ra)	348,5 (5)	0,0066 (22)					
$\gamma_{18,0}$(Ra)	350,54 (7)	0,110 (19)	E1	0,0204 (10)	0,00366 (11)	0,00090 (3)	0,0252 (8)
$\gamma_{23,4}$(Ra)	352,61 (10)	0,013 (3)	M1+50%E2	0,223 (7)	0,0525 (16)	0,0130 (4)	0,293 (9)
$\gamma_{22,3}$(Ra)	362,63 (10)	0,050 (3)					
$\gamma_{19,0}$(Ra)	369,35 (5)	0,0060 (13)					
$\gamma_{23,3}$(Ra)	370,93 (8)	0,004 (3)					

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{21,1}$(Ra)	374,8 (2)	0,00151 (7)					
$\gamma_{20,0}$(Ra)	376,27 (10)	0,0050 (13)					
$\gamma_{(-1,62)}$(Ra)	379,4 (1)	0,010 (3)					
$\gamma_{23,2}$(Ra)	382,2 (3)	0,0063 (13)					
$\gamma_{25,3}$(Ra)	383,51 (4)	0,03 (3)	M1+17,5%E2	0,267 (8)	0,0512 (15)	0,0124 (4)	0,335 (10)
$\gamma_{(-1,64)}$(Ra)	392,4 (5)	0,0098 (22)					
$\gamma_{26,3}$(Ra)	398,6 (3)	0,0014 (4)					
$\gamma_{23,1}$(Ra)	402,2 (3)	0,008 (5)					
$\gamma_{25,1}$(Ra)	415,11 (10)	0,0014 (6)					
$\gamma_{23,0}$(Ra)	432,33 (10)	0,0040 (5)					
$\gamma_{(-1,66)}$(Ra)	442,5 (10)	0,000058 (3)					
$\gamma_{(-1,68)}$(Ra)	445	0,0005 (5)					
$\gamma_{49,26}$(Ra)	448,0 (6)	0,000139 (8)					
$\gamma_{36,15}$(Ra)	452,9 (3)	0,001					
$\gamma_{36,14}$(Ra)	457,5 (1)	0,000068 (3)					
$\gamma_{(-1,70)}$(Ra)	462 (1)	0,000048 (2)					
$\gamma_{30,5}$(Ra)	466,8 (2)	0,0005 (3)					
$\gamma_{(-1,72)}$(Ra)	469,0 (2)	0,0009 (3)					
$\gamma_{40,17}$(Ra)	480 (1)	0,00029 (9)					
$\gamma_{43,20}$(Ra)	482 (1)	0,00014 (4)					
$\gamma_{40,14}$(Ra)	493,1 (2)	0,00053 (8)					
$\gamma_{42,15}$(Ra)	507,5 (1)	0,00064 (25)					
$\gamma_{43,16}$(Ra)	516,6 (3)	0,00028 (10)					
$\gamma_{(-1,74)}$(Ra)	521,8 (3)	0,00038 (13)					
$\gamma_{43,15}$(Ra)	524,5 (4)	0,00019 (4)					
$\gamma_{48,19}$(Ra)	534,6 (4)	0,00010 (3)					
$\gamma_{40,12}$(Ra)	536,9 (1)	0,00107 (17)					
$\gamma_{(-1,78)}$(Ra)	540,2 (3)	0,00025 (13)					
$\gamma_{36,9}$(Ra)	552,4 (5)	0,00023 (5)					
$\gamma_{42,12}$(Ra)	556,1 (2)	0,00037 (15)					
$\gamma_{(-1,80)}$(Ra)	565,4 (1)	0,0014 (3)					
$\gamma_{38,9}$(Ra)	569,1 (3)	0,00058 (9)					
$\gamma_{50,18}$(Ra)	576,0 (2)	0,00032 (19)					
$\gamma_{43,11}$(Ra)	579,0 (2)	0,0004 (3)					
$\gamma_{(-1,82)}$(Ra)	585,8 (1)	0,0009 (3)					
$\gamma_{40,9}$(Ra)	589,0 (6)	0,000058 (15)					
$\gamma_{50,14}$(Ra)	596 (1)	0,0000101 (5)					
$\gamma_{(-1,84)}$(Ra)	598,9 (2)	0,00063 (13)					
$\gamma_{42,9}$(Ra)	607,7 (3)	0,00018 (4)					
$\gamma_{49,12}$(Ra)	621,4 (5)	0,000058 (15)					
$\gamma_{53,20}$(Ra)	623,8 (5)	0,00016 (4)					
$\gamma_{33,4}$(Ra)	632,3 (7)	0,00014 (3)					
$\gamma_{52,14}$(Ra)	641,0 (5)	0,000019 (6)					
$\gamma_{45,9}$(Ra)	644,3 (3)	0,00009 (4)					
$\gamma_{(-1,86)}$(Ra)	648,5 (5)	0,000019 (6)					
$\gamma_{33,2}$(Ra)	662,8 (4)	0,000058 (18)					
$\gamma_{50,9}$(Ra)	692,0 (7)	0,000039 (11)					
$\gamma_{45,8}$(Ra)	704,3 (5)	0,000078 (16)					
$\gamma_{36,4}$(Ra)	707,2 (7)	0,000039 (11)					
$\gamma_{42,5}$(Ra)	718,5 (10)	0,000029 (11)					
$\gamma_{35,3}$(Ra)	722,1 (6)	0,00037 (12)					
$\gamma_{38,4}$(Ra)	723,5 (1)	0,00027 (10)					
$\gamma_{35,2}$(Ra)	734,4 (5)	0,00010 (4)					
$\gamma_{43,5}$(Ra)	735,4 (2)	0,00016 (5)					
$\gamma_{36,2}$(Ra)	738,4 (10)	0,000068 (17)					
$\gamma_{41,4}$(Ra)	746,4 (7)	0,00010 (4)					
$\gamma_{45,6}$(Ra)	748,8 (4)	0,00040 (12)					
$\gamma_{35,1}$(Ra)	754,1 (2)	0,00024 (14)					
$\gamma_{36,1}$(Ra)	756,9 (2)	0,00019 (5)					

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{(-1,88)}$(Ra)	757,3 (4)	0,00102 (24)					
$\gamma_{42,4}$(Ra)	762,6 (5)	0,00026 (5)					
$\gamma_{41,3}$(Ra)	766,3 (5)	0,00029 (6)					
$\gamma_{40,2}$(Ra)	773,4 (4)	0,00015 (4)					
$\gamma_{41,2}$(Ra)	775,8 (5)	0,00151 (15)					
$\gamma_{42,3}$(Ra)	781,0 (5)	0,00032 (6)					
$\gamma_{35,0}$(Ra)	784,2 (5)	0,000097 (24)					
$\gamma_{36,0}$(Ra)	787,4 (5)	0,000039 (10)					
$\gamma_{(-1,95)}$(Ra)	787,6 (5)	0,00011 (3)					
$\gamma_{40,1}$(Ra)	792,6 (6)	0,000029 (8)					
$\gamma_{37,0}$(Ra)	792,6 (6)	0,000039 (10)					
$\gamma_{43,3}$(Ra)	797,3 (5)	0,00090 (12)					
$\gamma_{38,0}$(Ra)	803,9 (4)	0,00063 (6)					
$\gamma_{43,2}$(Ra)	808,6 (4)	0,000076 (25)					
$\gamma_{42,1}$(Ra)	812,6 (4)	0,0017 (3)					
$\gamma_{(-1,92)}$(Ra)	818 (1)	0,000029 (11)					
$\gamma_{45,3}$(Ra)	818,1 (2)	0,00017 (8)					
$\gamma_{40,0}$(Ra)	823,4 (4)	0,0025 (3)					
$\gamma_{41,0}$(Ra)	826,7 (5)	0,00016 (5)					
$\gamma_{43,1}$(Ra)	828,5 (5)	0,00019 (5)					
$\gamma_{(-1,94)}$(Ra)	828,9 (2)	0,00076 (4)					
$\gamma_{44,1}$(Ra)	837,8 (5)	0,00052 (12)					
$\gamma_{42,0}$(Ra)	842,5 (3)	0,00087 (13)					
$\gamma_{50,4}$(Ra)	846,7 (5)	0,00015 (3)					
$\gamma_{45,1}$(Ra)	848,3 (6)	0,00027 (11)					
$\gamma_{46,1}$(Ra)	854,3 (5)	0,000068 (14)					
$\gamma_{49,2}$(Ra)	857,3 (7)	0,000058 (18)					
$\gamma_{43,0}$(Ra)	858,9 (2)	0,00025 (4)					
$\gamma_{51,4}$(Ra)	863 (1)	0,000019 (8)					
$\gamma_{44,0}$(Ra)	867,3 (5)	0,00029 (22)					
$\gamma_{50,2}$(Ra)	876,3 (4)	0,00023 (8)					
$\gamma_{49,1}$(Ra)	878,2 (4)	0,00014 (4)					
$\gamma_{47,0}$(Ra)	891 (1)	0,000019 (6)					
$\gamma_{51,2}$(Ra)	893 (1)	0,000013 (4)					
$\gamma_{50,1}$(Ra)	896,1 (5)	0,00011 (3)					
$\gamma_{49,0}$(Ra)	908,6 (4)	0,0023 (3)					
$\gamma_{52,3}$(Ra)	910 (1)	0,000015 (6)					
$\gamma_{53,4}$(Ra)	920,0 (5)	0,000011 (3)					
$\gamma_{50,0}$(Ra)	927 (1)	0,000006 (3)					
$\gamma_{53,3}$(Ra)	938,0 (8)	0,000010 (4)					
$\gamma_{52,1}$(Ra)	941,6 (3)	0,000069 (11)					
$\gamma_{55,3}$(Ra)	958,7 (3)	0,000061 (13)					
$\gamma_{53,1}$(Ra)	970,2 (2)	0,00014 (11)					
$\gamma_{52,0}$(Ra)	971,7 (10)	0,000010 (5)					
$\gamma_{55,1}$(Ra)	990,0 (7)	0,000034 (9)					
$\gamma_{56,1}$(Ra)	995 (1)	0,000006 (4)					
$\gamma_{53,0}$(Ra)	999,8 (5)	0,000029 (8)					
$\gamma_{54,0}$(Ra)	1015,2 (7)	0,000015 (4)					
$\gamma_{55,0}$(Ra)	1020 (1)	0,000019 (6)					
$\gamma_{56,0}$(Ra)	1025 (1)	0,000015 (4)					

3 Atomic Data

3.1 Ra

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

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	85,43		61,15
	$K\alpha_1$	88,47		100
	$K\beta_3$	99,432	}	
	$K\beta_1$	100,13	}	
	$K\beta_5''$	100,738	}	35,13
	$K\beta_2$	102,89	}	
	$K\beta_4$	103,295	}	11,49
	$KO_{2,3}$	103,74	}	
X_L				
	$L\ell$	10,662		
	$L\alpha$	12,196 – 12,339		
	$L\eta$	13,662		
	$L\beta$	14,236 – 15,447		
	$L\gamma$	17,848 – 18,412		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	65,149 – 72,729	100
KLX	79,721 – 88,466	58,2
KXY	94,27 – 103,91	8,36
Auger L	5,71 – 12,04	

4 α Emissions

	Energy keV	Probability × 100
$\alpha_{0,56}$	5033,5 (40)	0,00031 (2)
$\alpha_{0,53}$	5056,1 (40)	0,00023 (2)
$\alpha_{0,52}$	5083,5 (40)	0,000150 (15)

	Energy keV	Probability × 100
$\alpha_{0,51}$	5110,5 (40)	0,00028 (2)
$\alpha_{0,50}$	5128,7 (30)	0,00062 (5)
$\alpha_{0,49}$	5146,5 (20)	0,00410 (8)
$\alpha_{0,46}$	5171 (3)	0,00170 (17)
$\alpha_{0,45}$	5180,6 (40)	0,00120 (24)
$\alpha_{0,43}$	5193,7 (25)	0,0038 (3)
$\alpha_{0,42}$	5210,2 (20)	0,0070 (3)
$\alpha_{0,40}$	5229,2 (20)	0,0098 (3)
$\alpha_{0,38}$	5248,3 (20)	0,00320 (16)
$\alpha_{0,36}$	5264,3 (20)	0,0026 (2)
$\alpha_{0,34}$	5321,8 (40)	0,00024 (10)
$\alpha_{0,33}$	5335,9 (50)	0,0002 (1)
$\alpha_{0,32}$	5365,0 (25)	0,00066 (3)
$\alpha_{0,31}$	5408,7 (30)	0,00044 (7)
$\alpha_{0,30}$	5458,6 (20)	0,00270 (5)
$\alpha_{0,29}$	5480,4 (22)	0,0012 (1)
$\alpha_{0,28}$	5509,9 (20)	0,0166 (3)
$\alpha_{0,27}$	5531,7 (18)	0,021 (2)
$\alpha_{0,26}$	5585,9 (16)	0,176 (6)
$\alpha_{0,25}$	5600,6 (18)	0,170 (17)
$\alpha_{0,23}$	5613,3 (16)	0,216 (8)
$\alpha_{0,22}$	5622,0 (17)	0,0070 (4)
$\alpha_{0,21}$	5640,2 (15)	0,0179 (15)
$\alpha_{0,20}$	5668,0 (15)	2,06 (12)
$\alpha_{0,19}$	5674,3 (16)	0,057 (4)
$\alpha_{0,18}$	5693,0 (16)	1,5 (1)
$\alpha_{0,16}$	5700,8 (16)	3,63 (20)
$\alpha_{0,15}$	5708,8 (16)	8,3 (3)
$\alpha_{0,14}$	5713,2 (16)	4,89 (20)
$\alpha_{0,13}$	5728,1 (16)	0,0342 (25)
$\alpha_{0,12}$	5756,87 (15)	20,4 (9)
$\alpha_{0,11}$	5762,3 (15)	0,228 (10)
$\alpha_{0,10}$	5795,5 (15)	0,311 (5)
$\alpha_{0,9}$	5807,5 (15)	1,27 (2)
$\alpha_{0,7}$	5866,6	2,42 (10)
$\alpha_{0,6}$	5909,9 (15)	0,174 (8)
$\alpha_{0,5}$	5916,0 (15)	0,775 (30)
$\alpha_{0,4}$	5959,7 (15)	3,00 (15)
$\alpha_{0,3}$	5977,72 (10)	23,5 (9)
$\alpha_{0,2}$	5989,4 (20)	<0,005
$\alpha_{0,1}$	6008,8 (15)	2,90 (15)
$\alpha_{0,0}$	6038,01 (15)	24,2 (9)

5 Electron Emissions

		Energy keV	Electrons per 100 disint.
e_{AL}	(Ra)	5,71 - 12,04	55,9 (22)
e_{AK}	(Ra)		0,20 (3)
	KLL	65,149 - 72,729	}
	KLX	79,721 - 88,466	}
	KXY	94,27 - 103,91	}

		Energy keV	Electrons per 100 disint.
$ec_{2,1\ L}$	(Ra)	1,018 - 4,806	0,65 (9)
$ec_{7,3\ K}$	(Ra)	9,195	0,06 (3)
$ec_{4,2\ L}$	(Ra)	10,368 - 14,156	9,6 (9)
$ec_{1,0\ L}$	(Ra)	10,628 - 14,416	32 (5)
$ec_{3,1\ L}$	(Ra)	12,348 - 16,136	13,7 (25)
$ec_{2,1\ M}$	(Ra)	15,428 - 17,145	0,35 (5)
$ec_{2,1\ N}$	(Ra)	19,042 - 19,971	0,66 (9)
$ec_{4,2\ M}$	(Ra)	24,778 - 26,495	2,58 (23)
$ec_{5,4\ L}$	(Ra)	24,988 - 28,776	5,1 (13)
$ec_{1,0\ M}$	(Ra)	25,038 - 26,755	8,5 (14)
$ec_{3,1\ M}$	(Ra)	26,758 - 28,475	3,6 (6)
$ec_{4,2\ N}$	(Ra)	28,392 - 29,321	0,86 (8)
$ec_{1,0\ N}$	(Ra)	28,652 - 29,581	2,9 (5)
$ec_{15,12\ L}$	(Ra)	29,068 - 32,856	3,2 (12)
$ec_{3,1\ N}$	(Ra)	30,372 - 31,301	1,19 (22)
$ec_{2,0\ L}$	(Ra)	30,898 - 34,686	4,4 (4)
$ec_{5,4\ M}$	(Ra)	39,398 - 41,115	1,3 (3)
$ec_{3,0\ L}$	(Ra)	42,208 - 46,000	6,4 (9)
$ec_{5,4\ N}$	(Ra)	43,012 - 43,941	0,44 (11)
$ec_{17,11\ L}$	(Ra)	43,218 - 47,010	2,9 (4)
$ec_{15,12\ M}$	(Ra)	43,478 - 45,195	0,9 (3)
$ec_{2,0\ M}$	(Ra)	45,308 - 47,025	1,10 (11)
$ec_{15,12\ N}$	(Ra)	47,092 - 48,021	0,31 (11)
$ec_{2,0\ N}$	(Ra)	48,922 - 49,851	0,40 (4)
$ec_{6,3\ L}$	(Ra)	49,508 - 53,296	0,76 (15)
$ec_{3,0\ M}$	(Ra)	56,618 - 58,335	1,7 (3)
$ec_{17,11\ M}$	(Ra)	57,628 - 59,345	0,72 (11)
$ec_{3,0\ N}$	(Ra)	60,232 - 61,161	0,60 (9)
$ec_{17,11\ N}$	(Ra)	61,242 - 62,171	0,24 (4)
$ec_{6,3\ M}$	(Ra)	63,918 - 65,635	0,20 (4)
$ec_{6,3\ N}$	(Ra)	67,532 - 68,461	0,067 (13)
$ec_{7,3\ L}$	(Ra)	93,878 - 97,666	0,8 (4)
$ec_{7,3\ M}$	(Ra)	108,288 - 110,005	0,2 (1)
$ec_{7,3\ N}$	(Ra)	111,902 - 112,831	0,07 (3)
$ec_{20,5\ K}$	(Ra)	148,585 (50)	0,107 (16)
$ec_{12,1\ K}$	(Ra)	152,315 (20)	0,673 (45)
$ec_{15,3\ K}$	(Ra)	168,995 (50)	0,220 (15)
$ec_{12,0\ K}$	(Ra)	182,175 (20)	0,66 (7)
$ec_{20,4\ K}$	(Ra)	192,585 (50)	0,268 (26)
$ec_{14,1\ K}$	(Ra)	196,065 (30)	0,0618 (41)
$ec_{15,1\ K}$	(Ra)	200,585 (20)	1,06 (19)
$ec_{16,1\ K}$	(Ra)	208,775 (30)	0,268 (23)
$ec_{14,0\ K}$	(Ra)	225,935 (20)	0,067 (5)
$ec_{15,0\ K}$	(Ra)	230,455 (20)	0,386 (33)
$ec_{12,1\ L}$	(Ra)	236,998 - 240,786	0,78 (5)
$ec_{12,1\ M}$	(Ra)	251,408 - 253,125	0,207 (14)
$ec_{15,3\ L}$	(Ra)	253,678 - 257,466	0,0585 (40)
$ec_{12,0\ L}$	(Ra)	266,858 - 270,646	0,172 (18)
$ec_{15,1\ L}$	(Ra)	285,268 - 289,056	0,180 (33)
$ec_{15,0\ L}$	(Ra)	315,138 - 318,926	0,079 (7)

6 Photon Emissions

6.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Ra)	10,662 — 18,412		41,3 (17)	
XKα_2	(Ra)	85,43		1,81 (6)	} Kα
XKα_1	(Ra)	88,47		2,96 (10)	}
XKβ_3	(Ra)	99,432	}		
XKβ_1	(Ra)	100,13	}	1,04 (4)	K$'\beta_1$
XKβ_5''	(Ra)	100,738	}		
XKβ_2	(Ra)	102,89	}		
XKβ_4	(Ra)	103,295	}	0,340 (13)	K$'\beta_2$
XKO$_{2,3}$	(Ra)	103,74	}		

6.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{6,5}$(Ra)	6,5 (3)	0,09 (3)
$\gamma_{17,16}$(Ra)	8,15 (20)	0,008 (3)
$\gamma_{2,1}$(Ra)	20,25 (5)	0,23 (3)
$\gamma_{25,22}$(Ra)	20,94 (5)	0,006 (3)
$\gamma_{(-1,1)}$(Ra)	22,0 (2)	0,009 (9)
$\gamma_{(-1,2)}$(Ra)	24,13 (5)	0,086 (8)
$\gamma_{(-1,3)}$(Ra)	27,41 (9)	0,029 (5)
$\gamma_{4,2}$(Ra)	29,60 (3)	0,0058 (3)
$\gamma_{1,0}$(Ra)	29,86 (1)	0,074 (11)
$\gamma_{3,1}$(Ra)	31,58 (1)	0,067 (11)
$\gamma_{20,17}$(Ra)	33,39 (8)	0,008 (3)
$\gamma_{25,21}$(Ra)	40,20 (3)	0,015 (4)
$\gamma_{20,15}$(Ra)	41,93 (5)	0,028 (13)
$\gamma_{14,12}$(Ra)	43,77 (5)	0,208 (16)
$\gamma_{(-1,4)}$(Ra)	43,8 (5)	0,054 (22)
$\gamma_{5,4}$(Ra)	44,22 (12)	0,052 (13)
$\gamma_{8,6}$(Ra)	44,40 (5)	0,016 (10)
$\gamma_{15,12}$(Ra)	48,30 (3)	0,014 (5)
$\gamma_{4,1}$(Ra)	49,82 (5)	0,42 (9)
$\gamma_{2,0}$(Ra)	50,13 (1)	8,2 (5)
$\gamma_{7,5}$(Ra)	50,85 (5)	0,015 (6)
$\gamma_{15,11}$(Ra)	54,19 (4)	0,0063 (13)
$\gamma_{23,20}$(Ra)	56,00 (6)	0,0048 (2)
$\gamma_{16,12}$(Ra)	56,42 (7)	0,009 (8)
$\gamma_{(-1,8)}$(Ra)	59,6 (5)	0,010 (4)
$\gamma_{3,0}$(Ra)	61,44 (2)	0,088 (11)
$\gamma_{17,11}$(Ra)	62,45 (5)	0,20 (3)
$\gamma_{21,17}$(Ra)	62,68 (3)	0,007 (3)
$\gamma_{18,12}$(Ra)	64,35 (10)	0,025 (4)
$\gamma_{(-1,9)}$(Ra)	66,2 (5)	0,006 (4)
$\gamma_{(-1,10)}$(Ra)	66,4 (5)	0,008 (4)
$\gamma_{(-1,11)}$(Ra)	68,7 (1)	0,0058 (3)
$\gamma_{6,3}$(Ra)	68,74 (3)	0,057 (10)
$\gamma_{(-1,12)}$(Ra)	69,8 (3)	0,010 (4)

	Energy keV	Photons per 100 disint.
$\gamma_{10,7}$(Ra)	72,85 (5)	0,024 (19)
$\gamma_{5,2}$(Ra)	73,63 (5)	0,014 (5)
$\gamma_{(-1,0)}$(Ra)	75,01 (5)	0,026 (10)
$\gamma_{(-1,13)}$(Ra)	77,4 (4)	0,0101 (5)
$\gamma_{4,0}$(Ra)	79,69 (2)	1,90 (11)
$\gamma_{23,17}$(Ra)	89,6 (4)	0,0038 (13)
$\gamma_{5,1}$(Ra)	93,88 (5)	1,48 (8)
$\gamma_{7,4}$(Ra)	94,97 (5)	0,024 (14)
$\gamma_{20,11}$(Ra)	96,03 (5)	0,068 (13)
$\gamma_{15,9}$(Ra)	99,58 (10)	0,025 (6)
$\gamma_{24,17}$(Ra)	99,6 (2)	0,013 (1)
$\gamma_{6,1}$(Ra)	100,27 (3)	0,082 (16)
$\gamma_{23,14}$(Ra)	102,5 (1)	0,00113 (5)
$\gamma_{11,7}$(Ra)	105,2 (1)	0,0097 (5)
$\gamma_{16,9}$(Ra)	107,76 (7)	0,0076 (25)
$\gamma_{22,1}$(Ra)	109,2 (4)	0,0052 (15)
$\gamma_{25,15}$(Ra)	110,65 (5)	0,0032 (20)
$\gamma_{(-1,14)}$(Ra)	112,6 (5)	0,009 (4)
$\gamma_{7,3}$(Ra)	113,11	0,19 (9)
$\gamma_{8,3}$(Ra)	113,11 (5)	0,55 (10)
$\gamma_{10,6}$(Ra)	117,20 (5)	0,194 (17)
$\gamma_{(-1,61)}$(Ra)	117,5 (5)	0,012 (4)
$\gamma_{10,5}$(Ra)	123,58 (10)	0,014 (5)
$\gamma_{21,11}$(Ra)	124,44 (20)	0,0040 (22)
$\gamma_{(-1,15)}$(Ra)	128,02 (2)	0,0032 (5)
$\gamma_{(-1,19)}$(Ra)	129,4 (2)	0,0013 (6)
$\gamma_{19,9}$(Ra)	134,6 (1)	0,033 (7)
$\gamma_{(-1,23)}$(Ra)	138,4 (1)	0,014 (3)
$\gamma_{(-1,24)}$(Ra)	140,6 (3)	0,021 (3)
$\gamma_{20,9}$(Ra)	141,42 (5)	0,116 (23)
$\gamma_{11,6}$(Ra)	150,14 (20)	0,011 (3)
$\gamma_{24,11}$(Ra)	162,19 (10)	0,008 (3)
$\gamma_{(-1,25)}$(Ra)	164,52 (10)	0,014 (3)
$\gamma_{17,7}$(Ra)	168,36 (10)	0,014 (3)
$\gamma_{21,9}$(Ra)	169,95 (10)	0,0054 (22)
$\gamma_{(-1,27)}$(Ra)	171,5 (2)	0,0038 (13)
$\gamma_{9,3}$(Ra)	173,45 (3)	0,017 (3)
$\gamma_{(-1,30)}$(Ra)	175,8 (3)	0,020 (5)
$\gamma_{(-1,33)}$(Ra)	181,1 (3)	0,0025 (13)
$\gamma_{(-1,35)}$(Ra)	182,3 (2)	0,0038 (13)
$\gamma_{9,2}$(Ra)	184,65 (5)	0,035 (4)
$\gamma_{25,10}$(Ra)	197,56 (10)	0,013 (4)
$\gamma_{11,4}$(Ra)	200,5 (1)	0,013 (9)
$\gamma_{20,7}$(Ra)	201,64 (10)	0,023 (3)
$\gamma_{(-1,37)}$(Ra)	202,5 (5)	0,006 (3)
$\gamma_{15,6}$(Ra)	204,14 (10)	0,22 (3)
$\gamma_{9,1}$(Ra)	204,98 (10)	0,16 (3)
$\gamma_{14,5}$(Ra)	206,08 (5)	0,25 (3)
$\gamma_{15,5}$(Ra)	210,62 (5)	1,22 (11)
$\gamma_{17,6}$(Ra)	212,70 (4)	0,077 (10)
$\gamma_{26,10}$(Ra)	212,7 (3)	0,019 (5)
$\gamma_{(-1,40)}$(Ra)	216,0 (1)	0,00025 (13)
$\gamma_{11,3}$(Ra)	218,90 (5)	0,107 (11)
$\gamma_{(-1,43)}$(Ra)	219,0 (2)	0,049 (12)
$\gamma_{(-1,45)}$(Ra)	223,2 (4)	0,0050 (13)
$\gamma_{26,9}$(Ra)	225,5 (3)	0,009 (3)
$\gamma_{21,7}$(Ra)	229,9 (5)	0,0038 (13)
$\gamma_{9,0}$(Ra)	234,76 (10)	0,44 (5)
$\gamma_{12,2}$(Ra)	235,96 (2)	12,6 (6)

	Energy keV	Photons per 100 disint.
$\gamma_{20,6}$(Ra)	246,12 (10)	0,0120 (22)
$\gamma_{(-1,63)}$(Ra)	248,1 (1)	0,024 (5)
$\gamma_{22,8}$(Ra)	249,6 (5)	0,0076 (25)
$\gamma_{11,1}$(Ra)	250,15 (5)	0,0087 (17)
$\gamma_{14,4}$(Ra)	250,27 (8)	0,44 (4)
$\gamma_{20,5}$(Ra)	252,50 (5)	0,108 (16)
$\gamma_{15,4}$(Ra)	254,63 (3)	0,69 (13)
$\gamma_{12,1}$(Ra)	256,23 (2)	6,8 (4)
$\gamma_{(-1,47)}$(Ra)	260,6 (2)	0,0051 (13)
$\gamma_{16,4}$(Ra)	262,87 (5)	0,105 (9)
$\gamma_{(-1,50)}$(Ra)	265,3 (2)	0,0050 (13)
$\gamma_{27,10}$(Ra)	267,05 (20)	0,010 (3)
$\gamma_{24,8}$(Ra)	267,86 (20)	0,0069 (25)
$\gamma_{25,7}$(Ra)	270,56 (20)	0,028 (9)
$\gamma_{15,3}$(Ra)	272,91 (5)	0,50 (3)
$\gamma_{14,2}$(Ra)	279,80 (5)	0,053 (13)
$\gamma_{21,5}$(Ra)	280,7 (3)	0,0025 (13)
$\gamma_{17,3}$(Ra)	281,42 (5)	0,174 (14)
$\gamma_{15,10}$(Ra)	284,24 (10)	0,039 (13)
$\gamma_{26,7}$(Ra)	285,52 (10)	0,043 (12)
$\gamma_{12,0}$(Ra)	286,09 (2)	1,70 (17)
$\gamma_{19,4}$(Ra)	289,59 (10)	1,9 (4)
$\gamma_{28,10}$(Ra)	289,77 (10)	0,019 (4)
$\gamma_{16,2}$(Ra)	292,41 (5)	0,064 (8)
$\gamma_{20,4}$(Ra)	296,50 (5)	0,43 (4)
$\gamma_{14,1}$(Ra)	299,98 (3)	2,16 (12)
$\gamma_{18,2}$(Ra)	300,50 (16)	0,014 (3)
$\gamma_{15,1}$(Ra)	304,50 (2)	1,12 (14)
$\gamma_{(-1,53)}$(Ra)	306,1 (3)	0,010 (4)
$\gamma_{23,5}$(Ra)	308,40 (3)	0,017 (3)
$\gamma_{16,1}$(Ra)	312,69 (3)	0,50 (4)
$\gamma_{(-1,55)}$(Ra)	314,75 (10)	0,034 (2)
$\gamma_{20,3}$(Ra)	314,85 (4)	0,48 (4)
$\gamma_{24,5}$(Ra)	318,46 (20)	0,0066 (22)
$\gamma_{19,2}$(Ra)	319,24 (5)	0,031 (7)
$\gamma_{21,4}$(Ra)	324,88 (20)	0,010 (3)
$\gamma_{20,2}$(Ra)	325,99 (18)	0,0062 (25)
$\gamma_{14,0}$(Ra)	329,85 (2)	2,9 (2)
$\gamma_{(-1,57)}$(Ra)	332,2 (2)	0,0016 (5)
$\gamma_{15,0}$(Ra)	334,37 (2)	1,11 (9)
$\gamma_{27,8}$(Ra)	339,76 (10)	0,0038 (13)
$\gamma_{16,0}$(Ra)	342,55 (4)	0,34 (9)
$\gamma_{20,1}$(Ra)	346,45 (1)	0,0117 (14)
$\gamma_{(-1,60)}$(Ra)	348,5 (5)	0,0066 (22)
$\gamma_{18,0}$(Ra)	350,54 (7)	0,107 (18)
$\gamma_{23,4}$(Ra)	352,61 (10)	0,0098 (22)
$\gamma_{22,3}$(Ra)	362,63 (10)	0,050 (3)
$\gamma_{19,0}$(Ra)	369,35 (5)	0,0060 (13)
$\gamma_{23,3}$(Ra)	370,93 (8)	0,004 (3)
$\gamma_{21,1}$(Ra)	374,8 (2)	0,00151 (7)
$\gamma_{20,0}$(Ra)	376,27 (10)	0,0050 (13)
$\gamma_{(-1,62)}$(Ra)	379,4 (1)	0,010 (3)
$\gamma_{23,2}$(Ra)	382,2 (3)	0,0063 (13)
$\gamma_{25,3}$(Ra)	383,51 (4)	0,024 (23)
$\gamma_{(-1,64)}$(Ra)	392,4 (5)	0,0098 (22)
$\gamma_{26,3}$(Ra)	398,6 (3)	0,0014 (4)
$\gamma_{23,1}$(Ra)	402,2 (3)	0,008 (5)
$\gamma_{25,1}$(Ra)	415,11 (10)	0,0014 (6)
$\gamma_{23,0}$(Ra)	432,33 (10)	0,0040 (5)

	Energy keV	Photons per 100 disint.
$\gamma_{(-1,66)}$(Ra)	442,5 (10)	0,000058 (3)
$\gamma_{(-1,68)}$(Ra)	445	0,0005 (5)
$\gamma_{49,26}$(Ra)	448,0 (6)	0,000139 (7)
$\gamma_{36,15}$(Ra)	452,9 (3)	0,001
$\gamma_{36,14}$(Ra)	457,5 (1)	0,000068 (3)
$\gamma_{(-1,70)}$(Ra)	462 (1)	0,000048 (2)
$\gamma_{30,5}$(Ra)	466,8 (2)	0,0005 (3)
$\gamma_{(-1,72)}$(Ra)	469,0 (2)	0,0009 (3)
$\gamma_{40,17}$(Ra)	480 (1)	0,00029 (9)
$\gamma_{43,20}$(Ra)	482 (1)	0,00014 (4)
$\gamma_{40,14}$(Ra)	493,1 (2)	0,00053 (8)
$\gamma_{42,15}$(Ra)	507,5 (1)	0,00064 (25)
$\gamma_{43,16}$(Ra)	516,6 (3)	0,00028 (10)
$\gamma_{(-1,74)}$(Ra)	521,8 (3)	0,00038 (13)
$\gamma_{43,15}$(Ra)	524,5 (4)	0,00019 (4)
$\gamma_{48,19}$(Ra)	534,6 (4)	0,00010 (3)
$\gamma_{40,12}$(Ra)	536,9 (1)	0,00107 (17)
$\gamma_{(-1,78)}$(Ra)	540,2 (3)	0,00025 (13)
$\gamma_{36,9}$(Ra)	552,4 (5)	0,00023 (5)
$\gamma_{42,12}$(Ra)	556,1 (2)	0,00037 (15)
$\gamma_{(-1,80)}$(Ra)	565,4 (1)	0,0014 (3)
$\gamma_{38,9}$(Ra)	569,1 (3)	0,00058 (9)
$\gamma_{50,18}$(Ra)	576,0 (2)	0,00032 (19)
$\gamma_{43,11}$(Ra)	579,0 (2)	0,0004 (3)
$\gamma_{(-1,82)}$(Ra)	585,8 (1)	0,0009 (3)
$\gamma_{40,9}$(Ra)	589,0 (6)	0,000058 (15)
$\gamma_{50,14}$(Ra)	596 (1)	0,0000101 (5)
$\gamma_{(-1,84)}$(Ra)	598,9 (2)	0,00063 (13)
$\gamma_{42,9}$(Ra)	607,7 (3)	0,00018 (4)
$\gamma_{49,12}$(Ra)	621,4 (5)	0,000058 (15)
$\gamma_{53,20}$(Ra)	623,8 (5)	0,00016 (4)
$\gamma_{33,4}$(Ra)	632,3 (7)	0,00014 (3)
$\gamma_{52,14}$(Ra)	641,0 (5)	0,000019 (6)
$\gamma_{45,9}$(Ra)	644,3 (3)	0,00009 (4)
$\gamma_{(-1,86)}$(Ra)	648,5 (5)	0,000019 (6)
$\gamma_{33,2}$(Ra)	662,8 (4)	0,000058 (18)
$\gamma_{50,9}$(Ra)	692,0 (7)	0,000039 (11)
$\gamma_{45,8}$(Ra)	704,3 (5)	0,000078 (16)
$\gamma_{36,4}$(Ra)	707,2 (7)	0,000039 (11)
$\gamma_{42,5}$(Ra)	718,5 (10)	0,000029 (11)
$\gamma_{35,3}$(Ra)	722,1 (6)	0,00037 (12)
$\gamma_{38,4}$(Ra)	723,5 (1)	0,00027 (10)
$\gamma_{35,2}$(Ra)	734,4 (5)	0,00010 (4)
$\gamma_{43,5}$(Ra)	735,4 (2)	0,00016 (5)
$\gamma_{36,2}$(Ra)	738,4 (10)	0,000068 (17)
$\gamma_{41,4}$(Ra)	746,4 (7)	0,00010 (4)
$\gamma_{45,6}$(Ra)	748,8 (4)	0,00040 (12)
$\gamma_{35,1}$(Ra)	754,1 (2)	0,00024 (14)
$\gamma_{36,1}$(Ra)	756,9 (2)	0,00019 (5)
$\gamma_{(-1,88)}$(Ra)	757,3 (4)	0,00102 (24)
$\gamma_{42,4}$(Ra)	762,6 (5)	0,00026 (5)
$\gamma_{41,3}$(Ra)	766,3 (5)	0,00029 (6)
$\gamma_{40,2}$(Ra)	773,4 (4)	0,00015 (4)
$\gamma_{41,2}$(Ra)	775,8 (5)	0,00151 (15)
$\gamma_{42,3}$(Ra)	781,0 (5)	0,00032 (6)
$\gamma_{35,0}$(Ra)	784,2 (5)	0,000097 (24)
$\gamma_{36,0}$(Ra)	787,4 (5)	0,000039 (10)
$\gamma_{(-1,95)}$(Ra)	787,6 (5)	0,00011 (3)
$\gamma_{40,1}$(Ra)	792,6 (6)	0,000029 (8)

	Energy keV	Photons per 100 disint.
$\gamma_{37,0}$(Ra)	792,6 (6)	0,000039 (10)
$\gamma_{43,3}$(Ra)	797,3 (5)	0,00090 (12)
$\gamma_{38,0}$(Ra)	803,9 (4)	0,00063 (6)
$\gamma_{43,2}$(Ra)	808,6 (4)	0,000076 (25)
$\gamma_{42,1}$(Ra)	812,6 (4)	0,0017 (3)
$\gamma_{(-1,92)}$(Ra)	818 (1)	0,000029 (11)
$\gamma_{45,3}$(Ra)	818,1 (2)	0,00017 (8)
$\gamma_{40,0}$(Ra)	823,4 (4)	0,0025 (3)
$\gamma_{41,0}$(Ra)	826,7 (5)	0,00016 (5)
$\gamma_{43,1}$(Ra)	828,5 (5)	0,00019 (5)
$\gamma_{(-1,94)}$(Ra)	828,9 (2)	0,00076 (4)
$\gamma_{44,1}$(Ra)	837,8 (5)	0,00052 (12)
$\gamma_{42,0}$(Ra)	842,5 (3)	0,00087 (13)
$\gamma_{50,4}$(Ra)	846,7 (5)	0,00015 (3)
$\gamma_{45,1}$(Ra)	848,3 (6)	0,00027 (11)
$\gamma_{46,1}$(Ra)	854,3 (5)	0,000068 (14)
$\gamma_{49,2}$(Ra)	857,3 (7)	0,000058 (18)
$\gamma_{43,0}$(Ra)	858,9 (2)	0,00025 (4)
$\gamma_{51,4}$(Ra)	863 (1)	0,000019 (8)
$\gamma_{44,0}$(Ra)	867,3 (5)	0,00029 (22)
$\gamma_{50,2}$(Ra)	876,3 (4)	0,00023 (8)
$\gamma_{49,1}$(Ra)	878,2 (4)	0,00014 (4)
$\gamma_{47,0}$(Ra)	891 (1)	0,000019 (6)
$\gamma_{51,2}$(Ra)	893 (1)	0,000013 (4)
$\gamma_{50,1}$(Ra)	896,1 (5)	0,00011 (3)
$\gamma_{49,0}$(Ra)	908,6 (4)	0,0023 (3)
$\gamma_{52,3}$(Ra)	910 (1)	0,000015 (6)
$\gamma_{53,4}$(Ra)	920,0 (5)	0,000011 (3)
$\gamma_{50,0}$(Ra)	927 (1)	0,000006 (3)
$\gamma_{53,3}$(Ra)	938,0 (8)	0,000010 (4)
$\gamma_{52,1}$(Ra)	941,6 (3)	0,000069 (11)
$\gamma_{55,3}$(Ra)	958,7 (3)	0,000061 (13)
$\gamma_{53,1}$(Ra)	970,2 (2)	0,00014 (11)
$\gamma_{52,0}$(Ra)	971,7 (10)	0,000010 (5)
$\gamma_{55,1}$(Ra)	990,0 (7)	0,000034 (9)
$\gamma_{56,1}$(Ra)	995 (1)	0,000006 (4)
$\gamma_{53,0}$(Ra)	999,8 (5)	0,000029 (8)
$\gamma_{54,0}$(Ra)	1015,2 (7)	0,000015 (4)
$\gamma_{55,0}$(Ra)	1020 (1)	0,000019 (6)
$\gamma_{56,0}$(Ra)	1025 (1)	0,000015 (4)

7 Main Production Modes

Ra – 226(n,γ)Ra – 227
Ra – 227(β^-)Ac – 227
Ac – 227(β^-)Th – 227

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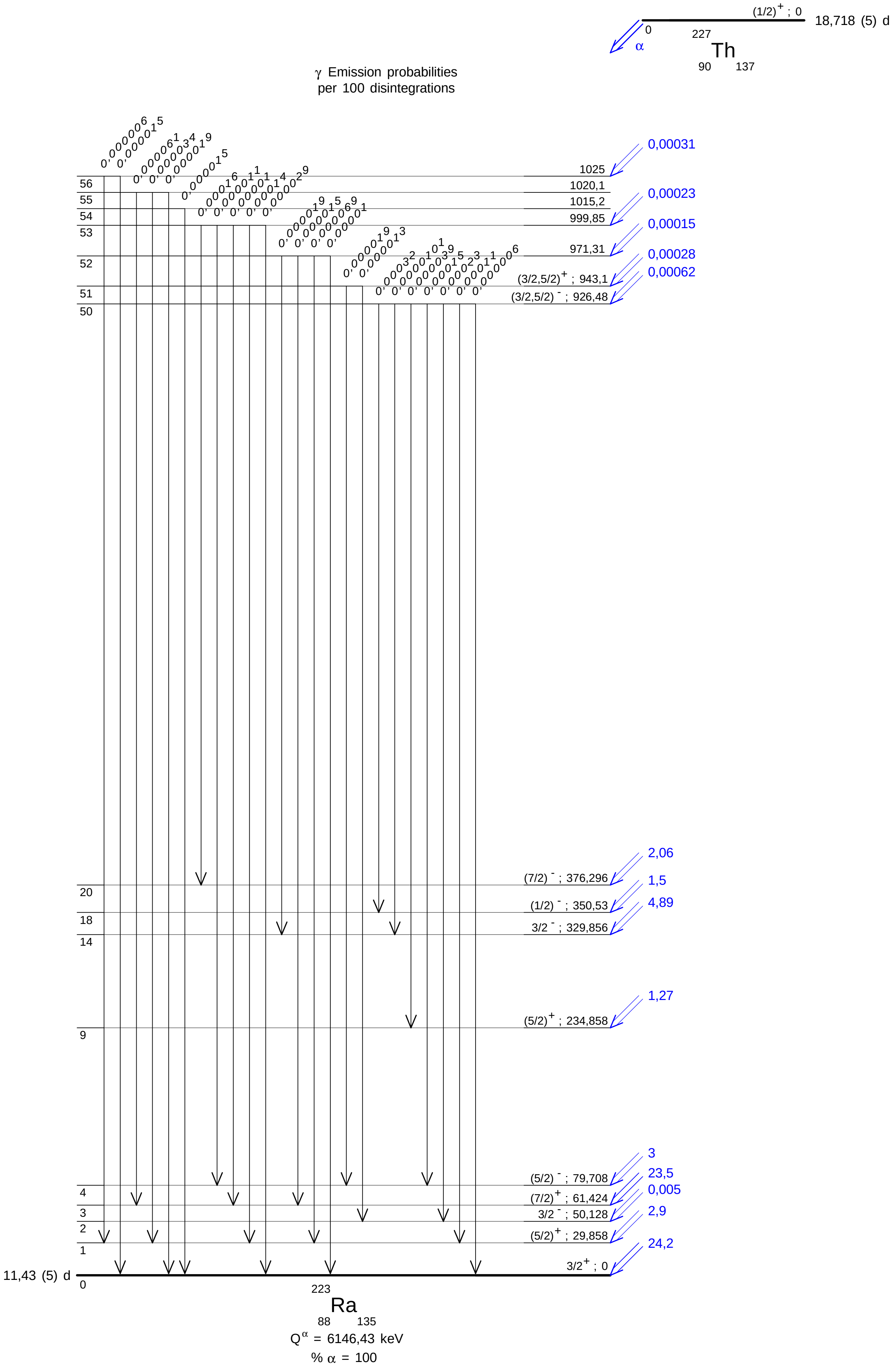
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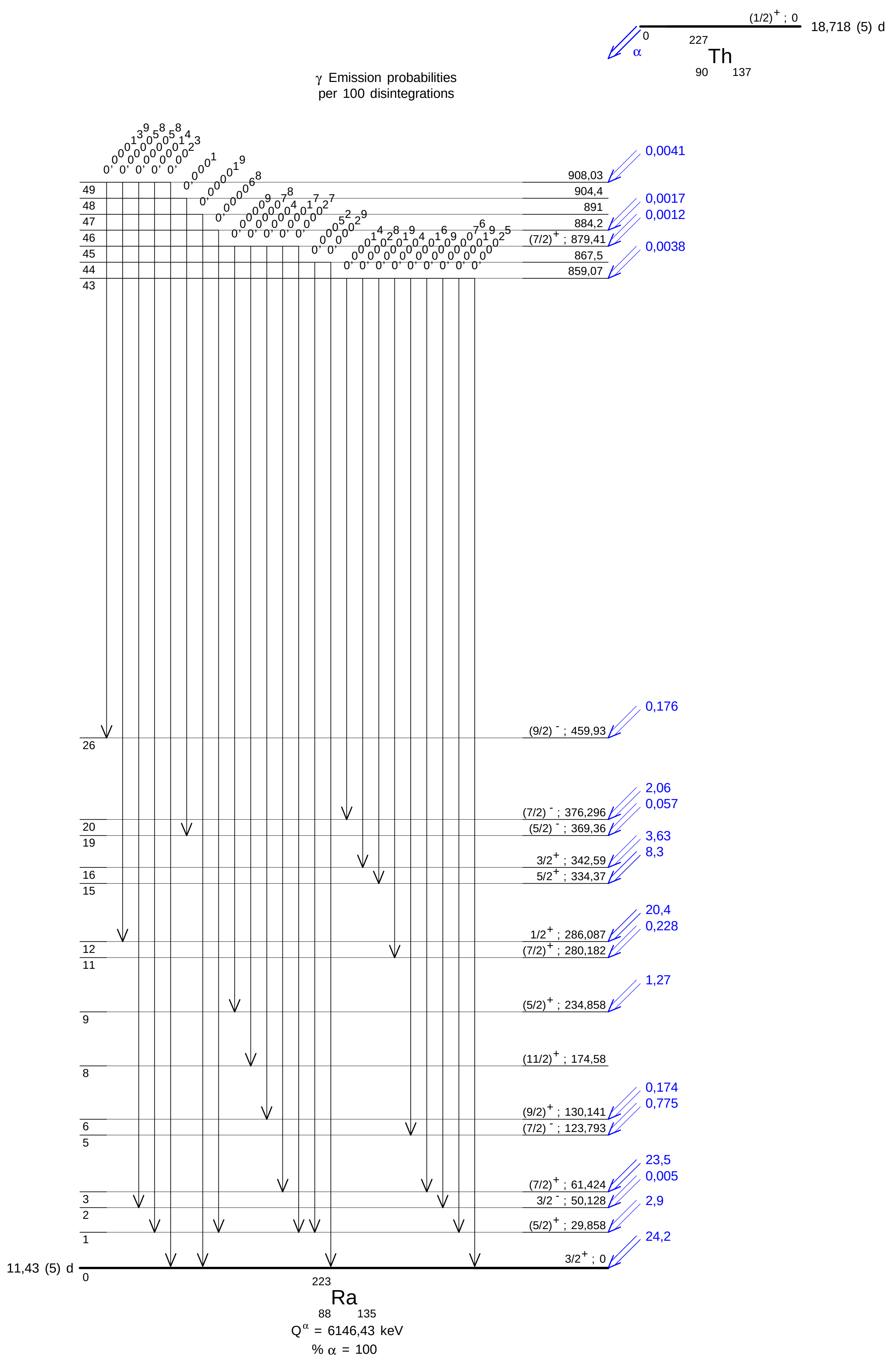
18,718 (5) d
227 Th 90 137
α
γ Emission probabilities
per 100 disintegrations
1025
1020,1
1015,2
999,85
971,31
(3/2,5/2)+ ; 943,1
(3/2,5/2)- ; 926,48
(7/2)- ; 376,296
(1/2)- ; 350,53
3/2- ; 329,856
(5/2)+ ; 234,858
(5/2)- ; 79,708
(7/2)+ ; 61,424
3/2- ; 50,128
(5/2)+ ; 29,858
3/2+ ; 0
0,00031
0,00023
0,00015
0,00028
0,00062
2,06
1,5
4,89
1,27
3
23,5
0,005
2,9
24,2
11,43 (5) d
223 Ra 88 135
Qα = 6146,43 keV
% α = 100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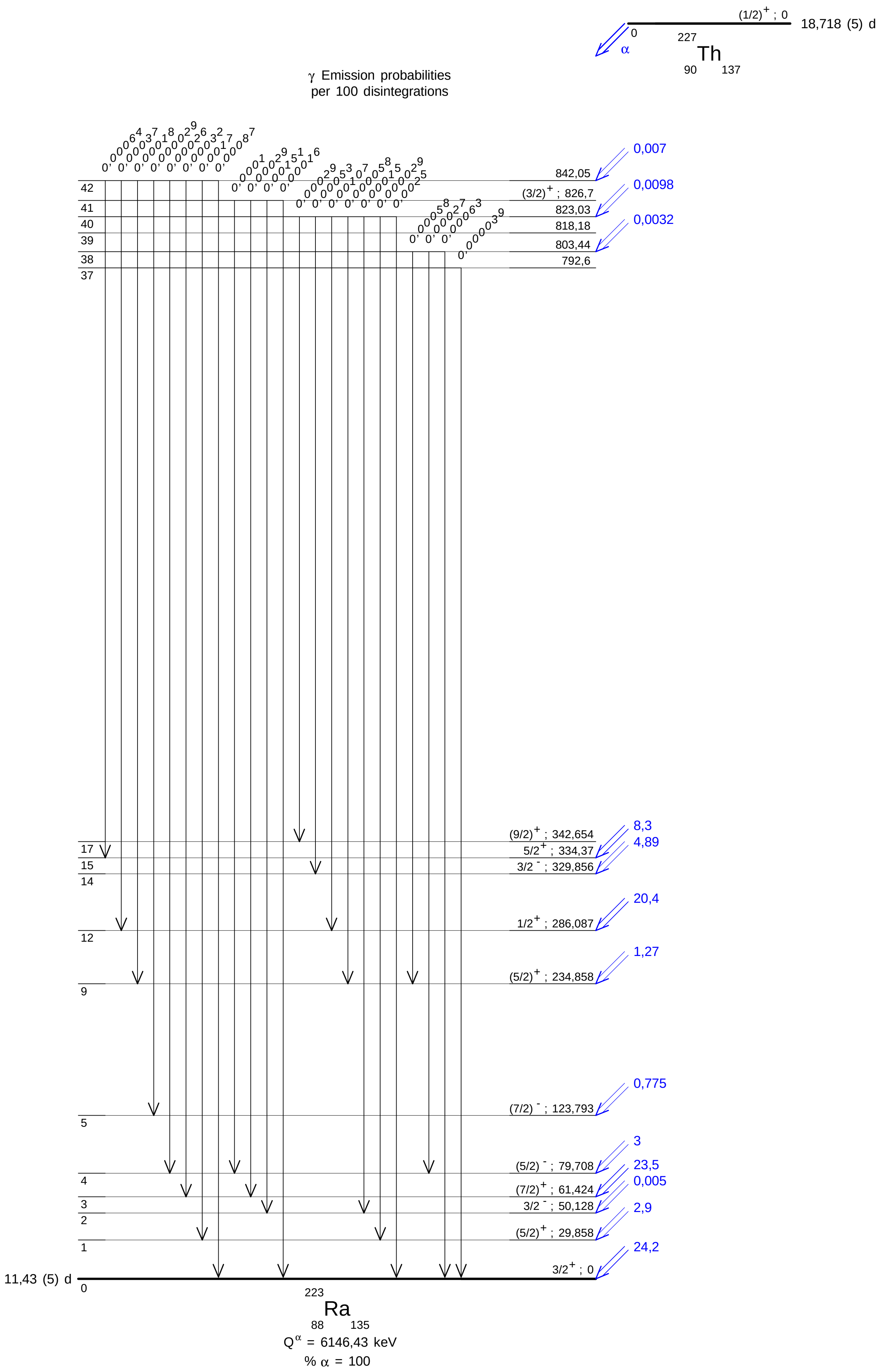
18,718 (5) d
227 Th 90 137
γ Emission probabilities
per 100 disintegrations
908,03
904,4
891
884,2
(7/2)+ ; 879,41
867,5
859,07
(9/2)- ; 459,93
(7/2)- ; 376,296
(5/2)- ; 369,36
3/2+ ; 342,59
5/2+ ; 334,37
1/2+ ; 286,087
(7/2)+ ; 280,182
(5/2)+ ; 234,858
(11/2)+ ; 174,58
(9/2)+ ; 130,141
(7/2)- ; 123,793
(7/2)+ ; 61,424
3/2- ; 50,128
(5/2)+ ; 29,858
3/2+ ; 0
0,0041
0,0017
0,0012
0,0038
0,176
2,06
0,057
3,63
8,3
20,4
0,228
1,27
0,174
0,775
23,5
0,005
2,9
24,2
11,43 (5) d
223 Ra 88 135
Qα = 6146,43 keV
% α = 100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18,718 (5) d
227 Th 90 137
α
γ Emission probabilities
per 100 disintegrations
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0,0098
0,0032
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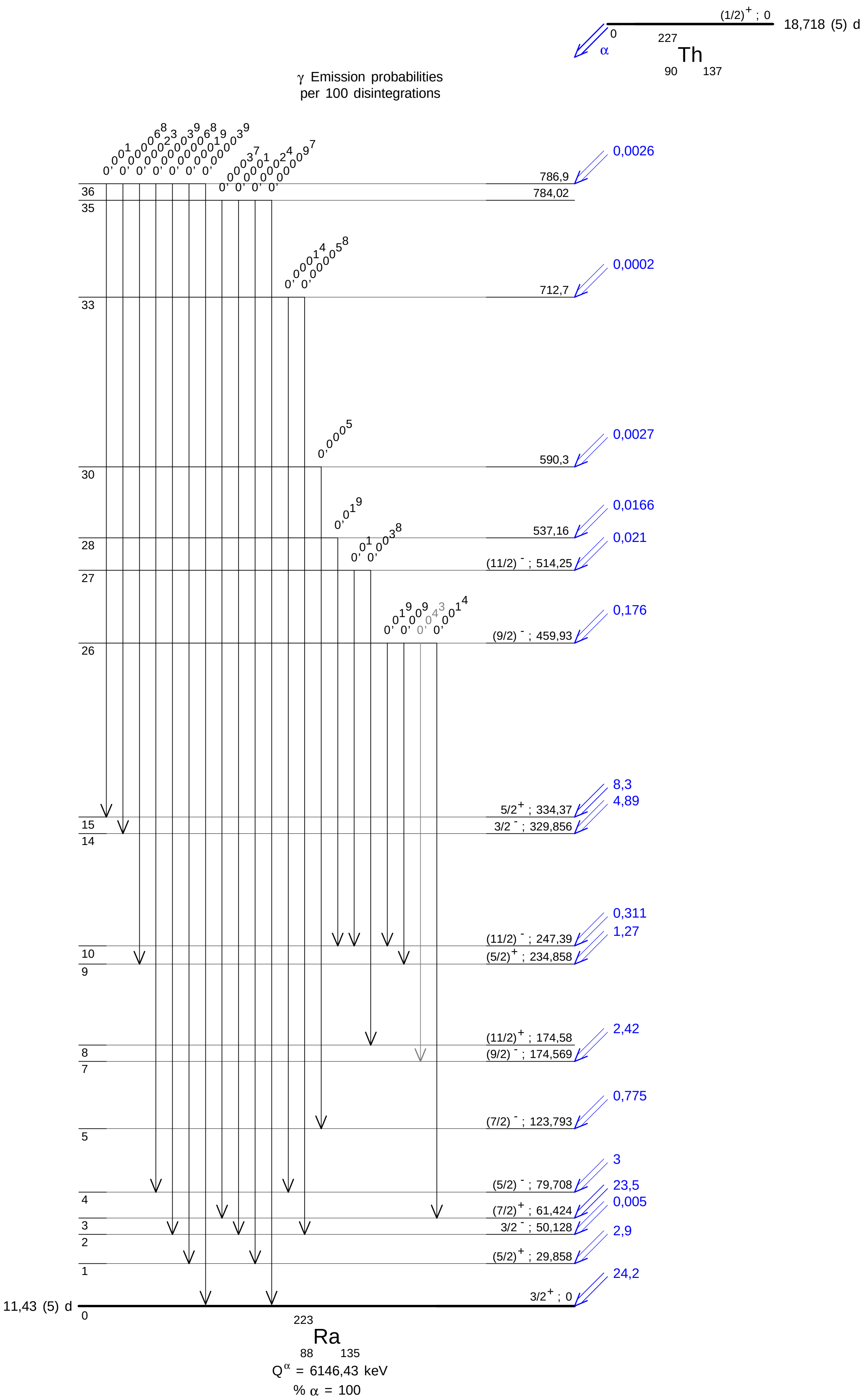
(3/2)+ ; 826,7
823,03
818,18
803,44
792,6
(9/2)+ ; 342,654
5/2+ ; 334,37
3/2 - ; 329,856
1/2+ ; 286,087
(5/2)+ ; 234,858
(7/2) - ; 123,793
(5/2) - ; 79,708
(7/2)+ ; 61,424
3/2 - ; 50,128
(5/2)+ ; 29,858
3/2+ ; 0
8,3
4,89
20,4
1,27
0,775
3
23,5
0,005
2,9
24,2
11,43 (5) d
223 Ra 88 135
Qα = 6146,43 keV
% α = 100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18,718 (5) d
α
227 Th 90 137
γ Emission probabilities
per 100 disintegrations
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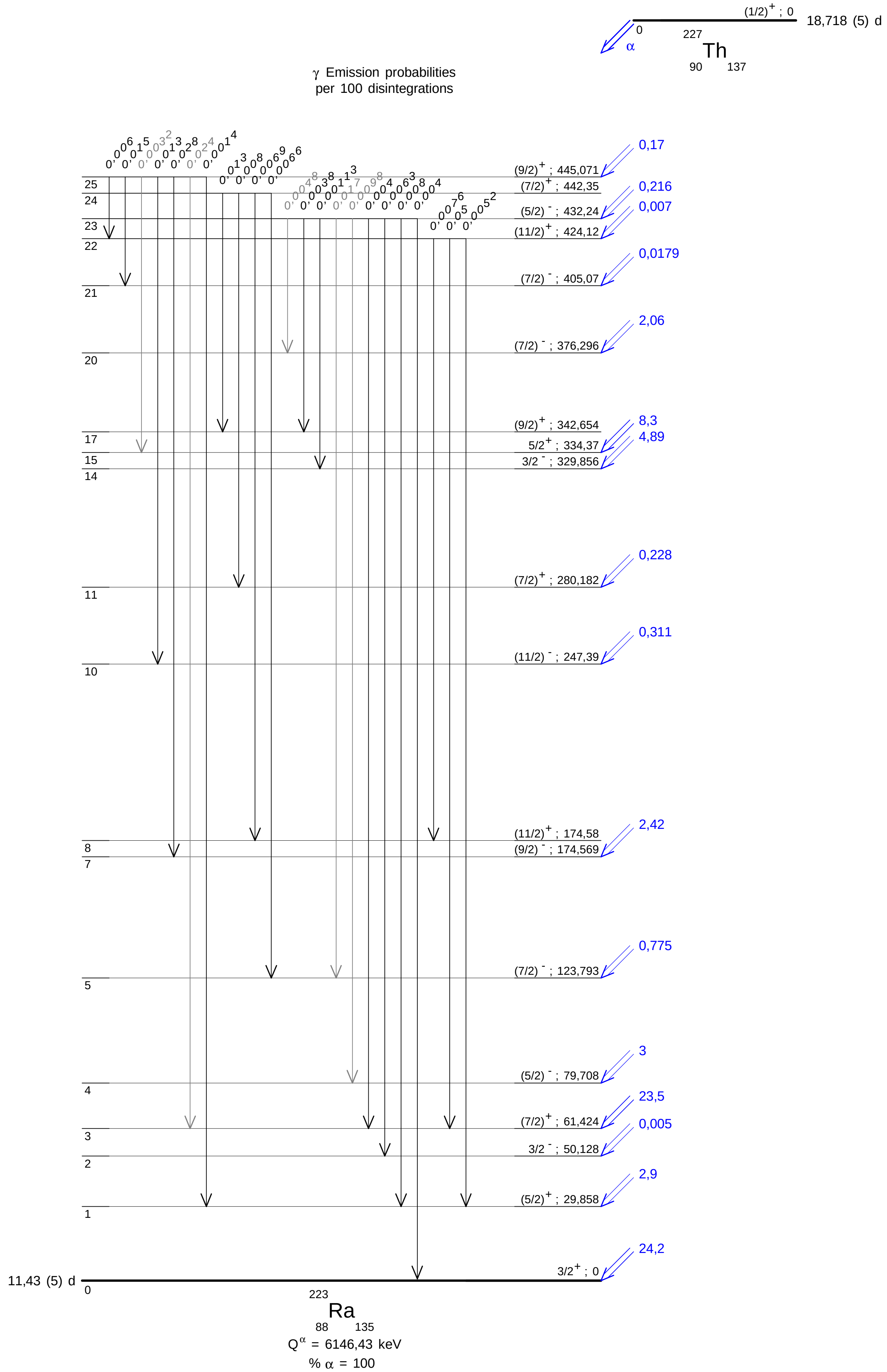
784,02
712,7
590,3
537,16
(11/2)- ; 514,25
(9/2)- ; 459,93
5/2+ ; 334,37
3/2- ; 329,856
(11/2)- ; 247,39
(5/2)+ ; 234,858
(11/2)+ ; 174,58
(9/2)- ; 174,569
(7/2)- ; 123,793
(5/2)- ; 79,708
(7/2)+ ; 61,424
3/2- ; 50,128
(5/2)+ ; 29,858
3/2+ ; 0
0,0026
0,0002
0,0027
0,0166
0,021
0,176
8,3
4,89
0,311
1,27
2,42
0,775
3
23,5
0,005
2,9
24,2
11,43 (5) d
223 Ra 88 135
Qα = 6146,43 keV
% α = 100



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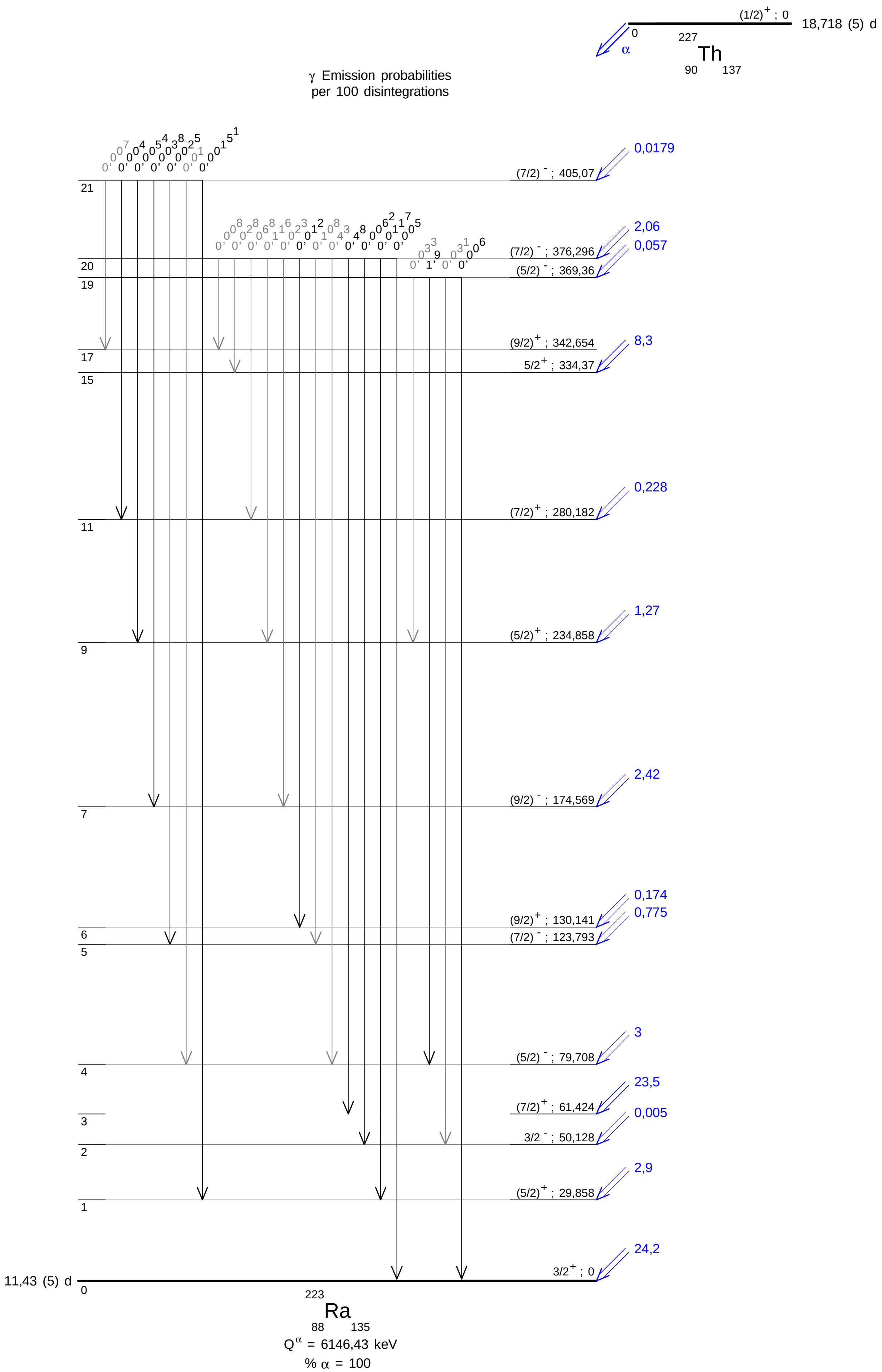
18,718 (5) d
227 Th 90 137
α
γ Emission probabilities
per 100 disintegrations
(9/2)+ ; 445,071
0,17
(7/2)+ ; 442,35
0,216
(5/2) - ; 432,24
0,007
(11/2)+ ; 424,12
(7/2) - ; 405,07
0,0179
(7/2) - ; 376,296
2,06
(9/2)+ ; 342,654
8,3
5/2+ ; 334,37
4,89
3/2 - ; 329,856
(7/2)+ ; 280,182
0,228
(11/2) - ; 247,39
0,311
(11/2)+ ; 174,58
2,42
(9/2) - ; 174,569
(7/2) - ; 123,793
0,775
(5/2) - ; 79,708
3
(7/2)+ ; 61,424
23,5
3/2 - ; 50,128
0,005
(5/2)+ ; 29,858
2,9
3/2+ ; 0
24,2
11,43 (5) d
223 Ra 88 135
Qα = 6146,43 keV
% α = 100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18,718 (5) d
α
227 Th 90 137
γ Emission probabilities
per 100 disintegrations
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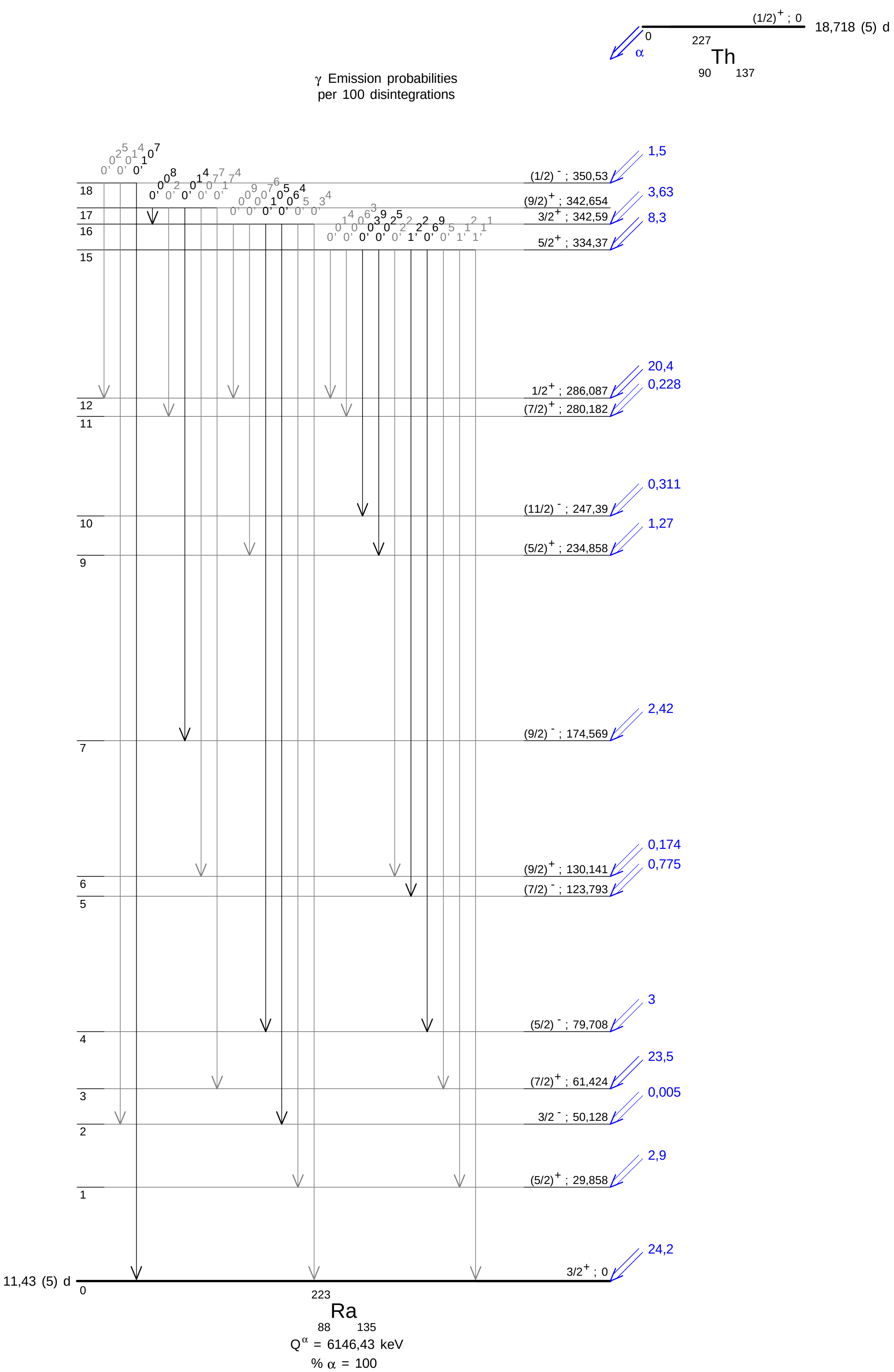
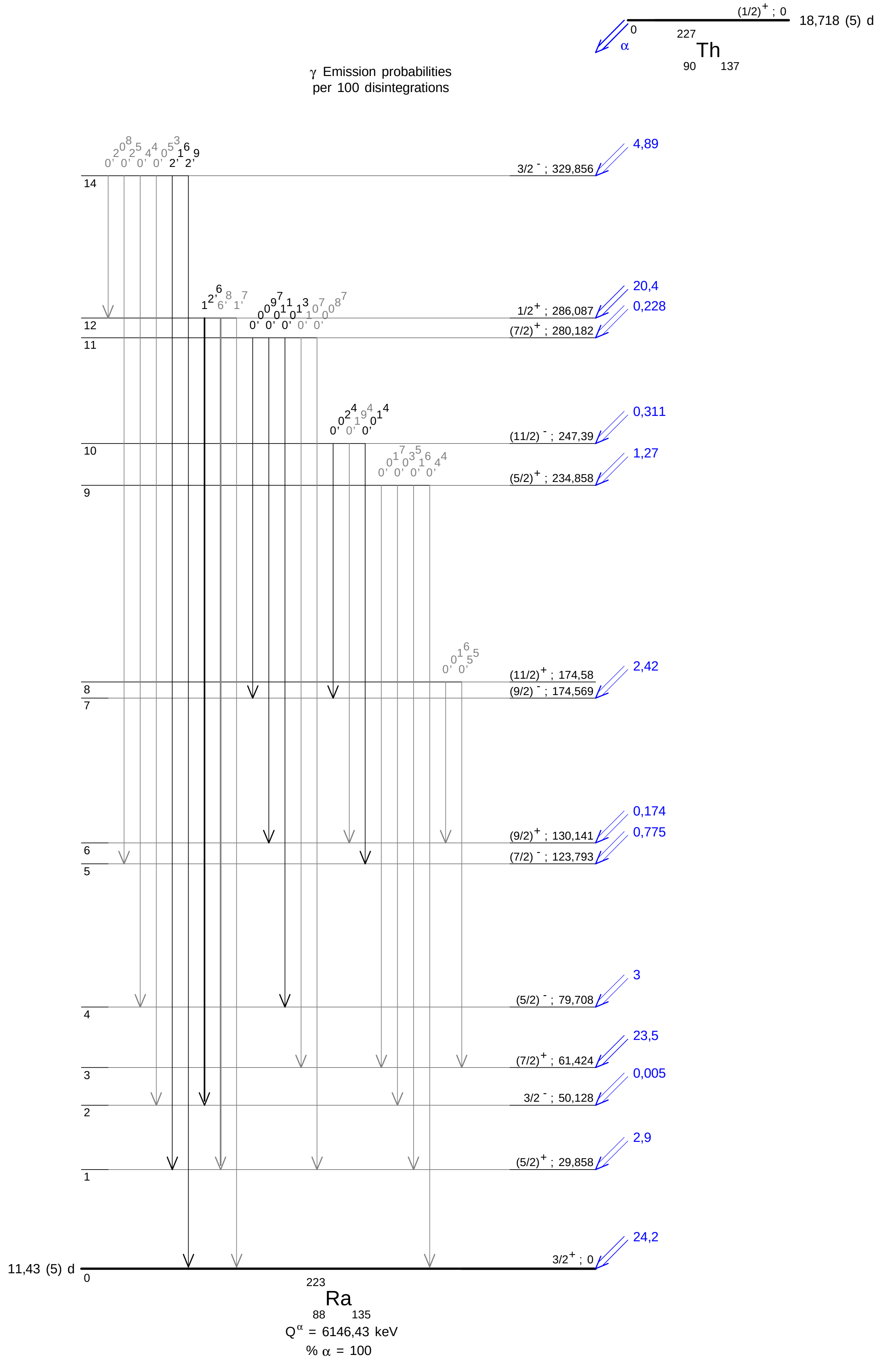
(7/2) - ; 405,07
2,06
0,057
(7/2) - ; 376,296
(5/2) - ; 369,36
8,3
(9/2)+ ; 342,654
5/2+ ; 334,37
0,228
(7/2)+ ; 280,182
1,27
(5/2)+ ; 234,858
2,42
(9/2) - ; 174,569
0,174
0,775
(9/2)+ ; 130,141
(7/2) - ; 123,793
3
(5/2) - ; 79,708
23,5
(7/2)+ ; 61,424
0,005
3/2 - ; 50,128
2,9
(5/2)+ ; 29,858
24,2
3/2+ ; 0
11,43 (5) d
223 Ra 88 135
Q$^{\alpha}$ = 6146,43 keV
% α = 100



(1/2)+ ; 0
18,718 (5) d
α
227 Th 90 137
γ Emission probabilities
per 100 disintegrations
(1/2)- ; 350,53
1,5
(9/2)+ ; 342,654
3,63
3/2+ ; 342,59
8,3
5/2+ ; 334,37
1/2+ ; 286,087
20,4
(7/2)+ ; 280,182
0,228
(11/2)- ; 247,39
0,311
(5/2)+ ; 234,858
1,27
(9/2)- ; 174,569
2,42
(9/2)+ ; 130,141
0,174
(7/2)- ; 123,793
0,775
(5/2)- ; 79,708
3
(7/2)+ ; 61,424
23,5
3/2- ; 50,128
0,005
(5/2)+ ; 29,858
2,9
3/2+ ; 0
24,2
11,43 (5) d
223 Ra 88 135
Qα = 6146,43 keV
% α = 100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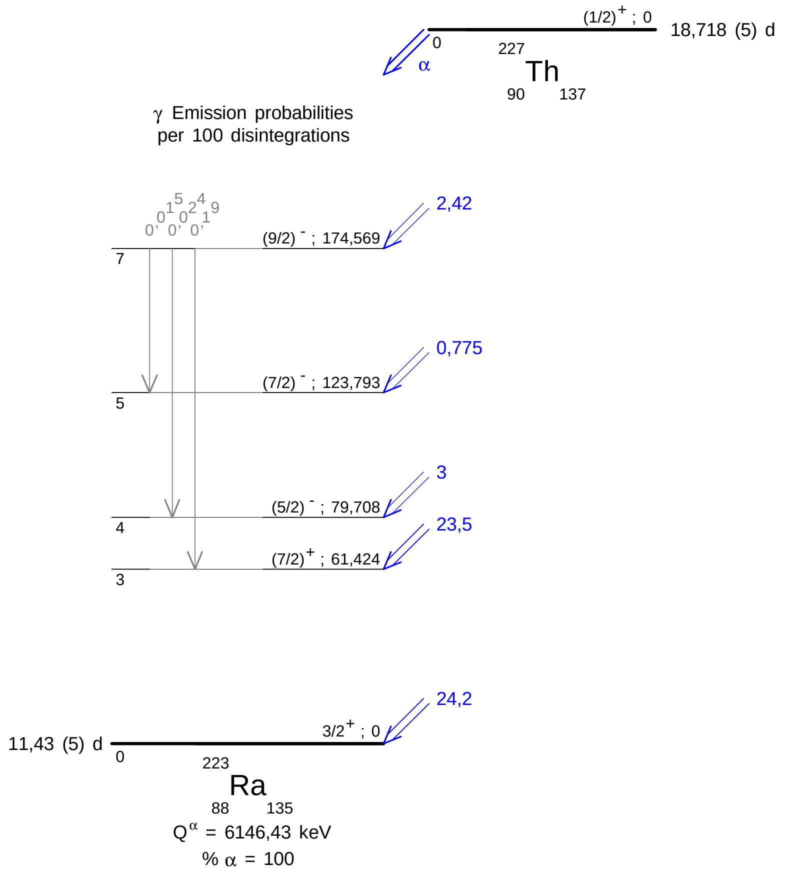
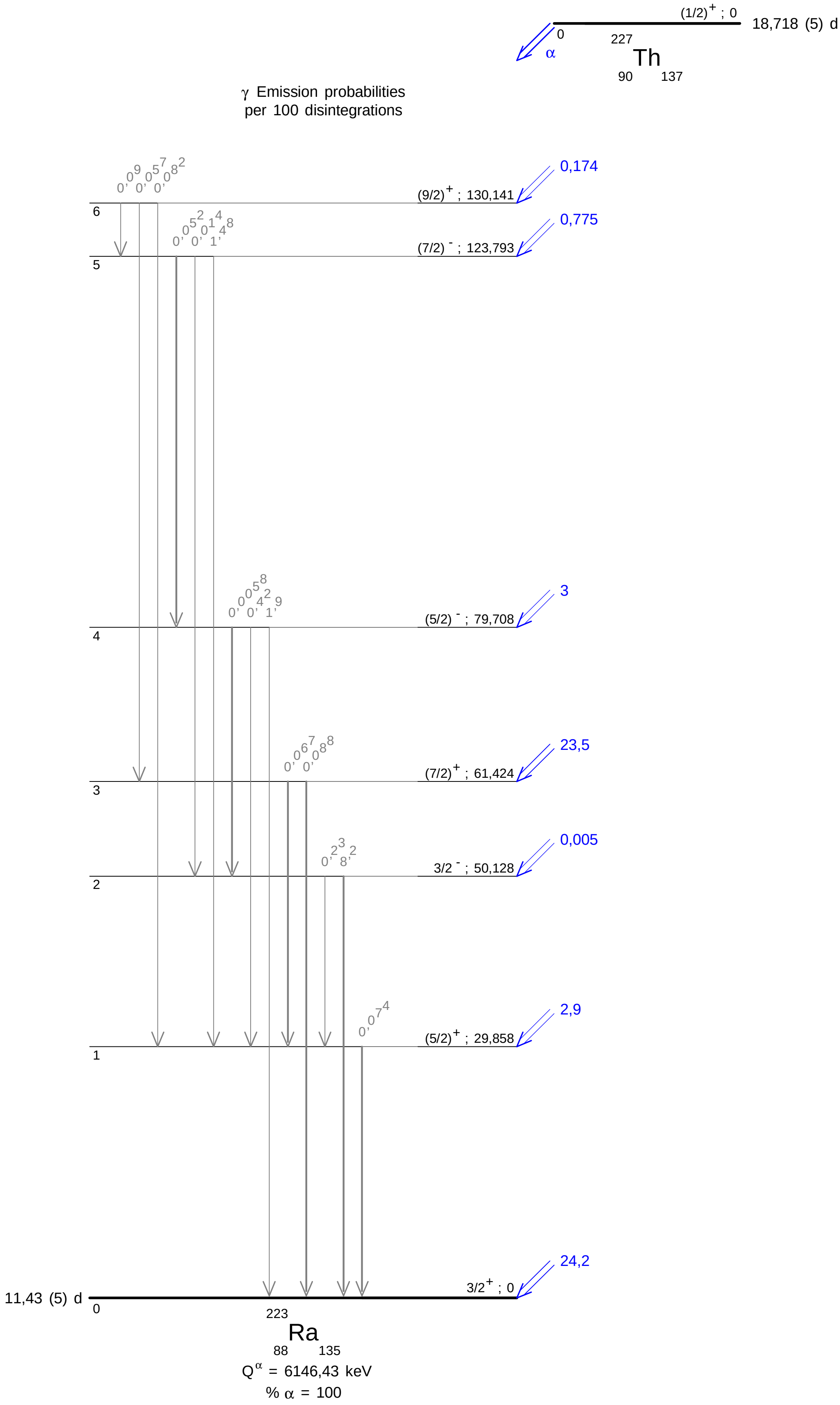
18,718 (5) d
α
227 Th 90 137
γ Emission probabilities
per 100 disintegrations
3/2 - ; 329,856
4,89
1/2+ ; 286,087
20,4
(7/2)+ ; 280,182
0,228
(11/2) - ; 247,39
0,311
(5/2)+ ; 234,858
1,27
(11/2)+ ; 174,58
(9/2) - ; 174,569
2,42
(9/2)+ ; 130,141
0,174
(7/2) - ; 123,793
0,775
(5/2) - ; 79,708
3
(7/2)+ ; 61,424
23,5
3/2 - ; 50,128
0,005
(5/2)+ ; 29,858
2,9
3/2+ ; 0
24,2
11,43 (5) d
223 Ra 88 135
Qα = 6146,43 keV
% α = 100


(1/2)+ ; 0
18,718 (5) d
0
α
227
Th
90 137
γ Emission probabilities
per 100 disintegrations
2,42
(9/2) - ; 174,569
7
0,775
(7/2) - ; 123,793
5
3
(5/2) - ; 79,708
4
23,5
(7/2)+ ; 61,424
3
24,2
3/2+ ; 0
11,43 (5) d
0
223
Ra
88 135
Qα = 6146,43 keV
% α = 100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18,718 (5) d
0
α
227
Th
90 137
γ Emission probabilities
per 100 disintegrations
(9/2)+ ; 130,141
0,174
(7/2) - ; 123,793
0,775
(5/2) - ; 79,708
3
(7/2)+ ; 61,424
23,5
3/2 - ; 50,128
0,005
(5/2)+ ; 29,858
2,9
3/2+ ; 0
24,2
11,43 (5) d
223
Ra
88 135
Qα = 6146,43 keV
% α = 100

$^{228}_{90}$Th$_{138}$

1 Decay Scheme

Th-228 decays 100% by alpha-particle emission to various excited levels and the ground state of Ra-224.
Le thorium 228 se désintègre par émission alpha principalement vers le niveau fondamental et le niveau excité de 84,4 keV de radium 224.

2 Nuclear Data

$T_{1/2}(^{228}$Th)	:	698,60	(23)	d
$T_{1/2}(^{224}$Ra)	:	3,627	(7)	d
$Q^{\alpha}(^{228}$Th)	:	5520,12	(22)	keV

2.1 α Transitions

	Energy keV	Probability × 100	F
$\alpha_{0,8}$	4527,5 (3)	0,0000044 (12)	7,37
$\alpha_{0,7}$	4603,8 (3)	0,000017 (3)	6,96
$\alpha_{0,6}$	5040,9 (4)	0,000025 (5)	4370
$\alpha_{0,5}$	5087,1 (3)	0,000010 (3)	21300
$\alpha_{0,4}$	5229,76 (26)	0,036 (7)	44,1
$\alpha_{0,3}$	5269,34 (23)	0,20 (2)	13,6
$\alpha_{0,2}$	5304,14 (22)	0,38 (3)	11,5
$\alpha_{0,1}$	5435,75 (22)	26,2 (2)	0,948
$\alpha_{0,0}$	5520,12 (22)	73,2 (2)	1

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M+	α_T
$\gamma_{4,2}$(Ra)	74,4 (1)	0,016 (6)	[E2]		28,9 (8)	7,89 (16)	39,5 (8)
$\gamma_{1,0}$(Ra)	84,373 (3)	26,6 (14)	E2		15,9 (3)	5,8 (1)	21,7 (4)
$\gamma_{2,1}$(Ra)	131,612 (4)	0,155 (8)	E1	0,195 (4)	0,041 (1)	0,013 (1)	0,249 (6)
$\gamma_{5,4}$(Ra)	142,7 (1)	0,0000041 (13)	[E2]	0,280 (6)	1,396 (28)	0,50 (1)	2,18 (4)
$\gamma_{3,1}$(Ra)	166,410 (4)	0,205 (16)	E2	0,225 (5)	0,704 (14)	0,256 (5)	1,185 (24)
$\gamma_{5,3}$(Ra)	182,3 (1)	0,0000056 (20)	[E1]	0,090 (2)	0,0178 (3)	0,0060 (1)	0,114 (2)
$\gamma_{4,1}$(Ra)	205,99 (4)	0,0201 (11)	[E1]	0,0676 (14)	0,0131 (3)	0,0042 (1)	0,0849 (17)
$\gamma_{2,0}$(Ra)	215,985 (4)	0,243 (22)	E1	0,0605 (12)	0,01160 (25)	0,0038 (1)	0,0759 (15)
$\gamma_{6,3}$(Ra)	228,4 (2)	0,000025 (5)	[E2]	0,125 (2)	0,182 (4)	0,065 (1)	0,372 (7)
$\gamma_{7,2}$(Ra)	700,4 (1)	0,0000029 (9)	E1	0,00508 (10)	0,00084 (2)	0,000270 (5)	0,00619 (12)
$\gamma_{8,3}$(Ra)	741,87 (1)	0,0000014 (4)	[E2]	0,0121 (2)	0,00330 (6)	0,00110 (2)	0,0165 (3)
$\gamma_{7,1}$(Ra)	832,0 (1)	0,000014 (2)	E2+M3	0,0098 (2)	0,00240 (5)	0,00090 (2)	0,0131 (3)
$\gamma_{8,1}$(Ra)	908,28 (1)	0,0000016 (5)	[M1+50%E2]	0,0203 (20)	0,0038 (4)	0,0012 (1)	0,0253 (25)
$\gamma_{8,0}$(Ra)	992,65 (6)	0,0000014 (4)	[E2]	0,00720 (15)	0,00160 (3)	0,00050 (1)	0,0093 (2)

3 Atomic Data

3.1 Ra

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

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	85,43		61,22
	$K\alpha_1$	88,47		100
	$K\beta_3$	99,432	}	
	$K\beta_1$	100,13	}	
	$K\beta_5''$	100,738	}	34,9
	$K\beta_2$	102,89	}	
	$K\beta_4$	103,295	}	11,51
	$KO_{2,3}$	103,74	}	
X_L				
	$L\ell$	10,622		
	$L\alpha$	12,196 – 12,339		
	$L\eta$	13,662		
	$L\beta$	14,236 – 15,447		
	$L\gamma$	17,848 – 18,412		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	65,15 – 72,73	100
KLX	79,72 – 88,47	58
KXY	94,27 – 103,91	8,4
Auger L	5,71 – 12,04	9050

4 α Emissions

	Energy keV	Probability × 100
$\alpha_{0,8}$	4448,0 (3)	0,0000044 (12)
$\alpha_{0,7}$	4523,0 (3)	0,000017 (3)
$\alpha_{0,6}$	4952,5 (4)	0,000025 (5)
$\alpha_{0,5}$	4997,8 (3)	0,000010 (3)
$\alpha_{0,4}$	5138,01 (26)	0,036 (7)
$\alpha_{0,3}$	5176,89 (23)	0,20 (2)
$\alpha_{0,2}$	5211,08 (22)	0,38 (3)
$\alpha_{0,1}$	5340,38 (22)	26,2 (2)
$\alpha_{0,0}$	5423,28 (22)	73,2 (2)

5 Electron Emissions

		Energy keV	Electrons per 100 disint.
e_{AL}	(Ra)	5,71 - 12,04	10,5 (4)
e_{AK}	(Ra)		0,00193 (26)
	KLL	65,15 - 72,73	}
	KLX	79,72 - 88,47	}
	KXY	94,27 - 103,91	}
$ec_{1,0\ T}$	(Ra)	65,14 - 84,09	25,4 (8)
$ec_{1,0\ L}$	(Ra)	65,14 - 68,93	18,6 (6)
$ec_{1,0\ M}$	(Ra)	79,55 - 84,09	6,8 (2)
$ec_{2,0\ K}$	(Ra)	112,067 (5)	0,180 (6)
$ec_{3,1\ L}$	(Ra)	147,17 - 150,97	0,066 (2)

6 Photon Emissions

6.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Ra)	10,622 — 18,412		8,8 (4)	
XKα_2	(Ra)	85,43		0,0172 (8)	} Kα
XKα_1	(Ra)	88,47		0,0281 (12)	}
XKβ_3	(Ra)	99,432	}		
XKβ_1	(Ra)	100,13	}	0,0098 (5)	K$'\beta_1$
XKβ_5''	(Ra)	100,738	}		
XKβ_2	(Ra)	102,89	}		
XKβ_4	(Ra)	103,295	}	0,00323 (16)	K$'\beta_2$
XKO$_{2,3}$	(Ra)	103,74	}		

6.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{4,2}$(Ra)	74,4 (1)	0,00039 (14)
$\gamma_{1,0}$(Ra)	84,373 (3)	1,17 (5)
$\gamma_{2,1}$(Ra)	131,612 (4)	0,124 (6)
$\gamma_{5,4}$(Ra)	142,7 (1)	0,0000013 (4)
$\gamma_{3,1}$(Ra)	166,410 (4)	0,094 (7)
$\gamma_{5,3}$(Ra)	182,3 (1)	0,0000050 (18)
$\gamma_{4,1}$(Ra)	205,99 (4)	0,0185 (10)
$\gamma_{2,0}$(Ra)	215,985 (4)	0,226 (20)
$\gamma_{6,3}$(Ra)	228,4 (2)	0,000018 (4)
$\gamma_{7,2}$(Ra)	700,4 (1)	0,0000029 (9)
$\gamma_{8,3}$(Ra)	741,87 (1)	0,0000014 (4)
$\gamma_{7,1}$(Ra)	832,0 (1)	0,000014 (2)
$\gamma_{8,1}$(Ra)	908,28 (1)	0,0000016 (5)
$\gamma_{8,0}$(Ra)	992,65 (6)	0,0000014 (4)

7 Main Production Modes

Th – 230(p,t)Th – 228

Th – 230(α,α2nγ)Th – 228

Ra – 226(α,2nγ)Th – 228

U – 232 alpha decay

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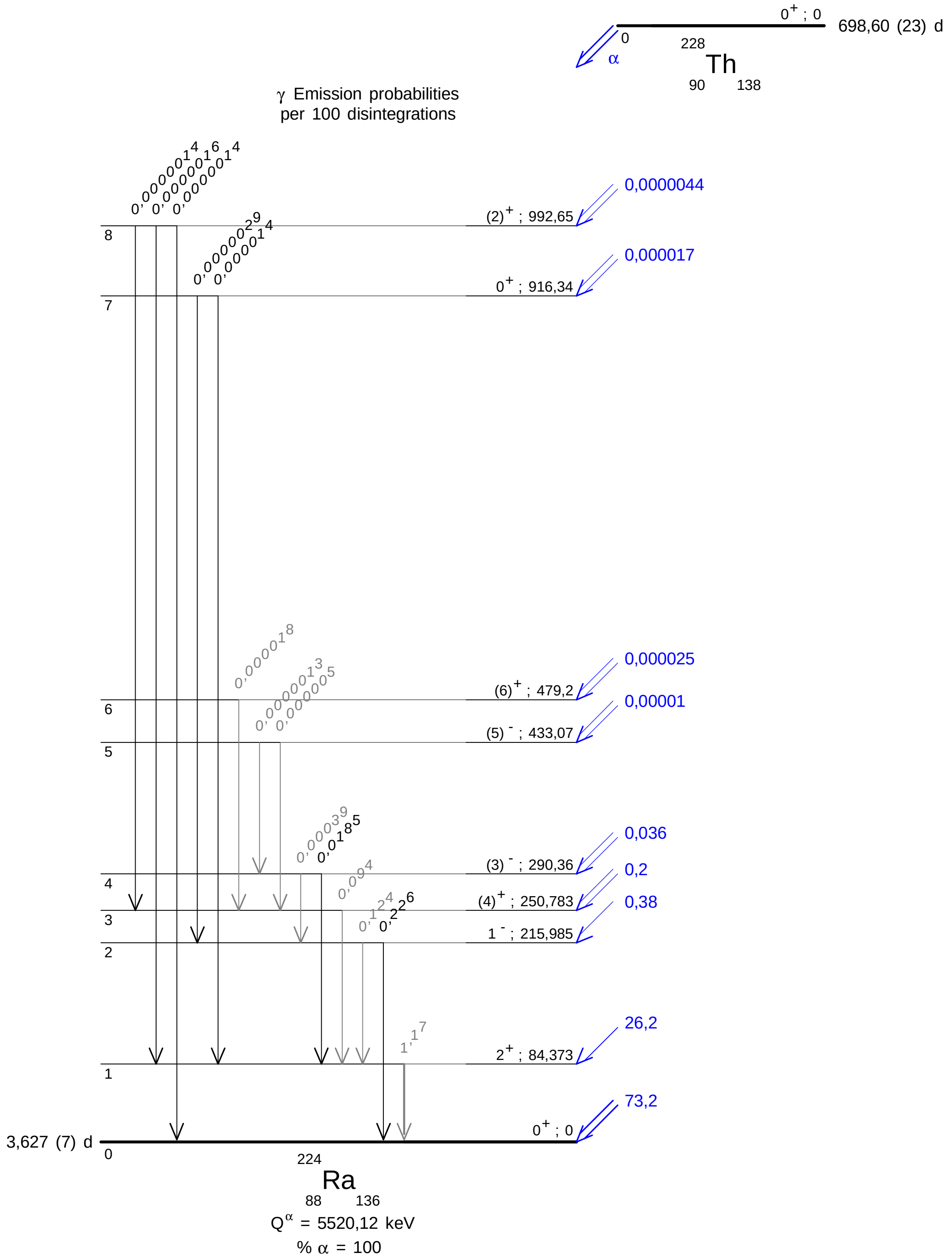
0+ ; 0
698,60 (23) d
0
α
228
Th
90
138
γ Emission probabilities
per 100 disintegrations
0,0000044
(2)+ ; 992,65
0,000017
0+ ; 916,34
0,000025
(6)+ ; 479,2
0,00001
(5) - ; 433,07
0,036
(3) - ; 290,36
0,2
(4)+ ; 250,783
0,38
1 - ; 215,985
26,2
2+ ; 84,373
73,2
0+ ; 0
8
7
6
5
4
3
2
1
0
3,627 (7) d
224
Ra
88
136
Qα = 5520,12 keV
% α = 100

$^{238}_{94}$Pu$_{144}$

1 Decay Scheme

Pu-238 decays by alpha transitions to U-234. Most of the alpha decay populates the U-234 ground state (71.04%) and the U-234 first excited level with energy of 43.5 keV (28.85%). Branching of Pu-238 decay by spontaneous fission is 1.85(5) 10^{-7} %.
Le plutonium 238 se désintègre par émission alpha vers le niveau fondamental de l'uranium 234 (71,04%) et vers l'état excité de 43,5 keV. Le nombre de désintégrations par fission spontanée est de 1,85(5) 10^{-7} *%.*

2 Nuclear Data

$T_{1/2}(^{238}$Pu)	:	87,74	(3)	a
$T_{1/2}(^{234}$U)	:	245,5	(6)	10^3 a
$Q^{\alpha}(^{238}$Pu)	:	5593,20	(19)	keV

2.1 α Transitions

	Energy keV	Probability × 100	F
$\alpha_{0,14}$	4507,90 (24)	~ 1,2 10^{-6}	3,5
$\alpha_{0,13}$	4548,67 (20)	1,17 (7) 10^{-6}	7,5
$\alpha_{0,12}$	4569,5 (3)	~ 2,0 10^{-7}	64
$\alpha_{0,11}$	4603,75 (20)	1,52 (16) 10^{-7}	152,9
$\alpha_{0,10}$	4645,35 (24)	1,7 (4) 10^{-7}	28
$\alpha_{0,9}$	4666,46 (20)	1,30 (5) 10^{-6}	53
$\alpha_{0,8}$	4741,50 (24)	8,2 (17) 10^{-6}	30,1
$\alpha_{0,7}$	4743,9 (2)	7,4 (22) 10^{-8}	3470
$\alpha_{0,6}$	4783,32 (20)	1,0 (4) 10^{-4}	5
$\alpha_{0,5}$	4806,91 (20)	8,21 (16) 10^{-6}	89,04
$\alpha_{0,4}$	5096,16 (20)	6,85 (23) 10^{-6}	10000
$\alpha_{0,3}$	5297,13 (19)	0,00297 (4)	432
$\alpha_{0,2}$	5449,85 (19)	0,105 (3)	101
$\alpha_{0,1}$	5549,70 (19)	28,85 (6)	1,394
$\alpha_{0,0}$	5593,20 (19)	71,04 (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
$\gamma_{8,6}$(U)	41,82 (11)	2,7 (14) 10^{-6}	(E2)		645 (13)	178 (4)	885 (18)
$\gamma_{1,0}$(U)	43,498 (1)	29,1 (8)	E2		532 (11)	147 (3)	731 (15)
$\gamma_{11,9}$(U)	62,70 (1)	1,6 (3) 10^{-8}	E1		0,325 (7)	0,0807 (16)	0,434 (9)
$\gamma_{2,1}$(U)	99,852 (3)	0,108 (2)	E2		9,97 (20)	2,78 (6)	13,7 (3)
$\gamma_{11,7}$(U)	140,15 (2)	2,2 (7) 10^{-8}	M1 + 63% E2	2,9 (8)	1,8 (5)	0,49 (14)	5,4 (15)
$\gamma_{3,2}$(U)	152,719 (2)	2,97 (4) 10^{-3}	E2	0,217 (5)	1,43 (3)	0,397 (8)	2,19 (5)
$\gamma_{13,8}$(U)	192,91 (7)	1,2 (4) 10^{-9}	(E2)	0,164 (3)	0,515 (10)	0,142 (3)	0,872 (18)
$\gamma_{4,3}$(U)	200,97 (3)	6,85 (23) 10^{-6}	E2	0,150 (3)	0,432 (9)	0,119 (3)	0,748 (15)
$\gamma_{11,5}$(U)	203,12 (3)	2,2 (5) 10^{-8}	M1+66% E2	0,88 (17)	0,44 (9)	0,116 (23)	1,56 (30)
$\gamma_{14,8}$(U)	233,6 (2)	4,1 10^{-7}	(E0+E2)				
$\gamma_{13,6}$(U)	234,6 (2)	0,1 10^{-6}	E0				
$\gamma_{14,7}$(U)	235,9 (3)	1,0 (5) 10^{-8}	(E1)	0,0537 (11)	0,0108 (2)	0,00262 (5)	0,0681 (14)
$\gamma_{13,5}$(U)	258,227 (3)	7,4 (12) 10^{-8}	(E1)	0,0439 (9)	0,0087 (2)	0,00211 (4)	0,0554 (11)
$\gamma_{14,5}$(U)	299,2 (2)	4,6 (3) 10^{-8}	(E1)	0,0318 (7)	0,00616 (13)	0,00149 (3)	0,0400 (8)
$\gamma_{7,2}$(U)	705,9 (3)	5,0 (13) 10^{-8}	(E1)	0,00577 (12)	0,00100 (2)	0,000239 (5)	0,00709 (14)
$\gamma_{8,2}$(U)	708,4 (2)	5,0 (3) 10^{-7}	(E2)	0,0156 (3)	0,00497 (10)	0,00127 (3)	0,0223 (5)
$\gamma_{12,3}$(U)	727,8 (2)	2,7 (3) 10^{-9}	(E2)	0,0149 (3)	0,00462 (9)	0,00118 (3)	0,0211 (4)
$\gamma_{5,1}$(U)	742,814 (5)	5,13 (13) 10^{-6}	E1	0,00526 (11)	0,00091 (2)	0,000216 (5)	0,00646 (13)
$\gamma_{6,1}$(U)	766,39 (10)	2,23 (5) 10^{-5}	E2	0,0136 (3)	0,00403 (8)	0,00103 (2)	0,0190 (4)
$\gamma_{9,2}$(U)	783,4 (1)	2,3 (3) 10^{-8}	(E2)	0,0130 (3)	0,00380 (8)	0,00097 (2)	0,0181 (4)
$\gamma_{5,0}$(U)	786,3 (1)	3,22 (9) 10^{-6}	E1	0,00474 (9)	0,000814 (17)	0,000194 (4)	0,00583 (12)
$\gamma_{10,2}$(U)	804,4 (4)	1,1 (3) 10^{-7}	E0+E2				0,57
$\gamma_{7,1}$(U)	805,6 (3)	5,6 (15) 10^{-8}	(E1)	0,00455 (9)	0,000778 (16)	0,000185 (4)	0,00558 (11)
$\gamma_{8,1}$(U)	808,25 (15)	4,1 10^{-6}	E0+17% E2	3,31	0,94		4,3
$\gamma_{6,0}$(U)	809,88 (3)	7,7 10^{-6}	E0	>60			
$\gamma_{8,0}$(U)	851,7 (1)	1,29 (4) 10^{-6}	(E2)	0,0112 (2)	0,00308 (6)	0,000775 (16)	0,0155 (3)
$\gamma_{12,2}$(U)	880,5 (3)	> 1,5 (4) 10^{-7}	(E0+E2)				
$\gamma_{9,1}$(U)	883,23 (10)	7,3 (4) 10^{-7}	E2	0,0105 (2)	0,00280 (6)	0,000705 (14)	0,0144 (3)
$\gamma_{10,1}$(U)	904,3 (2)	6,2 (11) 10^{-8}	(E2)	0,0102 (2)	0,00264 (5)	0,000664 (13)	0,0137 (3)
$\gamma_{9,0}$(U)	926,72 (15)	5,65 (25) 10^{-7}	(E2)	0,00974 (20)	0,00249 (5)	0,000625 (13)	0,0131 (3)
$\gamma_{14,2}$(U)	941,9 (2)	4,72 (23) 10^{-7}	(E2)	0,00946 (20)	0,00240 (5)	0,000601 (12)	0,0127 (3)
$\gamma_{11,1}$(U)	946,0 (3)	9,2 (13) 10^{-8}	(E1)	0,00342 (7)	0,000579 (12)	0,000137 (3)	0,00419 (9)
$\gamma_{12,1}$(U)	980,3 (1)	4,2 10^{-8}	(E2)	0,00882 (18)	0,00218 (5)	0,000544 (11)	0,0117 (3)
$\gamma_{13,1}$(U)	1001,03 (15)	9,9 (4) 10^{-7}	E2	0,00850 (17)	0,00207 (4)	0,000517 (11)	0,0113 (3)
$\gamma_{14,1}$(U)	1041,8 (3)	0,20 (2) 10^{-6}	(E0+E2)				
$\gamma_{14,0}$(U)	1085,4 (3)	7,8 (9) 10^{-8}	(E2)				

3 Atomic Data

3.1 U

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

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	94,666		62,47
	$K\alpha_1$	98,44		100
	$K\beta_3$	110,421	}	
	$K\beta_1$	111,298	}	
	$K\beta_5''$	111,964	}	36,08
	$K\beta_5'$	111,964	}	
	$K\beta_2$	114,46	}	
	$K\beta_4$	115,01	}	12,34
	$KO_{2,3}$	115,377	}	
X_L				
	$L\ell$	11,62		
	$L\alpha$	13,44 – 13,62		
	$L\eta$	15,4		
	$L\beta$	15,74 – 18,16		
	$L\gamma$	19,5 – 21,75		

3.1.2 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
$\alpha_{0,14}$	4432,00 (25)	$\sim$ 1,2 10^{-6}
$\alpha_{0,13}$	4472,09 (21)	1,17 (7) 10^{-6}
$\alpha_{0,12}$	4492,6 (3)	$\sim$ 2,0 10^{-7}

	Energy keV	Probability × 100
$\alpha_{0,11}$	4526,24 (21)	1,52 (16) 10^{-7}
$\alpha_{0,10}$	4567,14 (25)	1,7 (4) 10^{-7}
$\alpha_{0,9}$	4587,89 (21)	1,30 (5) 10^{-6}
$\alpha_{0,8}$	4661,67 (23)	8,2 (17) 10^{-6}
$\alpha_{0,7}$	4664,03 (21)	7,4 (22) 10^{-8}
$\alpha_{0,6}$	4702,79 (21)	1,0 (4) 10^{-4}
$\alpha_{0,5}$	4725,98 (21)	8,21 (16) 10^{-6}
$\alpha_{0,4}$	5010,36 (21)	6,85 (23) 10^{-6}
$\alpha_{0,3}$	5207,94 (20)	0,00297 (4)
$\alpha_{0,2}$	5358,09 (20)	0,105 (3)
$\alpha_{0,1}$	5456,26 (20)	28,85 (6)
$\alpha_{0,0}$	5499,03 (20)	71,04 (6)

5 Electron Emissions

		Energy keV	Electrons per 100 disint.
e_{AL}	(U)	5,9 - 21,6	10,6 (9)
e_{AK}	(U)		0,000011 (1)
	KLL	71,78 - 80,95	}
	KLX	88,15 - 98,34	}
	KXY	104,42 - 115,40	}
$ec_{1,0\ L}$	(U)	21,74 - 26,33	21,1 (6)
$ec_{3,2\ K}$	(U)	37,117 (2)	2,01 (5) 10^{-4}
$ec_{1,0\ M}$	(U)	37,950 - 39,948	5,83 (17)
$ec_{2,1\ L}$	(U)	78,094 - 82,684	0,0733 (17)
$ec_{4,3\ K}$	(U)	85,37 (3)	5,88 (23) 10^{-7}
$ec_{2,1\ M}$	(U)	94,304 - 96,302	0,0204 (5)
$ec_{3,2\ L}$	(U)	130,960 - 135,551	1,33 (3) 10^{-3}
$ec_{3,2\ M}$	(U)	147,171 - 149,169	3,69 (8) 10^{-4}
$ec_{4,3\ L}$	(U)	179,21 - 183,80	1,69 (7) 10^{-6}
$ec_{4,3\ M}$	(U)	195,42 - 197,42	4,7 (2) 10^{-7}
$ec_{6,1\ K}$	(U)	650,78 (2)	3,0 (1) 10^{-7}
$ec_{8,1\ K}$	(U)	692,6 (1)	2,6 10^{-5}
$ec_{6,1\ L}$	(U)	744,62 - 749,21	8,8 (3) 10^{-8}
$ec_{6,1\ M}$	(U)	760,83 - 762,83	2,26 (7) 10^{-8}
$ec_{8,1\ L}$	(U)	786,44 - 791,03	7,0 10^{-7}
$ec_{6,0\ K}$	(U)	894,28 (3)	6,0 10^{-5}

6 Photon Emissions

6.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(U)	11,62 — 21,75		10,63 (8)	
$XK\alpha_2$	(U)	94,666		0,000106 (3)	} $K\alpha$
$XK\alpha_1$	(U)	98,44		0,000169 (5)	}
$XK\beta_3$	(U)	110,421	}		
$XK\beta_1$	(U)	111,298	}	0,0000609 (16)	$K'\beta_1$
$XK\beta_5''$	(U)	111,964	}		
$XK\beta_5'$	(U)	111,964	}		
$XK\beta_2$	(U)	114,46	}		
$XK\beta_4$	(U)	115,01	}	0,0000202 (6)	$K'\beta_2$
$XKO_{2,3}$	(U)	115,377	}		

6.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{8,6}$(U)	41,82 (11)	3,0 (16) 10^{-9}
$\gamma_{1,0}$(U)	43,498 (1)	3,97 (8) 10^{-2}
$\gamma_{11,9}$(U)	62,70 (1)	1,1 (3) 10^{-8}
$\gamma_{2,1}$(U)	99,852 (3)	7,35 (8) 10^{-3}
$\gamma_{11,7}$(U)	140,15 (2)	3,5 (7) 10^{-8}
$\gamma_{3,2}$(U)	152,719 (2)	9,30 (7) 10^{-4}
$\gamma_{13,8}$(U)	192,91 (7)	6,6 (20) 10^{-10}
$\gamma_{4,3}$(U)	200,97 (3)	3,92 (13) 10^{-6}
$\gamma_{11,5}$(U)	203,12 (3)	8,5 (15) 10^{-9}
$\gamma_{14,7}$(U)	235,9 (3)	9 (5) 10^{-9}
$\gamma_{13,5}$(U)	258,227 (3)	7,0 (11) 10^{-8}
$\gamma_{14,5}$(U)	299,2 (2)	4,4 (3) 10^{-8}
$\gamma_{7,2}$(U)	705,9 (1)	5,0 (13) 10^{-8}
$\gamma_{8,2}$(U)	708,4 (2)	4,9 (3) 10^{-7}
$\gamma_{12,3}$(U)	727,8 (2)	2,7 (3) 10^{-9}
$\gamma_{5,1}$(U)	742,813 (5)	5,10 (13) 10^{-6}
$\gamma_{6,1}$(U)	766,38 (2)	2,19 (5) 10^{-4}
$\gamma_{9,2}$(U)	783,4 (1)	2,2 (3) 10^{-8}
$\gamma_{5,0}$(U)	786,27 (3)	3,20 (9) 10^{-6}
$\gamma_{10,2}$(U)	804,4 (3)	7,1 (17) 10^{-8}
$\gamma_{7,1}$(U)	805,80 (5)	5,6 (15) 10^{-8}
$\gamma_{8,1}$(U)	808,2 (1)	7,67 (25) 10^{-7}

	Energy keV	Photons per 100 disint.
$\gamma_{8,0}$(U)	851,7 (1)	1,27 (4) 10^{-6}
$\gamma_{12,2}$(U)	880,5 (1)	1,5 (4) 10^{-7}
$\gamma_{9,1}$(U)	883,24 (4)	7,2 (4) 10^{-7}
$\gamma_{10,1}$(U)	904,3 (2)	6,1 (11) 10^{-8}
$\gamma_{9,0}$(U)	926,74 (5)	5,58 (25) 10^{-7}
$\gamma_{14,2}$(U)	941,94 (10)	4,66 (23) 10^{-7}
$\gamma_{11,1}$(U)	946,00 (3)	9,2 (13) 10^{-8}
$\gamma_{12,1}$(U)	980,3 (1)	4,2 10^{-8}
$\gamma_{13,1}$(U)	1001,03 (3)	9,8 (4) 10^{-7}
$\gamma_{14,1}$(U)	1041,7 (2)	1,97 (16) 10^{-7}
$\gamma_{14,0}$(U)	1085,4 (2)	7,7 (9) 10^{-8}

7 Main Production Modes

$Np-238(\beta^-)Pu-238$

$Cm-242(\alpha)Pu-238$

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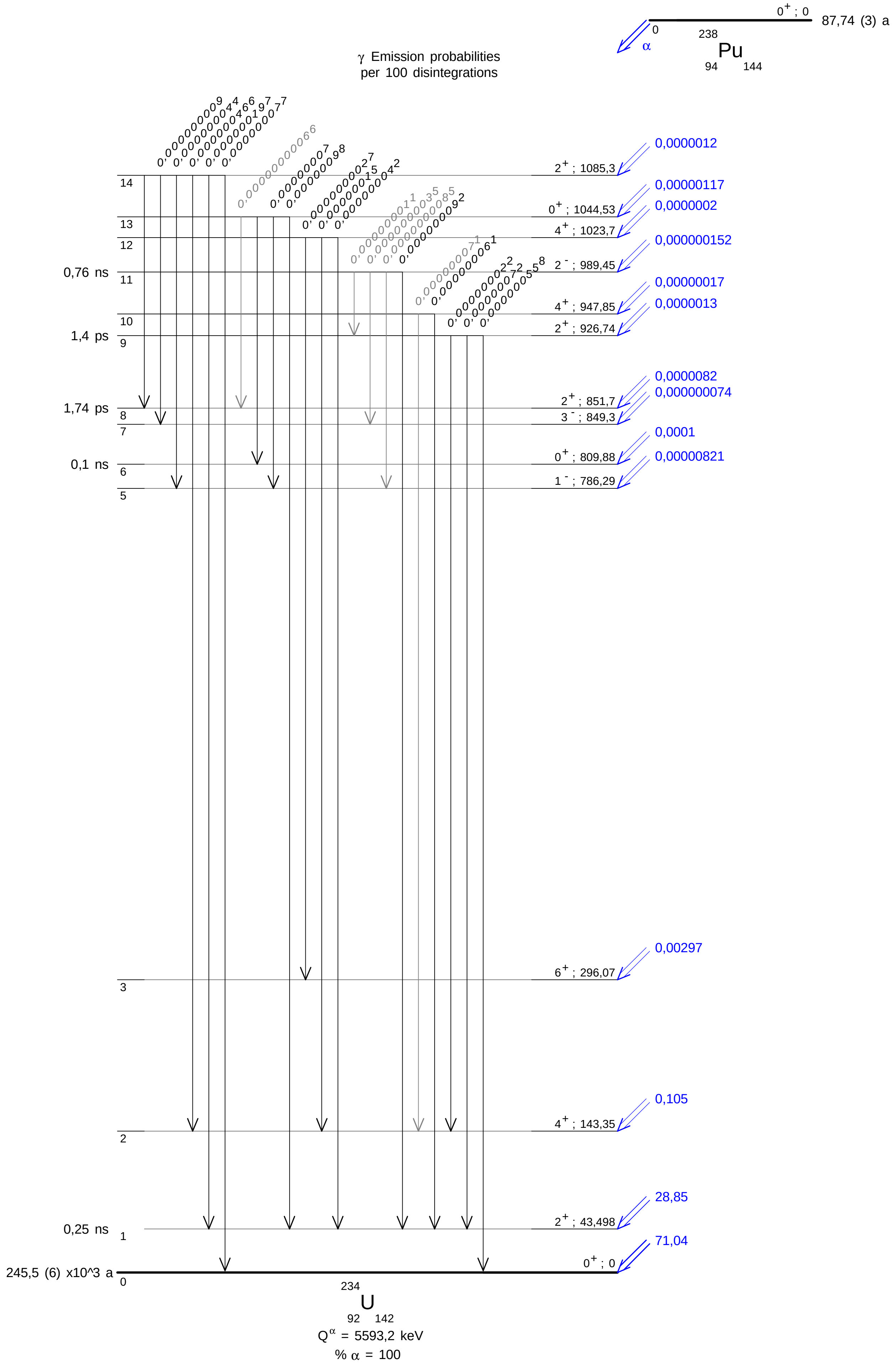
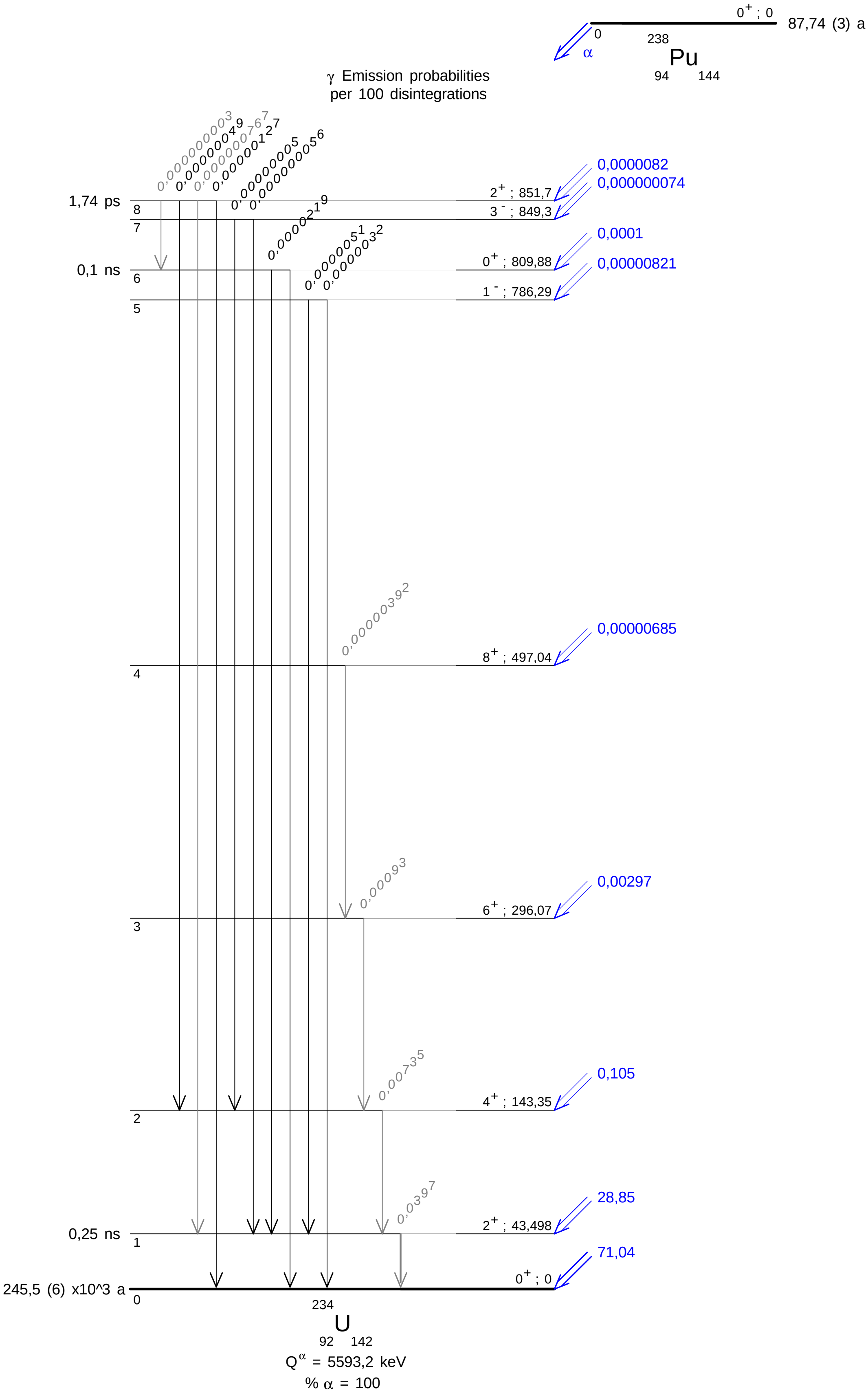

0+ ; 0
87,74 (3) a
α
238 Pu 94 144
γ Emission probabilities
per 100 disintegrations
2+ ; 1085,3
0,0000012
0+ ; 1044,53
0,00000117
4+ ; 1023,7
0,0000002
2- ; 989,45
0,000000152
4+ ; 947,85
0,00000017
2+ ; 926,74
0,0000013
2+ ; 851,7
0,0000082
3- ; 849,3
0,000000074
0+ ; 809,88
0,0001
1- ; 786,29
0,00000821
6+ ; 296,07
0,00297
4+ ; 143,35
0,105
2+ ; 43,498
28,85
0+ ; 0
71,04
0,76 ns
1,4 ps
1,74 ps
0,1 ns
0,25 ns
245,5 (6) x10^3 a
234 U 92 142
Qα = 5593,2 keV
% α = 100



0+ ; 0
87,74 (3) a
0
α
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Pu
94 144
γ Emission probabilities
per 100 disintegrations
0,0000082
0,000000074
2+ ; 851,7
3 - ; 849,3
1,74 ps
0,0001
0,00000821
0+ ; 809,88
1 - ; 786,29
0,1 ns
0,00000685
8+ ; 497,04
0,00297
6+ ; 296,07
0,105
4+ ; 143,35
28,85
2+ ; 43,498
0,25 ns
71,04
0+ ; 0
245,5 (6) x10^3 a
234
U
92 142
Q^α = 5593,2 keV
% α = 100

$^{240}_{94}$Pu$_{146}$

1 Decay Scheme

Pu-240 decays 100 % by alpha transitions to U-236 and by spontaneous fission with branching fraction of 5.7(2) 10^{-6} %. Most of the alpha decay populates the U-236 ground state (72.7 %) and the U-236 first excited level with energy of 45.24 keV (27.2 %).
Le plutonium 240 décroit à 100 % par émission alpha vers l'uranium 236, et pour une faible proportion par fission spontanée (5,7 (2) 10^{-6} %). Les branchements alpha principaux se font vers le niveau fondamental (72,7 %) et le niveau excité de 45,24 keV (27,2 %).

2 Nuclear Data

$T_{1/2}(^{240}$Pu)	:	6561	(7)	a
$T_{1/2}(^{236}$U)	:	23,42	(4)	10^6 a
$Q^{\alpha}(^{240}$Pu)	:	5255,78	(15)	keV

2.1 α Transitions

	Energy keV	Probability × 100	F
$\alpha_{0,10}$	4289,15 (18)	< 1,0 10^{-7}	> 70
$\alpha_{0,9}$	4295,5 (4)	< 1,3 10^{-7}	> 61
$\alpha_{0,8}$	4297,79 (23)	< 1,7 10^{-7}	> 49
$\alpha_{0,7}$	4336,57 (23)	≈ 6,5 10^{-7}	≈ 27
$\alpha_{0,5}$	4568,18 (16)	1,93 (4) 10^{-5}	66
$\alpha_{0,4}$	4733,54 (16)	4,7 (5) 10^{-5}	471
$\alpha_{0,3}$	4946,00 (15)	1,082 (18) 10^{-3}	648
$\alpha_{0,2}$	5106,30 (15)	0,0863 (18)	94,7
$\alpha_{0,1}$	5210,54 (15)	27,16 (11)	1,4
$\alpha_{0,0}$	5255,78 (15)	72,74 (11)	1

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{1,0}$(U)	45,242 (3)	27,2 (8)	E2		439 (9)	121,5 (24)	604 (12)
$\gamma_{6,5}$(U)	56,6 (5)		(E2)		148 (3)	41,1 (8)	204 (4)
$\gamma_{2,1}$(U)	104,234 (6)	0,0874 (18)	E2		8,16 (16)	2,27 (5)	11,24 (22)
$\gamma_{3,2}$(U)	160,307 (3)	1,129 (17) 10^{-4}	E2	0,208 (4)	1,154 (23)	0,320 (7)	1,79 (4)
$\gamma_{4,3}$(U)	212,46 (5)	4,7 (5) 10^{-5}	E2	0,141 (3)	0,341 (7)	0,0941 (19)	0,610 (12)
$\gamma_{10,6}$(U)	222,4 (1)						
$\gamma_{10,5}$(U)	279,0 (1)		(M1+E2)				
$\gamma_{5,2}$(U)	538,11 (10)	1,68 (14) 10^{-7}	E3	0,0631 (13)	0,0599 (12)	0,0164 (4)	0,145 (3)
$\gamma_{6,2}$(U)	594,5 (3)						
$\gamma_{5,1}$(U)	642,35 (9)	1,45 (4) 10^{-5}	E1+(M2+E3)	0,112 (10)	0,031 (3)		0,15 (2)
$\gamma_{5,0}$(U)	687,60 (5)	4,66 (22) 10^{-6}	E1	0,219 (12)	0,068 (6)		0,31 (2)
$\gamma_{6,1}$(U)	698,1	$< 2,5\ 10^{-8}$					
$\gamma_{9,2}$(U)	≈ 810,9						
$\gamma_{7,1}$(U)	873,92 (15)	5,9 (6) 10^{-7}	(E2)	0,01079 (22)	0,00288 (6)	0,000725 (15)	0,0147 (3)
$\gamma_{8,1}$(U)	≈ 912,7		(M1)	0,0440 (9)	0,00813 (16)	0,00196 (4)	0,0548 (11)
$\gamma_{9,1}$(U)	915,1 (3)		(M1+E0)				
$\gamma_{7,0}$(U)	918,9 (3)	$\approx 6,0\ 10^{-8}$	(E0)				
$\gamma_{10,1}$(U)	921,2 (2)		E1	0,00359 (7)	0,000607 (12)	0,000145 (3)	0,00439 (8)
$\gamma_{8,0}$(U)	958,0 (2)	$< 1,0\ 10^{-7}$					
$\gamma_{9,0}$(U)	≈ 959,9	$< 5,0\ 10^{-8}$					
$\gamma_{10,0}$(U)	966,9 (2)	$< 5,0\ 10^{-8}$	E1	0,00330 (6)	0,000556 (11)	0,000132 (3)	0,00404 (8)

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	}	36,06
	$K\beta_2$	114,407	}	
	$K\beta_4$	115,012	}	12,33
	$KO_{2,3}$	115,377	}	

		Energy keV	Relative probability
X_L			
	$L\ell$	11,62	
	$L\alpha$	13,44 – 13,62	
	$L\eta$	15,407	
	$L\beta$	15,74 – 18,16	
	$L\gamma$	19,5 – 21,75	

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	71,78 – 80,95	100
KLX	88,15 – 98,43	59,6
KXY	104,51 – 115,59	8,88
Auger L	5,9 – 21,6	

4 α Emissions

	Energy keV	Probability × 100
$\alpha_{0,10}$	4217,62 (18)	$< 1,0\ 10^{-7}$
$\alpha_{0,9}$	4223,8 (4)	$< 1,3\ 10^{-7}$
$\alpha_{0,8}$	4226,12 (23)	$< 1,7\ 10^{-7}$
$\alpha_{0,7}$	4264,25 (23)	$\approx 6,5\ 10^{-7}$
$\alpha_{0,5}$	4492,00 (16)	1,93 (4) 10^{-5}
$\alpha_{0,4}$	4654,60 (16)	4,7 (5) 10^{-5}
$\alpha_{0,3}$	4863,51 (15)	1,082 (18) 10^{-3}
$\alpha_{0,2}$	5021,15 (15)	0,0863 (18)
$\alpha_{0,1}$	5123,64 (15)	27,16 (11)
$\alpha_{0,0}$	5168,13 (15)	72,74 (11)

5 Electron Emissions

		Energy keV	Electrons per 100 disint.
e_{AL}	(U)	5,9 - 21,6	10,3 (8)
e_{AK}	(U)		0,0000027 (4)
	KLL	71,78 - 80,95	}
	KLX	88,15 - 98,43	}
	KXY	104,51 - 115,59	}
$ec_{1,0\ T}$	(U)	23,48 - 45,24	27,2 (8)
$ec_{1,0\ L}$	(U)	23,484 - 28,074	19,8 (6)
$ec_{1,0\ M}$	(U)	39,694 - 41,692	5,47 (15)
$ec_{2,1\ L}$	(U)	82,476 - 87,066	0,0583 (13)
$ec_{2,1\ M}$	(U)	98,686 - 100,684	0,0162 (4)

6 Photon Emissions

6.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(U)	11,62 — 21,75		10,34 (15)	
$XK\alpha_2$	(U)	94,666		0,0000260 (8)	} $K\alpha$
$XK\alpha_1$	(U)	98,44		0,0000416 (12)	}
$XK\beta_3$	(U)	110,421	}		
$XK\beta_1$	(U)	111,298	}	0,0000152 (5)	$K'\beta_1$
$XK\beta_5''$	(U)	111,964	}		
$XK\beta_2$	(U)	114,407	}		
$XK\beta_4$	(U)	115,012	}	0,0000049 (2)	$K'\beta_2$
$XKO_{2,3}$	(U)	115,377	}		

6.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(U)	45,242 (3)	0,0450 (9)
$\gamma_{6,5}$(U)	56,6 (5)	
$\gamma_{2,1}$(U)	104,234 (6)	0,00714 (7)
$\gamma_{3,2}$(U)	160,307 (3)	4,045 (22) 10^{-4}

	Energy keV	Photons per 100 disint.
$\gamma_{4,3}$(U)	212,46 (5)	2,9 (3) 10^{-5}
$\gamma_{10,6}$(U)	222,4 (1)	
$\gamma_{10,5}$(U)	279,0 (1)	
$\gamma_{5,2}$(U)	538,11 (10)	1,47 (12) 10^{-7}
$\gamma_{6,2}$(U)	594,5 (3)	
$\gamma_{5,1}$(U)	642,35 (9)	1,26 (3) 10^{-5}
$\gamma_{5,0}$(U)	687,60 (5)	3,56 (16) 10^{-6}
$\gamma_{6,1}$(U)	698,1	< 2,5 10^{-8}
$\gamma_{9,2}$(U)	≈ 810,9	
$\gamma_{7,1}$(U)	873,92 (15)	5,8 (6) 10^{-7}
$\gamma_{8,1}$(U)	≈ 912,7	
$\gamma_{9,1}$(U)	915,1 (3)	
$\gamma_{7,0}$(U)	918,9 (3)	
$\gamma_{10,1}$(U)	921,2 (2)	
$\gamma_{8,0}$(U)	958,0 (2)	< 1,0 10^{-7}
$\gamma_{9,0}$(U)	≈ 959,9	< 5,0 10^{-8}
$\gamma_{10,0}$(U)	966,9 (2)	< 5,0 10^{-8}

7 Main Production Modes

U – 238(n,γ)Np – 240
U – 238(α,2n)Pu – 240
U – 238(α,pn)Np – 240

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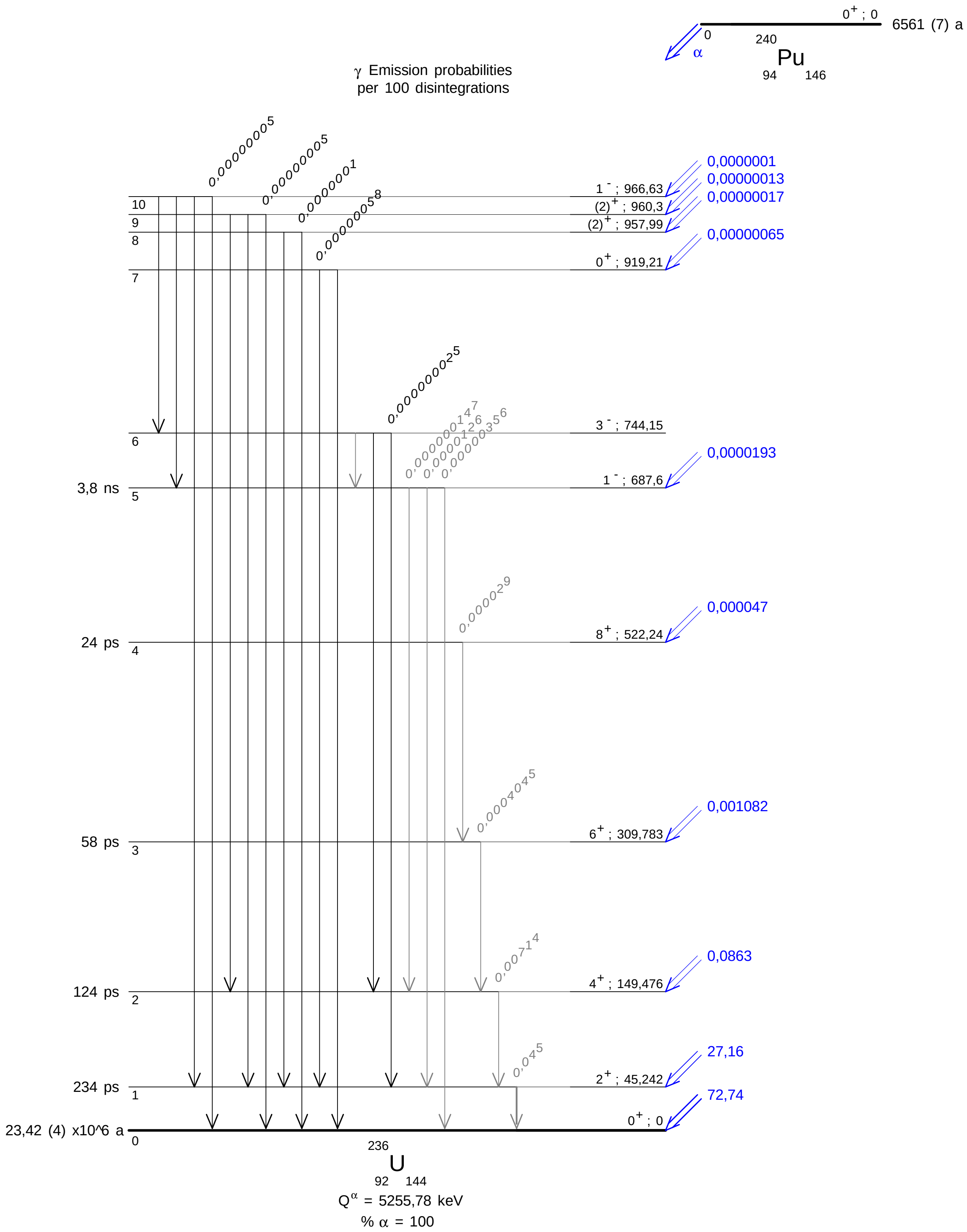
γ Emission probabilities
per 100 disintegrations
0+ ; 0
6561 (7) a
240
Pu
94 146
α
1 - ; 966,63
(2)+ ; 960,3
(2)+ ; 957,99
0+ ; 919,21
3 - ; 744,15
1 - ; 687,6
8+ ; 522,24
6+ ; 309,783
4+ ; 149,476
2+ ; 45,242
0+ ; 0
0,0000001
0,00000013
0,00000017
0,00000065
0,0000193
0,000047
0,001082
0,0863
27,16
72,74
3,8 ns
24 ps
58 ps
124 ps
234 ps
23,42 (4) x10^6 a
236
U
92 144
Qα = 5255,78 keV
% α = 100

241		
95	Am	146

1 Decay Scheme

Am-241 decays 100 % by alpha transitions to Np-237. Most of the decay (84.6 %) populate the excited level of Np-237 with energy of 59.54 keV. Branching of Am-241 decay by spontaneous fission is 4.3(18) 10^{-10}%.
L'américium 241 décroit à 100 % par émission alpha vers le neptunium 237. Le branchement principal (84,6%) se fait vers le niveau excité de 59 keV. Un faible branchement (4,3(18) 10^{-10}%) par fission spontanée existe.

2 Nuclear Data

$T_{1/2}(^{241}\text{Am})$	:	432,6	(6)	a
$T_{1/2}(^{237}\text{Np})$	:	2,14	(1)	10^6 a
$Q^{\alpha}(^{241}\text{Am})$	:	5637,81	(12)	keV

2.1 α Transitions

	Energy keV	Probability × 100	F
$\alpha_{0,36}$	4837,81 (16)	0,00004 (3)	47
$\alpha_{0,34}$	4881,81 (16)	0,000086	44
$\alpha_{0,33}$	4915,86 (13)	0,0007	9,5
$\alpha_{0,32}$	4971,6 (2)		
$\alpha_{0,30}$	5039,8 (3)		
$\alpha_{0,29}$	5044,8 (11)		
$\alpha_{0,28}$	5047,53 (20)		
$\alpha_{0,27}$	5092,22 (20)	0,0001	1000
$\alpha_{0,25}$	5140,79 (14)		
$\alpha_{0,24}$	5151,85 (17)	0,00011	2300
$\alpha_{0,23}$	5178,17 (13)	~0,0004	~1000
$\alpha_{0,22}$	5185,28 (13)	~0,0004	~1000
$\alpha_{0,21}$	5193,03 (16)		
$\alpha_{0,20}$	5203,69 (20)	0,0004	1400
$\alpha_{0,19}$	5220 (4)		

	Energy keV	Probability × 100	F
$\alpha_{0,18}$	5242,29 (13)	0,0007	1400
$\alpha_{0,17}$	5266,88 (13)	0,0003	4600
$\alpha_{0,16}$	5269,22 (13)	0,0009	1600
$\alpha_{0,15}$	5278,1 (2)	0,0006	2700
$\alpha_{0,14}$	5305,45 (13)		
$\alpha_{0,13}$	5313,39 (13)	0,0013	2100
$\alpha_{0,12}$	5321,0 (3)		
$\alpha_{0,11}$	5332,75 (13)	0,0022 (3)	1600
$\alpha_{0,9}$	5370,27 (14)	0,0005	12000
$\alpha_{0,8}$	5411,85 (13)	0,014 (3)	770
$\alpha_{0,6}$	5479,32 (13)	1,66 (3)	16,4
$\alpha_{0,5}$	5507,81 (13)	0,01	4000
$\alpha_{0,4}$	5534,85 (12)	13,23 (10)	4,3
$\alpha_{0,3}$	5561,91 (12)	0,04	2000
$\alpha_{0,2}$	5578,27 (12)	84,45 (10)	1,3
$\alpha_{0,1}$	5604,61 (12)	0,23 (1)	600
$\alpha_{0,0}$	5637,81 (12)	0,38 (1)	6100

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{10,9}$(Np)	13,81 (2)						
$\gamma_{2,1}$(Np)	26,3446 (2)	22,56 (70)	E1		6,12 (20)	1,6 (2)	8,4 (3)
$\gamma_{4,3}$(Np)	27,06						
$\gamma_{27,26}$(Np)	31,4						
$\gamma_{(-1,1)}$(Np)	32,183						
$\gamma_{1,0}$(Np)	33,1963 (3)	23,3 (6)	M1+1,7%E2		143 (5)	35 (5)	192 (5)
$\gamma_{(-1,2)}$(Np)	38,54 (3)						
$\gamma_{3,1}$(Np)	42,704 (5)	2,2 (5)	(M1+42%E2)		296 (30)	81 (8)	400 (4)
$\gamma_{4,2}$(Np)	43,420 (3)	12,9 (10)	M1+17%E2		136 (4)	36,5 (12)	186 (5)
$\gamma_{14,10}$(Np)	51,01 (3)	0,000046 (12)	(E1)		0,573 (12)	0,144 (3)	0,77 (2)
$\gamma_{5,3}$(Np)	54,1						
$\gamma_{6,4}$(Np)	55,55 (2)	1,2 (2)	M1+17%E2		49 (4)	13,1 (12)	67 (6)
$\gamma_{13,9}$(Np)	56,8						
$\gamma_{(-1,3)}$(Np)	57,85 (5)						
$\gamma_{2,0}$(Np)	59,5409 (1)	78,0 (11)	E1+0,01%M2		0,875 (18)	0,226 (7)	1,18 (3)
$\gamma_{7,5}$(Np)	61,44						
$\gamma_{14,9}$(Np)	64,83 (2)	0,00020 (3)	E1		0,305 (6)	0,076 (2)	0,41 (1)
$\gamma_{8,6}$(Np)	67,46 (5)	0,013 (4)	M1+17%E2		23 (5)	6,0 (13)	31 (8)
$\gamma_{4,1}$(Np)	69,76 (3)	0,0039 (5)	E1		0,252 (5)	0,0625 (13)	0,336 (7)
$\gamma_{3,0}$(Np)	75,8 (2)	0,0335	E2		39,6 (8)	11,1 (2)	54,8 (11)
$\gamma_{36,33}$(Np)	78,1						
$\gamma_{11,8}$(Np)	79,1						
$\gamma_{15,9}$(Np)	92,1						
$\gamma_{5,1}$(Np)	96,7 (2)	0,00099 (4)	E2		13,7 (3)	3,82 (4)	18,8 (4)
$\gamma_{6,2}$(Np)	98,95 (1)	0,337 (10)	E2		11,3 (3)	3,16 (7)	15,6 (3)
$\gamma_{4,0}$(Np)	102,97 (1)	0,0219 (5)	E1		0,091 (2)	0,0224 (5)	0,121 (3)

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{(-1,4)}$(Np)	106,42 (5)						
$\gamma_{20,13}$(Np)	109,70 (7)	0,0000524	if E2				9,7
$\gamma_{7,3}$(Np)	115,54						
$\gamma_{21,13}$(Np)	120,36 (8)						
$\gamma_{8,4}$(Np)	123,02 (2)	0,0069 (2)	E2	0,187 (4)	4,13 (8)	1,15 (2)	5,90 (12)
$\gamma_{6,1}$(Np)	125,29 (1)	0,0054 (3)	(E1)	0,239 (5)	0,0546 (11)	0,0134 (3)	0,306 (6)
$\gamma_{(-1,5)}$(Np)	128,05						
$\gamma_{20,11}$(Np)	129,2						
$\gamma_{22,13}$(Np)	135,3						
$\gamma_{(-1,6)}$(Np)	136,7						
$\gamma_{30,23}$(Np)	138,5						
$\gamma_{29,22}$(Np)	139,46 (8)	0,000023 (5)	if E2				3,4
$\gamma_{11,6}$(Np)	146,57 (1)	0,00175 (4)	E2	0,210 (4)	1,87 (4)	0,522 (11)	2,80 (6)
$\gamma_{8,3}$(Np)	150,08 (3)	0,000088 (5)	(E1)	0,153 (3)	0,0344 (7)	0,0084 (2)	0,199 (4)
$\gamma_{26,15}$(Np)	154,27 (20)	0,0000042	if M1				7,5
$\gamma_{(-1,7)}$(Np)	156,4 (3)						
$\gamma_{29,20}$(Np)	159,16 (20)	0,0000016 (5)	if E1				0,17
$\gamma_{24,13}$(Np)	161,54 (10)	0,0000114	if M1				6,6
$\gamma_{9,4}$(Np)	164,59 (1)	0,000180 (8)	E2	0,195 (4)	1,12 (2)	0,311 (6)	1,73 (4)
$\gamma_{13,6}$(Np)	165,91 (4)						
$\gamma_{18,8}$(Np)	169,55 (2)	0,00043 (3)		0,190 (4)	0,98 (2)	0,273 (6)	1,55 (3)
$\gamma_{11,5}$(Np)	175,08 (3)	0,000042 (3)	(E2)	0,183 (4)	0,85 (2)	0,237 (5)	1,36 (3)
$\gamma_{(-1,8)}$(Np)	190,4						
$\gamma_{25,11}$(Np)	191,90 (1)	0,0000419 (20)	E2	0,163 (4)	0,57 (1)	0,159 (4)	0,95 (2)
$\gamma_{29,18}$(Np)	197,0 (2)	0,00000054	if E1				0,1
$\gamma_{(-1,9)}$(Np)	201,70 (14)						
$\gamma_{18,7}$(Np)	204,06 (6)						
$\gamma_{9,2}$(Np)	208,00 (2)	0,00329 (10)	M1+2,4%E2	2,56 (6)	0,507 (11)	0,124 (3)	3,19 (7)
$\gamma_{13,4}$(Np)	221,45 (3)						
$\gamma_{26,10}$(Np)	232,81 (5)						
$\gamma_{9,1}$(Np)	234,33	0,0000084	if M2				8,6
$\gamma_{26,9}$(Np)	246,7 (1)						
$\gamma_{13,3}$(Np)	248,58 (8)	0,00000155 (8)	if E1				0,061
$\gamma_{21,7}$(Np)	260,9 (1)						
$\gamma_{13,2}$(Np)	264,87 (5)						
$\gamma_{9,0}$(Np)	267,54 (3)	0,000036 (2)	E1+5,4%M2	0,25 (1)	0,076 (3)	0,20 (1)	0,35 (3)
$\gamma_{(-1,10)}$(Np)	270,63						
$\gamma_{(-1,51)}$(Np)	271,54						
$\gamma_{20,6}$(Np)	275,73 (8)						
$\gamma_{27,9}$(Np)	278,18	0,0000032	if M1				1,4
$\gamma_{13,1}$(Np)	291,26 (20)						
$\gamma_{16,3}$(Np)	292,78 (4)	0,000017 (1)	E2	0,080 (2)	0,101 (2)	0,0276 (6)	0,219 (5)
$\gamma_{15,2}$(Np)	300,13 (6)						
$\gamma_{20,5}$(Np)	304,2 (2)	0,00000093 (2)					
$\gamma_{16,2}$(Np)	309,1 (3)	0,000002	if E1				0,038
$\gamma_{12,0}$(Np)	316,8 (2)						
$\gamma_{21,5}$(Np)	322,53 (3)	0,000264 (8)	(M1+26,5%E2)	0,59 (9)	0,13 (2)	0,032 (5)	0,75 (12)
$\gamma_{(-1,52)}$(Np)	324,69	0,0000018 (3)					
$\gamma_{(-1,53)}$(Np)	329,69	0,0000011 (2)					
$\gamma_{14,0}$(Np)	332,36 (2)	0,0001720 (8)	E2	0,0638 (13)	0,062 (13)	0,0169 (4)	0,150 (3)
$\gamma_{16,1}$(Np)	335,40 (3)	0,00084 (4)	M1+17,3%E2	0,59 (8)	0,12 (2)	0,030 (4)	0,75 (12)
$\gamma_{17,1}$(Np)	337,7 (2)	0,00000488 (7)					
$\gamma_{(-1,11)}$(Np)	350,71	0,00000139 (5)					
$\gamma_{20,3}$(Np)	358,3 (2)	0,00000129 (5)					
$\gamma_{16,0}$(Np)	368,63 (3)	0,00036 (2)	M1	0,538 (11)	0,103 (2)	0,0251 (5)	0,667 (14)
$\gamma_{17,0}$(Np)	370,94 (3)	0,000082 (6)	M1+16%E2	0,45 (5)	0,092 (9)	0,023 (2)	0,57 (6)
$\gamma_{(-1,54)}$(Np)	374,83	0,00000313 (5)					
$\gamma_{21,3}$(Np)	376,66 (3)	0,000225 (9)	M1	0,507 (11)	0,098 (2)	0,0237 (5)	0,629 (13)
$\gamma_{22,3}$(Np)	383,80 (3)	0,000045	if M1				0,6

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{(-1,12)}$(Np)	389,0 (3)	0,0000005					
$\gamma_{(-1,13)}$(Np)	390,61 (5)	0,00000573 (8)					
$\gamma_{32,9}$(Np)	398,6 (2)						
$\gamma_{29,7}$(Np)	401,68	0,00000018 (4)	M1+E2				0,31 (22)
$\gamma_{30,7}$(Np)	406,4 (2)	0,0000021	if M1				0,51
$\gamma_{(-1,14)}$(Np)	411,27	0,00000018 (4)					
$\gamma_{21,1}$(Np)	419,32 (4)	0,000036 (7)	M1+E2				0,27 (20)
$\gamma_{22,1}$(Np)	426,47 (4)	0,000031 (6)	M1+E2				0,27 (18)
$\gamma_{(-1,15)}$(Np)	429,9 (1)	0,00000109 (5)					
$\gamma_{(-1,55)}$(Np)	440,63	0,00000056 (3)					
$\gamma_{(-1,16)}$(Np)	442,81 (7)	0,00000331 (7)					
$\gamma_{35,13}$(Np)	446,68	0,00000011 (2)					
$\gamma_{21,0}$(Np)	452,5 (3)	0,0000025	if E2				0,063
$\gamma_{26,2}$(Np)	454,66 (8)	0,0000131 (4)	M1+E2				0,376
$\gamma_{22,0}$(Np)	459,68 (10)	0,0000043 (8)	M1+E2				0,21 (15)
$\gamma_{29,5}$(Np)	463,22 (20)	0,000001	if E2				0,059
$\gamma_{30,5}$(Np)	468,06 (15)	0,0000035 (2)	if M1				0,31
$\gamma_{(-1,17)}$(Np)	486,05	0,00000105 (6)					
$\gamma_{28,4}$(Np)	487,64	0,00000081 (7)	if M1				0,31
$\gamma_{(-1,56)}$(Np)	494,39	0,00000010 (2)					
$\gamma_{(-1,57)}$(Np)	501,39	0,00000014 (2)					
$\gamma_{27,1}$(Np)	512,4 (3)	0,0000021	if E1				0,013
$\gamma_{26,0}$(Np)	514,2 (2)	0,0000039 (2)	if E1				0,013
$\gamma_{30,3}$(Np)	522,11	0,00000125	if M1				0,26
$\gamma_{(-1,58)}$(Np)	525,14	0,00000016 (3)					
$\gamma_{38,13}$(Np)	528,87	0,00000072 (5)	if E2				0,043
$\gamma_{(-1,59)}$(Np)	532,44	0,00000008 (2)					
$\gamma_{27,0}$(Np)	545,7	0,00000025 (3)	if E1				0,011
$\gamma_{(-1,60)}$(Np)	548,15	0,00000005 (2)					
$\gamma_{(-1,61)}$(Np)	555,25	0,00000009 (2)					
$\gamma_{33,6}$(Np)	563,48	0,00000046 (2)	if E2				0,038
$\gamma_{36,8}$(Np)	573,94 (20)	0,00000154 (8)	if M1				0,2
$\gamma_{(-1,18)}$(Np)	582,89	0,00000101 (6)					
$\gamma_{31,2}$(Np)	586,5 (2)	0,00000148 (6)	if M1				0,19
$\gamma_{28,0}$(Np)	590,28 (15)	0,00000333 (6)	if M1				0,19
$\gamma_{34,6}$(Np)	597,44 (8)	0,0000086 (2)	if M1				0,18
$\gamma_{(-1,62)}$(Np)	600,26	0,00000022 (3)					
$\gamma_{33,4}$(Np)	619,01 (2)	0,000070 (3)	if M1				0,16
$\gamma_{38,8}$(Np)	627,2 (2)	0,00000059 (3)	if M1				0,16
$\gamma_{32,1}$(Np)	632,93 (15)	0,00000124 (5)					
$\gamma_{(-1,63)}$(Np)	636,9	0,00000021 (3)					
$\gamma_{36,6}$(Np)	641,46 (5)	0,0000081 (1)	if M1				0,15
$\gamma_{34,4}$(Np)	652,98 (4)	0,000043 (1)	if M1				0,14
$\gamma_{33,2}$(Np)	662,41 (2)	0,00045 (10)	E0+M1+E2	0,18 (4)			0,23 (5)
$\gamma_{32,0}$(Np)	666,2 (3)	0,00000095 (7)					
$\gamma_{36,5}$(Np)	669,9 (2)	0,00000051 (7)	if E1				0,008
$\gamma_{37,5}$(Np)	675,8 (3)	0,00000085 (5)					
$\gamma_{34,3}$(Np)	680,1 (1)	0,00000334 (7)	if E1				0,0078
$\gamma_{33,1}$(Np)	688,76 (4)	0,0000325 (5)	if E1				0,0076
$\gamma_{(-1,19)}$(Np)	693,46	0,00000354 (7)					
$\gamma_{34,2}$(Np)	696,48	0,0000058 (2)	if M1				0,12
$\gamma_{(-1,20)}$(Np)	709,42 (5)	0,00000641 (18)					
$\gamma_{(-1,64)}$(Np)	712,5	0,00000020 (3)					
$\gamma_{33,0}$(Np)	721,98 (3)	0,000196 (4)	if E1				0,007
$\gamma_{37,3}$(Np)	729,52 (15)	0,00000137 (5)					
$\gamma_{(-1,21)}$(Np)	731,44	0,00000046 (4)					
$\gamma_{(-1,65)}$(Np)	736,68	0,00000128 (5)					
$\gamma_{35,1}$(Np)	737,34 (5)	0,00000794 (8)					
$\gamma_{(-1,66)}$(Np)	740,51	0,00000019 (3)					

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{(-1,22)}$(Np)	742,9 (3)	0,00000035					
$\gamma_{(-1,67)}$(Np)	745,02	0,00000009 (2)					
$\gamma_{(-1,85)}$(Np)	750,39	0,000000006 (2)					
$\gamma_{34,0}$(Np)	755,91 (5)	0,0000079 (1)	if E1				0,0064
$\gamma_{(-1,23)}$(Np)	759,5 (1)	0,00000181 (5)					
$\gamma_{(-1,24)}$(Np)	763,31	0,00000023 (2)					
$\gamma_{36,1}$(Np)	767,0 (1)	0,00000502 (3)	if E1				0,0063
$\gamma_{35,0}$(Np)	770,6 (1)	0,00000481 (5)					
$\gamma_{37,1}$(Np)	772,17	0,00000305 (6)	if M1				0,092
$\gamma_{(-1,69)}$(Np)	774,67	0,00000011 (2)					
$\gamma_{(-1,25)}$(Np)	777,39	0,00000015 (2)					
$\gamma_{(-1,26)}$(Np)	780,53	0,00000031 (2)					
$\gamma_{(-1,27)}$(Np)	782,2 (5)	0,00000015					
$\gamma_{39,3}$(Np)	786,00 (15)	0,00000062					
$\gamma_{(-1,28)}$(Np)	789,0 (3)	0,00000042 (6)					
$\gamma_{(-1,70)}$(Np)	792,6	0,00000003 (1)					
$\gamma_{(-1,29)}$(Np)	794,92 (20)	0,00000094					
$\gamma_{39,2}$(Np)	801,94 (20)	0,00000123 (7)					
$\gamma_{(-1,71)}$(Np)	803,19	0,00000016 (3)					
$\gamma_{37,0}$(Np)	806,26 (30)	0,00000031					
$\gamma_{(-1,30)}$(Np)	811,9 (3)	0,00000063 (6)					
$\gamma_{(-1,31)}$(Np)	819,33	0,00000043 (6)					
$\gamma_{(-1,32)}$(Np)	822,21	0,00000024 (6)					
$\gamma_{39,1}$(Np)	828,54	0,00000021 (4)					
$\gamma_{(-1,33)}$(Np)	835,21	0,00000003					
$\gamma_{(-1,72)}$(Np)	838,88	0,00000004 (1)					
$\gamma_{(-1,34)}$(Np)	841,14	0,00000010 (3)					
$\gamma_{(-1,73)}$(Np)	843,7	0,00000097 (8)					
$\gamma_{(-1,74)}$(Np)	846,86	0,00000016 (3)					
$\gamma_{(-1,35)}$(Np)	847,4 (5)	0,0000003					
$\gamma_{(-1,36)}$(Np)	851,6 (10)	0,00000041 (6)					
$\gamma_{(-1,37)}$(Np)	854,95	0,00000023 (4)					
$\gamma_{(-1,75)}$(Np)	856,26	0,00000010 (3)					
$\gamma_{40,2}$(Np)	860,7	0,00000008					
$\gamma_{39,0}$(Np)	862,7 (5)	0,00000061 (6)					
$\gamma_{(-1,38)}$(Np)	870,63	0,00000150 (3)					
$\gamma_{(-1,76)}$(Np)	882	0,00000004 (1)					
$\gamma_{(-1,77)}$(Np)	886,53	0,00000015 (3)					
$\gamma_{40,1}$(Np)	887,73	0,00000033 (6)					
$\gamma_{(-1,78)}$(Np)	890,38	0,00000032 (5)					
$\gamma_{(-1,79)}$(Np)	894,47	0,00000003 (1)					
$\gamma_{(-1,39)}$(Np)	898,17	0,00000006 (2)					
$\gamma_{(-1,40)}$(Np)	902,61	0,00000033 (3)					
$\gamma_{(-1,80)}$(Np)	909,95	0,00000005 (1)					
$\gamma_{(-1,41)}$(Np)	912,4	0,00000028 (3)					
$\gamma_{40,0}$(Np)	922,19	0,00000019 (3)					
$\gamma_{(-1,42)}$(Np)	928,95	0,00000009 (2)					
$\gamma_{(-1,81)}$(Np)	939,2	0,00000005 (1)					
$\gamma_{41,0}$(Np)	946,06	0,00000010 (3)					
$\gamma_{(-1,82)}$(Np)	952,72	0,00000003 (1)					
$\gamma_{(-1,44)}$(Np)	955,91	0,00000060 (5)					
$\gamma_{42,0}$(Np)	962,19	0,00000004 (1)					
$\gamma_{(-1,83)}$(Np)	969,09	0,00000003 (1)					
$\gamma_{(-1,84)}$(Np)	980,84	0,00000003 (1)					
$\gamma_{43,0}$(Np)	1014,33	0,0000010 (2)					

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				
	$L\ell$	11,89		
	$L\alpha$	13,76 – 13,944		
	$L\eta$	15,876		
	$L\beta$	16,13 – 17,99		
	$L\gamma$	20,12 – 22,2		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	73,50 – 83,13	100
KLX	90,36 – 97,28	60,2
KXY	107,10 – 114,58	9,06
Auger L	6,04 – 13,52	55000000

4 α Emissions

	Energy keV	Probability × 100
$\alpha_{0,36}$	4757,41 (16)	0,00004 (3)
$\alpha_{0,34}$	4800,68 (16)	0,000086
$\alpha_{0,33}$	4834,16 (13)	0,0007
$\alpha_{0,32}$	4889,0 (2)	
$\alpha_{0,30}$	4956,1 (3)	
$\alpha_{0,29}$	4961,7 (11)	
$\alpha_{0,28}$	4963,64 (20)	
$\alpha_{0,27}$	5007,59 (20)	0,0001
$\alpha_{0,25}$	5055,35 (14)	
$\alpha_{0,24}$	5066,23 (17)	0,00011
$\alpha_{0,23}$	5092,06 (13)	0,0004
$\alpha_{0,22}$	5099,10 (13)	0,0004
$\alpha_{0,21}$	5106,72 (16)	
$\alpha_{0,20}$	5117,21 (20)	0,0004
$\alpha_{0,19}$	5133 (4)	
$\alpha_{0,18}$	5155,16 (13)	0,0007
$\alpha_{0,17}$	5179,35 (13)	0,0003
$\alpha_{0,16}$	5181,65 (13)	0,0009
$\alpha_{0,15}$	5190,4 (2)	0,0006
$\alpha_{0,14}$	5217,28 (13)	
$\alpha_{0,13}$	5225,08 (13)	0,0013
$\alpha_{0,12}$	5232,6 (3)	
$\alpha_{0,11}$	5244,12 (13)	0,0022 (3)
$\alpha_{0,9}$	5281,02 (14)	0,0005
$\alpha_{0,8}$	5321,91 (13)	0,014 (3)
$\alpha_{0,6}$	5388,26 (13)	1,66 (3)
$\alpha_{0,5}$	5416,27 (13)	0,01
$\alpha_{0,4}$	5442,86 (12)	13,23 (10)
$\alpha_{0,3}$	5469,47 (12)	0,04
$\alpha_{0,2}$	5485,56 (12)	84,45 (10)
$\alpha_{0,1}$	5511,47 (12)	0,23 (1)
$\alpha_{0,0}$	5544,11 (12)	0,38 (1)

5 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Np)	6,04 - 13,52		36,0 (14)
e_{AK}	(Np)			0,000115 (16)
	KLL	73,50 - 83,13	}	
	KLX	90,36 - 97,28	}	
	KXY	107,10 - 114,58	}	
$ec_{2,1\ L}$	(Np)	3,92 - 8,73		14,7 (5)
$ec_{1,0\ L}$	(Np)	10,77 - 15,58		17,3 (3)
$ec_{3,1\ L}$	(Np)	20,31 - 25,12		1,6 (4)
$ec_{2,1\ M}$	(Np)	20,61 - 22,67		3,8 (5)
$ec_{4,2\ L}$	(Np)	20,99 - 25,81		8,6 (9)
$ec_{1,0\ M}$	(Np)	27,47 - 29,53		4,3 (6)
$ec_{6,4\ L}$	(Np)	33,13 - 37,94		0,89 (12)
$ec_{3,1\ M}$	(Np)	37,01 - 39,07		0,5 (1)
$ec_{2,0\ L}$	(Np)	37,11 - 37,93		31,3 (5)
$ec_{4,2\ M}$	(Np)	37,70 - 39,75		2,3 (4)
$ec_{6,4\ M}$	(Np)	49,83 - 51,89		0,24 (3)
$ec_{2,0\ M}$	(Np)	53,80 - 55,88		8,09 (25)
$ec_{6,2\ L}$	(Np)	76,52 - 81,34		0,229 (8)
$ec_{6,2\ M}$	(Np)	93,21 - 95,29		0,064 (2)

6 Photon Emissions

6.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Np)	11,89 — 22,2		37,6 (3)	
$XK\alpha_2$	(Np)	97,069		0,00116 (2)	} $K\alpha$
$XK\alpha_1$	(Np)	101,059		0,00185 (4)	}
$XK\beta_3$	(Np)	113,303	}		
$XK\beta_1$	(Np)	114,234	}	0,000670 (14)	$K'\beta_1$
$XK\beta_5''$	(Np)	114,912	}		
$XK\beta_2$	(Np)	117,463	}		
$XK\beta_4$	(Np)	117,876	}	0,000231 (5)	$K'\beta_2$
$XKO_{2,3}$	(Np)	118,429	}		

6.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{2,1}$(Np)	26,3446 (2)	2,40 (3)
$\gamma_{1,0}$(Np)	33,1963 (3)	0,121 (3)
$\gamma_{3,1}$(Np)	42,704 (5)	0,0055 (11)
$\gamma_{4,2}$(Np)	43,420 (3)	0,069 (5)
$\gamma_{14,10}$(Np)	51,01 (3)	0,000026 (12)
$\gamma_{6,4}$(Np)	55,55 (2)	0,0181 (18)
$\gamma_{(-1,3)}$(Np)	57,85 (5)	0,0052 (15)
$\gamma_{2,0}$(Np)	59,5409 (1)	35,78 (9)
$\gamma_{14,9}$(Np)	64,83 (2)	0,00014 (3)
$\gamma_{8,6}$(Np)	67,46 (5)	0,00042 (10)
$\gamma_{4,1}$(Np)	69,76 (3)	0,0029 (4)
$\gamma_{3,0}$(Np)	75,8 (2)	0,0006
$\gamma_{5,1}$(Np)	96,7 (2)	0,00005 (2)
$\gamma_{6,2}$(Np)	98,95 (1)	0,0203 (4)
$\gamma_{4,0}$(Np)	102,97 (1)	0,0195 (4)
$\gamma_{(-1,4)}$(Np)	106,42 (5)	0,000015
$\gamma_{20,13}$(Np)	109,70 (7)	0,0000049
$\gamma_{21,13}$(Np)	120,36 (8)	0,0000045
$\gamma_{8,4}$(Np)	123,02 (2)	0,00100 (4)
$\gamma_{6,1}$(Np)	125,29 (1)	0,0041 (2)
$\gamma_{29,22}$(Np)	139,46 (8)	0,0000053 (11)
$\gamma_{11,6}$(Np)	146,57 (1)	0,00046 (1)
$\gamma_{8,3}$(Np)	150,08 (3)	0,000073 (5)
$\gamma_{26,15}$(Np)	154,27 (20)	0,0000005
$\gamma_{29,20}$(Np)	159,16 (20)	0,0000014 (5)
$\gamma_{24,13}$(Np)	161,54 (10)	0,0000015
$\gamma_{9,4}$(Np)	164,59 (1)	0,000066 (3)
$\gamma_{13,6}$(Np)	165,91 (4)	0,000023 (1)
$\gamma_{18,8}$(Np)	169,55 (2)	0,00017 (1)
$\gamma_{11,5}$(Np)	175,08 (3)	0,000018 (3)
$\gamma_{(-1,8)}$(Np)	190,4	0,0000022 (5)
$\gamma_{25,11}$(Np)	191,90 (1)	0,0000215 (10)
$\gamma_{29,18}$(Np)	197,0 (2)	0,00000049
$\gamma_{(-1,9)}$(Np)	201,70 (14)	0,0000008
$\gamma_{18,7}$(Np)	204,06 (6)	0,0000206 (5)
$\gamma_{9,2}$(Np)	208,00 (2)	0,000786 (5)
$\gamma_{13,4}$(Np)	221,45 (3)	0,0000434 (6)
$\gamma_{26,10}$(Np)	232,81 (5)	0,00000482 (8)
$\gamma_{9,1}$(Np)	234,33	0,00000087 (7)
$\gamma_{26,9}$(Np)	246,7 (1)	0,00000244 (6)
$\gamma_{13,3}$(Np)	248,58 (8)	0,00000146 (3)
$\gamma_{21,7}$(Np)	260,9 (1)	0,00000129 (6)
$\gamma_{13,2}$(Np)	264,87 (5)	0,00000943 (7)
$\gamma_{9,0}$(Np)	267,54 (3)	0,0000268 (5)
$\gamma_{(-1,10)}$(Np)	270,63 (15)	0,0000005 (2)

	Energy keV	Photons per 100 disint.
$\gamma_{(-1,51)}$(Np)	271,54	0,00000144 (5)
$\gamma_{20,6}$(Np)	275,73 (8)	0,00000632 (8)
$\gamma_{27,9}$(Np)	278,18	0,00000115
$\gamma_{13,1}$(Np)	291,26 (20)	0,00000305 (7)
$\gamma_{16,3}$(Np)	292,78 (4)	0,0000142 (2)
$\gamma_{20,5}$(Np)	304,2 (2)	0,00000093 (2)
$\gamma_{16,2}$(Np)	309,1 (3)	0,0000019 (3)
$\gamma_{21,5}$(Np)	322,53 (3)	0,000151 (3)
$\gamma_{(-1,52)}$(Np)	324,69	0,0000018 (3)
$\gamma_{(-1,53)}$(Np)	329,69	0,0000011 (2)
$\gamma_{14,0}$(Np)	332,36 (2)	0,000150 (3)
$\gamma_{16,1}$(Np)	335,40 (3)	0,000496 (5)
$\gamma_{17,1}$(Np)	337,7 (2)	0,00000488 (7)
$\gamma_{(-1,11)}$(Np)	350,71	0,00000139 (5)
$\gamma_{20,3}$(Np)	358,3 (2)	0,00000129 (5)
$\gamma_{16,0}$(Np)	368,63 (3)	0,000214 (4)
$\gamma_{17,0}$(Np)	370,94 (3)	0,0000520 (6)
$\gamma_{(-1,54)}$(Np)	374,83	0,00000313 (5)
$\gamma_{21,3}$(Np)	376,66 (3)	0,000137 (3)
$\gamma_{22,3}$(Np)	383,80 (3)	0,0000281 (5)
$\gamma_{(-1,12)}$(Np)	389,0 (3)	0,00000049
$\gamma_{(-1,13)}$(Np)	390,61 (5)	0,00000573 (8)
$\gamma_{29,7}$(Np)	401,68	0,00000014 (3)
$\gamma_{30,7}$(Np)	406,4 (2)	0,00000137 (5)
$\gamma_{(-1,14)}$(Np)	411,27	0,00000018 (4)
$\gamma_{21,1}$(Np)	419,32 (4)	0,0000284 (3)
$\gamma_{22,1}$(Np)	426,47 (4)	0,0000243 (7)
$\gamma_{(-1,15)}$(Np)	429,9 (1)	0,00000109 (5)
$\gamma_{(-1,55)}$(Np)	440,63	0,00000056 (3)
$\gamma_{(-1,16)}$(Np)	442,81 (7)	0,00000331 (7)
$\gamma_{35,13}$(Np)	446,68	0,00000011 (2)
$\gamma_{21,0}$(Np)	452,5 (3)	0,00000236 (6)
$\gamma_{26,2}$(Np)	454,66 (8)	0,00000953 (7)
$\gamma_{22,0}$(Np)	459,68 (10)	0,00000355 (6)
$\gamma_{29,5}$(Np)	463,22 (20)	0,000001
$\gamma_{30,5}$(Np)	468,06 (15)	0,00000269 (5)
$\gamma_{(-1,17)}$(Np)	486,05	0,00000105 (6)
$\gamma_{28,4}$(Np)	487,64	0,00000062 (5)
$\gamma_{(-1,56)}$(Np)	494,39	0,00000010 (2)
$\gamma_{(-1,57)}$(Np)	501,39	0,00000014 (2)
$\gamma_{27,1}$(Np)	512,4 (3)	0,0000021 (4)
$\gamma_{26,0}$(Np)	514,2 (2)	0,0000038 (2)
$\gamma_{30,3}$(Np)	522,11	0,00000099 (5)
$\gamma_{(-1,58)}$(Np)	525,14	0,00000016 (3)
$\gamma_{38,13}$(Np)	528,87	0,00000069 (5)
$\gamma_{(-1,59)}$(Np)	532,44	0,00000008 (2)
$\gamma_{27,0}$(Np)	545,7	0,00000025 (3)

	Energy keV	Photons per 100 disint.
$\gamma_{(-1,60)}$(Np)	548,15	0,00000005 (2)
$\gamma_{(-1,61)}$(Np)	555,25	0,00000009 (2)
$\gamma_{33,6}$(Np)	563,48	0,00000044 (2)
$\gamma_{36,8}$(Np)	573,94 (20)	0,00000128 (5)
$\gamma_{(-1,18)}$(Np)	582,89	0,00000101 (6)
$\gamma_{31,2}$(Np)	586,5 (2)	0,00000124 (5)
$\gamma_{28,0}$(Np)	590,28 (15)	0,00000280 (5)
$\gamma_{34,6}$(Np)	597,44 (8)	0,00000729 (8)
$\gamma_{(-1,62)}$(Np)	600,26	0,00000022 (3)
$\gamma_{33,4}$(Np)	619,01 (2)	0,000060 (2)
$\gamma_{38,8}$(Np)	627,2 (2)	0,00000051 (2)
$\gamma_{32,1}$(Np)	632,93 (15)	0,00000124 (5)
$\gamma_{(-1,63)}$(Np)	636,9	0,00000021 (3)
$\gamma_{36,6}$(Np)	641,46 (5)	0,00000704 (7)
$\gamma_{34,4}$(Np)	652,98 (4)	0,0000376 (8)
$\gamma_{33,2}$(Np)	662,41 (2)	0,000367 (5)
$\gamma_{32,0}$(Np)	666,2 (3)	0,00000095 (7)
$\gamma_{36,5}$(Np)	669,9 (2)	0,00000051 (7)
$\gamma_{37,5}$(Np)	675,8 (3)	0,00000085 (5)
$\gamma_{34,3}$(Np)	680,1 (1)	0,00000331 (7)
$\gamma_{33,1}$(Np)	688,76 (4)	0,0000323 (5)
$\gamma_{(-1,19)}$(Np)	693,46	0,00000354 (7)
$\gamma_{34,2}$(Np)	696,48	0,00000517 (6)
$\gamma_{(-1,20)}$(Np)	709,42 (5)	0,00000641 (18)
$\gamma_{(-1,64)}$(Np)	712,5	0,00000020 (3)
$\gamma_{33,0}$(Np)	721,98 (3)	0,000196 (4)
$\gamma_{37,3}$(Np)	729,52	0,00000137 (5)
$\gamma_{(-1,21)}$(Np)	731,44	0,00000046 (4)
$\gamma_{(-1,65)}$(Np)	736,68	0,00000128 (5)
$\gamma_{35,1}$(Np)	737,34 (5)	0,00000794 (8)
$\gamma_{(-1,66)}$(Np)	740,51	0,00000019 (3)
$\gamma_{(-1,22)}$(Np)	742,9 (3)	0,00000035
$\gamma_{(-1,67)}$(Np)	745,02	0,00000009 (2)
$\gamma_{(-1,85)}$(Np)	750,39	0,000000006 (2)
$\gamma_{34,0}$(Np)	755,91 (5)	0,00000784 (8)
$\gamma_{(-1,23)}$(Np)	759,5 (1)	0,00000181 (5)
$\gamma_{(-1,24)}$(Np)	763,31	0,00000023 (2)
$\gamma_{36,1}$(Np)	767,0 (1)	0,00000501 (3)
$\gamma_{35,0}$(Np)	770,6 (1)	0,00000481 (5)
$\gamma_{37,1}$(Np)	772,17	0,00000279 (3)
$\gamma_{(-1,69)}$(Np)	774,67	0,00000011 (2)
$\gamma_{(-1,25)}$(Np)	777,39	0,00000015 (2)
$\gamma_{(-1,26)}$(Np)	780,53	0,00000031 (2)
$\gamma_{(-1,27)}$(Np)	782,2 (5)	0,00000015
$\gamma_{39,3}$(Np)	786,00 (15)	0,00000062
$\gamma_{(-1,28)}$(Np)	789,0 (3)	0,00000042 (6)
$\gamma_{(-1,70)}$(Np)	792,6	0,00000003 (1)

	Energy keV	Photons per 100 disint.
$\gamma_{(-1,29)}$(Np)	794,92 (20)	0,00000094
$\gamma_{39,2}$(Np)	801,94 (20)	0,00000123 (7)
$\gamma_{(-1,71)}$(Np)	803,19	0,00000016 (3)
$\gamma_{37,0}$(Np)	806,26 (30)	0,00000031
$\gamma_{(-1,30)}$(Np)	811,9 (3)	0,00000063 (6)
$\gamma_{(-1,31)}$(Np)	819,33	0,00000043 (6)
$\gamma_{(-1,32)}$(Np)	822,21	0,00000024 (6)
$\gamma_{39,1}$(Np)	828,54	0,00000021 (4)
$\gamma_{(-1,33)}$(Np)	835,21	0,00000003
$\gamma_{(-1,72)}$(Np)	838,88	0,00000004 (1)
$\gamma_{(-1,34)}$(Np)	841,14	0,00000010 (3)
$\gamma_{(-1,73)}$(Np)	843,7	0,00000097 (8)
$\gamma_{(-1,74)}$(Np)	846,86	0,00000016 (3)
$\gamma_{(-1,35)}$(Np)	847,4 (5)	0,00000027 (3)
$\gamma_{(-1,36)}$(Np)	851,6 (10)	0,00000041 (6)
$\gamma_{(-1,37)}$(Np)	854,95	0,00000023 (4)
$\gamma_{(-1,75)}$(Np)	856,26	0,00000010 (3)
$\gamma_{40,2}$(Np)	860,7	0,00000008 (3)
$\gamma_{39,0}$(Np)	862,7 (5)	0,00000061 (6)
$\gamma_{(-1,38)}$(Np)	870,63	0,00000150 (3)
$\gamma_{(-1,76)}$(Np)	882	0,00000004 (1)
$\gamma_{(-1,77)}$(Np)	886,53	0,00000015 (3)
$\gamma_{40,1}$(Np)	887,73	0,00000033 (6)
$\gamma_{(-1,78)}$(Np)	890,38	0,00000032 (5)
$\gamma_{(-1,79)}$(Np)	894,47	0,00000003 (1)
$\gamma_{(-1,39)}$(Np)	898,17	0,00000006 (2)
$\gamma_{(-1,40)}$(Np)	902,61	0,00000033 (3)
$\gamma_{(-1,80)}$(Np)	909,95	0,00000005 (1)
$\gamma_{(-1,41)}$(Np)	912,4	0,00000028 (3)
$\gamma_{40,0}$(Np)	922,19	0,00000019 (3)
$\gamma_{(-1,42)}$(Np)	928,95	0,00000009 (2)
$\gamma_{(-1,81)}$(Np)	939,2	0,00000005 (1)
$\gamma_{41,0}$(Np)	946,06	0,000000010 (2)
$\gamma_{(-1,82)}$(Np)	952,72	0,00000003 (1)
$\gamma_{(-1,44)}$(Np)	955,91	0,00000060 (5)
$\gamma_{42,0}$(Np)	962,19	0,00000004 (1)
$\gamma_{(-1,83)}$(Np)	969,09	0,00000003 (1)
$\gamma_{(-1,84)}$(Np)	980,84	0,00000003 (1)
$\gamma_{43,0}$(Np)	1014,33	0,0000010 (2)

7 Remarks

7.1 Gamma Transitions and Conversion Electron Coefficients

Transitions (-1,x) are not placed in the decay scheme.
Transitions without uncertainty on the energy value or without transition probability are questionnable.

7.2 X Radiations

Intensity of M X-rays = 6,3 (6) %

8 Main Production Modes

Daughter of Pu – 241

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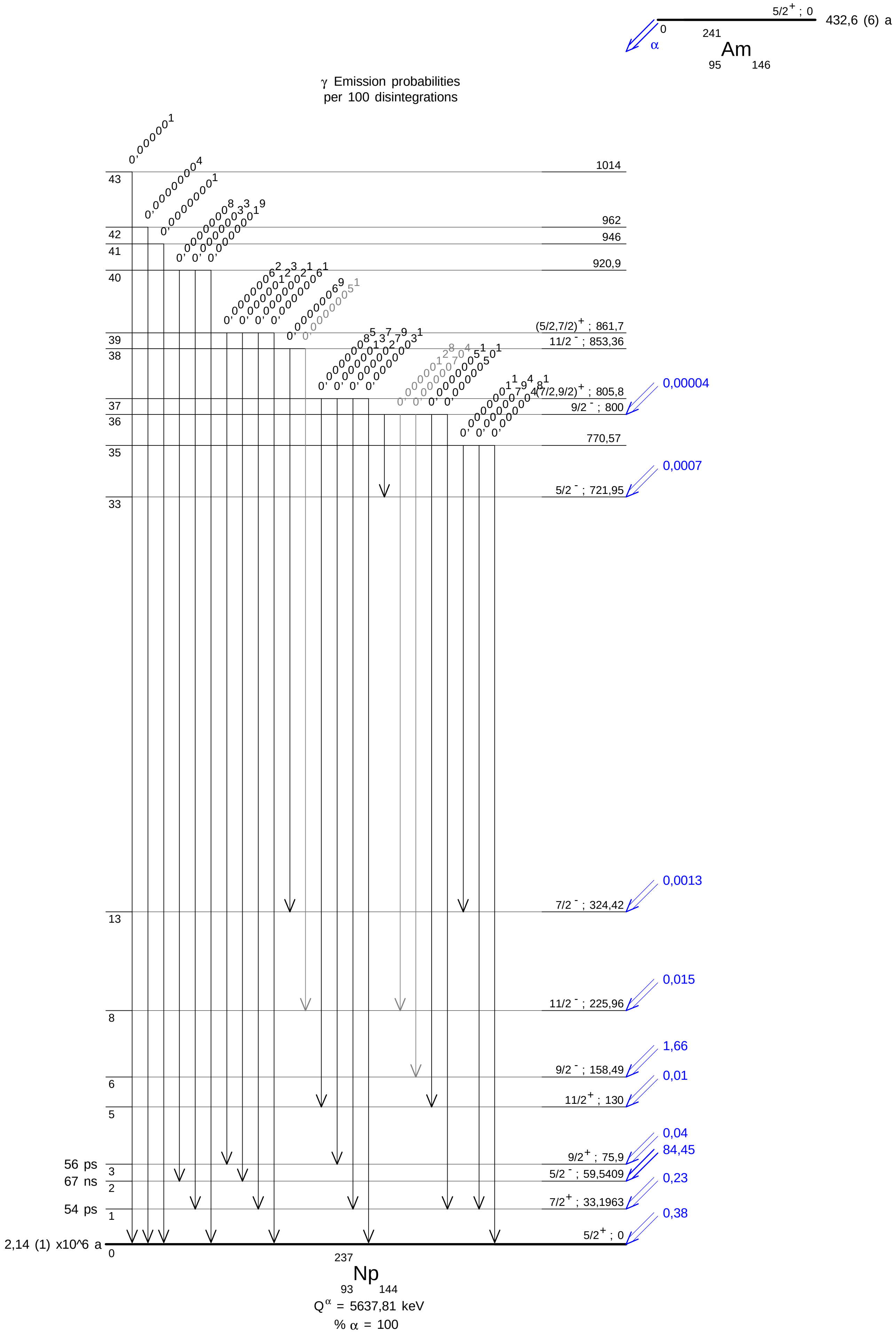
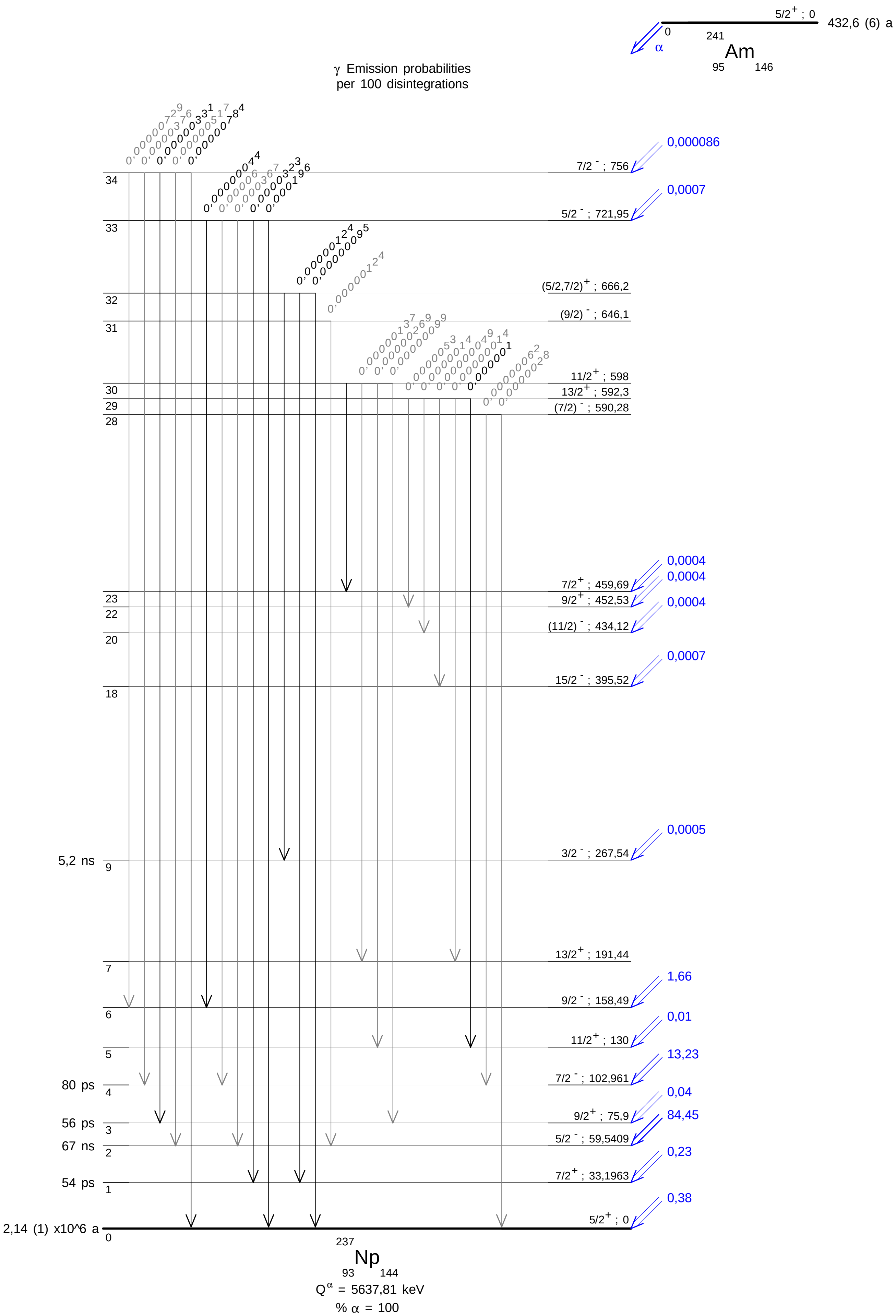
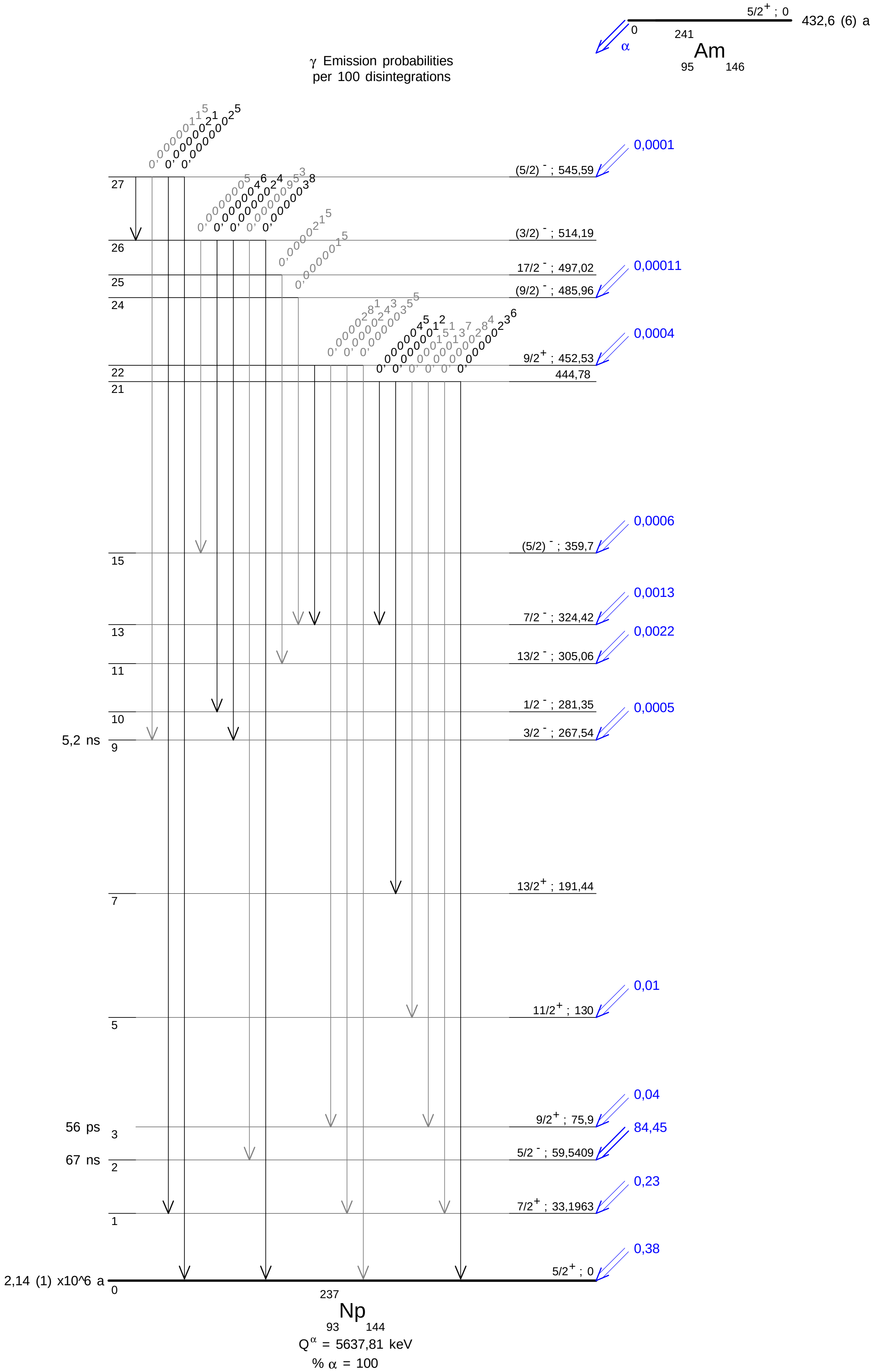
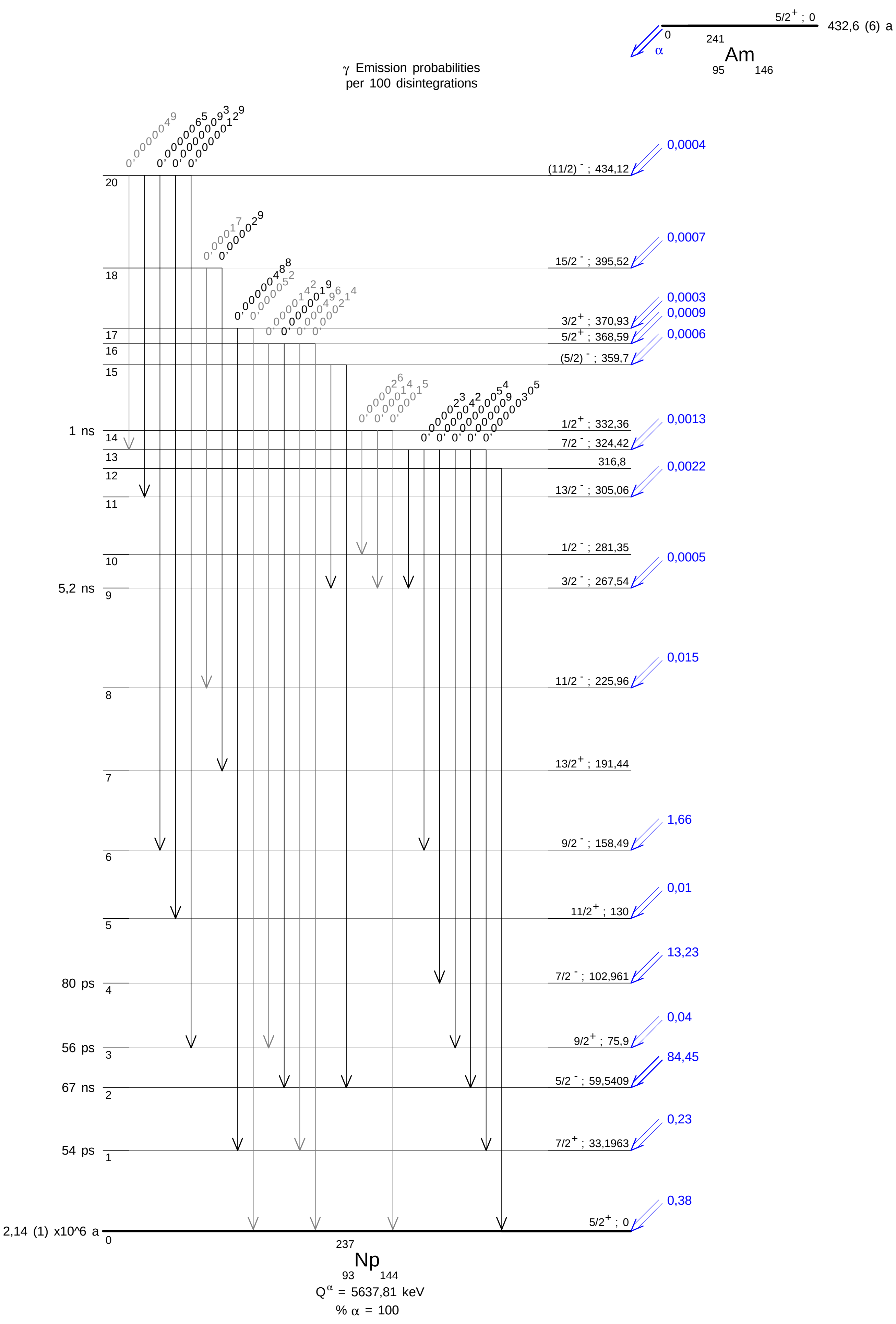
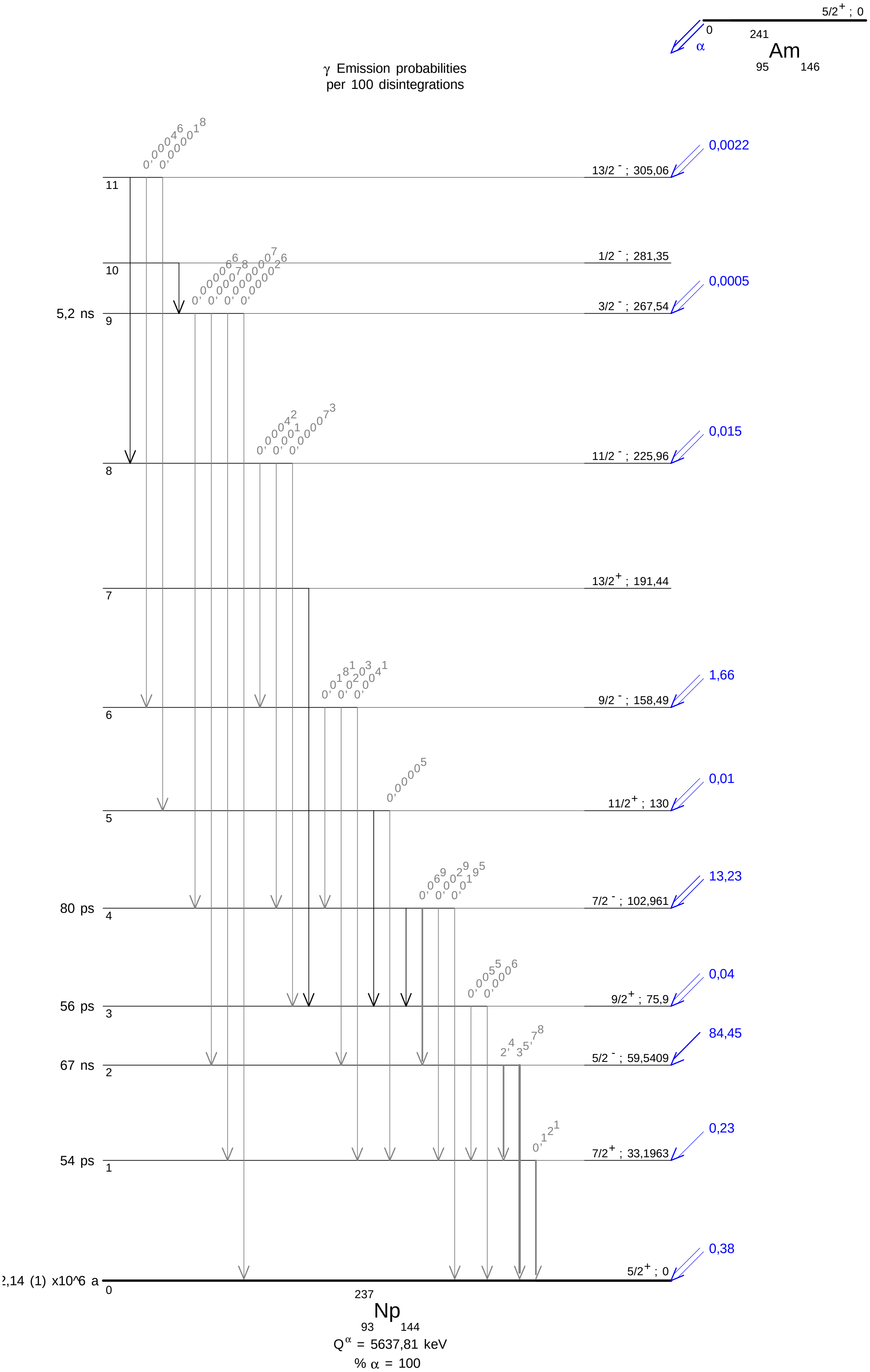


5/2+ ; 0
432,6 (6) a
α
241 Am 95 146
γ Emission probabilities
per 100 disintegrations
1014
962
946
920,9
(5/2,7/2)+ ; 861,7
11/2 - ; 853,36
(7/2,9/2)+ ; 805,8
9/2 - ; 800
770,57
5/2 - ; 721,95
7/2 - ; 324,42
11/2 - ; 225,96
9/2 - ; 158,49
11/2+ ; 130
9/2+ ; 75,9
5/2 - ; 59,5409
7/2+ ; 33,1963
5/2+ ; 0
0,00004
0,0007
0,0013
0,015
1,66
0,01
0,04
84,45
0,23
0,38
56 ps
67 ns
54 ps
2,14 (1) x10^6 a
237 Np 93 144
Qα = 5637,81 keV
% α = 100


5/2+ ; 0
432,6 (6) a
241 Am 95 146
α
γ Emission probabilities
per 100 disintegrations
7/2 - ; 756
5/2 - ; 721,95
(5/2,7/2)+ ; 666,2
(9/2) - ; 646,1
11/2+ ; 598
13/2+ ; 592,3
(7/2) - ; 590,28
7/2+ ; 459,69
9/2+ ; 452,53
(11/2) - ; 434,12
15/2 - ; 395,52
3/2 - ; 267,54
13/2+ ; 191,44
9/2 - ; 158,49
11/2+ ; 130
7/2 - ; 102,961
9/2+ ; 75,9
5/2 - ; 59,5409
7/2+ ; 33,1963
5/2+ ; 0
0,000086
0,0007
0,0004
0,0004
0,0004
0,0007
0,0005
1,66
0,01
13,23
0,04
84,45
0,23
0,38
5,2 ns
80 ps
56 ps
67 ns
54 ps
2,14 (1) x10^6 a
237 Np 93 144
Q^α = 5637,81 keV
% α = 100


5/2+ ; 0
432,6 (6) a
0
α
241
Am
95
146
γ Emission probabilities
per 100 disintegrations
(5/2) - ; 545,59
0,0001
(3/2) - ; 514,19
17/2 - ; 497,02
0,00011
(9/2) - ; 485,96
0,0004
9/2+ ; 452,53
444,78
0,0006
(5/2) - ; 359,7
0,0013
7/2 - ; 324,42
0,0022
13/2 - ; 305,06
1/2 - ; 281,35
0,0005
3/2 - ; 267,54
5,2 ns
13/2+ ; 191,44
0,01
11/2+ ; 130
0,04
9/2+ ; 75,9
56 ps
84,45
5/2 - ; 59,5409
67 ns
0,23
7/2+ ; 33,1963
0,38
5/2+ ; 0
2,14 (1) x10^6 a
27
26
25
24
22
21
15
13
11
10
9
7
5
3
2
1
0
237
Np
93
144
Qα = 5637,81 keV
% α = 100


γ Emission probabilities
per 100 disintegrations
5/2+ ; 0
432,6 (6) a
241 Am 95 146
α
(11/2)- ; 434,12
0,0004
15/2- ; 395,52
0,0007
3/2+ ; 370,93
0,0003
5/2+ ; 368,59
0,0009
(5/2)- ; 359,7
0,0006
1/2+ ; 332,36
0,0013
7/2- ; 324,42
316,8
0,0022
13/2- ; 305,06
1/2- ; 281,35
3/2- ; 267,54
0,0005
11/2- ; 225,96
0,015
13/2+ ; 191,44
9/2- ; 158,49
1,66
11/2+ ; 130
0,01
7/2- ; 102,961
13,23
9/2+ ; 75,9
0,04
5/2- ; 59,5409
84,45
7/2+ ; 33,1963
0,23
5/2+ ; 0
0,38
1 ns
5,2 ns
80 ps
56 ps
67 ns
54 ps
2,14 (1) x10^6 a
237 Np 93 144
Q^α = 5637,81 keV
% α = 100


γ Emission probabilities
per 100 disintegrations
5/2+ ; 0
241 Am 95 146
α
13/2 - ; 305,06
0,0022
1/2 - ; 281,35
3/2 - ; 267,54
0,0005
5,2 ns
11/2 - ; 225,96
0,015
13/2+ ; 191,44
9/2 - ; 158,49
1,66
11/2+ ; 130
0,01
80 ps
7/2 - ; 102,961
13,23
56 ps
9/2+ ; 75,9
0,04
67 ns
5/2 - ; 59,5409
84,45
54 ps
7/2+ ; 33,1963
0,23
2,14 (1) x10^6 a
5/2+ ; 0
0,38
237 Np 93 144
Qα = 5637,81 keV
% α = 100

$^{242}_{94}$Pu$_{148}$

1 Decay Scheme

Pu-242 decays 100% by alpha transitions to U-238 and by spontaneous fission with branching fraction of 5.49(9)10^{-4} %. Most of the alpha decay populates the U-238 ground state (76.5 %) and the U-238 first excited level with energy of 44.9 keV (23.5 %).

Le plutonium 242 se désintègre par émission alpha et par fission spontanée dans une proportion de 5,49(9) 10^{-4} %. L' émission alpha a lieu principalement vers le niveau excité de 44,9 keV (23,5 %) et le niveau fondamental (76,5 %) de l'uranium 238.

2 Nuclear Data

$T_{1/2}$(^{242}Pu)	:	3,73	(3)	10^5 a
$T_{1/2}$(^{238}U)	:	4,47	(2)	10^9 a
Q^{α}(^{242}Pu)	:	4984,4	(9)	keV

2.1 α Transitions

	Energy keV	Probability × 100	F
$\alpha_{0,3}$	4677,2 (9)	0,00085 (6)	602
$\alpha_{0,2}$	4836,0 (9)	0,0308 (13)	234
$\alpha_{0,1}$	4939,5 (9)	23,49 (18)	1,62
$\alpha_{0,0}$	4984,4 (9)	76,48 (18)	1

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{1,0}$(U)	44,915 (13)	23,52 (18)	E2		455 (9)	126 (3)	625 (13)
$\gamma_{2,1}$(U)	103,50 (4)	0,0316 (13)	E2		8,43 (17)	2,35 (5)	11,61 (23)
$\gamma_{3,2}$(U)	158,80 (8)	0,00085 (6)	E2	0,210 (4)	1,203 (24)	0,334 (7)	1,86 (4)

3 Atomic Data

3.1 U

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

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	94,666		62,47
	$K\alpha_1$	98,44		100
	$K\beta_3$	110,421	}	
	$K\beta_1$	111,298	}	
	$K\beta_5''$	111,964	}	36,06
	$K\beta_2$	114,407	}	
	$K\beta_4$	115,012	}	12,33
	$KO_{2,3}$	115,377	}	
X_L				
	$L\ell$	11,62		
	$L\alpha$	13,44 – 13,62		
	$L\eta$	15,4		
	$L\beta$	15,73 – 18,21		
	$L\gamma$	19,51 – 21,73		

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	0,10 – 21,65	

4 α Emissions

	Energy keV	Probability × 100
$\alpha_{0,3}$	4600,0 (9)	0,00085 (6)
$\alpha_{0,2}$	4756,1 (9)	0,0308 (13)
$\alpha_{0,1}$	4858,1 (9)	23,49 (18)
$\alpha_{0,0}$	4902,2 (9)	76,48 (18)

5 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(U)	0,10 - 21,65		8,6 (5)
e_{AK}	(U)			0,0000019 (3)
	KLL	71,776 - 80,954	}	
	KLX	88,153 - 98,429	}	
	KXY	104,51 - 115,59	}	
$ec_{1,0\ L}$	(U)	23,157 - 27,747		17,1 (5)
$ec_{1,0\ M}$	(U)	39,367 - 41,365		4,74 (15)

6 Photon Emissions

6.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(U)	11,62 — 21,73		8,56 (40)	
$XK\alpha_2$	(U)	94,666		0,0000180 (15)	} Kα
$XK\alpha_1$	(U)	98,44		0,0000288 (24)	}
$XK\beta_3$	(U)	110,421	}		
$XK\beta_1$	(U)	111,298	}	0,0000104 (10)	$K'\beta_1$
$XK\beta_5''$	(U)	111,964	}		
$XK\beta_2$	(U)	114,407	}		
$XK\beta_4$	(U)	115,012	}	0,0000032 (3)	$K'\beta_2$
$XKO_{2,3}$	(U)	115,377	}		

6.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(U)	44,915 (13)	0,0376 (8)
$\gamma_{2,1}$(U)	103,50 (4)	0,00251 (11)
$\gamma_{3,2}$(U)	158,80 (8)	0,000298 (20)

7 Main Production Modes

Multiple n – capture from U – 238, Pu – 238

Pu – 241(n,γ)Pu – 242
Possible impurities : Pu – 238, Pu – 239, Pu – 240, Pu – 241, Am – 241

Am – 241(n,γ)Am – 242
Possible impurities : Am – 241, Cm – 242

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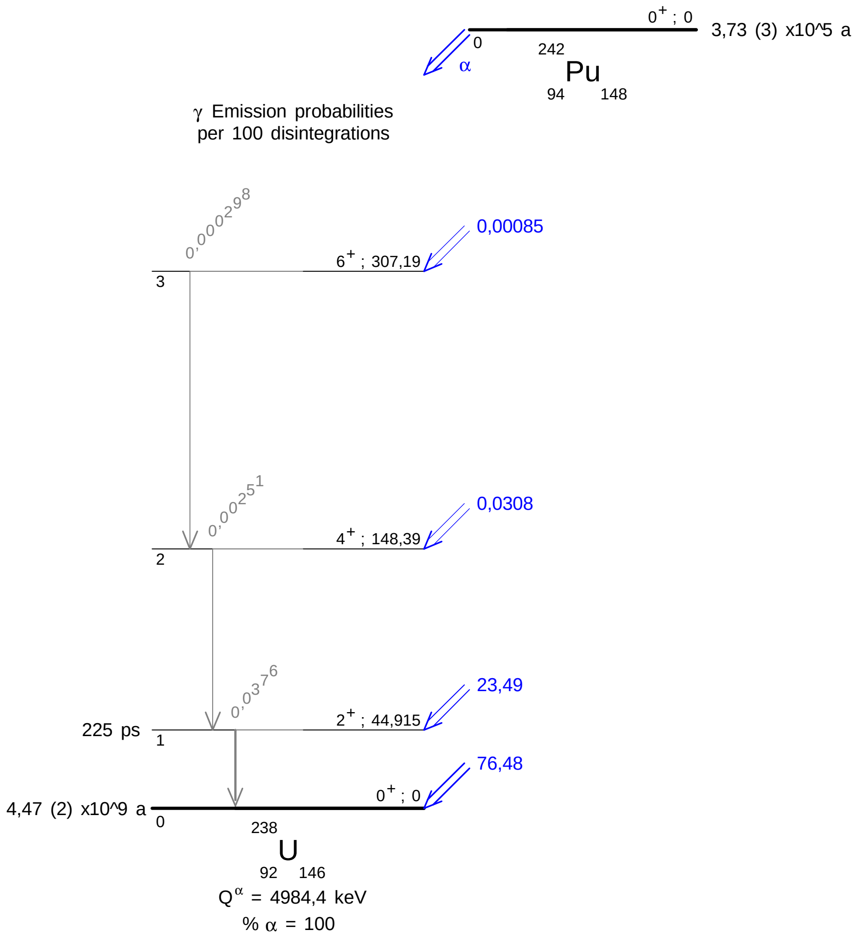
0+ ; 0
3,73 (3) x10^5 a
0
242
Pu
94 148
α
γ Emission probabilities
per 100 disintegrations
0,000298
0,00085
6+ ; 307,19
3
0,00251
0,0308
4+ ; 148,39
2
0,0376
23,49
225 ps
2+ ; 44,915
1
76,48
0+ ; 0
4,47 (2) x10^9 a
0
238
U
92 146
Qα = 4984,4 keV
% α = 100

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