Monographie BIPM-5

Table of Radionuclides (Vol. 1 - A = 1 to 150)

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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.

Errata to printed version of volumes 1 and 2

(corrections have been applied in CD-Rom files)

^{85}Sr

Main production modes

Sr-84 (n, γ) Sr-85m

^{89}Sr

Sr-89 disintegrates by beta minus emission mainly to the Y-89 fundamental level.

Caution:

^{125}Sb

Updating of the data is on-going (October 2004).

New issue will be available on the web pages :

http://www.nucleide.org/DDEP_WG/DDEPdata.htm

Monographie BIPM-5 - Table of Radionuclides (Vol. 1 - A = 1 to 150)

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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”

<u>Prólogo</u> – 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 $9{,}230 \pm 0{,}011$ und
9,2(11) bedeutet $9{,}2 \pm 1{,}1$

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

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

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 [^{87}Ta,^{99}Be]. 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 :
$U(y) = k \, . \, uc(y)$ 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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AUTORES PARA CORRESPONDENCIA

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

Information on the data and the evaluation 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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$^{7}_{4}Be_{3}$

1 Decay Scheme

Be-7 disintegrates by electron capture either directly to the ground state of Li-7 (89.56%) or via the 477 keV of Li-7 (10.44%). Recent experiments have shown that the half-life of Be-7 increases as much as 0.7% by embedding this radionuclide in different matrices. The recommended value presented in this evaluation should be adequate for Be and BeO sample.

Le Be-7 se désintègre par capture électronique soit directement vers le niveau fondamental de Li-7, soit via le niveau excité de 477 keV. Des expériences récentes ont montré que la valeur de la période pouvait être affectée jusqu'à 0,7% par une modification de l'environnement extérieur, par exemple la composition chimique. La valeur retenue pour cette évaluation s'applique plutôt à des échantillons de Be ou BeO.

2 Nuclear Data

$T_{1/2}(^{7}Be)$	:	53,22	(6)	d
$Q^{+}(^{7}Be)$	:	861,815	(18)	keV

2.1 Electron Capture Transitions

	Energy keV	Probability × 100	Nature	lg ft	P_K	P_L
$\epsilon_{0,1}$	384,194 (18)	10,44 (4)	Allowed	3,56	0,908 (12)	0,092 (12)
$\epsilon_{0,0}$	861,815 (18)	89,56 (4)	Allowed	3,32	0,908 (12)	0,092 (12)

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_T
$\gamma_{1,0}$(Li)	477,621 (2)	10,44 (4)	M1+4%E2	0,00000073 (11)

3 Atomic Data

3.1 Li

ω_K : 0,00029 (15)

3.1.1 X Radiations

		Energy keV	Relative probability
X_K			
	Kα	0,0543	

4 Photon Emissions

4.1 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Li)	477,6035 (20)	10,44 (4)

5 Main Production Modes

- Li – 6(d,n)Be – 7
  Possible impurities : Li – 7
- B – 10(p,α)Be – 7
  Possible impurities : C – 9,C – 11
- C – 12(He – 3,2α)Be – 7
  Possible impurities : C – 11,N – 13

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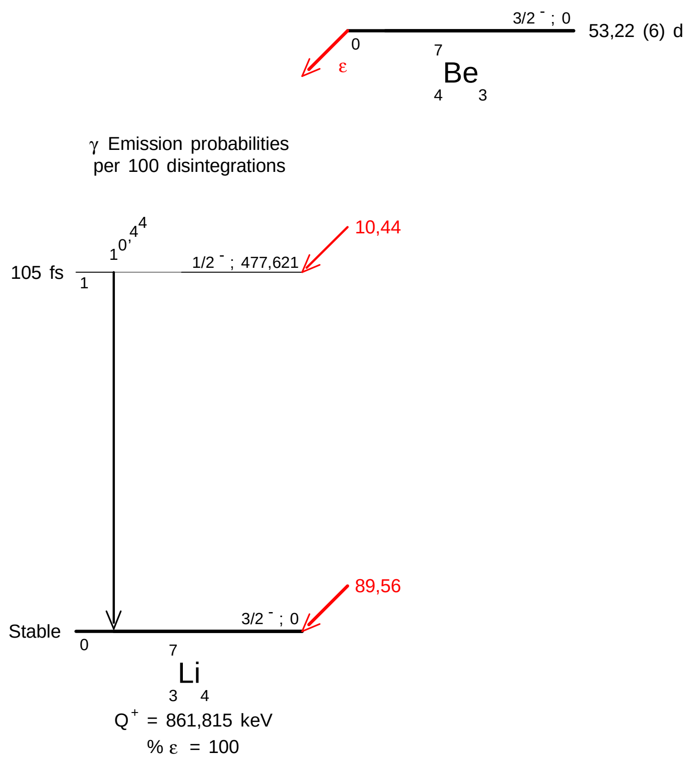
3/2 - ; 0
53,22 (6) d
0
ε
7
Be
4 3
γ Emission probabilities
per 100 disintegrations
10,44
105 fs
1/2 - ; 477,621
1
89,56
Stable
3/2 - ; 0
0
7
Li
3 4
Q+ = 861,815 keV
% ε = 100

$^{11}_{6}C_{5}$

1 Decay Scheme

Le carbone 11 se désintègre à 99,750(13)% par émission bêta-plus, et 0,250(13)% par capture électronique vers le niveau fondamental de bore 11.
C-11 disintegrates by 99.750(13) % beta-plus, and 0.250(13)% by electron capture to the ground state of the stable nuclide B-11.

2 Nuclear Data

$T_{1/2}(^{11}C)$	:	20,370	(29)	min
$Q^{+}(^{11}C)$	:	1982,5	(9)	keV

2.1 β^{+} Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^{+}_{0,0}$	960,5 (9)	99,750 (13)	Allowed	3,592

2.2 Electron Capture Transitions

	Energy keV	Probability × 100	Nature	P_K	P_L
$\epsilon_{0,0}$	1982,5 (9)	0,250 (13)	Allowed	0,9174 (91)	0,0826 (91)

3 Electron Emissions

		Energy keV	Electrons per 100 disint.
$\beta^+_{0,0}$	max:	960,5 (9)	99,750 (13)
$\beta^+_{0,0}$	avg:	385,7 (4)	

4 Photon Emissions

4.1 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma^{\pm}$	511	199,500 (26)

5 Main Production Modes

$C - 12(\gamma,n)C - 11$
$C - 12(d,t)C - 11$
$Li - 6(Li - 6,n)C - 11$
$Li - 7(Li - 6,2n)C - 11$
$B - 11(p,n)C - 11$
$B - 10(d,n)C - 11$
$N - 14(d,n\alpha)C - 11$
$B - 10(\alpha,t)C - 11$
$Be - 9(\alpha,2n)C - 11$
$B - 10(p,\gamma)C - 11$
$B - 11(d,2n)C - 11$
$C - 12(p,pn)C - 11$
$C - 12(He - 3,\alpha)C - 11$
$Be - 9(He - 3,n)C - 11$
$C - 13(p,p2n)C - 11$
$B - 10(He - 3,d)C - 11$
$C - 12(\pi_+,p)C - 11$

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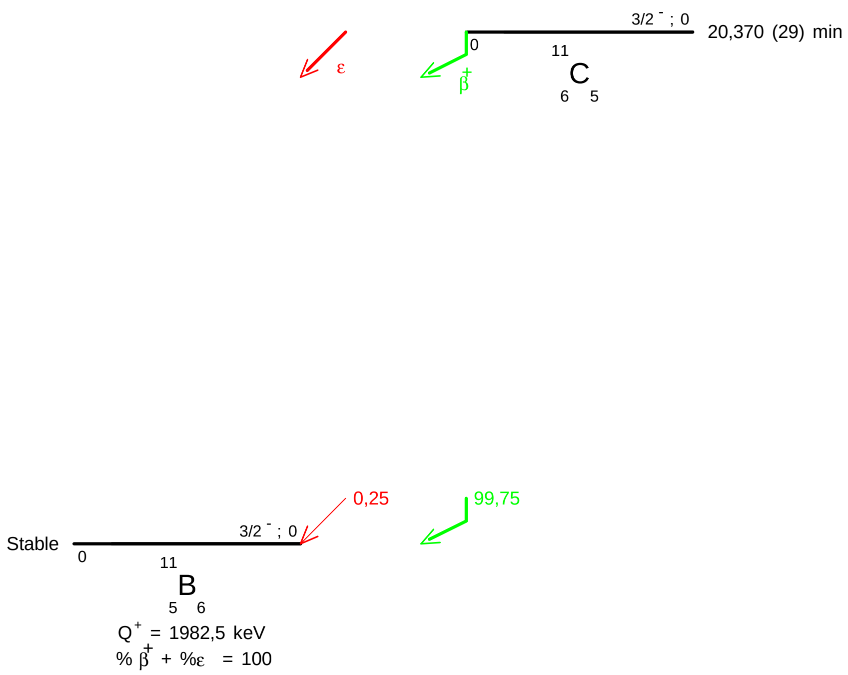
3/2 - ; 0
20,370 (29) min
0
11
C
6 5
ε
β+
0,25
99,75
Stable
3/2 - ; 0
0
11
B
5 6
Q+ = 1982,5 keV
% β+ + %ε = 100

$^{13}_{7}$N $_6$

1 Decay Scheme

N-13 disintegrates by 99.8 % beta-plus transition to the ground state of the stable nuclide C-13.
l'azote 13 se désintègre à 99,8% par émission bêta-plus vers le niveau fondamental de carbone 13.

2 Nuclear Data

$T_{1/2}$(^{13}N)	:	9,9670	(37)	min
Q^+(^{13}N)	:	2220,45	(27)	keV

2.1 β^+ Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^+_{0,0}$	1198,45 (27)	99,818 (13)	Allowed	3,654

2.2 Electron Capture Transitions

	Energy keV	Probability × 100	Nature	P_K	P_L
$\epsilon_{0,0}$	2220,45 (27)	0,182 (12)	Allowed	0,923 (7)	0,078 (7)

3 Atomic Data

3.1 C

ω_K : 0,0026 (3)

4 Photon Emissions

4.1 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma^{\pm}$	511	199,636 (26)

5 Electron Emissions

		Energy keV	Electrons per 100 disint.
$\beta^+_{0,0}$	max:	1198,45 (27)	99,818 (13)
$\beta^+_{0,0}$	avg:	493,0 (2)	

6 Main Production Modes

C – 12(d,n)N – 13
C – 13(p,n)N – 13
O – 16(p,α)N – 13
O – 16(d,nα)N – 13
N – 14(p,d)N – 13
N – 14(n,2n)N – 13
N – 14(γ,n)N – 13
N – 14(p,pn)N – 13
C – 12(p,γ)N – 13
Be – 9(Li – 6,2n)N – 13
B – 11(α,2n)N – 13

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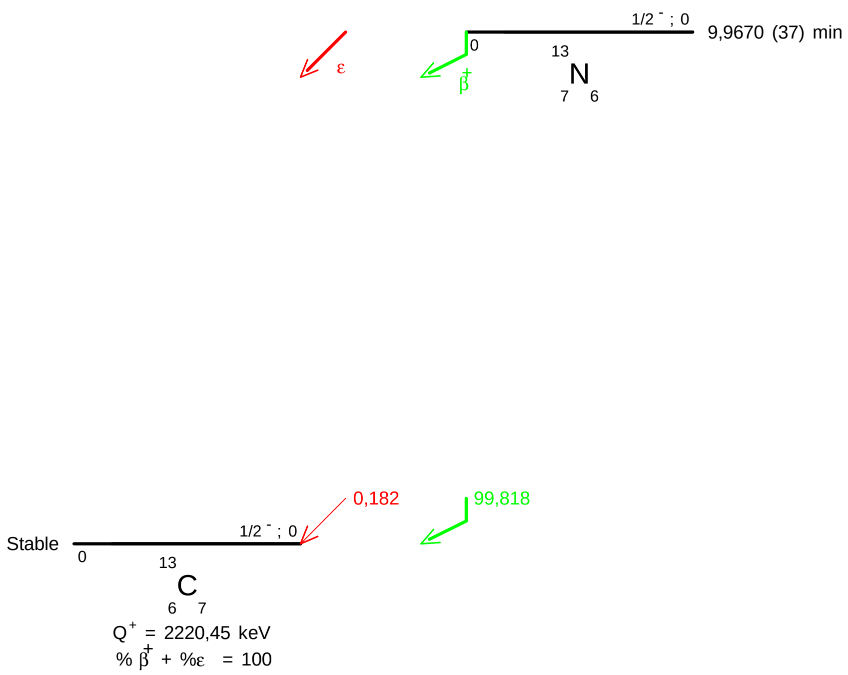
  (Q.)


1/2 - ; 0
9,9670 (37) min
0
13
N
7 6
ε
β+
0,182
99,818
Stable
1/2 - ; 0
0
13
C
6 7
Q+ = 2220,45 keV
% β+ + %ε = 100

$^{15}_{8}O_{7}$

1 Decay Scheme

O-15 disintegrates by 99,9% beta-plus transition to the ground state of the stable nuclide N-15.
L'oxygène 15 se désintègre pour 99,9% par émission bêta plus vers le niveau fondamental de l'azote 15.

2 Nuclear Data

$T_{1/2}(^{15}O)$	:	2,041	(6)	min
$Q^{+}(^{15}O)$	:	2757,0	(13)	keV

2.1 β^{+} Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^{+}_{0,0}$	1735,0 (13)	99,885 (6)	Allowed	3,6

2.2 Electron Capture Transitions

	Energy keV	Probability × 100	Nature	P_K	P_L
$\epsilon_{0,0}$	2757,0 (13)	0,115 (6)	Allowed	0,926 (6)	0,074 (6)

3 Atomic Data

3.1 N

ω_K : 0,0044 (4)

4 Electron Emissions

		Energy keV	Electrons per 100 disint.
$\beta^+_{0,0}$	max:	1735,0 (13)	99,885 (6)
$\beta^+_{0,0}$	avg:	736,7 (6)	

5 Photon Emissions

5.1 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma^{\pm}$	511	199,770 (12)

6 Main Production Modes

N – 14(p,γ)O – 15

N – 14(d,n)O – 15

C – 12(α,n)O – 15

N – 15(p,n)O – 15

O – 16(He – 3,$\alpha\gamma$)O – 15

{ Ne – 20(γ,nα)O – 15
Possible impurities : C – 11, Ne – 19

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(Half-life, end point energy, Q, log ft.)
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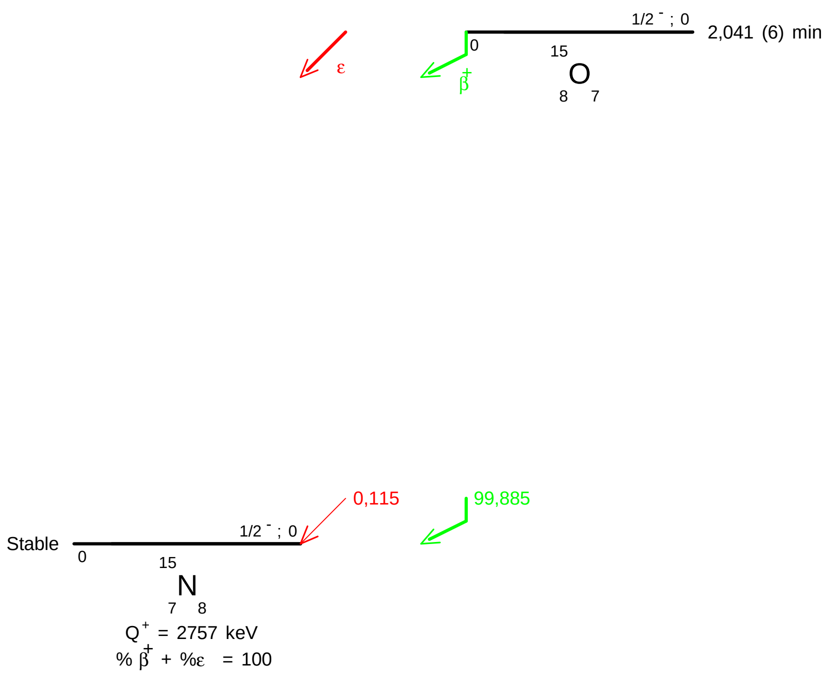
(m_0c^2 energy)


1/2 - ; 0
2,041 (6) min
0
15
O
8 7
ε
β+
0,115
99,885
Stable
1/2 - ; 0
0
15
N
7 8
Q+ = 2757 keV
% β+ + %ε = 100

$^{18}_{9}F_{9}$

1 Decay Scheme

Le fluor 18 se désintègre à 96,86(16) % par émission bêta plus, et 3,14(16) % par capture electronique vers le niveau fondamental de l'oxygène 18.
F-18 disintegrates 96.86(16) % by beta plus, and 3.14(16) % by electron capture to the ground state of the stable nuclide O-18

2 Nuclear Data

$T_{1/2}(^{18}F)$	:	1,8288	(3)	h
$Q^{+}(^{18}F)$	:	1655,5	(6)	keV

2.1 Electron Capture Transitions

	Energy keV	Probability × 100	Nature	lg ft	P_K	P_L
$\epsilon_{0,0}$	1655,5 (6)	3,14 (16)	Allowed	3,57	0,9267 (48)	0,0733 (48)

2.2 β^{+} Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^{+}_{0,0}$	633,5 (6)	96,86 (16)	Allowed	3,57

3 Atomic Data

3.1 O

ω_K : 0,0069 (5)

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AK}	(O)			2,91 (15)
	KLL	0,456 - 0,502	}	
$\beta^+_{0,0}$	max:	633,5 (6)		96,86 (19)
$\beta^+_{0,0}$	avg:	249,3 (3)		

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV	Photons per 100 disint.	
$XK\alpha_2$	(O)	0,53	0,017 (3)	} $K\alpha$

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma^{\pm}$	511	193,72 (27)

6 Main Production Modes

O – 18(p,n)F – 18
Possible impurities : none

O – 16(t,n)F – 18
F – 19(p,d)F – 18
O – 17(He – 3,d)F – 18

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  (Q)
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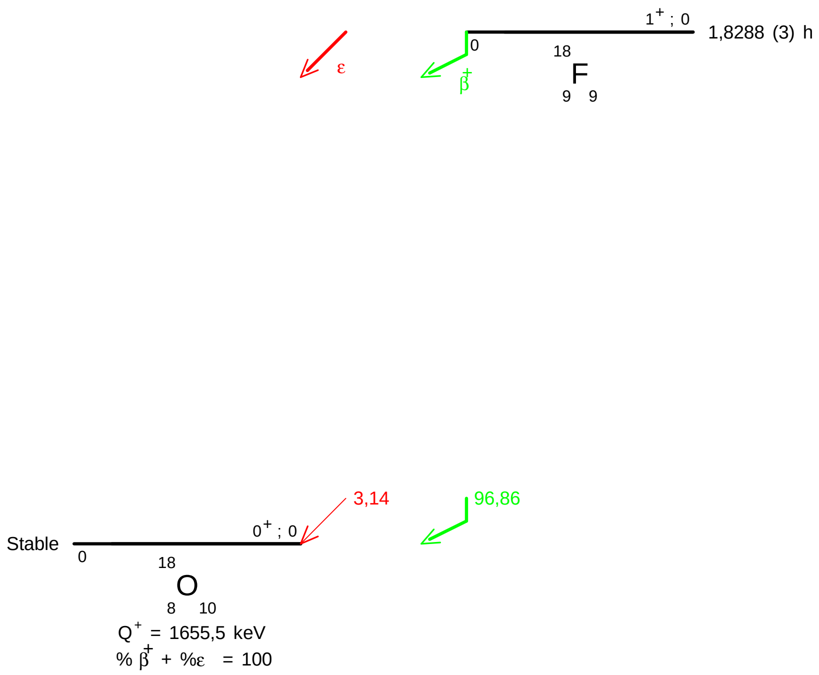
  (Half-life)



ε
β^+
1^+ ; 0
0
1,8288 (3) h
18
F
9 9
3,14
96,86
Stable
0^+ ; 0
0
18
O
8 10
Q^+ = 1655,5 keV
% β^+ + %ε = 100

$^{24}_{11}\mathrm{Na}_{13}$

1 Decay Scheme

Na-24 disintegrates by emission of beta- particles (100%). The main transition (99.939%) has a maximum energy of 1393 keV and populates the 4123 keV level of Mg-24. This process is followed by two gamma rays in a cascade (2754 and 1393 keV) which leads through the 1368 keV level to the ground state of Mg-24. Due to the high transition energies internal pair formation takes place.
Le Na-24 se désintègre par emission bêta moins (100%). La transition principale a une énergie maximale de 1393 keV et peuple le niveau d'énergie 4123 keV du Mg-24. Cette désintégration est suivie par deux émissions gamma en cascade vers le niveau fondamental de Mg-24. Les énergies élevées de ces transitions permettent la création de paires électron-positon.

2 Nuclear Data

$T_{1/2}(^{24}\mathrm{Na})$	:	14,9574	(20)	h
$Q^-(^{24}\mathrm{Na})$	:	5515,78	(16)	keV

2.1 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,4}$	279,3 (6)	0,057 (7)	Allowed	6,74
$\beta^-_{0,3}$	1277,5 (11)	0,001 (1)	2nd forbidden	10,6
$\beta^-_{0,2}$	1392,94 (16)	99,939 (8)	Allowed	6,12
$\beta^-_{0,1}$	4147,11 (16)	0,003 (2)	2nd forbidden	12,7

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K (10^{-5})	α_L (10^{-6})	α_T (10^{-5})	α_π (10^{-5})
$\gamma_{4,3}$(Mg)	996,09 (6)	0,00123 (27)	M1+18,1%E2	1,6 (5)	1	1,7 (5)	
$\gamma_{1,0}$(Mg)	1368,669 (5)	99,9990 (3)	E2	0,98	0,6	1,04	4,5 (4)
$\gamma_{2,1}$(Mg)	2754,177 (11)	99,940 (7)	E2	0,26	0,17	0,28	68 (4)
$\gamma_{3,1}$(Mg)	2869,69 (6)	0,00024 (3)	M1+99,8%E2	0,25	0,16	0,26	
$\gamma_{4,1}$(Mg)	3866,48 (10)	0,056 (7)	E2	0,14	0,1	0,15	
$\gamma_{3,0}$(Mg)	4238,37 (6)	0,00084 (10)	E2	0,15	0,1	0,16	

3 Atomic Data

3.1 Mg

ω_K : 0,0291 (9)
$\bar{\omega}_L$: 0,00030 (12)
n_{KL} : 1,938 (6)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	Kα_2	1,254		50,31
	Kα_1	1,254		100
	Kβ_1	1,302	}	
	Kβ_5''		}	2,6
X_L				
	Lℓ	0,039		
	Lη	0,049		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	1,10 – 1,18	

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AK}	(Mg)			0,00145 (11)
	KLL	1,10	- 1,18	}
$ec_{1,0\ \alpha}$	(Mg)	346,62	(1)	0,0045 (4)
$ec_{1,0\ K}$	(Mg)	1367,321	(5)	0,00028 (3)
$ec_{2,1\ \alpha}$	(Mg)	1732,177	(11)	0,068 (4)
$ec_{2,1\ K}$	(Mg)	2752,72		0,00026 (3)
$\beta^-_{0,4}$	max:	279,3	(6)	0,057 (7)
$\beta^-_{0,4}$	avg:	89,56	(19)	
$\beta^-_{0,3}$	max:	1277,5	(11)	0,001 (1)
$\beta^-_{0,3}$	avg:	502,7	(5)	
$\beta^-_{0,2}$	max:	1392,94	(16)	99,939 (8)
$\beta^-_{0,2}$	avg:	555,15	(8)	
$\beta^-_{0,1}$	max:	4147,11	(16)	0,003 (2)
$\beta^-_{0,1}$	avg:	1866,79	(8)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV	Photons per 100 disint.	
XL	(Mg)	0,039 — 0,049	0,00000071 (29)	
$XK\alpha_2$	(Mg)	1,254	0,0000119 (5)	} $K\alpha$
$XK\alpha_1$	(Mg)	1,254	0,0000236 (10)	}

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma^{\pm}$	511	0,145 (11)
$\gamma_{4,3}$(Mg)	996,09 (6)	0,00123 (27)
$\gamma_{1,0}$(Mg)	1368,626 (5)	99,9935 (5)
$\gamma_{2,1}$(Mg)	2754,007 (11)	99,872 (8)
$\gamma_{3,1}$(Mg)	2869,50 (6)	0,00024 (3)
$\gamma_{4,1}$(Mg)	3866,14 (10)	0,056 (7)
$\gamma_{3,0}$(Mg)	4237,96 (6)	0,00084 (10)

6 Main Production Modes

Na – 23(n,γ)Na – 24

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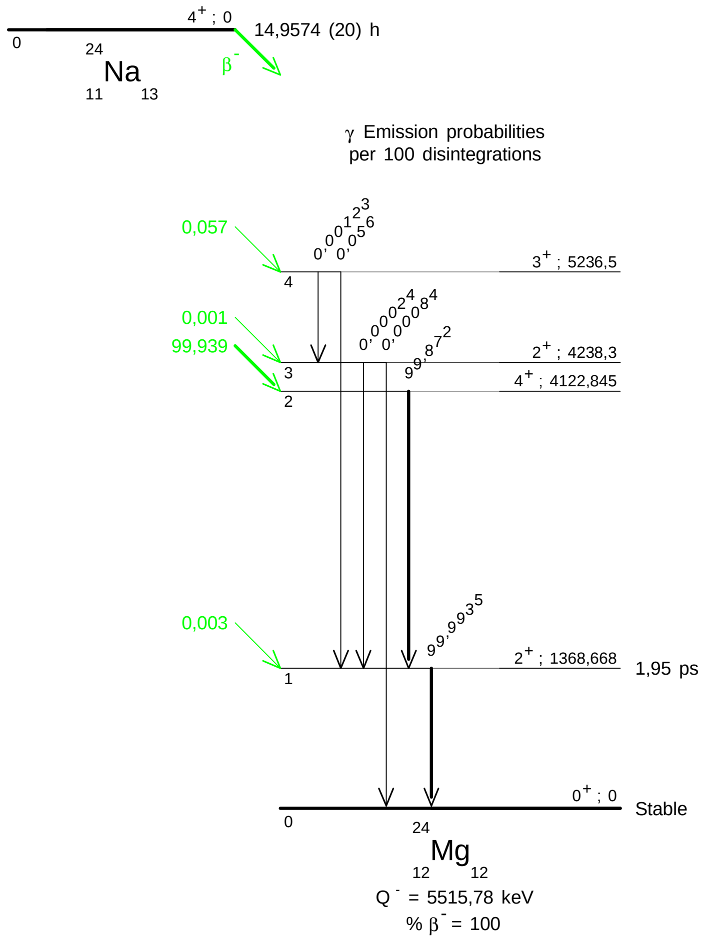
4+ ; 0
0
14,9574 (20) h
24
Na
11 13
β-
γ Emission probabilities
per 100 disintegrations
0,057
0,001
99,939
0,003
0,0123
0,0056
0,0024
0,0084
99,872
99,9935
4
3
2
1
0
3+ ; 5236,5
2+ ; 4238,3
4+ ; 4122,845
2+ ; 1368,668
1,95 ps
0+ ; 0
Stable
24
Mg
12 12
Q- = 5515,78 keV
% β- = 100

$^{32}_{15}\mathrm{P}_{17}$

1 Decay Scheme

P-32 decays by beta minus emission to the S-32 fundamental level.
Le phosphore 32 se désintègre par émission bêta moins vers le niveau fondamental de soufre 32.

2 Nuclear Data

$T_{1/2}(^{32}\mathrm{P})$	:	14,284	(36)	d
$Q^{-}(^{32}\mathrm{P})$	:	1710,66	(21)	keV

2.1 β^{-} Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^{-}_{0,0}$	1710,66 (21)	100	Allowed	7,9

3 Atomic Data

3.1 S

ω_K	:	0,0642	(16)
n_{KL}	:	1,856	(7)

4 Electron Emissions

		Energy keV	Electrons per 100 disint.
$\beta^-_{0,0}$	max:	1710,66 (21)	100
$\beta^-_{0,0}$	avg:	695,5 (3)	

5 Main Production Modes

P – 31(n,γ)P – 32 σ : 0,172 (6) barns
Possible impurities : None

S – 32(n,p)P – 32
Possible impurities : P – 33, S – 35

S – 34(d,α)P – 32
Possible impurities : None

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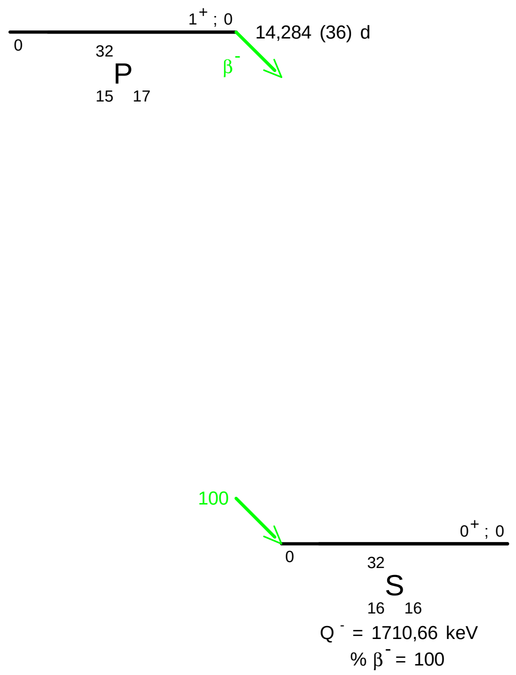
1+ ; 0
0
14,284 (36) d
32
P
15 17
β-
100
0+ ; 0
0
32
S
16 16
Q - = 1710,66 keV
% β- = 100

$^{33}_{15}P_{18}$

1 Decay Scheme

Le phosphore 33 se désintègre par émission bêta moins vers le niveau fondamental de soufre 33.
P-33 decays by beta minus emission to the S-33 fundamental level.

2 Nuclear Data

$T_{1/2}(^{33}P)$	:	25,383	(40)	d
$Q^{-}(^{33}P)$	:	248,5	(11)	keV

2.1 β^{-} Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^{-}_{0,0}$	248,5 (11)	100	Allowed	5

3 Atomic Data

3.1

ω_K	:	0,0642	(16)
n_{KL}	:	1,856	(7)

4 Electron Emissions

		Energy keV	Electrons per 100 disint.
$\beta^{-}_{0,0}$	max:	248,5 (11)	100
$\beta^{-}_{0,0}$	avg:	76,4 (5)	

5 Main Production Modes

S – 33(n,p)P – 33
P – 32(n,γ)P – 33
S – 34(γ,n)P – 33

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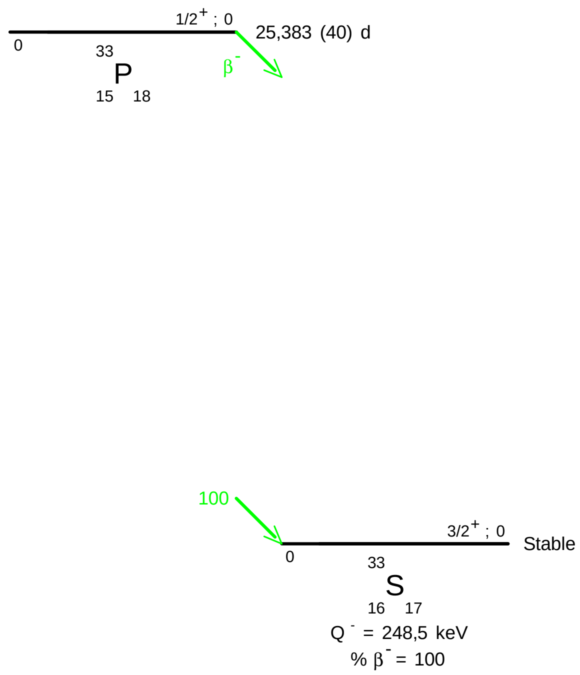
1/2+ ; 0
25,383 (40) d
0
33
P
15 18
β-
100
3/2+ ; 0
Stable
0
33
S
16 17
Q - = 248,5 keV
% β- = 100

$^{44}_{21}Sc_{23}$

1 Decay Scheme

Sc-44 disintegrates by beta plus emission mainly (94.27(5) %) and by electron capture (5.73(5)%) to excited levels in Ca-44. No transition to the ground state has been observed.
Le scandium 44 se désintègre principalement par émission bêta plus (94,27(5) %) et par capture électronique (5,73(5) %) vers des niveaux excités du calcium 44. Aucune transition vers le niveau fondamental n'a été observée.

2 Nuclear Data

$T_{1/2}(^{44}Sc)$	:	3,97	(4)	h
$Q^{+}(^{44}Sc)$	:	3653,3	(19)	keV

2.1 Electron Capture Transitions

	Energy keV	Probability × 100	Nature	lg ft	P_K	P_L	P_{M+}
$\epsilon_{0,3}$	351,8 (19)	0,00440 (11)	Allowed	6,6	0,8954 (20)	0,0911 (16)	0,0135 (7)
$\epsilon_{0,2}$	996,8 (19)	1,02 (2)	Super Allowed Or Allowed	5,2	0,8966 (19)	0,0900 (16)	0,0134 (7)
$\epsilon_{0,1}$	2496,3 (19)	4,70 (5)	Allowed	5,3	0,8970 (19)	0,0897 (16)	0,0133 (7)

2.2 β^+ Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^+_{0,1}$	1474,3 (19)	94,27 (5)	Allowed	

2.3 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K (10^{-5})	α_L (10^{-5})	α_M (10^{-5})	α_T (10^{-5})	α_π (10^{-5})
$\gamma_{1,0}$(Ca)	1157,023 (15)	99,882 (3)	E2	5,90 (18)	0,499 (15)	0,081 (2)	6,48 (19)	
$\gamma_{2,1}$(Ca)	1499,463 (20)	0,908 (15)	M1+1,8%E2	2,9 (1)	0,243 (7)	0,047 (2)	3,19 (10)	
$\gamma_{3,1}$(Ca)	2144,42 (8)	0,0036 (7)	[M1+E2+E0]					35 (4)
$\gamma_{2,0}$(Ca)	2656,444 (24)	0,112 (3)	[E2]					60 (6)
$\gamma_{3,0}$(Ca)	3301,33 (6)	0,0017 (2)	[E2]					78 (8)

3 Atomic Data

3.1 Ca

ω_K	:	0,169	(4)
$\bar{\omega}_L$	:	0,0022	(5)
n_{KL}	:	1,621	(6)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	3,68813		50,61
	$K\alpha_1$	3,69172		100
	$K\beta_1$	4,0128	}	
	$K\beta_5''$	4,0325	}	19,52
X_L				
	$L\ell$	0,350		
	$L\gamma$	– 0,412		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	3,123 – 3,307	100
KLX	3,543 – 3,666	25,9
KXY	3,951 – 3,987	1,68
Auger L	0,044 – 0,387	

4 Electron Emissions

		Energy keV	Electrons per 100 disint.
e_{AL}	(Ca)	0,044 - 0,387	8,71 (5)
e_{AK}	(Ca)		4,21 (3)
	KLL	3,123 - 3,307	}
	KLX	3,543 - 3,666	}
	KXY	3,951 - 3,987	}
$\beta^+_{0,1}$	max:	1474,3 (19)	94,27 (5)
$\beta^+_{0,1}$	avg:	632,0 (9)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Ca)	0,350 — 0,412		0,019 (4)	
$XK\alpha_2$	(Ca)	3,68813		0,255 (7)	} $K\alpha$
$XK\alpha_1$	(Ca)	3,69172		0,504 (13)	}
$XK\beta_1$	(Ca)	4,0128	}	0,098 (3)	$K'\beta_1$
$XK\beta''_5$	(Ca)	4,0325	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma^{\pm}$	511	188 (3)
$\gamma_{1,0}$(Ca)	1157,020 (15)	99,875 (3)
$\gamma_{2,1}$(Ca)	1499,46 (2)	0,908 (15)
$\gamma_{3,1}$(Ca)	2144,33 (10)	0,0036 (7)
$\gamma_{2,0}$(Ca)	2656,48 (7)	0,112 (3)
$\gamma_{3,0}$(Ca)	3301,35 (6)	0,0017 (2)

6 Main Production Modes

K – 41(α,n)Sc – 44
Sc – 45(γ,n)Sc – 44
Daughter of Ti – 44
Daughter of Sc – 44 (2,4d)

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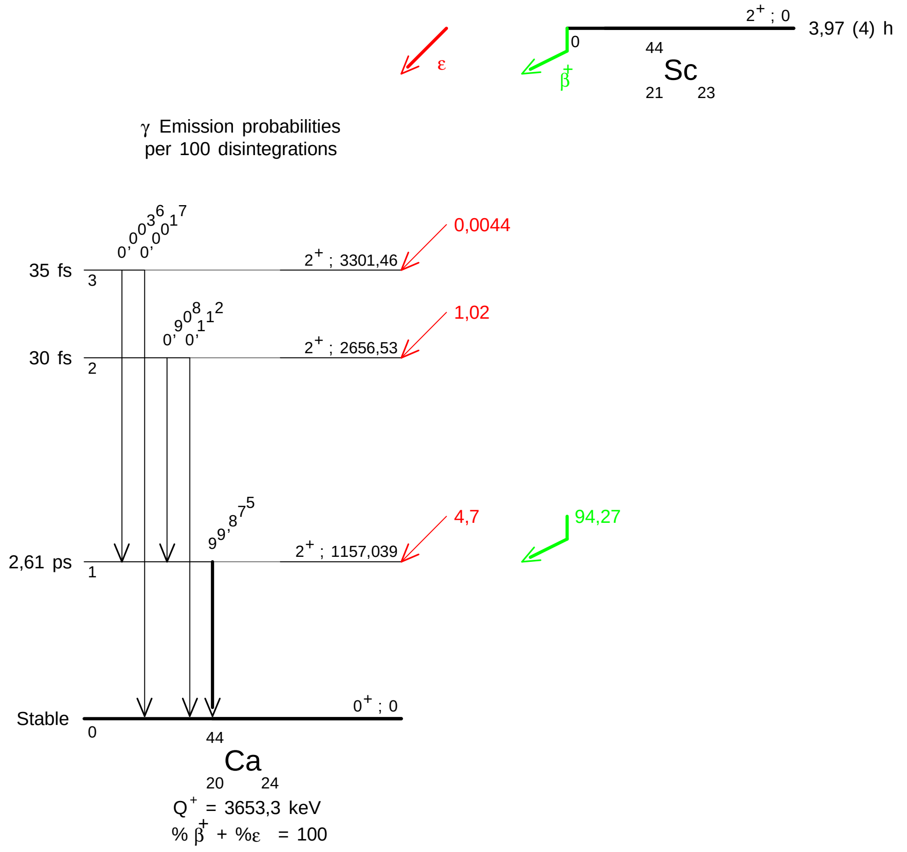
2+ ; 0
3,97 (4) h
0
44
Sc
21 23
ε
β+
γ Emission probabilities
per 100 disintegrations
35 fs
3
2+ ; 3301,46
0,0044
30 fs
2
2+ ; 2656,53
1,02
2,61 ps
1
2+ ; 1157,039
4,7
94,27
Stable
0
0+ ; 0
44
Ca
20 24
Q+ = 3653,3 keV
% β+ + %ε = 100

$^{44}_{22}$Ti $_{22}$

1 Decay Scheme

Ti-44 disintegrates 100% by electron capture to excited levels in Sc-44 ($T_{1/2} = 3.93$ h), which subsequently decays by EC and beta plus to Ca-44.
Le titane 44 se désintègre à 100% par capture électronique vers des niveaux excités du scandium 44; lequel décroît ($T_{1/2}$ = 3,93 h) par capture électronique et émission bêta plus vers le calcium 44.

2 Nuclear Data

$T_{1/2}(^{44}$Ti)	:	60,0	(11)	a
$T_{1/2}(^{44}$Sc)	:	3,97	(4)	h
$Q^{+}(^{44}$Ti)	:	267,5	(19)	keV

2.1 Electron Capture Transitions

	Energy keV	Probability × 100	Nature	lg ft	P_K	P_L	P_{M+}
$\epsilon_{0,2}$	121,3 (19)	99,6 (11)	1 st Forbidden	6,5	0,8891 (20)	0,0960 (16)	0,0149 (7)
$\epsilon_{0,1}$	199,6 (19)	0,4 (11)	1 st Forbidden	9,3	0,8917 (19)	0,0938 (16)	0,0145 (7)

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_{M+}	α_T
$\gamma_{1,0}$(Sc)	67,8680 (14)	100,9 (15)	E1	0,0766 (23)	0,00665	0,00125	0,0845 (25)
$\gamma_{2,1}$(Sc)	78,36 (3)	99,5 (11)	M1	0,0273 (8)	0,00244	0,00046	0,032 (1)
$\gamma_{2,0}$(Sc)	146,22 (3)	0,096 (3)	[M2]	0,0414 (12)	0,00385	0,00075	0,046 (1)

3 Atomic Data

3.1 Sc

ω_K	:	0,196	(5)
$\bar{\omega}_L$	:	0,0027	(6)
n_{KL}	:	1,594	(5)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	Kα_2	4,0862		50,69
	Kα_1	4,0906		100
	Kβ_1	4,4604	}	
	Kβ_5''	4,4866	}	20,13
X_L				
	Lℓ	0,348		
	Lγ	– 0,468		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	3,45 – 3,65	100
KLX	3,93 – 4,08	26,4
KXY	4,38 – 4,48	1,74
Auger L	0,3 – 0,5	270

4 Electron Emissions

		Energy keV	Electrons per 100 disint.
e_{AL}	(Sc)	0,3 - 0,5	167,5 (24)
e_{AK}	(Sc)		79,5 (21)
	KLL	3,45 - 3,65	}
	KLX	3,93 - 4,08	}
	KXY	4,38 - 4,48	}
$ec_{1,0\ K}$	(Sc)	63,375 (2)	7,12 (24)
$ec_{1,0\ L}$	(Sc)	67,37 - 67,47	0,621 (21)
$ec_{1,0\ M}$	(Sc)	67,81 - 67,86	0,116 (4)
$ec_{2,1\ K}$	(Sc)	73,83 (3)	2,63 (8)
$ec_{2,1\ L}$	(Sc)	77,82 - 77,92	0,235 (8)

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Sc)	0,348 — 0,468		0,45 (9)	
$XK\alpha_2$	(Sc)	4,0862		5,76 (18)	} $K\alpha$
$XK\alpha_1$	(Sc)	4,0906		11,4 (4)	}
$XK\beta_1$	(Sc)	4,4604	}	2,26 (8)	$K'\beta_1$
$XK\beta_5''$	(Sc)	4,4866	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Sc)	67,8679 (14)	93,0 (15)
$\gamma_{2,1}$(Sc)	78,36 (3)	96,4 (11)
$\gamma_{2,0}$(Sc)	146,22 (3)	0,092 (3)

6 Main Production Modes

Sc – 45(p,2n)Ti – 44

Sc – 45(d,3n)Ti – 44

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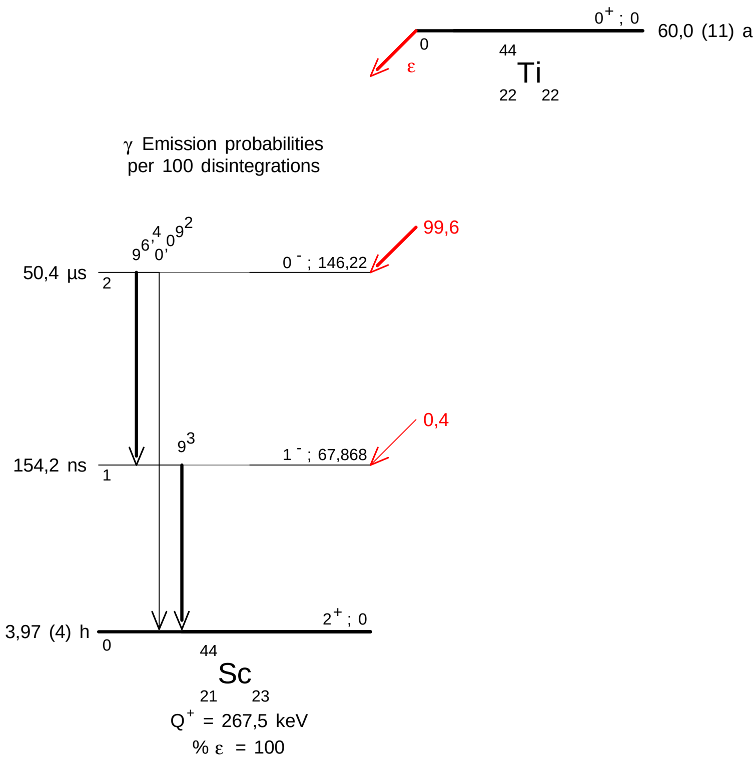
0+ ; 0
60,0 (11) a
0
ε
44 Ti 22 22
γ Emission probabilities
per 100 disintegrations
96,4
0,092
99,6
0 - ; 146,22
50,4 µs
2
0,4
93
1 - ; 67,868
154,2 ns
1
2+ ; 0
3,97 (4) h
0
44 Sc 21 23
Q+ = 267,5 keV
% ε = 100

$^{46}_{21}Sc_{25}$

1 Decay Scheme

Sc-46 disintegrates by 100% beta minus emission to excited levels in Ti-46. The main path (99.99%) leads to 2009.8 keV level of Ti-46. The ground state of Ti-46 is reached via a gamma cascade of 1120.5 and 889.3 keV.
Le scandium 46 se désintègre à 100% par émission bêta moins vers les niveaux excités du titane 46, dont 99,99% vers le niveau de 2009,8 keV. Le niveau fondamental du titane 46 est atteint par une cascade gamma de 1120,5 et 889,3 keV.

2 Nuclear Data

$T_{1/2}(^{46}Sc)$	:	83,788	(22)	d
$Q^{-}(^{46}Sc)$	:	2366,7	(7)	keV

2.1 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,2}$	356,9 (7)	99,98 (2)	Allowed	6,2
$\beta^-_{0,1}$	1477,4 (7)	0,02 (2)	2nd forbidden	≥ 11,9

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K (10^{-6})	α_L (10^{-7})	α_T (10^{-6})	α_π (10^{-7})
$\gamma_{1,0}$(Ti)	889,280 (2)	99,9999 (7)	E2	149 (4)	134 (4)	167 (5)	
$\gamma_{2,1}$(Ti)	1120,552 (3)	99,986 (36)	E2	85 (3)	76,1 (19)	95 (3)	22 (4)
$\gamma_{2,0}$(Ti)	2009,832 (4)	0,000013 (10)	[E4]	63,8 (2)	57,5 (17)	71,4 (21)	

3 Atomic Data

3.1 Ti

ω_K	:	0,226	(5)
$\bar{\omega}_L$	:	0,0032	(7)
n_{KL}	:	1,566	(5)

3.1.1 X Radiations

		Energy keV	Relative probability
X_K			
	$K\alpha_2$	4,505	50,8
	$K\alpha_1$	4,511	100
X_L			
	$L\ell$	0,40	
	$L\gamma$	– 0,46	

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	3,796 – 4,014	100
KLX	4,328 – 4,507	26,5
KXY	4,846 – 4,959	1,76

4 Electron Emissions

		Energy keV			Electrons per 100 disint.
e_{AK}	(Ti)				0,0181 (4)
	KLL	3,796	- 4,014	}	
	KLX	4,328	- 4,507	}	
	KXY	4,846	- 4,959	}	
$ec_{1,0\ K}$	(Ti)	884,314	(2)		0,0149 (4)
$ec_{1,0\ L}$	(Ti)	888,72	- 888,83		0,00134 (4)
$ec_{2,1\ K}$	(Ti)	1115,586	(3)		0,0085 (3)
$ec_{2,1\ L}$	(Ti)	1119,99	- 1120,10		0,00076 (2)
$\beta^-_{0,2}$	max:	356,9	(7)		99,98 (2)
$\beta^-_{0,2}$	avg:	111,8	(3)		
$\beta^-_{0,1}$	max:	1477,4	(7)		0,02 (2)
$\beta^-_{0,1}$	avg:	580,8	(4)		

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV	Photons per 100 disint.	
XL	(Ti)	0,40 — 0,46	0,00013 (3)	
$XK\alpha_2$	(Ti)	4,505	0,00157 (5)	} $K\alpha$
$XK\alpha_1$	(Ti)	4,511	0,0031 (1)	}

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Ti)	889,271 (2)	99,9833 (5)
$\gamma_{2,1}$(Ti)	1120,537 (3)	99,986 (36)
$\gamma_{2,0}$(Ti)	2009,785 (4)	0,000013 (10)

6 Main Production Modes

Sc – 46(I.T.)
Ca – 43(α,pγ)Sc – 46
Ca – 44(He – 3,p)Sc – 46
Sc – 45(n,γ)Sc – 46
Sc – 45(d,p)Sc – 46
Sc – 45(d,pγ)Sc – 46
Sc – 45(t,d)Sc – 46
Ca – 46(He – 3,t)Sc – 46
Ti – 46(t,He – 3)Sc – 46
Ti – 47(d,He – 3)Sc – 46
Ti – 48(p,He – 3)Sc – 46
Ti – 48(d,α)Sc – 46

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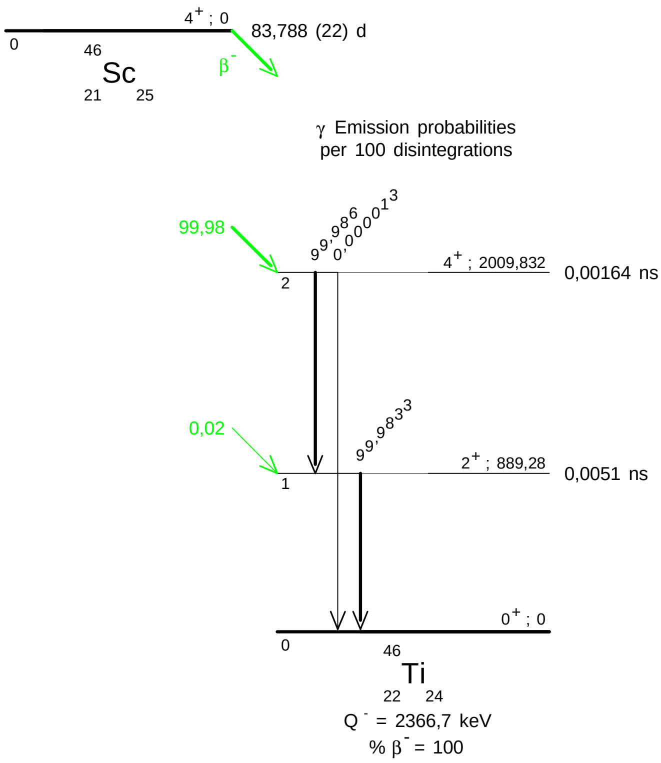
(J, multipolarities)


4+ ; 0
83,788 (22) d
0
46
Sc
21 25
β-
γ Emission probabilities
per 100 disintegrations
99,98
99,9866
0,00013
4+ ; 2009,832
0,00164 ns
2
0,02
99,9833
2+ ; 889,28
0,0051 ns
1
0+ ; 0
0
46
Ti
22 24
Q- = 2366,7 keV
% β- = 100

$^{51}_{24}$Cr $_{27}$

1 Decay Scheme

Cr-51 disintegrates by electron capture either to the ground state of V-51 (90.11%) or via the 320 keV level of V-51 (9.89%).
Le Cr-51 se désintègre par capture électronique vers l'état fondamental (90,11%) ou vers le niveau à 320 keV (9,89%) du V-51.

2 Nuclear Data

$T_{1/2}$(^{51}Cr)	:	27,703	(3)	d
Q^{+}(^{51}Cr)	:	752,73	(24)	keV

2.1 Electron Capture Transitions

	Energy keV	Probability × 100	Nature	lg ft	P_K	P_L	P_{M+}
$\epsilon_{0,1}$	432,65 (24)	9,89 (5)	Allowed	5,86	0,8910 (17)	0,0941 (14)	0,0145 (6)
$\epsilon_{0,0}$	752,73 (24)	90,11 (5)	Allowed	5,39	0,8919 (17)	0,0934 (14)	0,0144 (6)

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K (10^{-3})	α_L (10^{-4})	α_M (10^{-5})	α_T (10^{-3})
$\gamma_{1,0}$(V)	320,0835 (4)	9,89 (5)	M1+12,6%E2	1,54 (3)	1,36 (8)	2,7 (4)	1,69 (5)

3 Atomic Data

3.1 V

ω_K	:	0,256	(5)
$\bar{\omega}_L$	:	0,0038	(8)
n_{KL}	:	1,539	(5)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	4,9447		50,83
	$K\alpha_1$	4,95224		100
	$K\beta_3$	5,42735	}	
	$K\beta_1$	5,42735	}	
	$K\beta_5''$	5,46296	}	20,12
X_L				
	$L\ell$	0,446		
	$L\gamma$	– 0,585		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	4,16 – 4,38	100
KLX	4,76 – 4,90	26,7
KXY	5,32 – 5,46	1,78
Auger L	0,45 – 0,59	282,4

4 Electron Emissions

		Energy keV	Electrons per 100 disint.
e_{AL}	(V)	0,45 - 0,59	147,6 (1)
e_{AK}	(V)		66,4 (6)
	KLL	4,16 - 4,38	}
	KLX	4,76 - 4,90	}
	KXY	5,32 - 5,46	}
$ec_{1,0\ K}$	(V)	314,618 (4)	0,0152 (3)
$ec_{1,0\ L}$	(V)	319,45 - 319,57	0,00134 (8)
$ec_{1,0\ M}$	(V)	320,02 - 320,08	0,00027 (4)

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(V)	0,446 — 0,585		0,56 (11)	
$XK\alpha_2$	(V)	4,9447		6,79 (14)	} $K\alpha$
$XK\alpha_1$	(V)	4,95224		13,36 (27)	}
$XK\beta_3$	(V)	5,42735	}		
$XK\beta_1$	(V)	5,42735	}	2,69 (7)	$K'\beta_1$
$XK\beta_5''$	(V)	5,46296	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(V)	320,0835 (4)	9,87 (5)

6 Main Production Modes

$\left\{ \begin{array}{l} Cr-50(n,\gamma)Cr-51 \quad \sigma : 15{,}9\ (2)\ \text{barns} \\ \text{Possible impurities : } K-42 \end{array} \right.$

$V-51(p,n)Cr-51 \quad \sigma : 0{,}52\ \text{barns}$
$Ti-48(\alpha,n)Cr-51$
$Cr-50(d,p)Cr-51$
$Fe-54(n,\alpha)Cr-51$
$Cr-52(n,2n)Cr-51$
$Cr-50(d,n)Mn-51$

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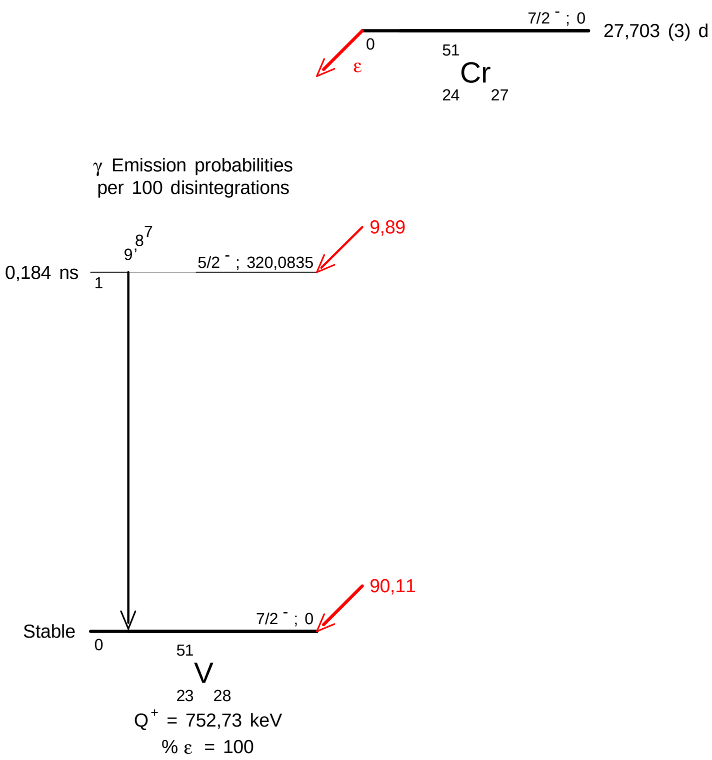
7/2 - ; 0
27,703 (3) d
0
ε
51
Cr
24 27
γ Emission probabilities
per 100 disintegrations
9,87
9,89
0,184 ns
1
5/2 - ; 320,0835
90,11
Stable
7/2 - ; 0
0
51
V
23 28
Q+ = 752,73 keV
% ε = 100

$^{54}_{25}$Mn $_{29}$

1 Decay Scheme

Mn-54 disintegrates by electron capture via the 835 keV level of Cr-54. An electron capture and a beta plus transition to the ground state of Cr-54 have not been observed but upper limits have been determined.
Le Mn-54 se désintègre par capture électronique vers le niveau à 835 keV du Cr-54. Une capture électronique et une émission bêta plus vers l'état fondamental n'ont jamais été mesurées, mais des limites supérieures ont été déterminées.

2 Nuclear Data

$T_{1/2}$(^{54}Mn)	:	312,13	(3)	d
Q^{+}(^{54}Mn)	:	1377,1	(10)	keV
Q^{-}(^{54}Mn)	:	697,1	(11)	keV

2.1 β^+ Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^+_{0,1}$	355,1 (10)	0,00000057	Unique 2nd forbidden	13,8

2.2 Electron Capture Transitions

	Energy keV	Probability × 100	Nature	lg ft	P_K	P_L	P_{M+}
$\epsilon_{0,1}$	542,3 (10)	99,9997 (3)	Allowed	6,17	0,8895 (17)	0,0950 (15)	0,0150 (16)
$\epsilon_{0,0}$	1377,1 (10)	0,0003 (3)	Unique 2nd forbidden	< 13,9	0,8198 (17)	0,0858 (15)	0,0149 (16)

2.3 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K (10^{-4})	α_L (10^{-5})	α_T (10^{-4})
$\gamma_{1,0}$(Cr)	834,845 (5)	99,9997 (3)	E2	2,24 (11)	2,20 (13)	2,51 (11)

3 Atomic Data

3.1 Cr

ω_K	:	0,289	(5)
$\bar{\omega}_L$	:	0,0045	(9)
n_{KL}	:	1,508	(5)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	5,405		50,91
	$K\alpha_1$	5,415		100
	$K\beta_3$	5,947	}	
	$K\beta_1$	5,947	}	
	$K\beta_5''$		}	20,31
X_L				
	$L\ell$	0,50		
	$L\gamma$	– 0,65		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	4,554 – 4,794	100
KLX	5,206 – 5,412	26,92
KXY	5,841 – 5,985	1,913
Auger L	0,4 – 0,7	2,91

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Cr)	0,4 - 0,7		143,0 (6)
e_{AK}	(Cr)			63,3 (5)
	KLL	4,554 - 4,794	}	
	KLX	5,206 - 5,412	}	
	KXY	5,841 - 5,985	}	
$ec_{1,0\ K}$	(Cr)	828,849 (5)		0,0224 (11)
$ec_{1,0\ L}$	(Cr)	834,143 - 834,264		0,00220 (13)
$\beta^+_{0,1}$	max:	355,1 (10)		0,00000057
$\beta^+_{0,1}$	avg:	182		

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Cr)	0,50 — 0,65		0,65 (13)	
$XK\alpha_2$	(Cr)	5,405		7,66 (13)	} $K\alpha$
$XK\alpha_1$	(Cr)	5,415		15,0 (3)	}
$XK\beta_3$	(Cr)	5,947	}		
$XK\beta_1$	(Cr)	5,947	}	3,05 (6)	$K'\beta_1$

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Cr)	834,838 (5)	99,9746 (11)

6 Main Production Modes

$\left\{ \begin{array}{l} Fe-54(n,p)Mn-54 \\ \text{Possible impurities : } Cr-51,\ Fe-55,\ Fe-57 \end{array} \right.$

$\left\{ \begin{array}{l} Cr-53(d,n)Mn-54 \\ \text{Possible impurities : } V-48,\ Mn-52 \end{array} \right.$

V – 51(α,n)Mn – 54
Cr – 52(t,n)Mn – 54
Cr – 52(α,d)Mn – 54
Cr – 53(d,n)Mn – 54
Cr – 54(p,n)Mn – 54
Cr – 54(t,He – 3)Mn – 54
Fe – 54(n,p)Mn – 54

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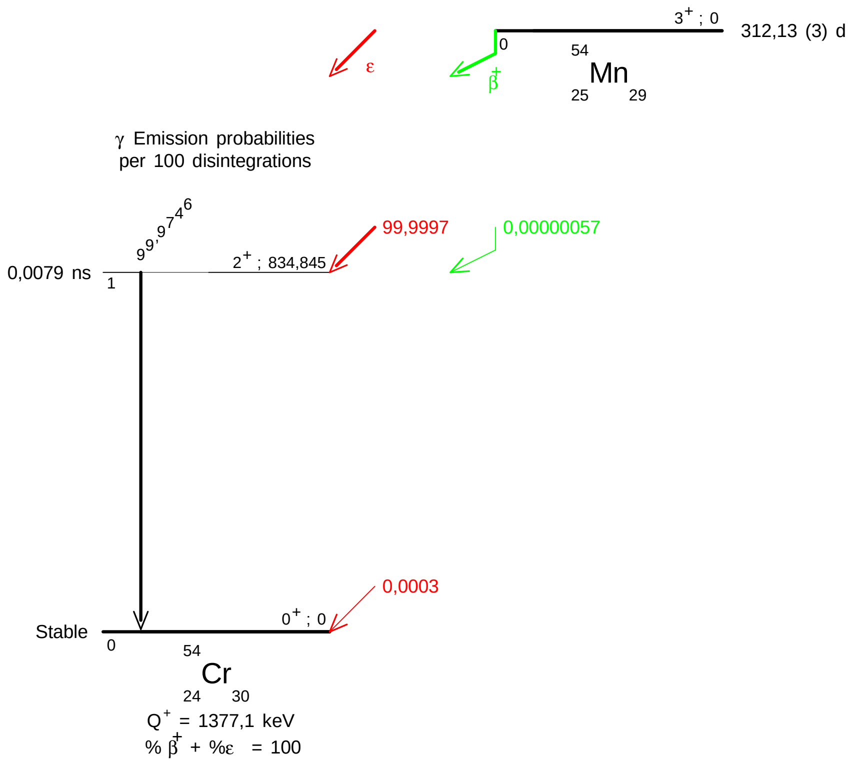
3+ ; 0
312,13 (3) d
0
54
Mn
25 29
ε
β+
γ Emission probabilities
per 100 disintegrations
99,9746
99,9997
0,00000057
2+ ; 834,845
0,0079 ns
1
0,0003
0+ ; 0
Stable
0
54
Cr
24 30
Q+ = 1377,1 keV
% β+ + %ε = 100

$^{56}_{25}Mn_{31}$

1 Decay Scheme

Mn-56 decays by beta minus emission to excited levels of Fe-56.
Le manganèse 56 se désintègre par émission bêta moins vers les niveaux excités du fer 56.

2 Nuclear Data

$T_{1/2}(^{56}Mn)$	:	2,57878	(46)	h
$Q^{-}(^{56}Mn)$	:	3695,5	(3)	keV

2.1 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,7}$	250,2 (3)	0,020 (2)	Allowed	6,57
$\beta^-_{0,6}$	325,7 (3)	1,20 (3)	Allowed	5,17
$\beta^-_{0,5}$	572,6 (3)	0,040 (4)	Allowed	7,5
$\beta^-_{0,4}$	735,6 (3)	14,5 (3)	Allowed	5,34
$\beta^-_{0,3}$	1037,9 (3)	27,5 (4)	Allowed	5,621
$\beta^-_{0,2}$	1610,4 (3)	0,057 (6)	Allowed	9,06
$\beta^-_{0,1}$	2848,7 (3)	56,6 (7)	Allowed	7,101

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M+	α_T
$\gamma_{1,0}$(Fe)	846,776 (5)	98,88 (3)	E2	0,000270 (8)	0,0000250 (8)	0,0000037 (1)	0,000300 (9)
$\gamma_{5,2}$(Fe)	1037,85 (2)	0,040 (4)	M1+0.04%E2	0,000130 (4)	0,0000120 (4)	0,0000060 (2)	0,0001500 (45)
$\gamma_{2,1}$(Fe)	1238,300 (12)	0,097 (2)	E2	0,000110 (3)	0,0000100 (3)	0,00000200 (6)	0,000120 (4)
$\gamma_{3,1}$(Fe)	1810,786 (15)	26,9 (4)	M1+3%E2	0,0000460 (14)	0,00000430 (13)	0,00000063 (2)	0,0000510 (15)
$\gamma_{4,1}$(Fe)	2113,15 (1)	14,2 (3)	M1+4%E2				

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M+	α_T
$\gamma_{6,1}$(Fe)	2523,06 (5)	1,02 (2)	M1+E2				
$\gamma_{7,1}$(Fe)	2598,53 (2)	0,020 (2)	M1+E2				
$\gamma_{3,0}$(Fe)	2657,56 (1)	0,645 (7)	E2				
$\gamma_{4,0}$(Fe)	2959,92 (1)	0,307 (5)	E2				
$\gamma_{6,0}$(Fe)	3369,84 (4)	0,17 (1)	E2				

3 Atomic Data

3.1 Fe

ω_K	:	0,355	(4)
$\bar{\omega}_L$	:	0,0060	(6)
n_{KL}	:	1,447	(4)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	6,39091		51
	$K\alpha_1$	6,40391		100
	$K\beta_1$	7,05804	}	
	$K\beta_5''$	7,1083	}	20,6

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	5,370 – 5,645	100
KLX	6,158 – 6,400	27,4
KXY	6,926 – 7,105	1,87
Auger L	0,510 – 0,594	307

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Fe)	0,510 - 0,594		0,0428 (3)
e_{AK}	(Fe)			0,0180 (1)
	KLL	5,370 - 5,645	}	
	KLX	6,158 - 6,400	}	
	KXY	6,926 - 7,105	}	
$\beta^-_{0,7}$	max:	250,2	(3)	0,020 (2)
$\beta^-_{0,7}$	avg:	73,5	(1)	
$\beta^-_{0,6}$	max:	325,7	(3)	1,20 (3)
$\beta^-_{0,6}$	avg:	99,1	(1)	
$\beta^-_{0,5}$	max:	572,6	(3)	0,040 (4)
$\beta^-_{0,5}$	avg:	190,4	(2)	
$\beta^-_{0,4}$	max:	735,6	(3)	14,5 (3)
$\beta^-_{0,4}$	avg:	255,2	(2)	
$\beta^-_{0,3}$	max:	1037,9	(3)	27,5 (4)
$\beta^-_{0,3}$	avg:	381,9	(2)	
$\beta^-_{0,2}$	max:	1610,4	(3)	0,057 (6)
$\beta^-_{0,2}$	avg:	636,3	(2)	
$\beta^-_{0,1}$	max:	2848,7	(3)	56,6 (7)
$\beta^-_{0,1}$	avg:	1216,8	(2)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XKα_2	(Fe)	6,39091		0,00295 (4)	} Kα
XKα_1	(Fe)	6,40391		0,00578 (7)	}
XKβ_1	(Fe)	7,05804	}	0,00119 (2)	K$'\beta_1$
XKβ_5''	(Fe)	7,1083	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Fe)	846,7638 (19)	98,85 (3)
$\gamma_{5,2}$(Fe)	1037,8333 (24)	0,040 (4)
$\gamma_{2,1}$(Fe)	1238,2736 (22)	0,097 (2)
$\gamma_{3,1}$(Fe)	1810,726 (4)	26,9 (4)
$\gamma_{4,1}$(Fe)	2113,092 (6)	14,2 (3)
$\gamma_{6,1}$(Fe)	2523,06 (5)	1,02 (2)
$\gamma_{7,1}$(Fe)	2598,438 (4)	0,020 (2)
$\gamma_{3,0}$(Fe)	2657,56 (1)	0,645 (7)
$\gamma_{4,0}$(Fe)	2959,92 (1)	0,307 (5)
$\gamma_{6,0}$(Fe)	3369,84 (4)	0,17 (1)

6 Main Production Modes

Cr – 56(β^-)Mn – 56
Mn – 55(n,γ)Mn – 56
Mn – 55(d,p)Mn – 56
Fe – 58(d,α)Mn – 56

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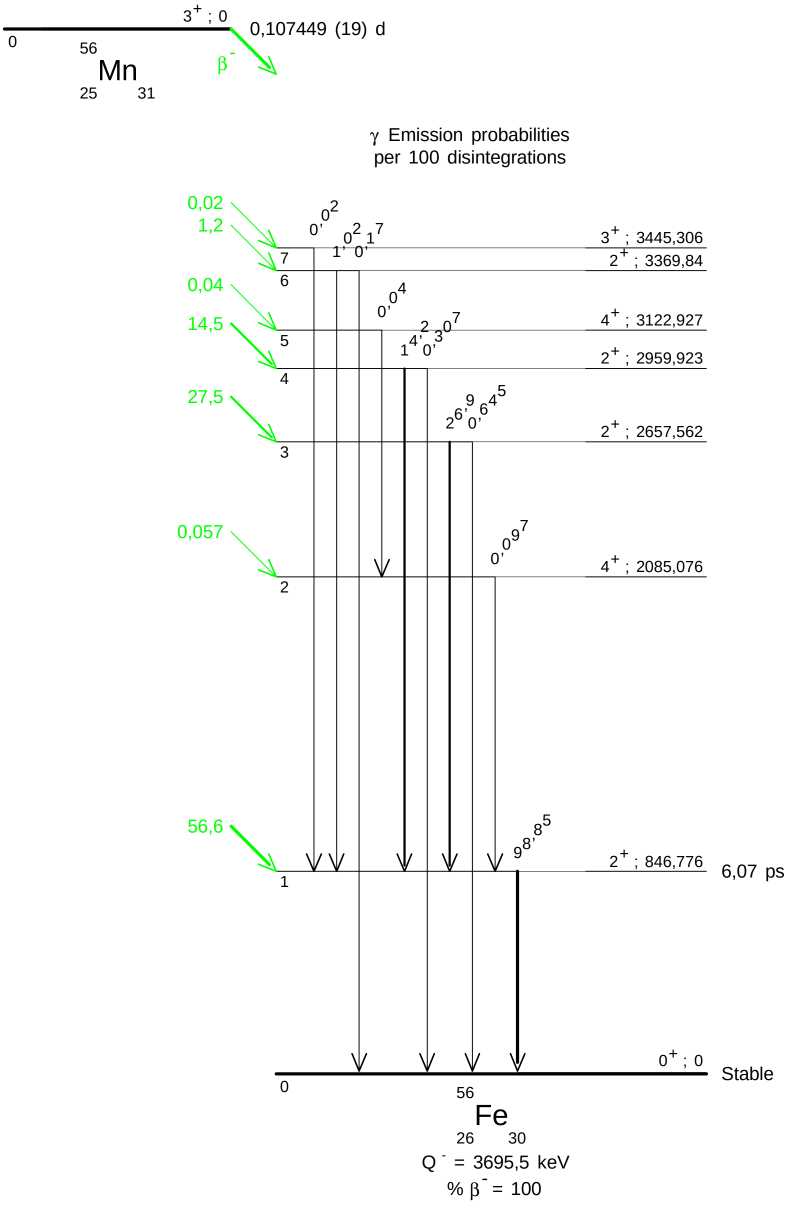
3+ ; 0
0,107449 (19) d
Mn
β-
γ Emission probabilities
per 100 disintegrations
0,02
1,2
0,04
14,5
27,5
0,057
56,6
3+ ; 3445,306
2+ ; 3369,84
4+ ; 3122,927
2+ ; 2959,923
2+ ; 2657,562
4+ ; 2085,076
2+ ; 846,776
6,07 ps
0+ ; 0
Stable
Fe
Q - = 3695,5 keV
% β- = 100

$^{57}_{27}$Co $_{30}$

1 Decay Scheme

Co-57 disintegrates by 100% electron capture to the excited levels of 706.42 keV (0.18%), and 136.47 keV (99.82%) in Fe-57.
Le cobalt 57 se désintègre à 100 % par capture électronique principalement vers les niveaux excités de 706 et 136 keV du fer 57.

2 Nuclear Data

$T_{1/2}$(^{57}Co)	:	271,80	(5)	d
Q^{+}(^{57}Co)	:	836,0	(4)	keV

2.1 Electron Capture Transitions

	Energy keV	Probability × 100	Nature	lg ft	P_K	P_L	P_M
$\epsilon_{0,4}$	129,6 (4)	0,183 (7)	Allowed	7,69	0,8789 (17)	0,1035 (14)	0,0168 (6)
$\epsilon_{0,3}$	469,2 (4)	< 0,002	2nd forbidden	> 10,8			
$\epsilon_{0,2}$	699,5 (4)	99,82 (20)	Allowed	6,45	0,8875 (16)	0,0963 (13)	0,0154 (5)
$\epsilon_{0,1}$	821,6 (4)	< 0,003	2nd forbidden	> 11,1			
$\epsilon_{0,0}$	836,0 (4)	< 0,00035	2nd forbidden unique	> 12,9			

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M (10^{-3})	α_T
$\gamma_{1,0}$(Fe)	14,41295 (31)	87,69 (7)	M1+0,0005%E2	7,69 (16)	0,782 (16)	113 (3)	8,58 (18)
$\gamma_{2,1}$(Fe)	122,06079 (12)	87,53 (8)	M1+1,4%E2	0,0212 (5)	0,00208 (5)	0,303 (7)	0,0236 (5)
$\gamma_{2,0}$(Fe)	136,47374 (29)	12,30 (18)	E2	0,133 (3)	0,0136 (3)	1,96 (4)	0,148 (3)
$\gamma_{3,2}$(Fe)	230,27 (3)	0,0004 (4)	M1+0,04%E2	0,00374 (8)	0,000356 (8)	0,0524 (11)	0,00415 (9)

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M (10^{-3})	α_T
$\gamma_{4,3}$(Fe)	339,67 (3)	0,0039 (4)	M1+0,7%E2	0,00149 (3)	0,000142 (3)	0,0208 (5)	0,00165 (4)
$\gamma_{3,1}$(Fe)	352,34 (2)	0,0032 (4)	M1+0,06%E2	0,00135 (3)	0,000129 (3)	0,0188 (4)	0,00150 (3)
$\gamma_{3,0}$(Fe)	366,74 (3)	0,0013 (4)	M1+17%E2	0,00160 (5)	0,000153 (5)	0,0223 (7)	0,00178 (6)
$\gamma_{4,2}$(Fe)	569,94 (4)	0,015 (2)	M1+0,94%E2	0,000458 (10)	0,0000434 (9)	0,00631 (14)	0,000508 (12)
$\gamma_{4,1}$(Fe)	692,01 (2)	0,159 (6)	M1+17,8%E2	0,000328 (10)	0,000031 (1)	0,00452 (14)	0,000364 (12)
$\gamma_{4,0}$(Fe)	706,42 (2)	0,0050 (5)	(E2)				

3 Atomic Data

3.1 Fe

ω_K : 0,352 (4)
$\bar{\omega}_L$: 0,0061 (5)
n_{KL} : 1,456 (12)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	6,39084		50,7
	$K\alpha_1$	6,40384		100
	$K\beta_3$	7,05798	}	
	$K\beta_5''$	7,1081	}	21,4
X_L				
	$L\ell$	0,61		
	$L\beta$	– 0,79		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	5,37 – 5,64	100
KLX	6,16 – 6,40	23,9
KXY	6,91 – 7,10	2,2
Auger L	0,6 – 0,7	302

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Fe)	0,6 - 0,7		252 (3)
e_{AK}	(Fe)			105,2 (13)
	KLL	5,37 - 5,64	}	
	KLX	6,16 - 6,40	}	
	KXY	6,91 - 7,10	}	
$ec_{1,0\ K}$	(Fe)	7,3009 (3)		70,4 (20)
$ec_{1,0\ L}$	(Fe)	13,567 - 13,705		7,16 (20)
$ec_{1,0\ M}$	(Fe)	14,312 - 14,409		1,03 (3)
$ec_{2,1\ K}$	(Fe)	114,9486 (1)		1,81 (4)
$ec_{2,1\ L}$	(Fe)	121,215 - 121,353		0,178 (4)
$ec_{2,1\ M}$	(Fe)	121,968 - 122,057		0,0259 (6)
$ec_{2,0\ K}$	(Fe)	129,3616 (3)		1,42 (4)
$ec_{2,0\ L}$	(Fe)	135,628 - 135,766		0,146 (4)
$ec_{2,0\ M}$	(Fe)	136,381 - 136,470		0,0210 (5)

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Fe)	0,61 — 0,79		1,55 (13)	
$XK\alpha_2$	(Fe)	6,39084		16,8 (3)	} $K\alpha$
$XK\alpha_1$	(Fe)	6,40384		33,2 (5)	}
$XK\beta_3$	(Fe)	7,05798	}		
$XK\beta_1$	(Fe)		}	7,1 (2)	$K'\beta_1$
$XK\beta_5''$	(Fe)	7,1081	}		
$XK\beta_4$	(Fe)		}		$K'\beta_2$

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Fe)	14,41295 (31)	9,15 (17)
$\gamma_{2,1}$(Fe)	122,06065 (12)	85,51 (6)
$\gamma_{2,0}$(Fe)	136,47356 (29)	10,71 (15)

	Energy keV	Photons per 100 disint.
$\gamma_{3,2}$(Fe)	230,27 (3)	0,0004 (4)
$\gamma_{4,3}$(Fe)	339,67 (3)	0,0038 (4)
$\gamma_{3,1}$(Fe)	352,34 (2)	0,0032 (4)
$\gamma_{3,0}$(Fe)	366,74 (3)	0,0013 (4)
$\gamma_{4,2}$(Fe)	569,94 (4)	0,015 (2)
$\gamma_{4,1}$(Fe)	692,01 (2)	0,159 (6)
$\gamma_{4,0}$(Fe)	706,42 (2)	0,0050 (5)

6 Main Production Modes

Ni – 60(p,α)Co – 57
Possible impurities : Co – 56, Co – 58

Ni – 58(p,2p)Co – 57
Possible impurities : Co – 56, Co – 58

Fe – 56(d,n)Co – 57
Possible impurities : Co – 56, Co – 58

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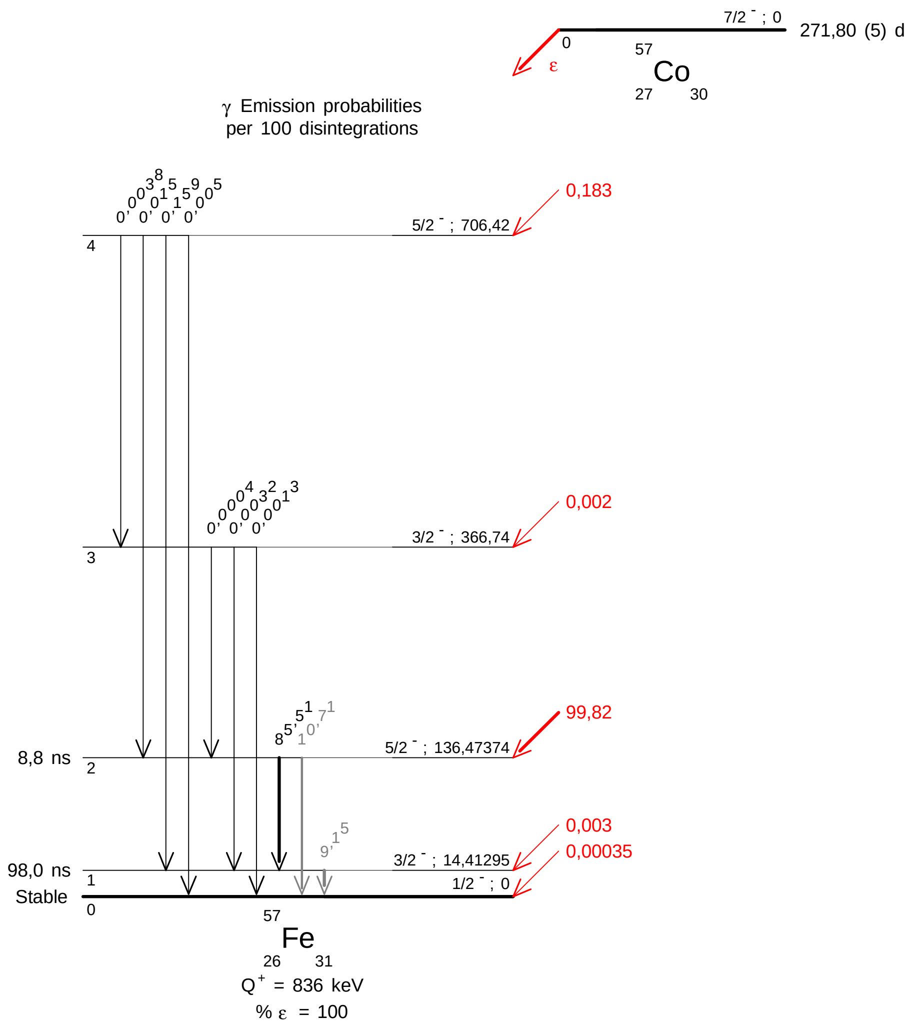
7/2 - ; 0
271,80 (5) d
0
ε
57
Co
27 30
γ Emission probabilities
per 100 disintegrations
0,183
5/2 - ; 706,42
0,002
3/2 - ; 366,74
99,82
5/2 - ; 136,47374
8,8 ns
0,003
0,00035
3/2 - ; 14,41295
98,0 ns
1/2 - ; 0
Stable
57
Fe
26 31
Q+ = 836 keV
% ε = 100

$^{57}_{28}\mathrm{Ni}_{29}$

1 Decay Scheme

Ni-57 disintegrates by electron capture (56.6 %) and positron emission (43.4 %) to excited levels in Co-57. The transition to the ground state has not been observed.
Le nickel 57 se désintègre par capture électronique (56,6%) et émission de positrons (43,4%) vers des niveaux excités de cobalt 57. La transition vers le niveau fondamental n'a pas été observée.

2 Nuclear Data

$T_{1/2}(^{57}\mathrm{Ni})$	:	35,9	(3)	h
$T_{1/2}(^{57}\mathrm{Co})$	:	271,80	(5)	d
$Q^{+}(^{57}\mathrm{Ni})$	:	3264,2	(26)	keV

2.1 β^+ Transitions

	Energy keV	Probability × 100	Nature
$\beta^+_{0,6}$	320,6 (3)	0,45 (3)	Allowed
$\beta^+_{0,4}$	482,6 (3)	0,85 (6)	Allowed
$\beta^+_{0,3}$	735,4 (3)	6,8 (3)	Allowed
$\beta^+_{0,2}$	862,6 (3)	35,3 (5)	Allowed

2.2 Electron Capture Transitions

	Energy keV	Probability × 100	Nature	lg ft	P_K	P_L	P_M
$\epsilon_{0,11}$	87 (3)	0,025 (5)	Allowed	6	0,8706 (19)	0,1103 (15)	0,0181 (6)
$\epsilon_{0,10}$	156 (3)	0,063 (4)	Allowed	6,1	0,8790 (17)	0,1033 (14)	0,0168 (5)
$\epsilon_{0,9}$	460 (3)	0,308 (23)	Allowed	6,4	0,8853 (16)	0,0980 (13)	0,0158 (5)
$\epsilon_{0,8}$	533 (3)	0,020 (3)	Allowed	7,7	0,8857 (16)	0,0977 (13)	0,0158 (5)

	Energy keV	Probability × 100	Nature	lg ft	P_K	P_L	P_M
$\epsilon_{0,7}$	1131 (3)	0,039 (5)	Allowed	8,1	0,8871 (16)	0,0965 (13)	0,0156 (5)
$\epsilon_{0,6}$	1345 (3)	12,1 (6)	Allowed	5,7	0,8873 (16)	0,0964 (13)	0,0155 (5)
$\epsilon_{0,4}$	1507 (3)	5,2 (3)	Allowed	6,2	0,8874 (16)	0,0963 (13)	0,0155 (5)
$\epsilon_{0,3}$	1759 (3)	9,6 (4)	Allowed	6,1	0,8875 (16)	0,0962 (13)	0,0155 (5)
$\epsilon_{0,2}$	1887 (3)	29,3 (5)	Allowed	5,6	0,8876 (16)	0,0961 (13)	0,0155 (5)

2.3 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_T
$\gamma_{3,2}$(Co)	127,164 (3)	16,4 (5)	M1+0,0064%E2	0,0193 (6)	0,00191 (6)	0,0215 (6)
$\gamma_{6,4}$(Co)	161,86 (3)	0,0204 (24)	M1	0,0104 (3)	0,00102 (3)	0,0115 (3)
$\gamma_{10,9}$(Co)	304,1 (1)	0,0020 (6)				
$\gamma_{4,2}$(Co)	379,941 (20)	0,072 (6)	[M1]	0,00129 (4)	0,000124 (4)	0,00143 (4)
$\gamma_{6,2}$(Co)	541,9 (1)	0,0036 (5)	[E2]	0,00105 (3)	0,000102 (3)	0,00116 (3)
$\gamma_{5,1}$(Co)	673,44 (4)	0,0483 (15)	M1+0,04%E2	0,00036 (1)	0,000034 (1)	0,00040 (1)
$\gamma_{6,1}$(Co)	696,0 (4)	0,0009 (6)	[E2]	0,00050 (2)	0,000048 (1)	0,00056 (2)
$\gamma_{7,2}$(Co)	755,31 (10)	0,0054 (6)	M1+10,9%E2	0,000295 (9)	0,0000282 (8)	0,00033 (1)
$\gamma_{9,5}$(Co)	906,99 (5)	0,075 (14)				
$\gamma_{9,4}$(Co)	1046,55 (14)	0,132 (3)				
$\gamma_{1,0}$(Co)	1223,8 (3)	0,076 (13)	M1+6,3%E2	0,000108 (3)	0,0000103 (3)	0,000120 (4)
$\gamma_{11,5}$(Co)	1280,01 (6)	0,0096 (7)				
$\gamma_{10,4}$(Co)	1350,54 (6)	0,002 (1)				
$\gamma_{2,0}$(Co)	1377,64 (4)	81,2 (6)	E2	0,000095 (3)	0,0000091 (3)	0,000105 (3)
$\gamma_{10,3}$(Co)	1603,30 (6)	0,0039 (6)				
$\gamma_{10,2}$(Co)	1730,48 (6)	0,055 (3)				
$\gamma_{4,0}$(Co)	1757,58 (3)	6,1 (4)	E2			
$\gamma_{5,0}$(Co)	1897,0 (5)	0,0252 (25)	M1+0,16%E2			
$\gamma_{6,0}$(Co)	1919,65 (14)	12,5 (5)	M1+5,0%E2			
$\gamma_{7,0}$(Co)	2133,08 (5)	0,033 (5)	M1			
$\gamma_{8,0}$(Co)	2730,83 (14)	0,020 (3)				
$\gamma_{9,0}$(Co)	2804,15 (15)	0,102 (17)	E2			
$\gamma_{11,0}$(Co)	3177,37 (5)	0,015 (4)				

3 Atomic Data

3.1 Co

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

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	6,9153		51,16
	$K\alpha_1$	6,93032		100
	$K\beta_1$	7,6495	}	
	$K\beta_5''$	7,706	}	20,74
X_L				
	$L\ell$	0,678		
	$L\gamma$	– 0,87		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	5,81 – 6,10	100
KLX	6,67 – 6,86	27,3
KXY	7,50 – 7,58	1,88
Auger L	0,564 – 0,653	319

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Co)	0,564 - 0,653		76,7 (12)
e_{AK}	(Co)			31,0 (6)
	KLL	5,81 - 6,10	}	
	KLX	6,67 - 6,86	}	
	KXY	7,50 - 7,58	}	
$ec_{3,2\ K}$	(Co)	119,46	(3)	0,310 (14)
$ec_{6,4\ K}$	(Co)	154,15	(3)	0,00021 (3)
$\beta^+_{0,6}$	max:	320,6	(3)	0,45 (3)
$\beta^+_{0,6}$	avg:	138,6		
$\beta^+_{0,4}$	max:	482,6	(3)	0,85 (6)
$\beta^+_{0,4}$	avg:	206,1		
$\beta^+_{0,3}$	max:	735,4	(3)	6,8 (3)
$\beta^+_{0,3}$	avg:	313,4		
$\beta^+_{0,2}$	max:	862,6	(3)	35,3 (5)
$\beta^+_{0,2}$	avg:	368,3		

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Co)	0,678 — 0,870		0,56 (4)	
$XK\alpha_2$	(Co)	6,9153		5,84 (12)	} $K\alpha$
$XK\alpha_1$	(Co)	6,93032		11,42 (23)	}
$XK\beta_1$	(Co)	7,6495	}	2,37 (6)	$K'\beta_1$
$XK\beta''_5$	(Co)	7,706	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{3,2}$(Co)	127,164 (3)	16,0 (5)
$\gamma_{6,4}$(Co)	161,86 (3)	0,0202 (24)
$\gamma_{10,9}$(Co)	304,1 (1)	0,0020 (6)
$\gamma_{4,2}$(Co)	379,94 (2)	0,072 (6)
$\gamma^{\pm}$	511	86,8 (12)
$\gamma_{6,2}$(Co)	541,9 (1)	0,0036 (5)
$\gamma_{5,1}$(Co)	673,44 (4)	0,0483 (15)
$\gamma_{6,1}$(Co)	696,0 (4)	0,0009 (6)
$\gamma_{7,2}$(Co)	755,3 (1)	0,0054 (6)
$\gamma_{9,5}$(Co)	906,98 (5)	0,075 (14)
$\gamma_{9,4}$(Co)	1046,68 (14)	0,132 (3)
$\gamma_{1,0}$(Co)	1223,8 (3)	0,076 (13)
$\gamma_{11,5}$(Co)	1279,99 (6)	0,0096 (7)
$\gamma_{10,4}$(Co)	1350,52 (6)	0,002 (1)
$\gamma_{2,0}$(Co)	1377,62 (4)	81,2 (6)
$\gamma_{10,3}$(Co)	1603,28 (6)	0,0039 (6)
$\gamma_{10,2}$(Co)	1730,45 (6)	0,055 (3)
$\gamma_{4,0}$(Co)	1757,55 (3)	6,1 (4)
$\gamma_{5,0}$(Co)	1897,0 (5)	0,0252 (25)
$\gamma_{6,0}$(Co)	1919,62 (14)	12,5 (5)
$\gamma_{7,0}$(Co)	2133,04 (5)	0,033 (5)
$\gamma_{8,0}$(Co)	2730,76 (14)	0,020 (3)
$\gamma_{9,0}$(Co)	2804,08 (15)	0,102 (17)
$\gamma_{11,0}$(Co)	3177,27 (5)	0,015 (4)

6 Main Production Modes

Ni – 58(γ,n)Ni – 57
Ni – 58(n,2n)Ni – 57
Ni – 58(d,dn)Ni – 57
Fe – 56(p,γ)Ni – 57
Fe – 56(d,n)Ni – 57
Mn – 55(α,2n)Ni – 57

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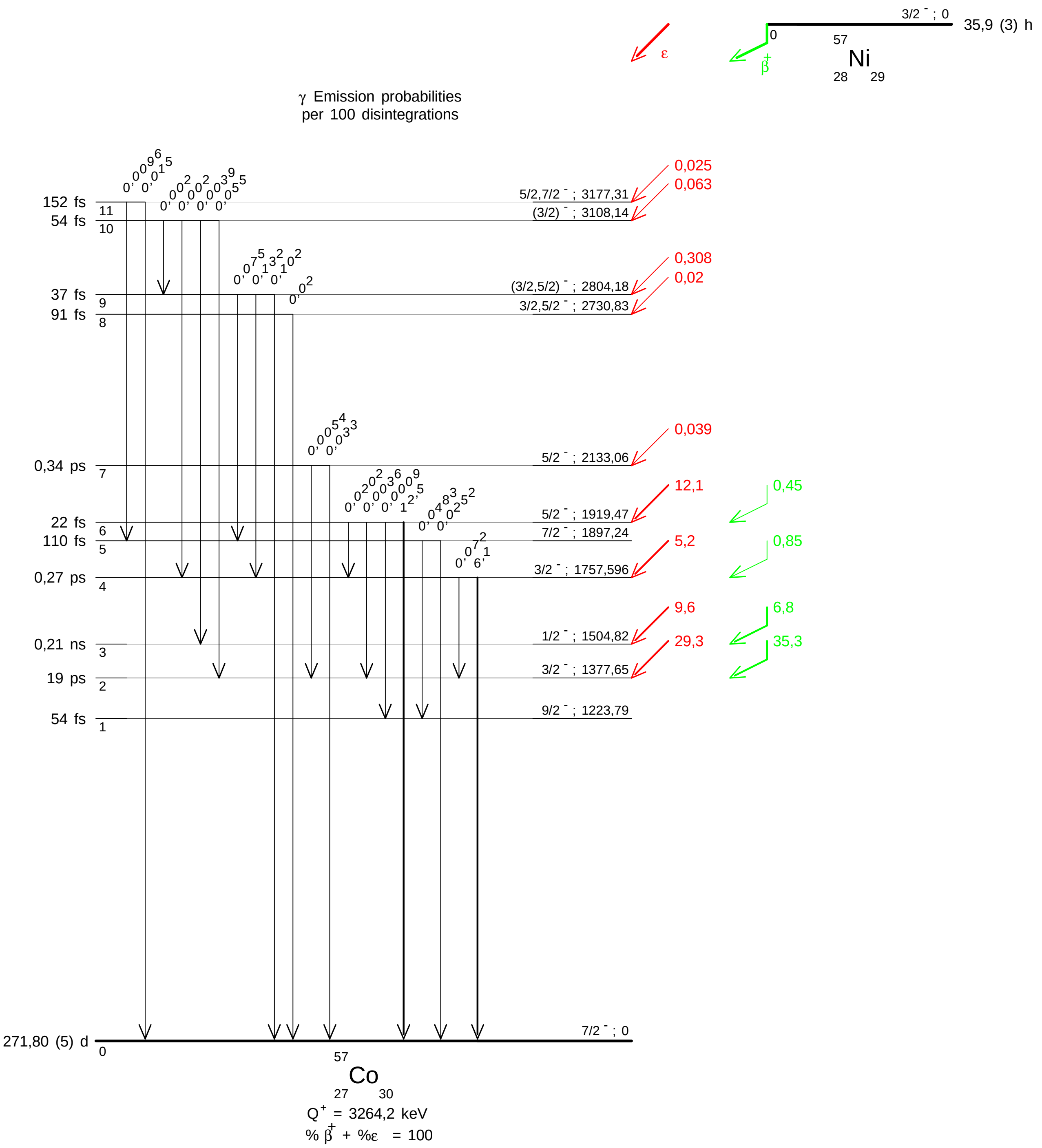
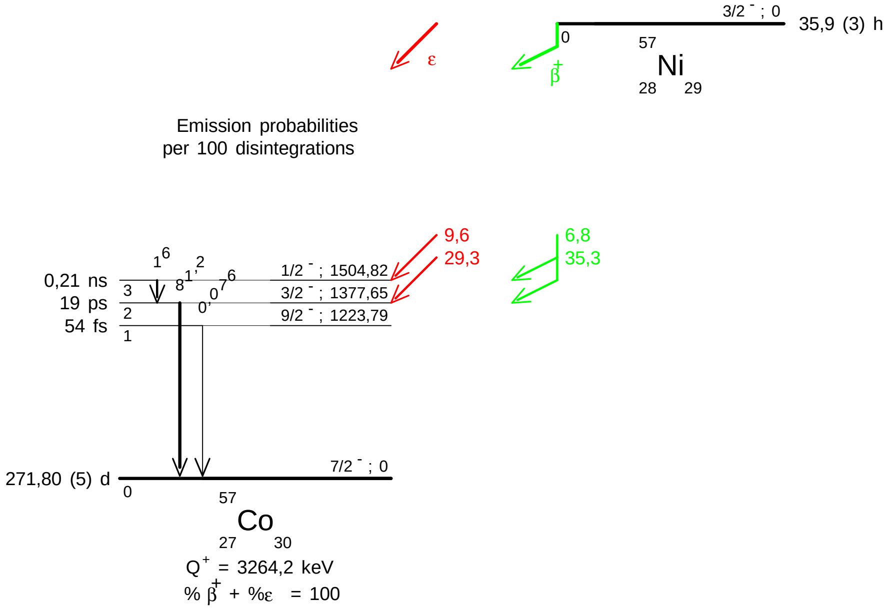


ε
β+
3/2 - ; 0
35,9 (3) h
57 Ni 28 29
γ Emission probabilities per 100 disintegrations
152 fs
54 fs
37 fs
91 fs
0,34 ps
22 fs
110 fs
0,27 ps
0,21 ns
19 ps
54 fs
271,80 (5) d
5/2,7/2 - ; 3177,31
(3/2) - ; 3108,14
(3/2,5/2) - ; 2804,18
3/2,5/2 - ; 2730,83
5/2 - ; 2133,06
5/2 - ; 1919,47
7/2 - ; 1897,24
3/2 - ; 1757,596
1/2 - ; 1504,82
3/2 - ; 1377,65
9/2 - ; 1223,79
7/2 - ; 0
0,025
0,063
0,308
0,02
0,039
12,1
5,2
9,6
29,3
0,45
0,85
6,8
35,3
57 Co 27 30
Q+ = 3264,2 keV
% β+ + %ε = 100


3/2 - ; 0
35,9 (3) h
57
Ni
28
29
ε
β+
Emission probabilities
per 100 disintegrations
9,6
29,3
6,8
35,3
0,21 ns
19 ps
54 fs
1/2 - ; 1504,82
3/2 - ; 1377,65
9/2 - ; 1223,79
7/2 - ; 0
271,80 (5) d
57
Co
27
30
Q+ = 3264,2 keV
% β+ + %ε = 100

$^{59}_{26}$Fe $_{33}$

1 Decay Scheme

Le fer 59 se désintègre par émission bêta moins principalement vers des niveaux excités de 1099 et 1291 keV de cobalt 59.
Fe-59 decays to the 1099 and 1291 keV excited levels of Co-59 mainly.

2 Nuclear Data

$T_{1/2}$(^{59}Fe)	:	44,495	(8)	d
Q^-(^{59}Fe)	:	1565,2	(6)	keV

2.1 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,4}$	83,6 (6)	0,082 (4)	Allowed	6,9
$\beta^-_{0,3}$	130,9 (6)	1,25 (2)	Allowed	6,5
$\beta^-_{0,2}$	273,6 (6)	45,21 (25)	Allowed	5,9
$\beta^-_{0,1}$	465,9 (6)	53,33 (23)	Allowed	6,7
$\beta^-_{0,0}$	1565,2 (6)	0,25 (15)	2nd Forbidden	11

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{3,2}$(Co)	142,652 (2)	0,988 (15)	M1+0,0064%E2	0,01433 (43)	0,001428 (43)	0,000199 (6)	0,0160 (1)
$\gamma_{2,1}$(Co)	192,349 (5)	2,944 (29)	M1+4,22%E2	0,00807 (24)	0,000804 (24)	0,0001119 (34)	0,00899 (15)
$\gamma_{3,1}$(Co)	335,00 (1)	0,265 (7)	M1+1,42%E2	0,00179 (5)	0,000175 (5)	0,0000244 (7)	0,00199 (6)
$\gamma_{4,1}$(Co)	382,32 (20)	0,0215 (16)	M1+E2				
$\gamma_{1,0}$(Co)	1099,262 (5)	56,60 (21)	E2	0,0001572 (47)	0,00001516 (45)	0,00000211 (6)	0,000175 (5)
$\gamma_{2,0}$(Co)	1291,611 (6)	43,22 (25)	E2	0,00011 (3)	0,0000106 (30)	0,0000015 (5)	0,000122 (4)
$\gamma_{4,0}$(Co)	1481,58 (20)	0,0603 (37)	M1+E2				

3 Atomic Data

3.1 Co

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

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	6,9154		51,16
	$K\alpha_1$	6,9304		100
	$K\beta_1$	7,6495	}	
	$K\beta_5''$		}	21,11

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
$\beta^-_{0,4}$	max:	83,6	(6)	0,082 (4)
$\beta^-_{0,4}$	avg:	22,0	(6)	
$\beta^-_{0,3}$	max:	130,9	(6)	1,25 (2)
$\beta^-_{0,3}$	avg:	35,8	(8)	
$\beta^-_{0,2}$	max:	273,6	(6)	45,21 (25)
$\beta^-_{0,2}$	avg:	81	(1)	
$\beta^-_{0,1}$	max:	465,9	(6)	53,33 (23)
$\beta^-_{0,1}$	avg:	149,5	(10)	
$\beta^-_{0,0}$	max:	1565,2	(6)	0,25 (15)
$\beta^-_{0,0}$	avg:	522	(2)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
$XK\alpha_2$	(Co)	6,9154		0,00596 (13)	} $K\alpha$
$XK\alpha_1$	(Co)	6,9304		0,01170 (28)	}
$XK\beta_1$	(Co)	7,6495	}	0,00243 (7)	$K'\beta_1$

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{3,2}$(Co)	142,651 (2)	0,972 (15)
$\gamma_{2,1}$(Co)	192,349 (5)	2,918 (29)
$\gamma_{3,1}$(Co)	334,8 (2)	0,264 (7)
$\gamma_{4,1}$(Co)	382,0 (4)	0,0215 (16)
$\gamma_{1,0}$(Co)	1099,245 (3)	56,59 (21)
$\gamma_{2,0}$(Co)	1291,590 (6)	43,21 (25)
$\gamma_{4,0}$(Co)	1481,7 (2)	0,0603 (37)

6 Main Production Modes

Fe – 58(n,γ)Fe – 59 σ : 1,15 (2) barns
Possible impurities : Fe – 55, Cr – 51

Co – 59(n,p)Fe – 59
Possible impurities : Fe – 55, Co – 60

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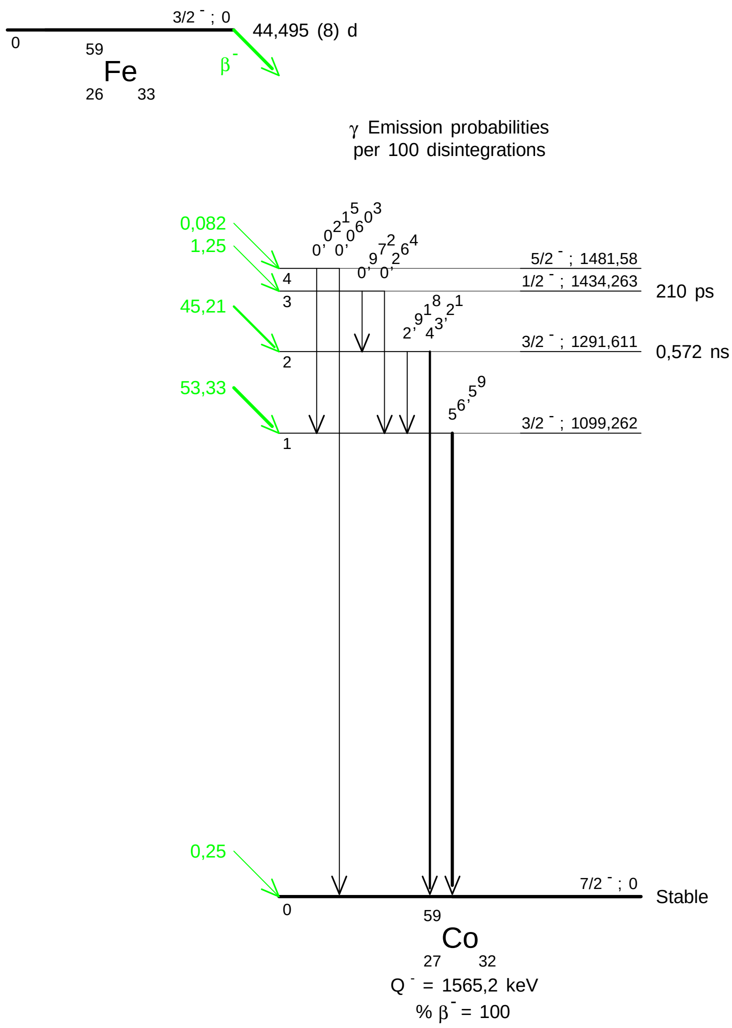
3/2 - ; 0
44,495 (8) d
0
59
Fe
26 33
β -
γ Emission probabilities
per 100 disintegrations
0,082
1,25
45,21
53,33
0,25
4
3
2
1
0
5/2 - ; 1481,58
1/2 - ; 1434,263
210 ps
3/2 - ; 1291,611
0,572 ns
3/2 - ; 1099,262
7/2 - ; 0
Stable
59
Co
27 32
Q - = 1565,2 keV
% β - = 100

$^{64}_{29}Cu_{35}$

1 Decay Scheme

Cu-64 disintegrates by beta minus emission to the Zn-64 ground state (39%) and by electron capture to the excited level and the ground state of Ni-64.
Le Cu-64 se désintègre par émission bêta moins (39%) vers le niveau fondamental de Zn-64 et par capture électronique vers le niveau excité et le fondamental de Ni-64.

2 Nuclear Data

$T_{1/2}(^{64}Cu)$	:	12,701	(2)	h
$Q^{-}(^{64}Cu)$	:	578,7	(9)	keV
$Q^{+}(^{64}Cu)$	:	1675,1	(2)	keV

2.1 β^{-} Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^{-}_{0,0}$	578,7 (9)	39,0 (3)	allowed	5,29

2.2 β^{+} Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^{+}_{0,0}$	653,1 (2)	17,86 (14)	Allowed	4,97

2.3 Electron Capture Transitions

	Energy keV	Probability × 100	Nature	lg ft	P_K	P_L	P_M
$\epsilon_{0,1}$	329,33 (26)	0,475 (10)	Allowed	5,51	0,884 (3)	0,099 (2)	0,0162 (5)
$\epsilon_{0,0}$	1675,1 (2)	42,6 (5)	Allowed	4,97	0,888 (3)	0,095 (2)	0,0155 (5)

2.4 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K (10^{-4})	α_L (10^{-4})	α_T (10^{-4})	α_π (10^{-5})
$\gamma_{1,0}$(Ni)	1345,79 (16)	0,475 (10)	E2	1,12 (3)	0,108 (3)	1,26 (4)	3,4

3 Atomic Data

3.1 Ni

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

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	7,46093		51,24
	$K\alpha_1$	7,47819		100
	$K\beta_3$	8,2647	}	
	$K\beta_5''$	8,3287	}	13,78
X_L				
	$L\ell$	0,74		
	$L\gamma$	– 0,94		

3.1.2 Auger Electrons

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

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Ni)	0,6 - 0,9		52,7 (6)
e_{AK}	(Ni)			22,1 (3)
	KLL	6,262 - 6,567	}	
	KLX	7,196 - 7,475	}	
	KXY	8,109 - 8,326	}	
$ec_{1,0\ K}$	(Ni)	1337,46 (16)		0,0000532 (18)
$\beta^+_{0,0}$	max:	653,1 (2)		17,86 (14)
$\beta^+_{0,0}$	avg:	278,21 (9)		
$\beta^-_{0,0}$	max:	578,7 (9)		39,0 (3)
$\beta^-_{0,0}$	avg:	190,4 (4)		

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Ni)	0,74 — 0,94		0,448 (9)	
XKα_2	(Ni)	7,46093		4,79 (8)	} Kα
XKα_1	(Ni)	7,47819		9,36 (15)	}
XKβ_3	(Ni)	8,2647	}		
XKβ_1	(Ni)		}	1,95 (4)	K$'\beta_1$
XKβ_5''	(Ni)	8,3287	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma^{\pm}$	511	35,36 (28)
$\gamma_{1,0}$(Ni)	1345,77 (16)	0,475 (10)

6 Main Production Modes

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

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

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

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

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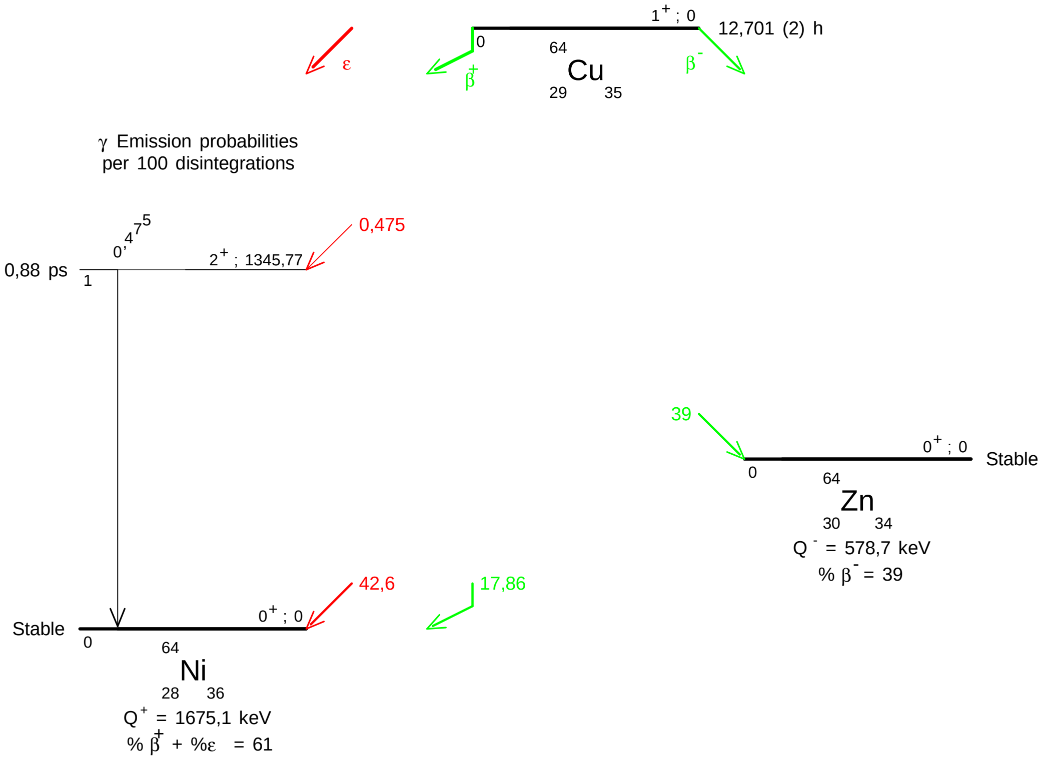
ε
0
β+
64
Cu
29 35
1+ ; 0
12,701 (2) h
β-
γ Emission probabilities
per 100 disintegrations
0,4775
1
0,88 ps
2+ ; 1345,77
0,475
39
0+ ; 0
Stable
0
64
Zn
30 34
Q- = 578,7 keV
% β- = 39
42,6
17,86
Stable
0
0+ ; 0
64
Ni
28 36
Q+ = 1675,1 keV
% β+ + %ε = 61

$^{66}_{31}Ga_{35}$

1 Decay Scheme

Ga-66 disintegrates 56 (4)% by beta plus and 44 (4)% by electron capture to Zn-66. Ga-66 emits gamma-rays up to 4800 keV and their emission probabilities are useful for the efficiency calibration of Ge detectors.
Le gallium 66 se désintègre vers le zinc 66, par émission bêta plus (56 (4)%) et capture électronique (44 (4)%). Les émissions gamma du gallium 66 (jusqu' à 4800 keV) sont utiles pour l'étalonnage de détecteurs au germanium.

2 Nuclear Data

$T_{1/2}(^{66}Ga)$	:	9,49	(7)	h
$Q^{+}(^{66}Ga)$	:	5175	(3)	keV

2.1 Electron Capture Transitions

	Energy keV	Probability × 100	Nature	lg ft	P_K	P_L	P_M
$\epsilon_{0,32}$	169 (3)	0,00122 (15)		7,47	0,8742 (16)	0,1067 (13)	0,0178 (5)
$\epsilon_{0,31}$	217 (3)	0,0020 (5)		7,48	0,8768 (16)	0,1046 (13)	0,0174 (5)
$\epsilon_{0,30}$	309 (3)	0,047 (6)		6,42	0,8794 (15)	0,1024 (13)	0,0170 (5)
$\epsilon_{0,29}$	325 (3)	0,033 (4)		6,62	0,8797 (15)	0,1021 (13)	0,0170 (5)
$\epsilon_{0,28}$	369 (3)	2,27 (19)	Allowed	4,9	0,8804 (15)	0,1016 (13)	0,0169 (4)
$\epsilon_{0,27}$	499 (3)	0,0015 (5)		8,35	0,8817 (15)	0,1005 (12)	0,0166 (4)
$\epsilon_{0,26}$	537 (3)	0,0042 (10)		7,96	0,8820 (15)	0,1003 (12)	0,0166 (4)
$\epsilon_{0,25}$	714 (3)	1,96 (17)	Allowed	5,54	0,8828 (15)	0,0996 (12)	0,0165 (4)
$\epsilon_{0,24}$	880 (3)	6,2 (5)	Allowed	5,23	0,8833 (15)	0,0992 (12)	0,0164 (4)
$\epsilon_{0,23}$	1089 (3)	1,67 (14)		5,99	0,8837 (15)	0,0988 (12)	0,0163 (4)
$\epsilon_{0,22}$	1293 (3)	0,0014 (9)		9,2	0,8840 (15)	0,0986 (12)	0,0163 (4)
$\epsilon_{0,21}$	1350 (3)	0,0030 (6)		8,92	0,8840 (15)	0,0986 (12)	0,0163 (4)
$\epsilon_{0,20}$	1384 (3)	26,0 (21)	Allowed	5	0,8841 (15)	0,0985 (12)	0,0163 (4)
$\epsilon_{0,18}$	1437 (3)	0,015 (6)		8,27	0,8841 (15)	0,0985 (12)	0,0163 (4)
$\epsilon_{0,13}$	1743 (3)	0,39 (4)	1st forbidden	7,03	0,8843 (15)	0,0983 (12)	0,0162 (4)
$\epsilon_{0,12}$	1748 (3)	0,0047 (11)	1st forbidden	8,95	0,8843 (15)	0,0983 (12)	0,0162 (4)
$\epsilon_{0,11}$	1794 (3)	1,31 (11)	1st forbidden	6,53	0,8843 (15)	0,0983 (12)	0,0162 (4)
$\epsilon_{0,9}$	1946 (3)	3,7 (3)	Allowed	6,14	0,8844 (15)	0,0982 (12)	0,0162 (4)

	Energy keV	Probability × 100	Nature	lg *ft*	P_K	P_L	P_M
$\epsilon_{0,5}$	2348 (3)	0,0017 (3)		9,66	0,8846 (15)	0,0981 (12)	0,0162 (4)
$\epsilon_{0,3}$	2803 (3)	0,038 (3)	Allowed	8,46	0,8847 (15)	0,0980 (12)	0,0162 (4)
$\epsilon_{0,0}$	5175 (3)	0,47 (4)	Allowed	7,88	0,8850 (15)	0,0978 (12)	0,0161 (4)

2.2 β^+ Transitions

	Energy keV	Probability × 100	Nature	lg *ft*
$\beta^+_{0,20}$	362 (3)	0,94 (8)	Allowed	5
$\beta^+_{0,18}$	415 (3)	0,0009 (3)		8,3
$\beta^+_{0,13}$	721 (3)	0,16 (2)	1st forbidden	7,03
$\beta^+_{0,12}$	726 (3)	0,0020 (5)	1st forbidden	8,9
$\beta^+_{0,11}$	772 (3)	0,70 (6)	1st forbidden	6,53
$\beta^+_{0,9}$	924 (3)	3,7 (3)	Allowed	6,14
$\beta^+_{0,5}$	1326 (3)	0,0053 (8)	1st forbidden	9,7
$\beta^+_{0,3}$	1781 (3)	0,30 (3)	Allowed	8,46
$\beta^+_{0,0}$	4153 (3)	50 (4)	Allowed	7,88

2.3 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity
$\gamma_{(-1,1)}$(Zn)			
$\gamma_{20,14}$(Zn)	283,87 (3)	0,0036 (8)	
$\gamma_{9,6}$(Zn)	290,812 (6)	0,049 (4)	
$\gamma_{23,18}$(Zn)	347,775 (25)	0,0018 (6)	
$\gamma_{25,23}$(Zn)	375,388 (9)	0,0021 (6)	
$\gamma_{20,11}$(Zn)	410,179 (7)	0,065 (6)	
$\gamma_{24,22}$(Zn)	412,915 (14)	0,0034 (6)	
$\gamma_{11,6}$(Zn)	442,870 (7)	0,01554 (16)	
$\gamma_{9,4}$(Zn)	448,728 (10)	0,107 (9)	M1+E2
$\gamma_{20,10}$(Zn)	459,681 (9)	0,088 (8)	
$\gamma_{13,6}$(Zn)	494,334 (7)	0,0056 (9)	
$\gamma_{3,2}$(Zn)	499,590 (6)	0,0048 (12)	E2+M3
$\gamma_{10,4}$(Zn)	551,284 (13)	0,0070 (8)	
$\gamma_{23,15}$(Zn)	554,291 (18)	0,0045 (6)	
$\gamma_{24,18}$(Zn)	557,13 (5)	0,0061 (8)	M1+E2
$\gamma_{20,9}$(Zn)	562,237 (6)	0,0066 (8)	
$\gamma_{20,8}$(Zn)	578,541 (11)	0,059 (6)	
$\gamma_{11,4}$(Zn)	600,786 (11)	0,0135 (14)	
$\gamma_{23,13}$(Zn)	653,576 (8)	0,0013 (5)	
$\gamma_{23,12}$(Zn)	658,578 (22)	0,0075 (10)	

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity
$\gamma_{25,20}$(Zn)	670,249 (8)	0,0041 (7)	
$\gamma_{14,5}$(Zn)	680,56 (10)	0,0015 (4)	
$\gamma_{20,7}$(Zn)	686,083 (7)	0,252 (22)	
$\gamma_{23,11}$(Zn)	705,040 (8)	0,0038 (5)	
$\gamma_{25,19}$(Zn)	708,36 (5)	0,0087 (10)	
$\gamma_{24,16}$(Zn)	718,97 (5)	0,0099 (10)	
$\gamma_{25,18}$(Zn)	723,163 (26)	0,0034 (6)	
$\gamma_{16,5}$(Zn)	749,68 (7)	0,0014 (4)	
$\gamma_{24,15}$(Zn)	763,646 (15)	0,0089 (10)	
$\gamma_{16,4}$(Zn)	796,212 (29)	0,0029 (7)	
$\gamma_{18,6}$(Zn)	800,135 (24)	0,0010 (5)	
$\gamma_{2,1}$(Zn)	833,5365 (45)	5,9 (5)	M1+E2
$\gamma_{20,6}$(Zn)	853,049 (6)	0,076 (6)	M1+E2
$\gamma_{9,3}$(Zn)	856,532 (7)	0,111 (11)	
$\gamma_{23,9}$(Zn)	857,098 (7)	0,015 (5)	
$\gamma_{24,13}$(Zn)	862,931 (8)	0,0152 (14)	
$\gamma_{24,12}$(Zn)	867,933 (22)	0,0043 (6)	
$\gamma_{23,8}$(Zn)	873,402 (12)	0,0170 (18)	
$\gamma_{25,16}$(Zn)	885,002 (27)	0,0019 (5)	
$\gamma_{4,2}$(Zn)	907,393 (9)	0,0218 (23)	M1+E2
$\gamma_{24,11}$(Zn)	914,395 (8)	0,027 (3)	
$\gamma_{25,15}$(Zn)	929,679 (19)	0,0046 (7)	
$\gamma_{5,2}$(Zn)	953,93 (9)	0,00100 (13)	
$\gamma_{25,14}$(Zn)	954,123 (28)	0,0045 (7)	
$\gamma_{24,10}$(Zn)	963,897 (10)	0,0144 (16)	
$\gamma_{23,7}$(Zn)	980,944 (8)	0,048 (19)	
$\gamma_{11,3}$(Zn)	1008,590 (8)	0,059 (9)	
$\gamma_{20,4}$(Zn)	1010,965 (10)	0,027 (3)	
$\gamma_{28,20}$(Zn)	1015,076 (8)	0,012 (3)	
$\gamma_{1,0}$(Zn)	1039,2268 (20)	37 (3)	E2
$\gamma_{13,3}$(Zn)	1060,054 (8)	0,0155 (17)	
$\gamma_{6,2}$(Zn)	1065,309 (5)	0,0023 (5)	
$\gamma_{24,9}$(Zn)	1066,453 (7)	0,0024 (5)	
$\gamma_{24,8}$(Zn)	1082,757 (12)	0,0133 (13)	
$\gamma_{26,15}$(Zn)	1106,53 (24)	0,0012 (4)	
$\gamma_{25,10}$(Zn)	1129,930 (11)	0,0136 (13)	
$\gamma_{28,17}$(Zn)	1135,48 (6)	0,0047 (6)	
$\gamma_{23,6}$(Zn)	1147,910 (7)	0,078 (9)	M1+E2
$\gamma_{24,7}$(Zn)	1190,299 (8)	0,128 (13)	
$\gamma_{30,17}$(Zn)	1195,33 (9)	0,0009 (3)	
$\gamma_{7,2}$(Zn)	1232,275 (6)	0,50 (4)	
$\gamma_{25,9}$(Zn)	1232,486 (8)	0,056 (19)	
$\gamma_{25,8}$(Zn)	1248,790 (13)	0,0010 (3)	
$\gamma_{28,15}$(Zn)	1274,506 (19)	0,0070 (8)	
$\gamma_{28,14}$(Zn)	1298,950 (28)	0,0038 (5)	
$\gamma_{23,4}$(Zn)	1305,826 (11)	0,0040 (5)	
$\gamma_{3,1}$(Zn)	1333,125 (6)	1,17 (9)	E2
$\gamma_{9,2}$(Zn)	1356,121 (5)	0,36 (5)	
$\gamma_{25,7}$(Zn)	1356,332 (9)	0,122 (21)	
$\gamma_{24,6}$(Zn)	1357,265 (7)	0,16 (5)	M1+E2
$\gamma_{26,9}$(Zn)	1409,36 (14)	0,0016 (7)	
$\gamma_{20,3}$(Zn)	1418,769 (7)	0,61 (5)	
$\gamma_{28,11}$(Zn)	1425,255 (9)	0,0060 (7)	
$\gamma_{30,13}$(Zn)	1433,648 (20)	0,0018 (4)	
$\gamma_{10,2}$(Zn)	1458,680 (8)	0,096 (23)	M1+E2
$\gamma_{29,11}$(Zn)	1468,99 (3)	0,0014 (4)	
$\gamma_{11,2}$(Zn)	1508,179 (6)	0,55 (4)	
$\gamma_{24,4}$(Zn)	1515,181 (11)	0,0062 (7)	
$\gamma_{25,6}$(Zn)	1523,298 (8)	0,0055 (7)	

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity
$\gamma_{30,10}$(Zn)	1534,614 (22)	0,0057 (16)	
$\gamma_{12,2}$(Zn)	1554,64 (2)	0,0183 (18)	
$\gamma_{13,2}$(Zn)	1559,643 (6)	0,0219 (23)	
$\gamma_{28,9}$(Zn)	1577,313 (8)	0,0040 (7)	
$\gamma_{14,2}$(Zn)	1634,48 (3)	0,0035 (6)	
$\gamma_{16,2}$(Zn)	1703,61 (2)	0,0054 (19)	
$\gamma_{23,3}$(Zn)	1713,630 (8)	0,0243 (23)	
$\gamma_{4,1}$(Zn)	1740,930 (9)	0,029 (4)	M1+E2
$\gamma_{5,1}$(Zn)	1787,46 (5)	0,0089 (10)	(E1)
$\gamma_{17,2}$(Zn)	1797,96 (5)	0,0019 (5)	
$\gamma_{28,6}$(Zn)	1868,125 (8)	0,0027 (6)	
$\gamma_{2,0}$(Zn)	1872,740 (6)	0,0229 (24)	[E2]
$\gamma_{6,1}$(Zn)	1898,850 (5)	0,39 (3)	(M1+E2)
$\gamma_{20,2}$(Zn)	1918,358 (5)	1,99 (16)	M1+E2
$\gamma_{30,6}$(Zn)	1927,98 (2)	0,0022 (8)	
$\gamma_{22,2}$(Zn)	2009,659 (12)	0,0031 (7)	
$\gamma_{28,4}$(Zn)	2026,041 (12)	0,0026 (6)	
$\gamma_{7,1}$(Zn)	2065,811 (6)	0,031 (3)	
$\gamma_{30,4}$(Zn)	2085,898 (23)	0,0021 (15)	
$\gamma_{25,3}$(Zn)	2089,018 (9)	0,011 (3)	
$\gamma_{8,1}$(Zn)	2173,353 (10)	0,084 (8)	
$\gamma_{9,1}$(Zn)	2189,657 (5)	5,3 (4)	M1+E2
$\gamma_{23,2}$(Zn)	2213,219 (6)	0,131 (12)	M1+E2
$\gamma_{26,3}$(Zn)	2265,89 (14)	0,0014 (5)	
$\gamma_{10,1}$(Zn)	2292,213 (8)	0,0170 (18)	
$\gamma_{11,1}$(Zn)	2341,715 (6)	0,0032 (7)	
$\gamma_{13,1}$(Zn)	2393,179 (6)	0,23 (2)	E1
$\gamma_{24,2}$(Zn)	2422,574 (6)	1,88 (15)	M1+E2
$\gamma_{28,3}$(Zn)	2433,845 (9)	0,0074 (9)	
$\gamma_{14,1}$(Zn)	2468,02 (3)	0,0084 (10)	
$\gamma_{15,1}$(Zn)	2492,46 (2)	0,0222 (23)	
$\gamma_{16,1}$(Zn)	2537,14 (2)	0,0051 (12)	
$\gamma_{25,2}$(Zn)	2588,607 (7)	0,0263 (26)	M1+E2
$\gamma_{17,1}$(Zn)	2631,49 (5)	0,0029 (11)	
$\gamma_{18,1}$(Zn)	2698,98 (2)	0,0037 (7)	
$\gamma_{19,1}$(Zn)	2713,78 (4)	0,0062 (19)	
$\gamma_{20,1}$(Zn)	2751,894 (5)	22,7 (18)	(M1+E2)
$\gamma_{4,0}$(Zn)	2780,156 (16)	0,123 (10)	E2
$\gamma_{21,1}$(Zn)	2785,8 (3)	0,0030 (6)	
$\gamma_{27,2}$(Zn)	2802,8 (5)	0,0015 (4)	
$\gamma_{22,1}$(Zn)	2843,190 (12)	0,0017 (4)	
$\gamma_{28,2}$(Zn)	2933,434 (7)	0,213 (17)	M1+E2
$\gamma_{29,2}$(Zn)	2977,17 (3)	0,023 (3)	
$\gamma_{30,2}$(Zn)	2993,29 (2)	0,031 (4)	
$\gamma_{23,1}$(Zn)	3046,755 (6)	0,057 (5)	M1+E2
$\gamma_{31,2}$(Zn)	3085,4 (4)	0,0020 (5)	
$\gamma_{8,0}$(Zn)	3212,499 (19)	0,0019 (4)	
$\gamma_{9,0}$(Zn)	3228,884 (3)	1,51 (12)	M1+E2
$\gamma_{24,1}$(Zn)	3256,110 (6)	0,094 (8)	M1+E2
$\gamma_{10,0}$(Zn)	3331,440 (14)	0,0023 (30)	
$\gamma_{11,0}$(Zn)	3380,940 (6)	1,46 (12)	
$\gamma_{25,1}$(Zn)	3422,140 (7)	0,86 (7)	M1+E2
$\gamma_{13,0}$(Zn)	3432,406 (7)	0,288 (24)	
$\gamma_{(-1,4)}$(Zn)	3724,8 (10)	0,0024 (4)	
$\gamma_{18,0}$(Zn)	3738,21 (5)	0,0138 (13)	E0
$\gamma_{28,1}$(Zn)	3766,970 (7)	0,149 (13)	M1+E2
$\gamma_{20,0}$(Zn)	3791,121 (8)	1,09 (9)	M1+E2
$\gamma_{(-1,3)}$(Zn)	3806,3 (10)	0,0024 (4)	
$\gamma_{29,1}$(Zn)	3810,70 (3)	0,0092 (11)	

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity
$\gamma_{(-1,2)}$(Zn)	3827,5 (8)	0,0069 (10)	
$\gamma_{23,0}$(Zn)	4085,982 (9)	1,27 (10)	M1+E2
$\gamma_{24,0}$(Zn)	4295,337 (10)	3,8 (3)	
$\gamma_{25,0}$(Zn)	4461,370 (9)	0,84 (7)	
$\gamma_{28,0}$(Zn)	4806,197 (9)	1,86 (15)	
$\gamma_{30,0}$(Zn)	4866,05 (4)	0,0028 (3)	
$\gamma_{32,0}$(Zn)	5005,8 (3)	0,00124 (18)	

3 Atomic Data

3.1 Zn

ω_K	:	0,486	(4)
$\bar{\omega}_L$	:	0,0108	(4)
n_{KL}	:	1,326	(4)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	8,61587		51,42
	$K\alpha_1$	8,63896		100
	$K\beta_1$	9,5721	}	
	$K\beta_5''$	9,6499	}	21,35
X_L				
	$L\ell$	0,884		
	$L\beta$	– 1,035		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	7,21 – 7,55	100
KLX	8,31 – 8,63	28,3
KXY	9,39 – 9,65	2,01
Auger L	0,732 – 0,997	361,7

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Zn)	0,732 - 0,997		57,2 (16)
e_{AK}	(Zn)			20,6 (10)
	KLL	7,21 - 7,55	}	
	KLX	8,31 - 8,63	}	
	KXY	9,39 - 9,65	}	
$\beta^+_{0,0}$	max:	4153	(3)	50 (4)
$\beta^+_{0,0}$	avg:	1904,1	(15)	
$\beta^+_{0,3}$	max:	1781	(3)	0,30 (3)
$\beta^+_{0,3}$	avg:	781,6	(14)	
$\beta^+_{0,5}$	max:	1326	(3)	0,0053 (8)
$\beta^+_{0,5}$	avg:	575,3	(14)	
$\beta^+_{0,9}$	max:	924	(3)	3,7 (3)
$\beta^+_{0,9}$	avg:	397,1	(14)	
$\beta^+_{0,11}$	max:	772	(3)	0,70 (6)
$\beta^+_{0,11}$	avg:	331,1	(13)	
$\beta^+_{0,12}$	max:	726	(3)	0,0020 (5)
$\beta^+_{0,12}$	avg:	311,1	(13)	
$\beta^+_{0,13}$	max:	721	(3)	0,16 (2)
$\beta^+_{0,13}$	avg:	308,9	(13)	
$\beta^+_{0,18}$	max:	415	(3)	0,0009 (3)
$\beta^+_{0,18}$	avg:	179,2	(13)	
$\beta^+_{0,20}$	max:	362	(3)	0,94 (8)
$\beta^+_{0,20}$	avg:	157,0	(13)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Zn)	0,884 — 1,035		0,597 (19)	
XKα_2	(Zn)	8,61587		5,8 (3)	} Kα
XKα_1	(Zn)	8,63896		11,3 (6)	}
XKβ_1	(Zn)	9,5721	}	2,42 (12)	K$'\beta_1$

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{(-1,1)}$(Zn)	171,9 (2)	0,0104 (9)
$\gamma_{20,14}$(Zn)	283,87 (3)	0,0036 (8)
$\gamma_{9,6}$(Zn)	290,8105 (11)	0,049 (4)
$\gamma_{23,18}$(Zn)	347,77 (5)	0,0018 (6)
$\gamma_{25,23}$(Zn)	375,398 (17)	0,0021 (6)
$\gamma_{20,11}$(Zn)	410,178 (12)	0,065 (6)
$\gamma_{24,22}$(Zn)	412,916 (16)	0,0034 (6)
$\gamma_{11,6}$(Zn)	442,873 (14)	0,01554 (16)
$\gamma_{9,4}$(Zn)	448,73 (2)	0,107 (9)
$\gamma_{20,10}$(Zn)	459,683 (14)	0,088 (8)
$\gamma_{13,6}$(Zn)	494,336 (13)	0,0056 (9)
$\gamma_{3,2}$(Zn)	499,590 (6)	0,0048 (12)
$\gamma_{10,4}$(Zn)	551,284 (22)	0,0070 (8)
$\gamma_{23,15}$(Zn)	554,28 (3)	0,0045 (6)
$\gamma_{24,18}$(Zn)	557,13 (5)	0,0061 (8)
$\gamma_{20,9}$(Zn)	562,241 (10)	0,0066 (8)
$\gamma_{20,8}$(Zn)	578,540 (19)	0,059 (6)
$\gamma_{11,4}$(Zn)	600,788 (21)	0,0135 (14)
$\gamma_{23,13}$(Zn)	653,568 (14)	0,0013 (5)
$\gamma_{23,12}$(Zn)	658,57 (3)	0,0075 (10)
$\gamma_{25,20}$(Zn)	670,251 (14)	0,0041 (7)
$\gamma_{14,5}$(Zn)	680,56 (10)	0,0015 (4)
$\gamma_{20,7}$(Zn)	686,080 (6)	0,252 (22)
$\gamma_{23,11}$(Zn)	705,031 (15)	0,0038 (5)
$\gamma_{25,19}$(Zn)	708,36 (5)	0,0087 (10)
$\gamma_{24,16}$(Zn)	718,97 (5)	0,0099 (10)
$\gamma_{25,18}$(Zn)	723,17 (5)	0,0034 (6)
$\gamma_{16,5}$(Zn)	749,68 (10)	0,0014 (4)
$\gamma_{24,15}$(Zn)	763,64 (3)	0,0089 (10)
$\gamma_{16,4}$(Zn)	796,21 (5)	0,0029 (7)
$\gamma_{18,6}$(Zn)	800,13 (5)	0,0010 (5)
$\gamma_{2,1}$(Zn)	833,5324 (21)	5,9 (5)
$\gamma_{20,6}$(Zn)	853,038 (8)	0,076 (6)
$\gamma_{9,3}$(Zn)	856,527 (10)	0,111 (11)
$\gamma_{23,9}$(Zn)	857,093 (9)	0,015 (5)
$\gamma_{24,13}$(Zn)	862,926 (13)	0,0152 (14)
$\gamma_{24,12}$(Zn)	867,93 (3)	0,0043 (6)
$\gamma_{23,8}$(Zn)	873,392 (21)	0,0170 (18)
$\gamma_{25,16}$(Zn)	885,00 (5)	0,0019 (5)
$\gamma_{4,2}$(Zn)	907,390 (19)	0,0218 (23)
$\gamma_{24,11}$(Zn)	914,388 (14)	0,027 (3)
$\gamma_{25,15}$(Zn)	929,68 (3)	0,0046 (7)
$\gamma_{5,2}$(Zn)	953,93 (9)	0,00100 (13)
$\gamma_{25,14}$(Zn)	954,12 (7)	0,0045 (7)
$\gamma_{24,10}$(Zn)	963,892 (15)	0,0144 (16)

	Energy keV	Photons per 100 disint.
$\gamma_{23,7}$(Zn)	980,934 (13)	0,048 (19)
$\gamma_{11,3}$(Zn)	1008,588 (12)	0,059 (9)
$\gamma_{20,4}$(Zn)	1010,957 (19)	0,027 (3)
$\gamma_{28,20}$(Zn)	1015,081 (18)	0,012 (3)
$\gamma_{1,0}$(Zn)	1039,220 (3)	37 (3)
$\gamma_{13,3}$(Zn)	1060,051 (11)	0,0155 (17)
$\gamma_{6,2}$(Zn)	1065,305 (9)	0,0023 (5)
$\gamma_{24,9}$(Zn)	1066,450 (12)	0,0024 (5)
$\gamma_{24,8}$(Zn)	1082,75 (2)	0,0133 (13)
$\gamma_{26,15}$(Zn)	1106,53 (24)	0,0012 (4)
$\gamma_{25,10}$(Zn)	1129,923 (18)	0,0136 (13)
$\gamma_{28,17}$(Zn)	1135,47 (9)	0,0047 (6)
$\gamma_{23,6}$(Zn)	1147,896 (10)	0,078 (9)
$\gamma_{24,7}$(Zn)	1190,287 (7)	0,128 (13)
$\gamma_{30,17}$(Zn)	1195,32 (9)	0,0009 (3)
$\gamma_{7,2}$(Zn)	1232,264 (8)	0,50 (4)
$\gamma_{25,9}$(Zn)	1232,480 (15)	0,056 (19)
$\gamma_{25,8}$(Zn)	1248,779 (22)	0,0010 (3)
$\gamma_{28,15}$(Zn)	1274,50 (3)	0,0070 (8)
$\gamma_{28,14}$(Zn)	1298,95 (7)	0,0038 (5)
$\gamma_{23,4}$(Zn)	1305,807 (21)	0,0040 (5)
$\gamma_{3,1}$(Zn)	1333,112 (5)	1,17 (9)
$\gamma_{9,2}$(Zn)	1356,104 (9)	0,36 (5)
$\gamma_{25,7}$(Zn)	1356,320 (15)	0,122 (21)
$\gamma_{24,6}$(Zn)	1357,250 (12)	0,16 (5)
$\gamma_{26,9}$(Zn)	1409,35 (24)	0,0016 (7)
$\gamma_{20,3}$(Zn)	1418,754 (5)	0,61 (5)
$\gamma_{28,11}$(Zn)	1425,25 (2)	0,0060 (7)
$\gamma_{30,13}$(Zn)	1433,63 (4)	0,0018 (4)
$\gamma_{10,2}$(Zn)	1458,662 (12)	0,096 (23)
$\gamma_{29,11}$(Zn)	1468,97 (5)	0,0014 (4)
$\gamma_{11,2}$(Zn)	1508,158 (7)	0,55 (4)
$\gamma_{24,4}$(Zn)	1515,162 (20)	0,0062 (7)
$\gamma_{25,6}$(Zn)	1523,279 (15)	0,0055 (7)
$\gamma_{30,10}$(Zn)	1534,60 (4)	0,0057 (16)
$\gamma_{12,2}$(Zn)	1554,62 (3)	0,0183 (18)
$\gamma_{13,2}$(Zn)	1559,627 (10)	0,0219 (23)
$\gamma_{28,9}$(Zn)	1577,308 (20)	0,0040 (7)
$\gamma_{14,2}$(Zn)	1634,46 (7)	0,0035 (6)
$\gamma_{16,2}$(Zn)	1703,59 (5)	0,0054 (19)
$\gamma_{23,3}$(Zn)	1713,602 (12)	0,0243 (23)
$\gamma_{4,1}$(Zn)	1740,904 (16)	0,029 (4)
$\gamma_{5,1}$(Zn)	1787,44 (9)	0,0089 (10)
$\gamma_{17,2}$(Zn)	1797,94 (9)	0,0019 (5)
$\gamma_{28,6}$(Zn)	1868,105 (20)	0,0027 (6)
$\gamma_{2,0}$(Zn)	1872,740 (6)	0,0229 (24)
$\gamma_{6,1}$(Zn)	1898,823 (8)	0,39 (3)

	Energy keV	Photons per 100 disint.
$\gamma_{20,2}$(Zn)	1918,329 (5)	1,99 (16)
$\gamma_{30,6}$(Zn)	1927,96 (4)	0,0022 (8)
$\gamma_{22,2}$(Zn)	2009,628 (16)	0,0031 (7)
$\gamma_{28,4}$(Zn)	2026,016 (25)	0,0026 (6)
$\gamma_{7,1}$(Zn)	2065,778 (7)	0,031 (3)
$\gamma_{30,4}$(Zn)	2085,86 (4)	0,0021 (15)
$\gamma_{25,3}$(Zn)	2088,985 (13)	0,011 (3)
$\gamma_{8,1}$(Zn)	2173,319 (15)	0,084 (8)
$\gamma_{9,1}$(Zn)	2189,616 (6)	5,3 (4)
$\gamma_{23,2}$(Zn)	2213,181 (9)	0,131 (12)
$\gamma_{26,3}$(Zn)	2265,84 (24)	0,0014 (5)
$\gamma_{10,1}$(Zn)	2292,171 (13)	0,0170 (18)
$\gamma_{11,1}$(Zn)	2341,673 (11)	0,0032 (7)
$\gamma_{13,1}$(Zn)	2393,129 (7)	0,23 (2)
$\gamma_{24,2}$(Zn)	2422,525 (7)	1,88 (15)
$\gamma_{28,3}$(Zn)	2433,807 (18)	0,0074 (9)
$\gamma_{14,1}$(Zn)	2467,97 (7)	0,0084 (10)
$\gamma_{15,1}$(Zn)	2492,42 (3)	0,0222 (23)
$\gamma_{16,1}$(Zn)	2537,09 (5)	0,0051 (12)
$\gamma_{25,2}$(Zn)	2588,553 (13)	0,0263 (26)
$\gamma_{17,1}$(Zn)	2631,44 (9)	0,0029 (11)
$\gamma_{18,1}$(Zn)	2698,92 (5)	0,0037 (7)
$\gamma_{19,1}$(Zn)	2713,73 (5)	0,0062 (19)
$\gamma_{20,1}$(Zn)	2751,835 (5)	22,7 (18)
$\gamma_{4,0}$(Zn)	2780,095 (16)	0,123 (10)
$\gamma_{21,1}$(Zn)	2785,7 (3)	0,0030 (6)
$\gamma_{27,2}$(Zn)	2802,8 (5)	0,0015 (4)
$\gamma_{22,1}$(Zn)	2843,130 (16)	0,0017 (4)
$\gamma_{28,2}$(Zn)	2933,358 (9)	0,213 (17)
$\gamma_{29,2}$(Zn)	2977,08 (4)	0,023 (3)
$\gamma_{30,2}$(Zn)	2993,21 (3)	0,031 (4)
$\gamma_{23,1}$(Zn)	3046,684 (9)	0,057 (5)
$\gamma_{31,2}$(Zn)	3085,4 (4)	0,0020 (5)
$\gamma_{8,0}$(Zn)	3212,499 (19)	0,0019 (4)
$\gamma_{9,0}$(Zn)	3228,800 (6)	1,51 (12)
$\gamma_{24,1}$(Zn)	3256,021 (9)	0,094 (8)
$\gamma_{10,0}$(Zn)	3331,351 (14)	0,0023 (30)
$\gamma_{11,0}$(Zn)	3380,850 (6)	1,46 (12)
$\gamma_{25,1}$(Zn)	3422,040 (8)	0,86 (7)
$\gamma_{13,0}$(Zn)	3432,309 (7)	0,288 (24)
$\gamma_{(-1,4)}$(Zn)	3724,8 (10)	0,0024 (4)
$\gamma_{18,0}$(Zn)	3738,10 (5)	0,0138 (13)
$\gamma_{28,1}$(Zn)	3766,850 (9)	0,149 (13)
$\gamma_{20,0}$(Zn)	3791,004 (8)	1,09 (9)
$\gamma_{(-1,3)}$(Zn)	3806,3 (10)	0,0024 (4)
$\gamma_{29,1}$(Zn)	3810,59 (5)	0,0092 (11)
$\gamma_{(-1,2)}$(Zn)	3827,5 (8)	0,0069 (10)

	Energy keV	Photons per 100 disint.
$\gamma_{23,0}$(Zn)	4085,853 (9)	1,27 (10)
$\gamma_{24,0}$(Zn)	4295,187 (10)	3,8 (3)
$\gamma_{25,0}$(Zn)	4461,202 (9)	0,84 (7)
$\gamma_{28,0}$(Zn)	4806,007 (9)	1,86 (15)
$\gamma_{30,0}$(Zn)	4865,87 (4)	0,0028 (3)
$\gamma_{32,0}$(Zn)	5005,6 (3)	0,00124 (18)

6 Main Production Modes

{ Zn – 66(p,n)Ga – 66
Possible impurities : Ga – 68 (68min) and Ga – 67 (3,3d)

Cu – 63(α,n)Ga – 66

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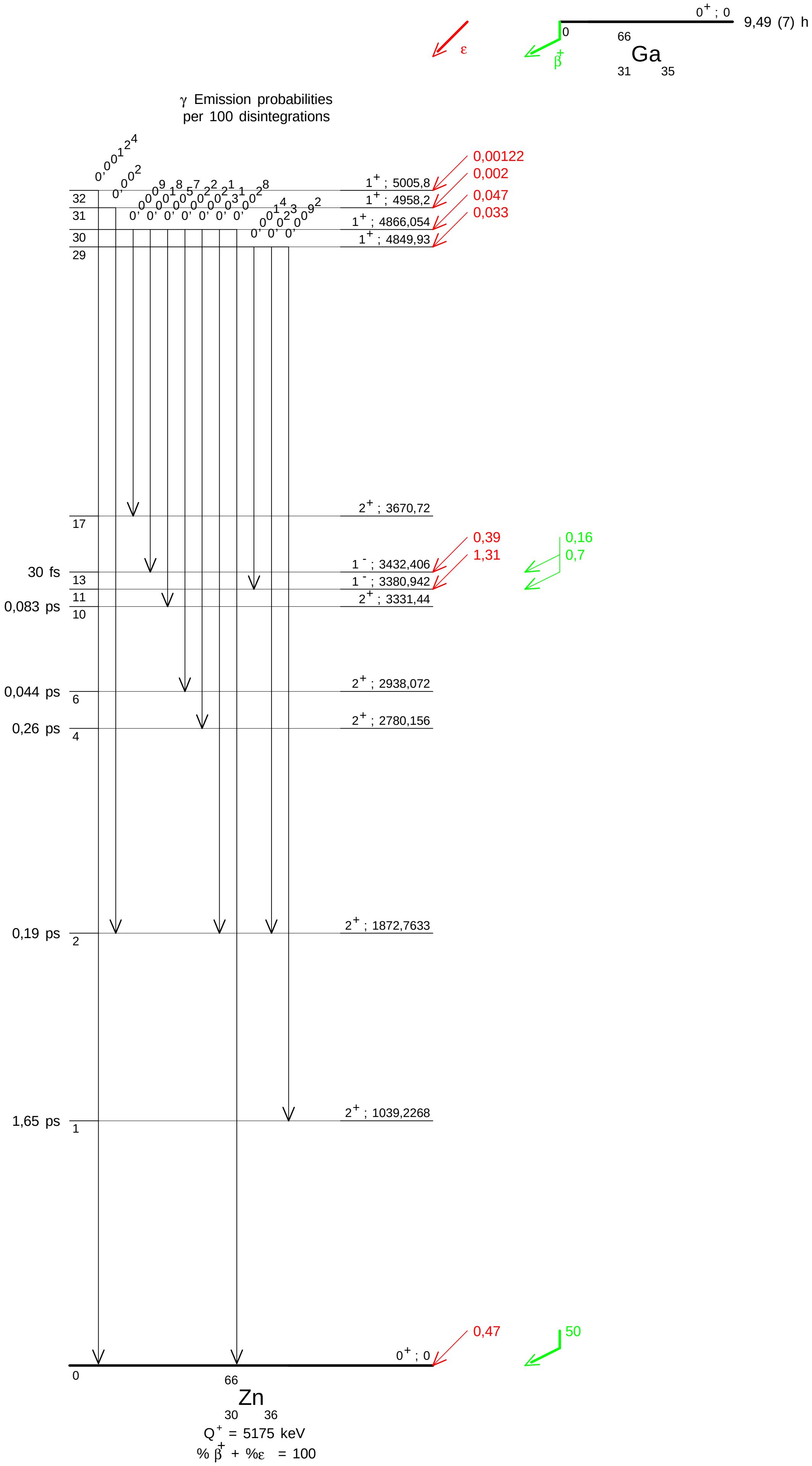
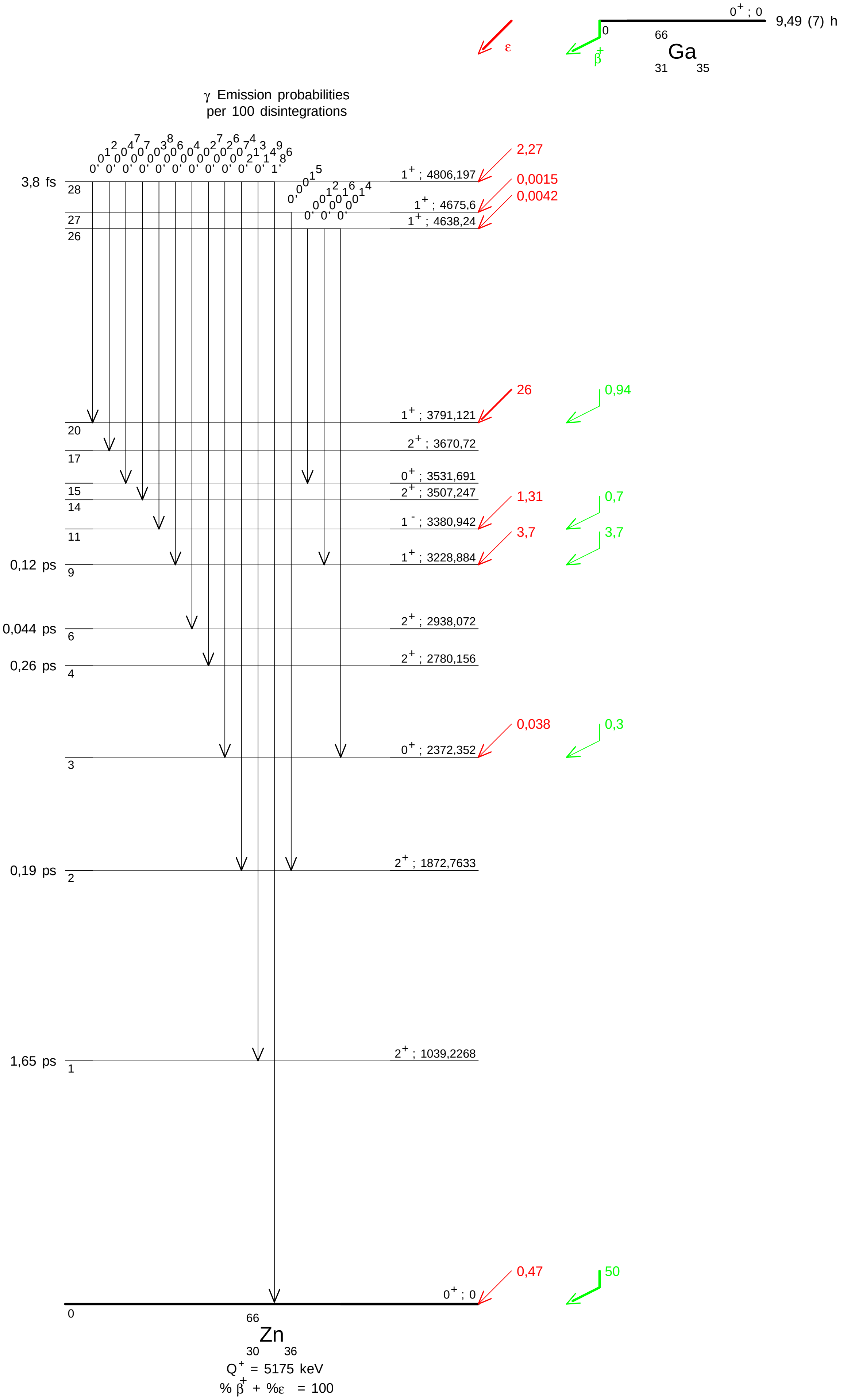
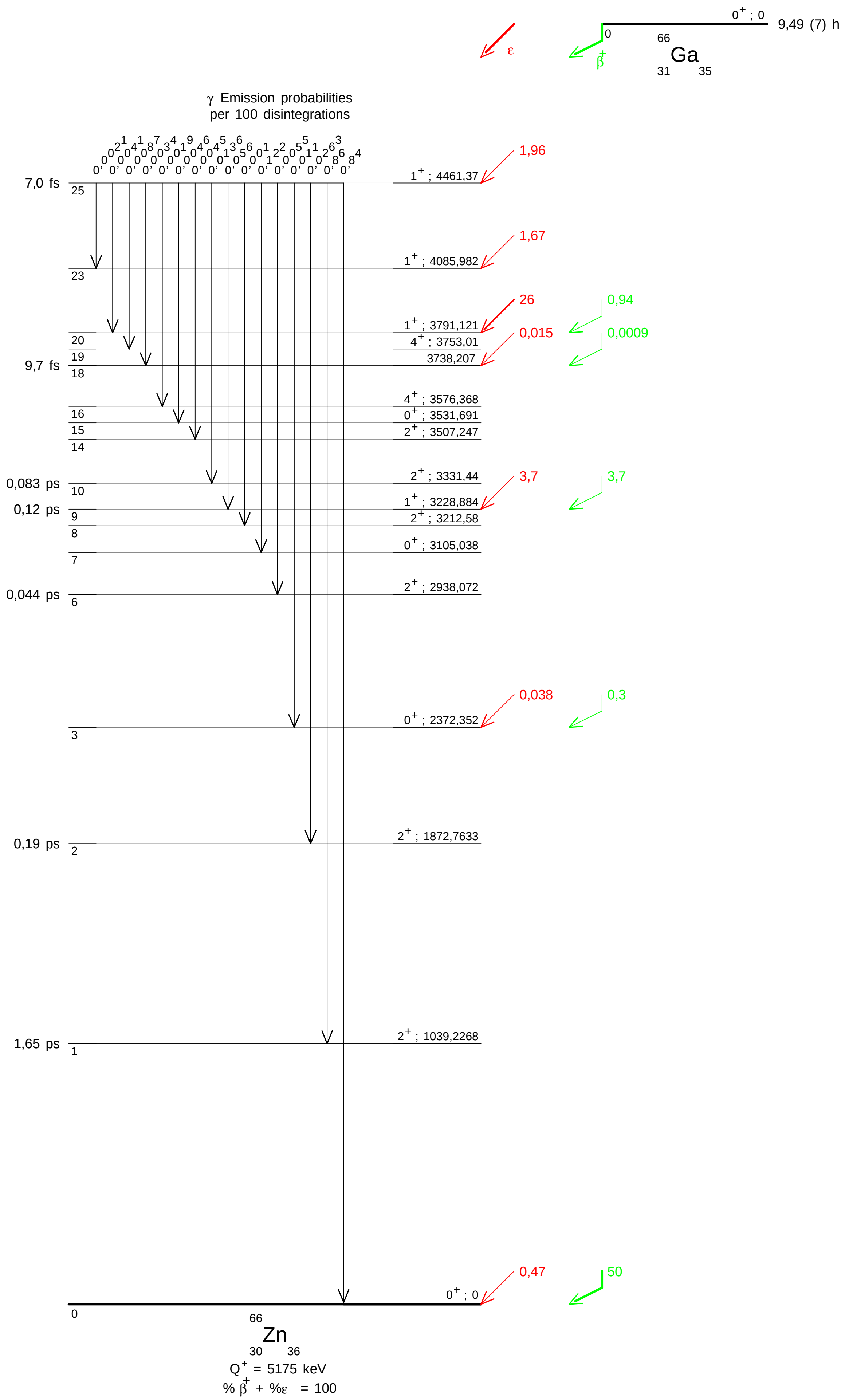
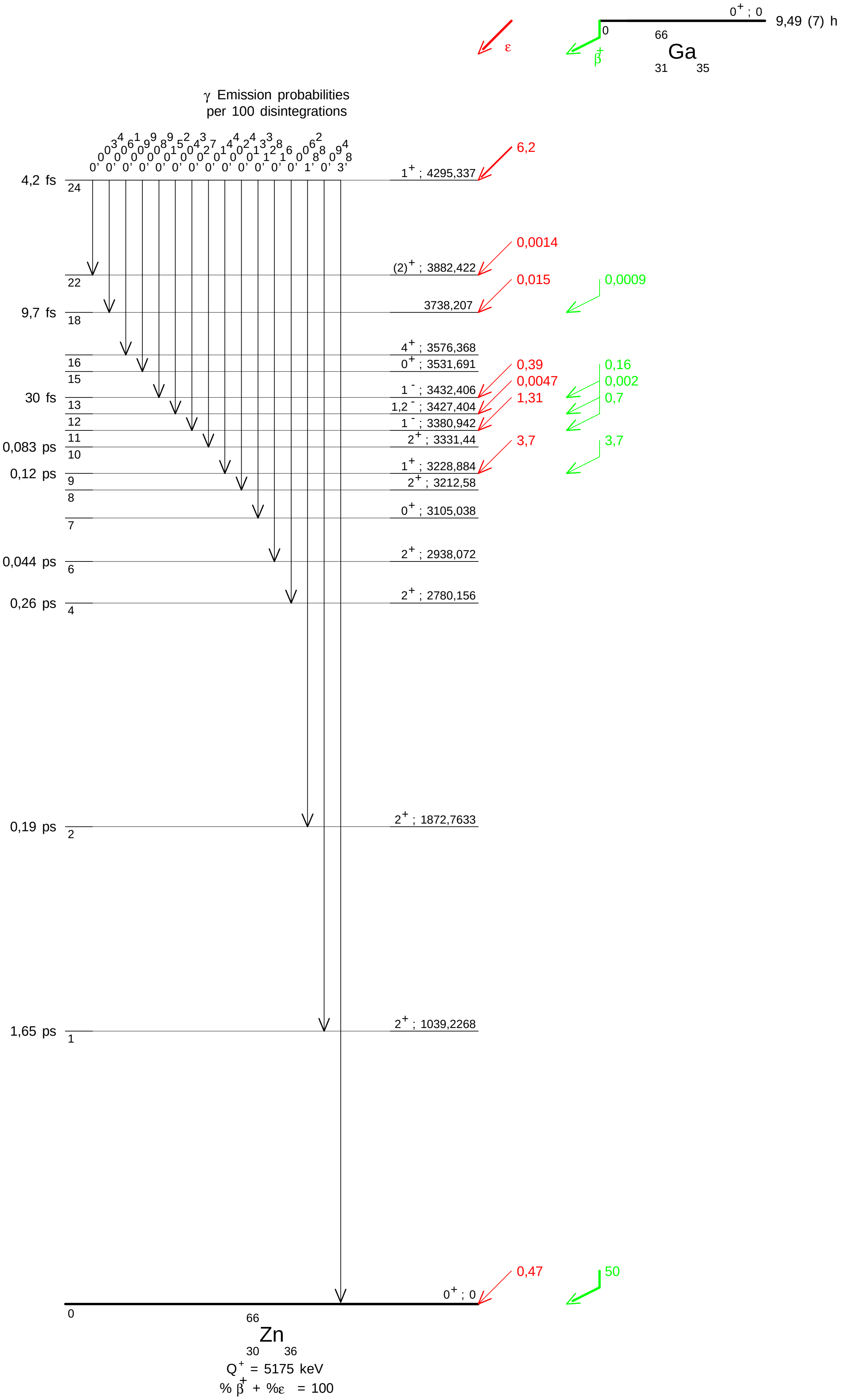

0+ ; 0
9,49 (7) h
ε
β+
66
Ga
31 35
γ Emission probabilities
per 100 disintegrations
1+ ; 5005,8
1+ ; 4958,2
1+ ; 4866,054
1+ ; 4849,93
0,00122
0,002
0,047
0,033
2+ ; 3670,72
30 fs
0,083 ps
1- ; 3432,406
1- ; 3380,942
2+ ; 3331,44
0,39
1,31
0,16
0,7
0,044 ps
2+ ; 2938,072
0,26 ps
2+ ; 2780,156
0,19 ps
2+ ; 1872,7633
1,65 ps
2+ ; 1039,2268
0+ ; 0
0,47
50
66
Zn
30 36
Q+ = 5175 keV
% β+ + %ε = 100


0+ ; 0
9,49 (7) h
0
66
Ga
31 35
ε
β+
γ Emission probabilities
per 100 disintegrations
3,8 fs
28
27
26
20
17
15
14
11
0,12 ps
9
0,044 ps
6
0,26 ps
4
3
0,19 ps
2
1,65 ps
1
0
1+ ; 4806,197
1+ ; 4675,6
1+ ; 4638,24
1+ ; 3791,121
2+ ; 3670,72
0+ ; 3531,691
2+ ; 3507,247
1- ; 3380,942
1+ ; 3228,884
2+ ; 2938,072
2+ ; 2780,156
0+ ; 2372,352
2+ ; 1872,7633
2+ ; 1039,2268
0+ ; 0
2,27
0,0015
0,0042
26
0,94
1,31
0,7
3,7
3,7
0,038
0,3
0,47
50
66
Zn
30 36
Q+ = 5175 keV
% β+ + %ε = 100


0+ ; 0
9,49 (7) h
66
Ga
31 35
ε
β+
γ Emission probabilities
per 100 disintegrations
7,0 fs
9,7 fs
0,083 ps
0,12 ps
0,044 ps
0,19 ps
1,65 ps
1+ ; 4461,37
1+ ; 4085,982
1+ ; 3791,121
4+ ; 3753,01
3738,207
4+ ; 3576,368
0+ ; 3531,691
2+ ; 3507,247
2+ ; 3331,44
1+ ; 3228,884
2+ ; 3212,58
0+ ; 3105,038
2+ ; 2938,072
0+ ; 2372,352
2+ ; 1872,7633
2+ ; 1039,2268
0+ ; 0
1,96
1,67
26
0,015
3,7
0,038
0,47
0,94
0,0009
3,7
0,3
50
66
Zn
30 36
Q+ = 5175 keV
% β+ + %ε = 100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9,49 (7) h
0
66 Ga 31 35
ε
β+
γ Emission probabilities
per 100 disintegrations
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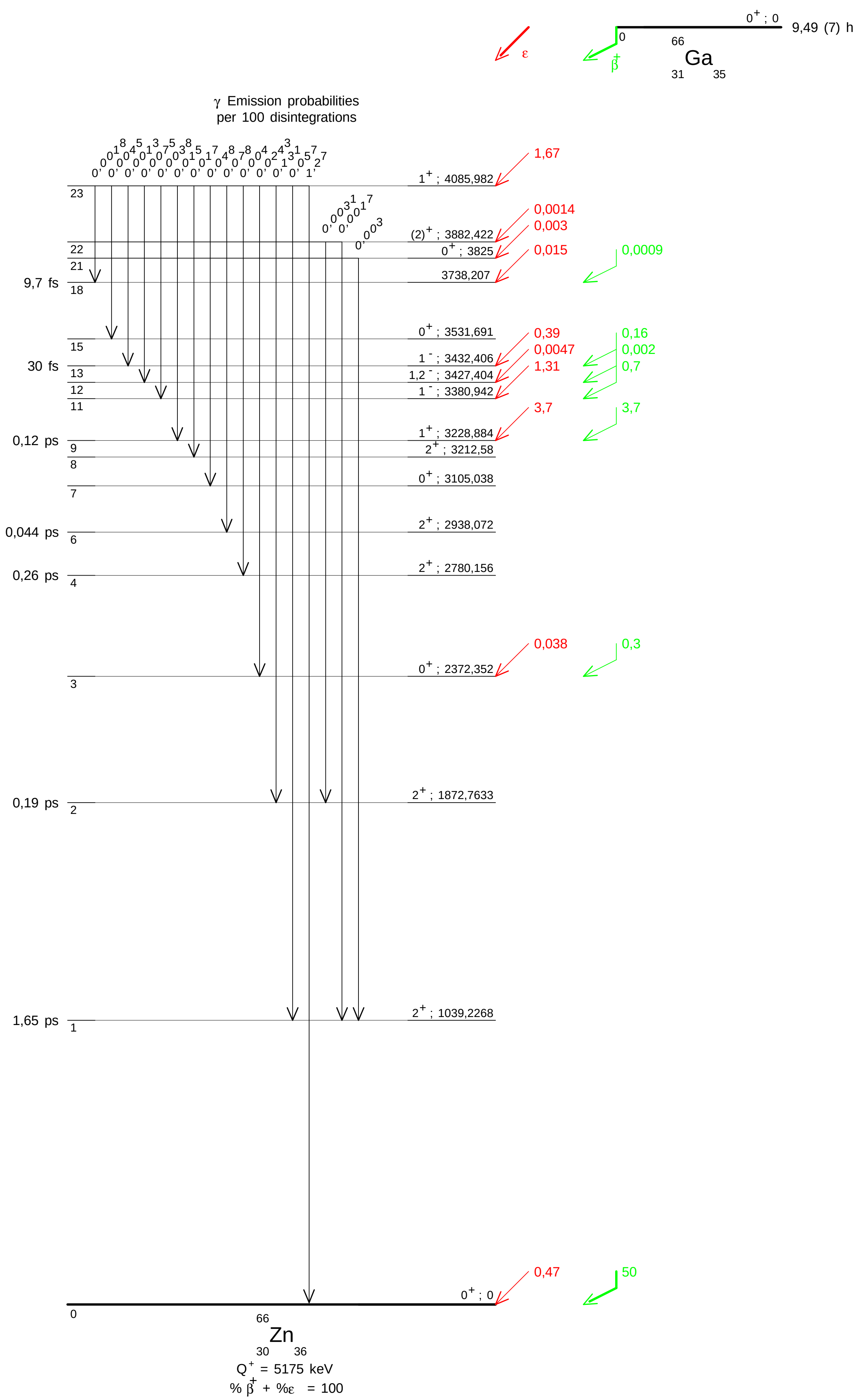
1+ ; 4295,337
6,2
(2)+ ; 3882,422
0,0014
9,7 fs
3738,207
0,015
0,0009
4+ ; 3576,368
0+ ; 3531,691
30 fs
1 - ; 3432,406
1,2 - ; 3427,404
1 - ; 3380,942
0,39
0,0047
1,31
0,16
0,002
0,7
0,083 ps
2+ ; 3331,44
0,12 ps
1+ ; 3228,884
2+ ; 3212,58
3,7
3,7
0+ ; 3105,038
0,044 ps
2+ ; 2938,072
0,26 ps
2+ ; 2780,156
0,19 ps
2+ ; 1872,7633
1,65 ps
2+ ; 1039,2268
0+ ; 0
0,47
50
66 Zn 30 36
Q+ = 5175 keV
% β+ + %ε = 100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9,49 (7) h
ε
β+
66 Ga 31 35
γ Emission probabilities
per 100 disintegrations
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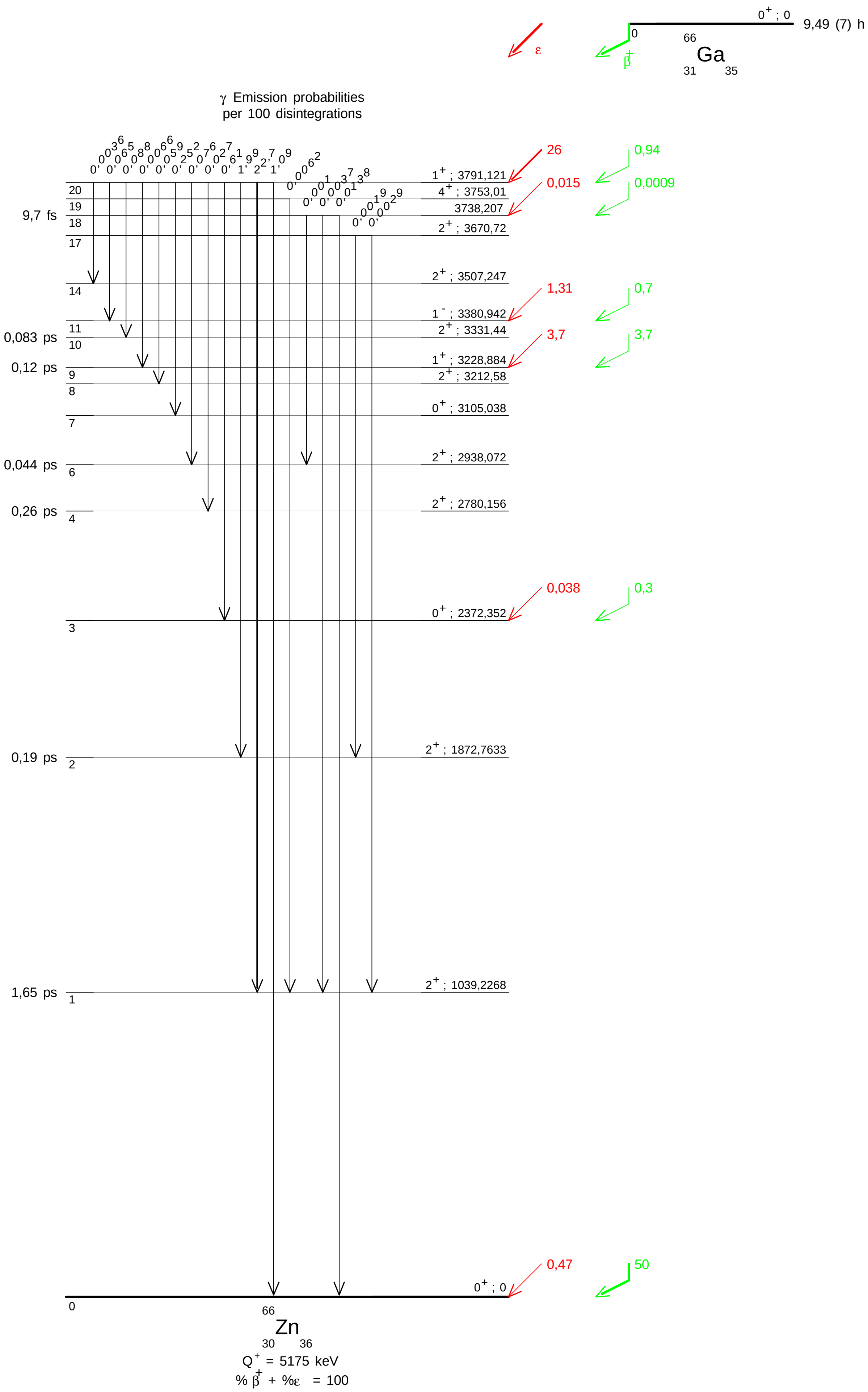
(2)+ ; 3882,422
0+ ; 3825
3738,207
0+ ; 3531,691
1- ; 3432,406
1,2- ; 3427,404
1- ; 3380,942
1+ ; 3228,884
2+ ; 3212,58
0+ ; 3105,038
2+ ; 2938,072
2+ ; 2780,156
0+ ; 2372,352
2+ ; 1872,7633
2+ ; 1039,2268
0+ ; 0
1,67
0,0014
0,003
0,015
0,0009
0,39
0,0047
1,31
0,16
0,002
0,7
3,7
3,7
0,038
0,3
0,47
50
9,7 fs
30 fs
0,12 ps
0,044 ps
0,26 ps
0,19 ps
1,65 ps
66 Zn 30 36
Q+ = 5175 keV
% β+ + %ε = 100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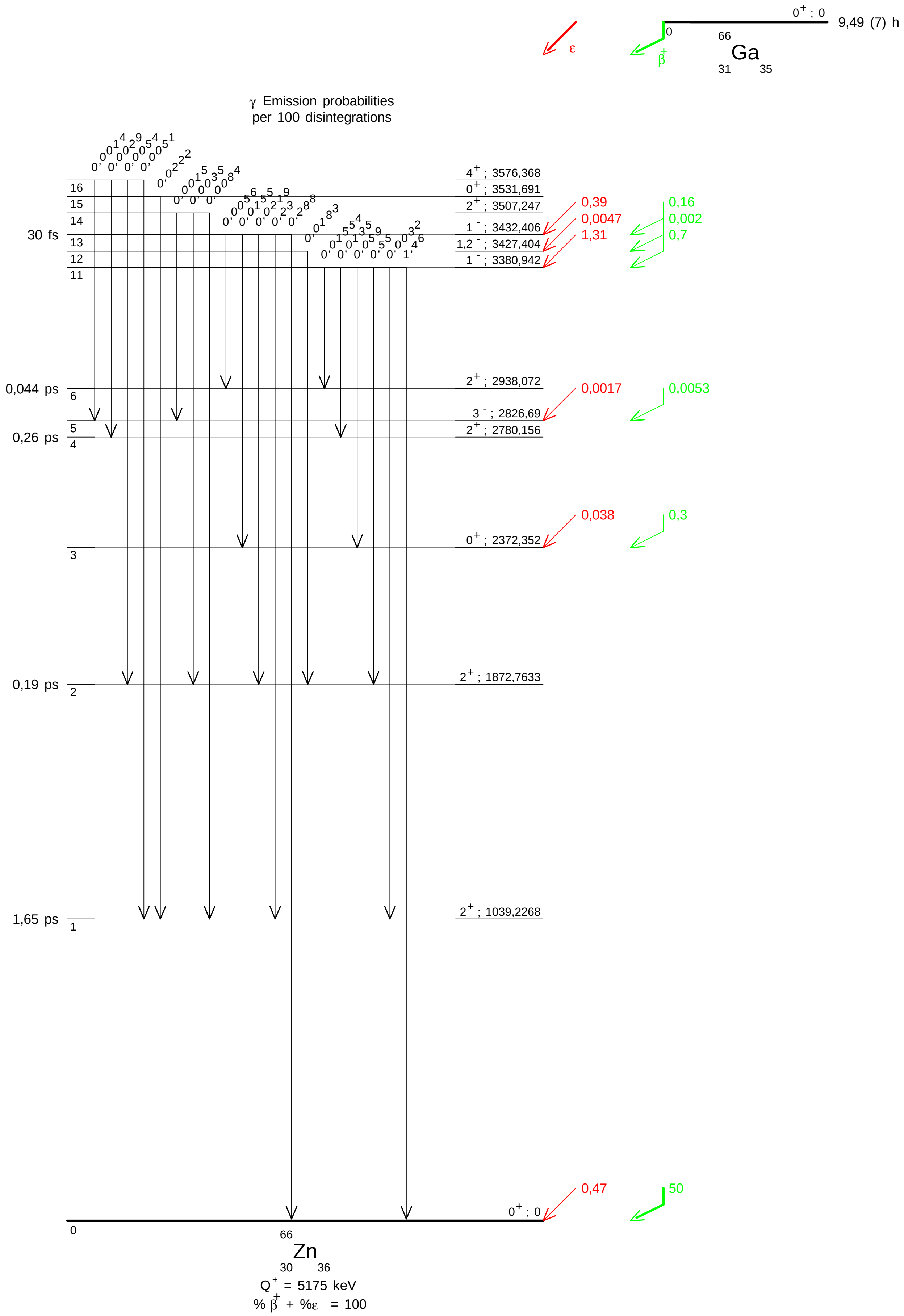
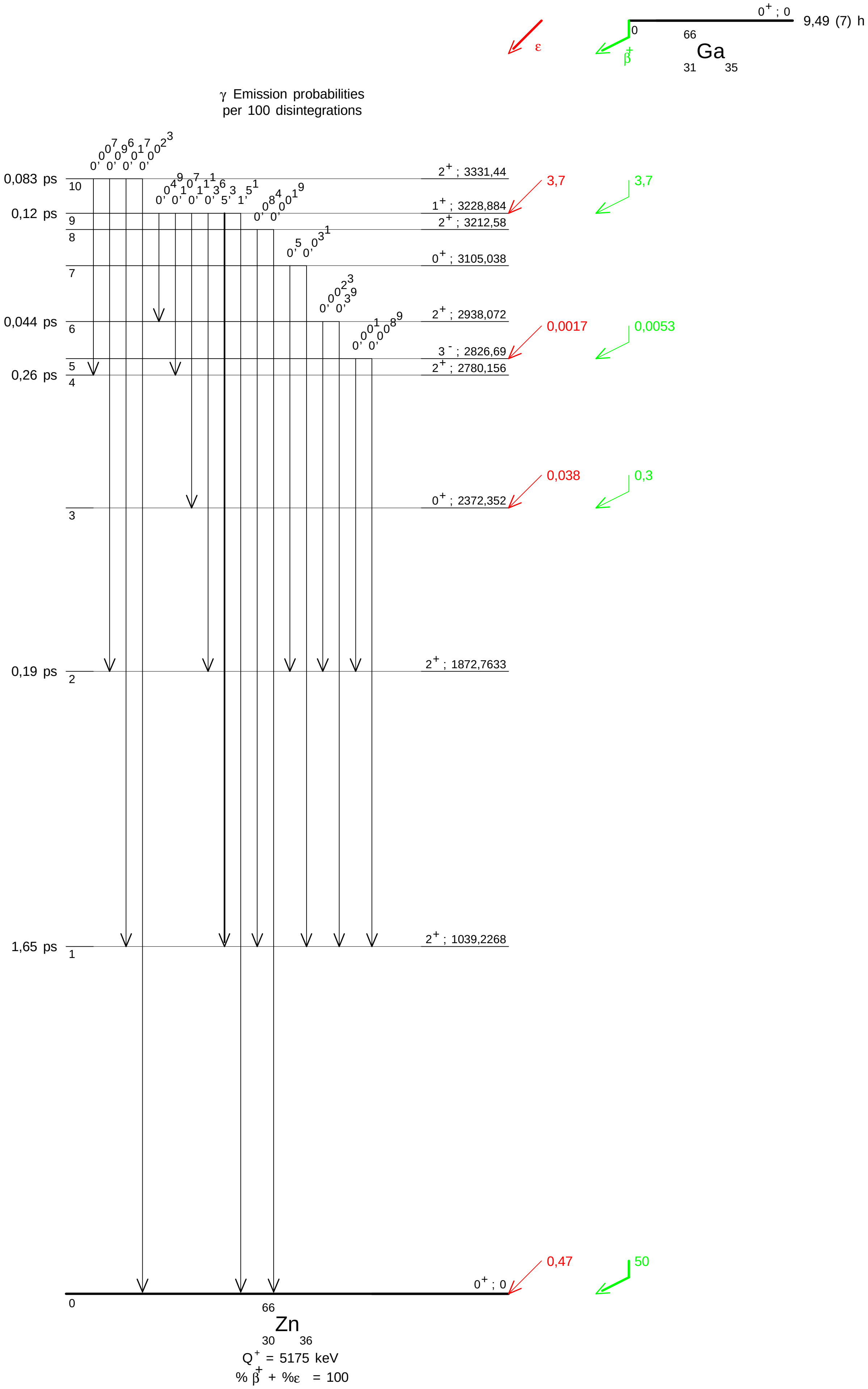
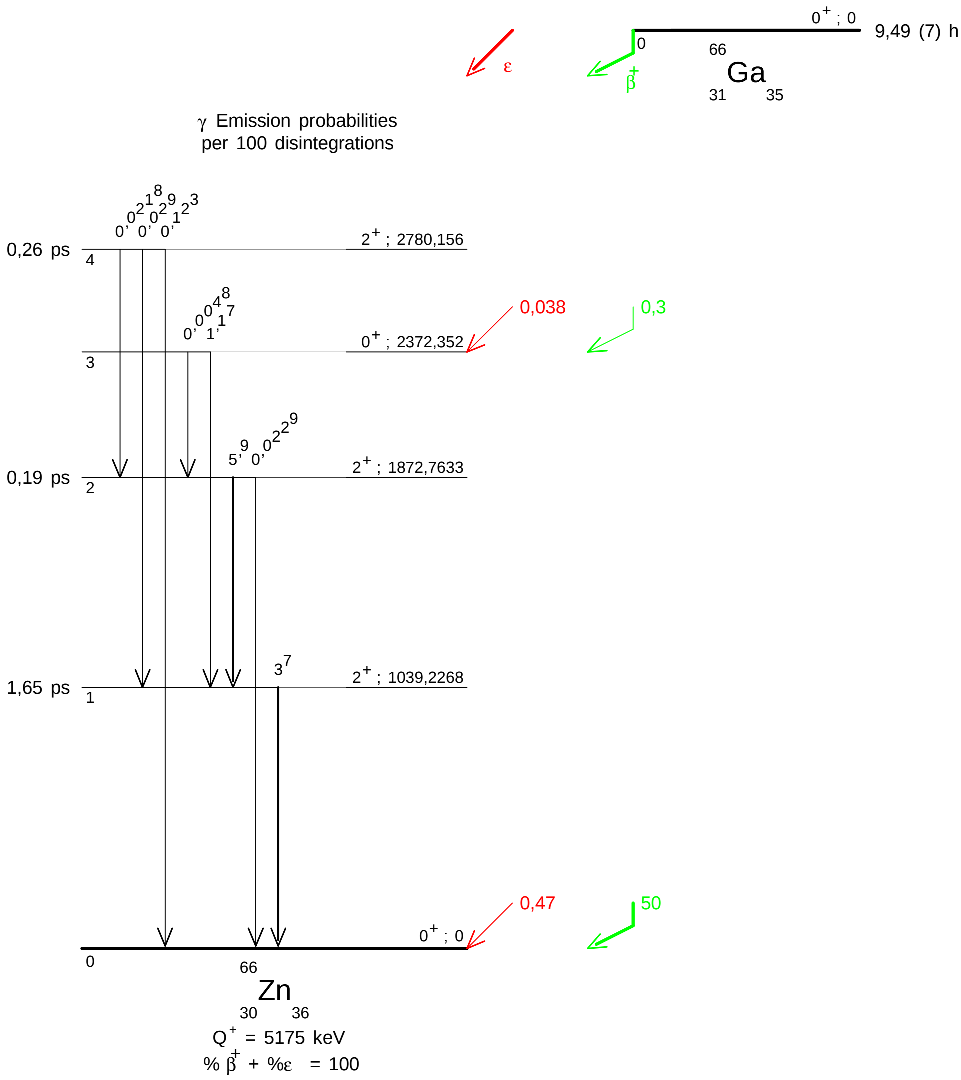
9,49 (7) h
ε
β+
66 Ga 31 35
γ Emission probabilities
per 100 disintegrations
1+ ; 3791,121
4+ ; 3753,01
3738,207
2+ ; 3670,72
2+ ; 3507,247
1- ; 3380,942
2+ ; 3331,44
1+ ; 3228,884
2+ ; 3212,58
0+ ; 3105,038
2+ ; 2938,072
2+ ; 2780,156
0+ ; 2372,352
2+ ; 1872,7633
2+ ; 1039,2268
0+ ; 0
26
0,015
1,31
3,7
0,038
0,47
0,94
0,0009
0,7
3,7
0,3
50
9,7 fs
0,083 ps
0,12 ps
0,044 ps
0,26 ps
0,19 ps
1,65 ps
20
19
18
17
14
11
10
9
8
7
6
4
3
2
1
0
66 Zn 30 36
Q+ = 5175 keV
% β+ + %ε = 100


0+ ; 0
9,49 (7) h
66 Ga 31 35
ε
β+
γ Emission probabilities
per 100 disintegrations
4+ ; 3576,368
0+ ; 3531,691
2+ ; 3507,247
1- ; 3432,406
1,2- ; 3427,404
1- ; 3380,942
2+ ; 2938,072
3- ; 2826,69
2+ ; 2780,156
0+ ; 2372,352
2+ ; 1872,7633
2+ ; 1039,2268
0+ ; 0
30 fs
0,044 ps
0,26 ps
0,19 ps
1,65 ps
0,39
0,0047
1,31
0,0017
0,038
0,47
0,16
0,002
0,7
0,0053
0,3
50
66 Zn 30 36
Q+ = 5175 keV
% β+ + %ε = 100


0+ ; 0
9,49 (7) h
66 Ga 31 35
ε
β+
γ Emission probabilities
per 100 disintegrations
0,083 ps
0,12 ps
0,044 ps
0,26 ps
0,19 ps
1,65 ps
2+ ; 3331,44
1+ ; 3228,884
2+ ; 3212,58
0+ ; 3105,038
2+ ; 2938,072
3- ; 2826,69
2+ ; 2780,156
0+ ; 2372,352
2+ ; 1872,7633
2+ ; 1039,2268
0+ ; 0
3,7
3,7
0,0017
0,0053
0,038
0,3
0,47
50
66 Zn 30 36
Q+ = 5175 keV
% β+ + %ε = 100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9,49 (7) h
0
66
Ga
31 35
ε
β+
γ Emission probabilities
per 100 disintegrations
0,26 ps
4
2+ ; 2780,156
0,038
0,3
0+ ; 2372,352
3
0,19 ps
2
2+ ; 1872,7633
1,65 ps
1
2+ ; 1039,2268
0,47
50
0+ ; 0
0
66
Zn
30 36
Q+ = 5175 keV
% β+ + %ε = 100

$^{67}_{31}$Ga$_{36}$

1 Decay Scheme

Ga-67 disintegrates by 100 % electron capture to the excited levels of 887.7 keV, 393.5 keV, 184.6 keV, 93.3 keV and ground state of the stable Zn-67.
Le gallium 67 se désintègre à 100 % par capture électronique vers les niveaux excités (887,7 ; 393,5 ; 184,6 ; et 93,3 keV) et le niveau fondamental de zinc 67.

2 Nuclear Data

$T_{1/2}(^{67}\text{Ga})$	:	3,2613	(5)	d
$Q^{+}(^{67}\text{Ga})$	:	1000,5	(13)	keV

2.1 Electron Capture Transitions

	Energy keV	Probability × 100	Nature	lg ft	P_K	P_L	P_M
$\epsilon_{0,4}$	112,8 (13)	0,279 (6)	Allowed	5,647	0,8680 (17)	0,1119 (14)	0,0188 (5)
$\epsilon_{0,3}$	607,0 (13)	23,8 (6)	Allowed	5,234	0,8824 (15)	0,0999 (12)	0,0165 (4)
$\epsilon_{0,2}$	815,9 (13)	22,2 (7)	Allowed	5,525	0,8832 (15)	0,0993 (12)	0,0164 (4)
$\epsilon_{0,1}$	907,6 (13)	50,1 (18)	Allowed	5,264	0,8834 (15)	0,0991 (12)	0,0164 (4)
$\epsilon_{0,0}$	1000,5 (13)	3,6 (20)	Allowed, 1st forbidden	6,49	0,8836 (15)	0,0989 (12)	0,0164 (4)

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K (10^{-4})	α_L (10^{-4})	α_M (10^{-4})	α_T (10^{-4})
$\gamma_{2,1}$(Zn)	91,265 (5)	3,32 (12)	M1+0,4(4)%E2	735 (15)	78,1 (16)	11,7 (3)	827 (17)
$\gamma_{1,0}$(Zn)	93,310 (5)	70,3 (17)	E2	7510 (15)	939 (19)	138 (3)	8590 (17)
$\gamma_{2,0}$(Zn)	184,576 (10)	21,3 (7)	M1+11(2)%E2	158 (6)	16,7 (7)	2,5 (1)	178 (7)
$\gamma_{3,2}$(Zn)	208,95 (1)	2,39 (8)	M1+0,1%E2	81,1 (17)	8,4 (2)	1,25 (3)	90,9 (18)
$\gamma_{3,1}$(Zn)	300,217 (10)	16,9 (6)	M1+3,1(2)%E2	35,6 (15)	3,64 (16)	0,54 (3)	39,8 (18)
$\gamma_{3,0}$(Zn)	393,527 (10)	4,67 (16)	M1+0,18(6)%E2	17,4 (4)	1,77 (4)	0,264 (6)	19,5 (4)

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K (10^{-4})	α_L (10^{-4})	α_M (10^{-4})	α_T (10^{-4})
$\gamma_{4,3}$(Zn)	494,166 (15)	0,0686 (27)	M1+1,9(6)%E2	10,4 (3)	1,05 (3)	0,157 (5)	11,7 (4)
$\gamma_{4,2}$(Zn)	703,110 (15)	0,0111 (6)	(M1+E2)				
$\gamma_{4,1}$(Zn)	794,386 (15)	0,0520 (24)	E2+0,16%M3	4,76 (10)	0,481 (10)	0,072 (2)	5,31 (11)
$\gamma_{4,0}$(Zn)	887,694 (15)	0,147 (5)	M1+48(4)%E2	3,2 (3)	0,32 (3)	0,047 (5)	3,6 (4)

3 Atomic Data

3.1 Zn

ω_K : 0,486 (4)
$\bar{\omega}_L$: 0,0108 (4)
n_{KL} : 1,326 (4)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	8,61587		51,42
	$K\alpha_1$	8,63896		100
	$K\beta_3$	9,5728	}	
	$K\beta_5''$	9,6499	}	21,46
	$K\beta_2$	9,65806	}	

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	7,21 – 7,55	100
KLX	8,31 – 8,63	28,3
KXY	9,39 – 9,65	2,01
Auger L	0,732 – 0,997	361,7

4 Electron Emissions

		Energy keV	Electrons per 100 disint.
e_{AL}	(Zn)	0,732 - 0,997	167,1 (22)
e_{AK}	(Zn)		60,2 (10)
	KLL	7,21 - 7,55	}
	KLX	8,31 - 8,63	}
	KXY	9,39 - 9,65	}
$ec_{2,1\ K}$	(Zn)	81,606 (5)	0,230 (9)
$ec_{1,0\ K}$	(Zn)	83,651 (5)	28,4 (7)
$ec_{1,0\ L}$	(Zn)	92,116 - 93,290	3,55 (9)
$ec_{1,0\ M}$	(Zn)	93,174 - 93,302	0,522 (13)
$ec_{2,0\ K}$	(Zn)	174,917 (10)	0,332 (17)
$ec_{3,1\ K}$	(Zn)	290,558 (10)	0,060 (3)

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Zn)	0,884 — 1,107		1,82 (12)	
$XK\alpha_2$	(Zn)	8,61587		17,0 (6)	} $K\alpha$
$XK\alpha_1$	(Zn)	8,63896		33,0 (11)	}
$XK\beta_3$	(Zn)	9,5728	}		
$XK\beta_1$	(Zn)		}	7,09 (20)	$K'\beta_1$
$XK\beta_5''$	(Zn)	9,6499	}		
$XK\beta_2$	(Zn)	9,65806	}		
$XK\beta_4$	(Zn)		}	0,01	$K'\beta_2$

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{2,1}$(Zn)	91,265 (5)	3,07 (11)
$\gamma_{1,0}$(Zn)	93,310 (5)	37,8 (9)
$\gamma_{2,0}$(Zn)	184,576 (10)	20,9 (7)

	Energy keV	Photons per 100 disint.
$\gamma_{3,2}$(Zn)	208,95 (1)	2,37 (8)
$\gamma_{3,1}$(Zn)	300,217 (11)	16,8 (6)
$\gamma_{3,0}$(Zn)	393,527 (10)	4,66 (16)
$\gamma_{4,3}$(Zn)	494,166 (15)	0,0685 (27)
$\gamma_{4,2}$(Zn)	703,106 (15)	0,0111 (6)
$\gamma_{4,1}$(Zn)	794,381 (15)	0,0520 (24)
$\gamma_{4,0}$(Zn)	887,688 (15)	0,147 (5)

6 Main Production Modes

$\begin{cases} \text{Zn} - 67(\text{p,n})\text{Ga} - 67 \\ \text{Possible impurities : Ga} - 66 \end{cases}$

$\begin{cases} \text{Zn} - 67(\text{d,n})\text{Ga} - 67 \\ \text{Possible impurities : Ga} - 66 \end{cases}$

$\begin{cases} \text{Zn} - 67(\text{p,n})\text{Ga} - 67 \\ \text{Possible impurities : Ga} - 66 \end{cases}$

$\begin{cases} \text{Zn} - 66(\text{d,n})\text{Ga} - 67 \\ \text{Possible impurities : Ga} - 66 \end{cases}$

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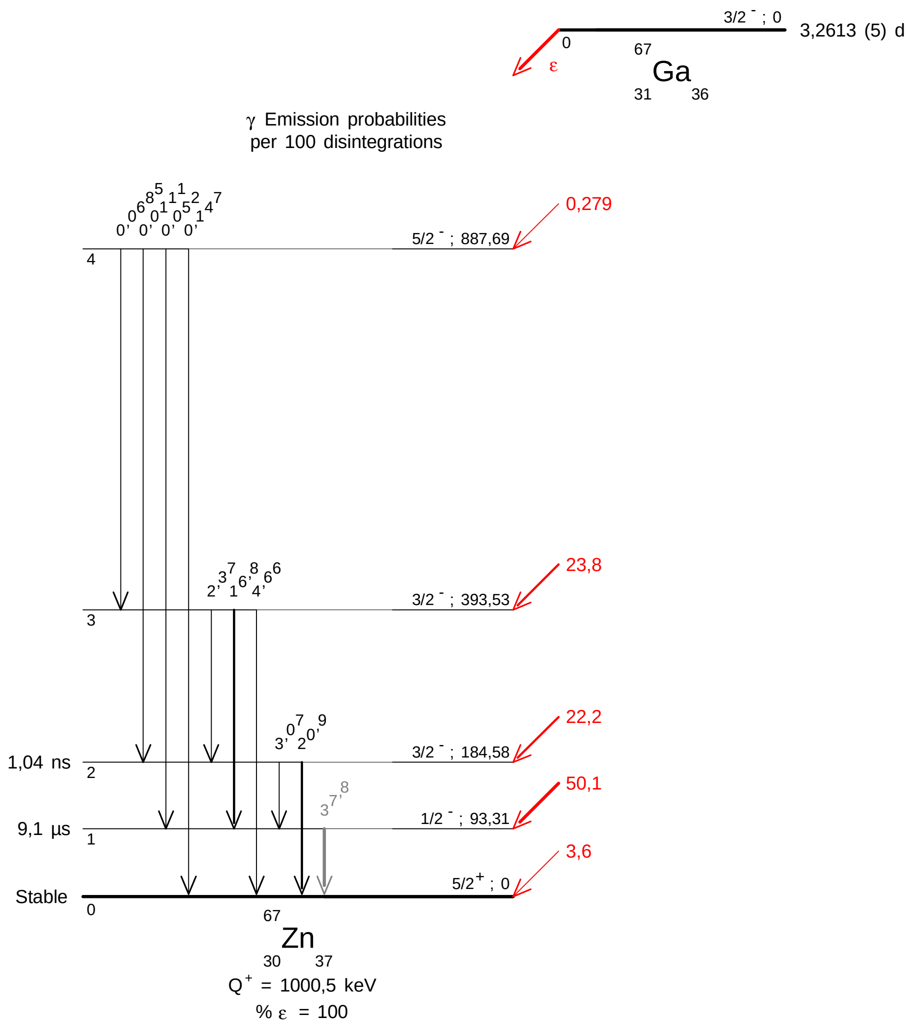
3/2 - ; 0
3,2613 (5) d
0
ε
67
Ga
31
36
γ Emission probabilities
per 100 disintegrations
0,279
5/2 - ; 887,69
4
23,8
3/2 - ; 393,53
3
22,2
1,04 ns
2
3/2 - ; 184,58
50,1
9,1 µs
1
1/2 - ; 93,31
3,6
Stable
0
5/2+ ; 0
67
Zn
30
37
Q+ = 1000,5 keV
% ε = 100

$^{85}_{36}$Kr $_{49}$

1 Decay Scheme

The Kr-85 disintegrates by beta minus emission mainly to the Rb-85 ground state level.
Le krypton 85 se désintègre par émission bêta moins principalement vers le niveau fondamental de rubidium 85.

2 Nuclear Data

$T_{1/2}(^{85}\text{Kr})$	:	10,752	(23)	a
$Q^{-}(^{85}\text{Kr})$	:	687,1	(19)	keV

2.1 β^{-} Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^{-}_{0,2}$	173,1 (19)	0,438 (10)	Allowed	9,5
$\beta^{-}_{0,0}$	687,1 (19)	99,562 (10)	1st Forbidden Unique	8,4

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_T
$\gamma_{1,0}$(Rb)	151,18 (3)	0,0000023 (14)	M1 + 0,52(4)% E2	0,0430 (13)	0,00485 (14)	0,0488 (14)
$\gamma_{2,1}$(Rb)	362,81 (3)	0,00000225 (45)	(E3)	0,0292 (9)	0,00400 (12)	0,034 (1)
$\gamma_{2,0}$(Rb)	513,998 (5)	0,438 (10)	M2	0,00635 (19)	0,00072 (2)	0,00721 (22)

3 Atomic Data

3.1 Rb

ω_K	:	0,674	(4)
$\bar{\omega}_L$	:	0,0237	(6)
n_{KL}	:	1,125	(4)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	13,3359		51,95
	$K\alpha_1$	13,3955		100
	$K\beta_3$	14,9519	}	
	$K\beta_1$	14,9614	}	
	$K\beta_5''$	15,085	}	24,34
	$K\beta_2$	15,1856	}	
	$K\beta_4$	15,205	}	2,82

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	10,987 – 11,503	100
KLX	12,782 – 13,381	35,8
KXY	14,556 – 15,172	3,2
Auger L	1,1 – 2,0	

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Rb)	1,1 - 2,0		0,00336 (6)
e_{AK}	(Rb)			0,000901 (24)
	KLL	10,987 - 11,503	}	
	KLX	12,782 - 13,381	}	
	KXY	14,556 - 15,172	}	
$\beta^-_{0,2}$	max:	173,1	(19)	0,438 (10)
$\beta^-_{0,2}$	avg:	47,5	(6)	
$\beta^-_{0,0}$	max:	687,1	(19)	99,562 (10)
$\beta^-_{0,0}$	avg:	251,4	(8)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
$XK\alpha_2$	(Rb)	13,3359		0,000540 (14)	} $K\alpha$
$XK\alpha_1$	(Rb)	13,3955		0,001040 (25)	}
$XK\beta_3$	(Rb)	14,9519	}		
$XK\beta_1$	(Rb)	14,9614	}	0,000253 (7)	$K'\beta_1$
$XK\beta_5''$	(Rb)	15,085	}		
$XK\beta_2$	(Rb)	15,1856	}		
$XK\beta_4$	(Rb)	15,205	}	0,0000294 (13)	$K'\beta_2$

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Rb)	151,18 (3)	0,0000022 (13)
$\gamma_{2,1}$(Rb)	362,81 (4)	0,00000218 (44)
$\gamma_{2,0}$(Rb)	513,997 (5)	0,435 (10)

6 Main Production Modes

$Kr-84(n,\gamma)Kr-85$ σ : 0,042 (4) barns
$Kr-84(n,\gamma)Kr-85m$ σ : 0,090 (13) barns

$$\begin{cases} Kr-85m(I.T.)Kr-85 \\ \text{Possible impurities :}\ \ Half-life(Kr-85m) = 4{,}48h \end{cases}$$

$$\begin{cases} \text{Fission products} \\ \text{Possible impurities :}\ \ \text{None} \end{cases}$$

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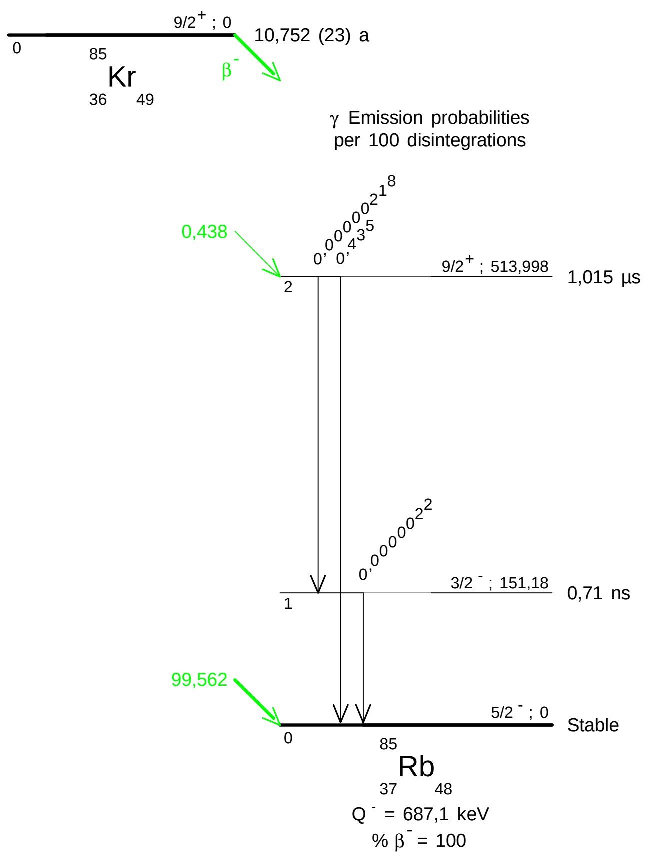
9/2+ ; 0
10,752 (23) a
0
85
Kr
36
49
β-
γ Emission probabilities
per 100 disintegrations
0,438
0,000218
0,435
9/2+ ; 513,998
1,015 µs
2
0,0000022
3/2 - ; 151,18
0,71 ns
1
99,562
5/2 - ; 0
Stable
0
85
Rb
37
48
Q - = 687,1 keV
% β- = 100

$^{85}_{38}\mathrm{Sr}_{47}$

1 Decay Scheme

The Sr-85 disintegrates by electron capture to the Rb-85 excited levels, mainly to the 514 keV level.
Le strontium 85 se désintégre par capture électronique vers les niveaux excités de rubidium 85, principalement vers celui de 514 keV.

2 Nuclear Data

$T_{1/2}(^{85}\mathrm{Sr})$	:	64,850	(7)	d
$Q^{+}(^{85}\mathrm{Sr})$	:	1065	(3)	keV

2.1 Electron Capture Transitions

	Energy keV	Probability × 100	Nature	lg ft	P_K	P_L	P_M
$\epsilon_{0,4}$	196 (3)	0,0129 (4)	1st Forbidden	9,1	0,8610 (16)	0,1146 (13)	0,0214 (4)
$\epsilon_{0,3}$	551 (3)	99,2 (4)	Allowed	6,2	0,8718 (15)	0,1059 (12)	0,0195 (4)
$\epsilon_{0,2}$	784 (3)	0,0005	Unique 3rd Forbidden	11,8			
$\epsilon_{0,1}$	914 (3)	0,0005	3rd Forbidden	11,5			
$\epsilon_{0,0}$	1065 (3)	0,8 (4)	Unique 1st Forbidden	9,3	0,85 (3)	0,12 (3)	0,03 (1)

2.2 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
$\gamma_{2,1}$(Rb)	129,826 (10)	0,0005	(M1)	0,0635 (19)	7,17 (21)	1,208 (36)	0,0721 (22)
$\gamma_{1,0}$(Rb)	151,160 (6)	0,0012 (9)	M1+E2	0,0430 (13)	4,85 (15)	0,817 (25)	0,0488 (15)
$\gamma_{4,3}$(Rb)	354,97 (5)	0,0005 (2)	(E1)	0,00225 (7)	0,242 (7)	0,0405 (12)	0,00253 (8)
$\gamma_{3,1}$(Rb)	362,847 (6)	0,0014 (3)	(E3)	0,0292 (9)	3,97 (12)	0,67 (2)	0,0339 (10)
$\gamma_{3,0}$(Rb)	514,007 (3)	99,2 (4)	M2	0,00635 (19)	0,722 (22)	0,1219 (37)	0,00721 (22)

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L (10^{-3})	α_M (10^{-3})	α_T
$\gamma_{4,1}$(Rb)	717,81 (5)	0,00032 (3)	(E2)	0,00109 (3)	0,120 (4)	0,0202 (6)	0,00124 (4)
$\gamma_{4,0}$(Rb)	868,98 (5)	0,0121 (4)	M1+E2	0,00065 (2)	0,070 (2)	0,01176 (35)	0,00073 (3)

3 Atomic Data

3.1 Rb

ω_K	:	0,674	(4)
$\bar{\omega}_L$	:	0,0237	(6)
n_{KL}	:	1,125	(4)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	13,3359		51,95
	$K\alpha_1$	13,3955		100
	$K\beta_3$	14,9519	}	
	$K\beta_1$	14,9614	}	
	$K\beta_5''$	15,085	}	24,34
	$K\beta_2$	15,1856	}	
	$K\beta_4$	15,205	}	2,82
X_L				
	$L\ell$	1,48		
	$L\gamma$	– 2,05		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	10,987 – 11,503	100
KLX	12,782 – 13,381	35,8
KXY	14,556 – 15,172	3,2
Auger L	1,1 – 2,0	

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Rb)	1,1 - 2,0		96,5 (4)
e_{AK}	(Rb)			28,6 (4)
	KLL	10,987 - 11,503	}	
	KLX	12,782 - 13,381	}	
	KXY	14,556 - 15,172	}	
$ec_{3,0\ K}$	(Rb)	498,811 (12)		0,630 (19)

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Rb)	1,48 — 2,05		2,30 (5)	
$XK\alpha_2$	(Rb)	13,3359		17,16 (17)	} $K\alpha$
$XK\alpha_1$	(Rb)	13,3955		33,04 (29)	}
$XK\beta_3$	(Rb)	14,9519	}		
$XK\beta_1$	(Rb)	14,9614	}	8,04 (10)	$K'\beta_1$
$XK\beta_5''$	(Rb)	15,085	}		
$XK\beta_2$	(Rb)	15,1856	}		
$XK\beta_4$	(Rb)	15,205	}	0,93 (4)	$K'\beta_2$

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{2,1}$(Rb)	129,826 (10)	0,0005
$\gamma_{1,0}$(Rb)	151,160 (6)	0,0012 (9)
$\gamma_{4,3}$(Rb)	354,97 (5)	0,0005 (2)
$\gamma_{3,1}$(Rb)	362,847 (6)	0,0014 (3)
$\gamma_{3,0}$(Rb)	514,0048 (22)	98,5 (4)
$\gamma_{4,1}$(Rb)	717,81 (5)	0,00032 (3)
$\gamma_{4,0}$(Rb)	868,98 (5)	0,0121 (4)

6 Main Production Modes

$$\left\{\begin{array}{l} Sr-84(n,\gamma)Sr-85 \quad \sigma : 0{,}35\ (7)\ barns \\ Possible\ impurities:\ Sr-89,\ Rb-84 \end{array}\right.$$

$$\left\{\begin{array}{l} Sr-84(n,\gamma)Sr-85m \quad \sigma : 0{,}60\ (6)\ barns \\ Possible\ impurities:\ Sr-89,\ Rb-84 \end{array}\right.$$

$$\left\{\begin{array}{l} Sr-85m(I.T.)Sr-85 \\ Possible\ impurities:\ Sr-85m,\ half-life:\ 68\ min \end{array}\right.$$

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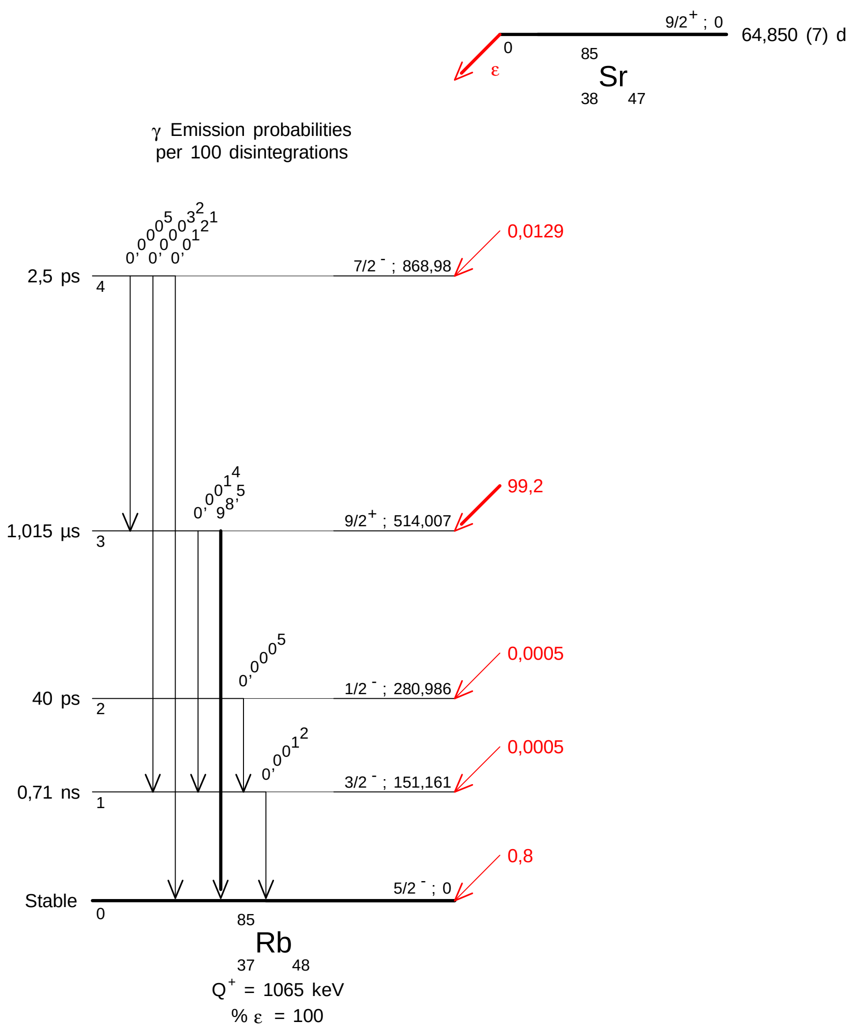
9/2+ ; 0
64,850 (7) d
0
ε
85
Sr
38 47
γ Emission probabilities
per 100 disintegrations
0,0005
0,0032
0,0021
0,0129
2,5 ps
4
7/2 - ; 868,98
0,014
98,5
99,2
1,015 µs
3
9/2+ ; 514,007
0,0005
0,0005
40 ps
2
1/2 - ; 280,986
0,0012
0,0005
0,71 ns
1
3/2 - ; 151,161
0,8
Stable
0
5/2 - ; 0
85
Rb
37 48
Q+ = 1065 keV
% ε = 100

$^{88}_{39}Y_{49}$

1 Decay Scheme

Le Y-88 se désintègre par capture électronique et émission bêta plus vers des niveaux excités de Sr-88. Aucune transition vers le niveau fondamental de Sr-88 n'a été mise en évidence.
Y-88 decays by electron capture and beta plus emission towards excited levels of Sr-88. None transition towards the fundamental level of Sr-88 was shown.

2 Nuclear Data

$T_{1/2}(^{88}Y)$	:	106,626	(21)	d
$Q^{+}(^{88}Y)$	:	3622,6	(15)	keV

2.1 β^{+} Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^{+}_{0,1}$	764,5 (15)	0,204 (11)	Unique 1st Forbidden	9,7

2.2 Electron Capture Transitions

	Energy keV	Probability × 100	Nature	lg ft	P_K	P_L	P_{M+}
$\epsilon_{0,4}$	37,6 (15)	0,048 (18)	Allowed	6,9	0,72 (4)	0,23 (4)	0,047 (9)
$\epsilon_{0,3}$	404,0 (15)	0,023 (4)	Unique 1st Forbidden	9,4			
$\epsilon_{0,2}$	888,5 (15)	94,50 (23)	Allowed	7	0,8725 (15)	0,1050 (14)	0,0195 (5)
$\epsilon_{0,1}$	1776,5 (15)	5,23 (23)	Unique 1st Forbidden	9,8	0,65 (15)	0,20 (5)	

2.3 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K (10^{-4})	α_L (10^{-4})	α_T (10^{-4})	α_π (10^{-4})
$\gamma_{3,2}$(Sr)	484,368 (26)	0,0009	E1	10,8	1,17	12,3	
$\gamma_{4,2}$(Sr)	850,647 (24)	0,048 (18)	(M1,E2)	7,4 (7)	0,8 (1)	8,3 (8)	
$\gamma_{2,1}$(Sr)	898,041 (4)	93,93 (23)	E1	2,77 (20)	0,29 (3)	3,15 (23)	
$\gamma_{3,1}$(Sr)	1382,409 (26)	0,016 (3)	M1+0,3%E2	2,6 (3)	0,28 (3)	2,9 (3)	
$\gamma_{1,0}$(Sr)	1836,073 (13)	99,38 (3)	E2	1,35 (14)	0,15 (2)	1,52 (15)	2,3 (2)
$\gamma_{2,0}$(Sr)	2734,132 (15)	0,614 (25)	E3	1,1 (2)	0,2 (1)	1,3 (2)	4,4 (4)
$\gamma_{3,0}$(Sr)	3218,546 (49)	0,007 (2)	E2	0,55	0,1	0,65	

3 Atomic Data

3.1 Sr

ω_K	:	0,696	(4)
$\bar{\omega}_L$	:	0,0262	(7)
n_{KL}	:	1,102	(4)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	14,098		52,05
	$K\alpha_1$	14,1652		100
	$K\beta_3$	15,8252	}	
	$K\beta_1$	15,8359	}	
	$K\beta_5''$	15,969	}	24,69
	$K\beta_2$	16,0847	}	
	$K\beta_4$	16,104	}	3,21
X_L				
	$L\ell$	1,6		
	$L\gamma$	– 2,2		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	11,59 – 12,13	100
KLX	13,50 – 14,14	36,7
KXY	15,39 – 16,07	3,37
Auger L	1,2 – 2,1	

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Sr)	1,2 - 2,1		102,9 (10)
e_{AK}	(Sr)			26,1 (5)
	KLL	11,59 - 12,13	}	
	KLX	13,50 - 14,14	}	
	KXY	15,39 - 16,07	}	
$ec_{1,0}$ ±	(Sr)	814,058 (15)		0,0228 (20)
$ec_{2,1}$ K	(Sr)	881,936 (4)		0,0260 (19)
$ec_{2,1}$ L	(Sr)	895,825 - 896,101		0,00272 (28)
$ec_{2,0}$ ±	(Sr)	1712,080 (18)		0,00027 (4)
$ec_{1,0}$ K	(Sr)	1819,968 (13)		0,0134 (14)
$ec_{1,0}$ L	(Sr)	1833,857 - 1834,133		0,00149 (20)
$ec_{2,0}$ K	(Sr)	2718,027 (15)		0,000068 (13)
$ec_{2,0}$ L	(Sr)	2731,916 - 2732,192		0,000012 (6)
$\beta^+_{0,1}$	max:	764,5 (15)		0,204 (11)
$\beta^+_{0,1}$	avg:	359,4 (2)		

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Sr)	1,6 — 2,2		2,77 (8)	
$XK\alpha_2$	(Sr)	14,098		17,30 (22)	} $K\alpha$
$XK\alpha_1$	(Sr)	14,1652		33,2 (4)	}
$XK\beta_3$	(Sr)	15,8252	}		
$XK\beta_1$	(Sr)	15,8359	}	8,21 (12)	$K\beta_1'$
$XK\beta_5''$	(Sr)	15,969	}		
$XK\beta_2$	(Sr)	16,0847	}		
$XK\beta_4$	(Sr)	16,104	}	1,07 (4)	$K\beta_2'$

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{3,2}$(Sr)	484,368 (26)	0,0009
$\gamma^{\pm}$	511	0,408 (22)
$\gamma_{4,2}$(Sr)	850,643 (24)	0,048 (18)
$\gamma_{2,1}$(Sr)	898,036 (4)	93,90 (23)
$\gamma_{3,1}$(Sr)	1382,397 (26)	0,016 (3)
$\gamma_{1,0}$(Sr)	1836,052 (13)	99,32 (3)
$\gamma_{2,0}$(Sr)	2734,068 (14)	0,614 (25)
$\gamma_{3,0}$(Sr)	3218,419 (22)	0,007 (2)

6 Main Production Modes

{ Sr – 88(p,n)Y – 88
Possible impurities : Y – 84, Y – 85, Y – 86, Y – 87, Rb – 83, Rb – 84, Rb – 86

{ Sr – 88(d,2n)Y – 88
Possible impurities : Y – 84, Y – 87, Sr – 89

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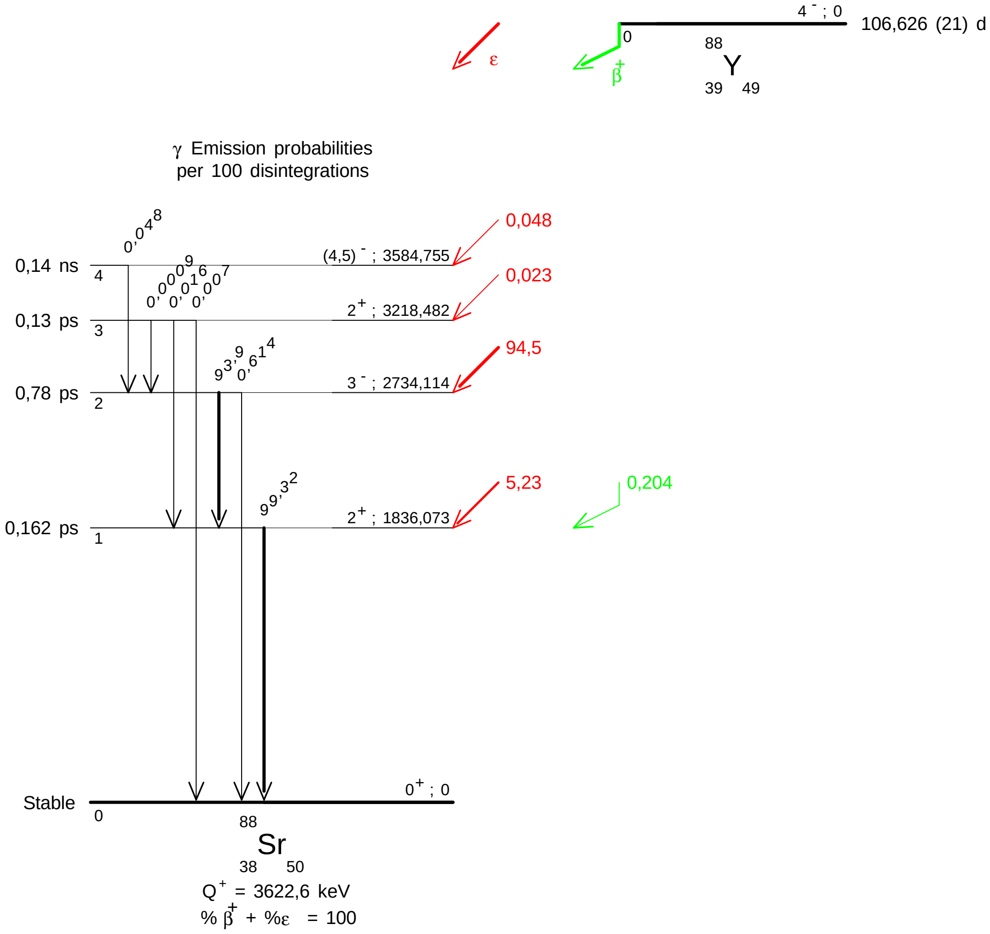
4 - ; 0
106,626 (21) d
88
Y
39 49
ε
β+
γ Emission probabilities
per 100 disintegrations
0,048
0,023
94,5
5,23
0,204
0,14 ns
0,13 ps
0,78 ps
0,162 ps
Stable
(4,5) - ; 3584,755
2+ ; 3218,482
3 - ; 2734,114
2+ ; 1836,073
0+ ; 0
88
Sr
38 50
Q+ = 3622,6 keV
% β+ + %ε = 100

$^{89}_{38}Sr_{51}$

1 Decay Scheme

Sr-89 disintegrates by beta minus emission mainly to the Y-89 fundamental level. A small fraction 0,0096% populates the isomeric level at 909 keV in Y-89.
Le strontium 89 se désintègre par émission bêta moins principalement vers le niveau fondamental de l'yttrium 89 ainsi que vers le niveau excité de 909 keV avec une intensité de 0,0096 %.

2 Nuclear Data

$T_{1/2}(^{89}Sr)$	:	50,57	(3)	d
$Q^-(^{89}Sr)$	:	1495,1	(22)	keV

2.1 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,1}$	586,1 (22)	0,00964 (6)	2nd Forbidden	11,1
$\beta^-_{0,0}$	1495,1 (22)	99,99036 (4)	Unique 1st Forbidden	9,4

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_T
$\gamma_{1,0}$(Y)	909,0 (1)	0,00964 (6)	(M4)	0,00746 (23)	0,00091 (3)	0,00850 (26)

3 Atomic Data

3.1 Y

ω_K	:	0,716	(4)
$\bar{\omega}_L$	:	0,0289	(7)
n_{KL}	:	1,081	(4)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	Kα_2	14,8829		52,15
	Kα_1	14,9585		100
	Kβ_3	16,7259	}	
	Kβ_1	16,7381	}	
	Kβ_5''	16,88	}	25,11
	Kβ_2	17,0156	}	
	Kβ_4	17,0362	}	3,47

4 Electron Emissions

		Energy keV	Electrons per 100 disint.
$\beta^-_{0,1}$	max:	586,1 (22)	0,00964 (6)
$\beta^-_{0,1}$	avg:	189,1 (9)	
$\beta^-_{0,0}$	max:	1495,1 (22)	99,99036 (4)
$\beta^-_{0,0}$	avg:	584,6 (10)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV	Photons per 100 disint.	
$XK\alpha_2$	(Y)	14,8829		} $K\alpha$
$XK\alpha_1$	(Y)	14,9585	0,086 (7)	}

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Y)	909,0 (1)	0,00956 (6)

6 Main Production Modes

{ Sr – 88(n,γ)Sr – 89 σ : 0,058 (4) barns
  Possible impurities : Sr – 85, Sr – 90

{ Fission product
  Possible impurities : Sr – 90

Rb – 89(β^-)

Sr – 87(t,p)Sr – 89

Kr – 86(α,nγ)Sr – 89

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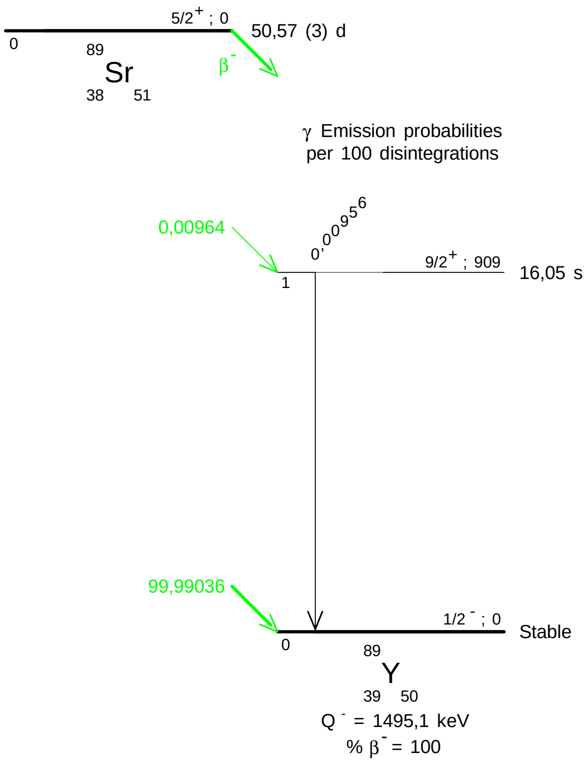
5/2+ ; 0
50,57 (3) d
0
89
Sr
38 51
β-
γ Emission probabilities
per 100 disintegrations
0,00964
0,00956
9/2+ ; 909
16,05 s
1
99,99036
1/2 - ; 0
Stable
0
89
Y
39 50
Q - = 1495,1 keV
% β- = 100

$^{93}_{41}\mathrm{Nb}^{m}_{52}$

1 Decay Scheme

Nb-93m disintegrates by 100 % gamma transition to the ground state of the stable nuclide Nb-93.
Le niobium 93m se désexcite à 100% par transition gamma vers le noyau stable de niobium 93.

2 Nuclear Data

$T_{1/2}(^{93}\mathrm{Nb}^{m})$: 16,12 (15) a

2.1 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K (10^5)	α_L (10^5)	α_M (10^5)	α_T (10^5)
$\gamma_{1,0}$(Nb)	30,77 (2)	100	M4	0,262 (8)	1,216 (40)	0,269 (8)	1,79 (5)

3 Atomic Data

3.1 Nb

ω_K : 0,751 (4)
$\bar{\omega}_L$: 0,0347 (9)
n_{KL} : 1,045 (4)

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

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	16,5213		52,36
	$K\alpha_1$	16,6152		100
	$K\beta_3$	18,607	}	
	$K\beta_1$	18,623	}	
	$K\beta_5''$	18,78	}	25,8
	$K\beta_2$	18,952	}	
	$K\beta_4$	18,982	}	3,86
X_L				
	$L\ell$	1,90		
	$L\gamma$	– 2,66		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	13,49 – 14,14	100
KLX	15,79 – 16,58	39,1
KXY	18,02 – 18,91	3,81
Auger L	1,4 – 2,6	

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Nb)	1,4 - 2,6		80,4 (30)
e_{AK}	(Nb)			3,64 (11)
	KLL	13,49 - 14,14	}	
	KLX	15,79 - 16,58	}	
	KXY	18,02 - 18,91	}	
$ec_{1,0\ T}$	(Nb)	11,78 - 30,74		99,999441 (16)
$ec_{1,0\ K}$	(Nb)	11,78 (2)		14,6 (3)
$ec_{1,0\ L}$	(Nb)	28,07 - 28,40		68 (3)
$ec_{1,0\ M}$	(Nb)	30,30 - 30,56		15,0 (9)
$ec_{1,0\ N}$	(Nb)	30,71 - 30,74		2,4 (1)

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Nb)	1,90 — 2,66		2,89 (13)	
$XK\alpha_2$	(Nb)	16,5213		3,16 (7)	} $K\alpha$
$XK\alpha_1$	(Nb)	16,6152		6,04 (12)	}
$XK\beta_3$	(Nb)	18,607	}		
$XK\beta_1$	(Nb)	18,623	}	1,56 (5)	$K'\beta_1$
$XK\beta_5''$	(Nb)	18,78	}		
$XK\beta_2$	(Nb)	18,952	}		
$XK\beta_4$	(Nb)	18,982	}	0,23 (1)	$K'\beta_2$

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Nb)	30,77 (2)	0,000559 (16)

6 Main Production Modes

$\left\{ \begin{array}{l} \mathrm{Nb-93(n,n')Nb-93m} \\ \text{Possible impurities : } \mathrm{Nb-92m,\ Nb-94,\ Nb-95} \end{array} \right.$

$\left\{ \begin{array}{l} \mathrm{Mo-92(n,\gamma)Mo-93} \\ \text{Possible impurities : none} \end{array} \right.$

$\left\{ \begin{array}{l} \text{Separation from } \mathrm{Zr-93+Nb-93m} \text{ (Fission product)} \\ \text{Possible impurities : } \mathrm{Nb-94} \end{array} \right.$

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γ Emission probabilities
per 100 disintegrations
0,000559
1/2⁻ ; 30,77
16,12 a
1
9/2⁺ ; 0
Stable
0
93
Nb
41
52
Q^IT = 30,77 keV
% IT = 100

$^{99}_{42}$Mo $_{57}$

1 Decay Scheme

Mo-99 disintegrates to the Tc-99 excited levels by beta minus emissions.
The 142 keV excited level (Tc-99m) has a half-life of 6,0082 h. At the equilibrium (t>60 h), the Tc-99m activity in relation to those of Mn-99 is :

Le Mo-99 se désintègre par émission bêta moins vers les niveaux excités de Tc-99.
Une proportion p = 87,6 (19)% de désintégrations conduit au niveau excité de 142 keV (Tc-99m) de 6,0082 heures de période. Ce niveau excité est alimenté directement par émission bêta moins (82,1 (15)) % et aussi par des transitions gamma.
A l'équilibre (t>60 heures) l'activité de Tc-99m par rapport à celle de Mo-99 s'écrit :

A(Tc-99m) / A(Mo-99) = p x $T_{1/2}$(Mo-99) / [$T_{1/2}$(Mo-99) - $T_{1/2}$(Tc-99m)] = 0,963(21)
$T_{1/2}$(Mo-99) / [$T_{1/2}$(Mo-99) - $T_{1/2}$(Tc-99m)] = 1,1005 (8)
with p = 0,876(19)
For this evaluation Mo-99 and Tc-99m are considered in equilibrium
Pour cette évaluation Mo-99 et Tc-99m sont considérés à l'équilibre.

2 Nuclear Data

$T_{1/2}(^{99}\text{Mo})$	:	2,7479	(5)	d
$T_{1/2}(^{99}\text{Tc})$	:	214	(8)	10^3 a
$Q^-(^{99}\text{Mo})$	:	1357,2	(10)	keV

2.1 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,15}$	158,3 (10)	0,0021 (3)	Allowed	8,65
$\beta^-_{0,14}$	185,2 (10)	0,0016 (4)	Allowed	8,91
$\beta^-_{0,13}$	215,3 (10)	0,111 (3)	Allowed	7,39
$\beta^-_{0,12}$	228,1 (10)	0,011 (1)	1st Forbidden	8,5
$\beta^-_{0,11}$	285 (1)	0,0027 (7)	2nd Forbidden	

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,10}$	353,1 (10)	0,134 (5)	1st Forbidden	7,97
$\beta^-_{0,9}$	436,6 (10)	16,45 (30)	Allowed	6,21
$\beta^-_{0,6}$	685,7 (10)	0,052 (5)	1st Forbidden	9,46
$\beta^-_{0,5}$	822,8 (10)	0,0010 (2)		
$\beta^-_{0,4}$	848,1 (10)	1,18 (3)	1st Forbidden	8,38
$\beta^-_{0,2}$	1214,5 (10)	82,1 (15)	1st Forbidden	7,1

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{2,1}$(Tc)	2,1726 (4)	86,8 (19)	E3			119 (3).10^8	135 (4).10^8
$\gamma_{3,1}$(Tc)	40,5833 (2)	5,30 (19)	M1+1,4(2)%E2	3,50 (8)	0,560 (13)	0,104 (3)	4,19 (10)
$\gamma_{1,0}$(Tc)	140,511 (1)	92,1 (19)	M1+3,2(3)%E2	0,104 (3)	0,0129 (4)	0,00236 (7)	0,119 (3)
$\gamma_{2,0}$(Tc)	142,683 (1)	0,88 (6)	M4	29,3 (6)	9,35 (20)	1,86 (6)	40,9 (8)
$\gamma_{9,7}$(Tc)	158,782 (15)	0,0145 (9)					
$\gamma_{6,4}$(Tc)	162,370 (15)	0,0114 (6)					
$\gamma_{3,0}$(Tc)	181,094 (2)	6,91 (13)	E2	0,125 (3)	0,0191 (4)	0,00353 (7)	0,149 (3)
$\gamma_{10,7}$(Tc)	242,29 (8)	0,0014 (3)	(E1)	0,0093 (2)	0,00106 (2)	0,000193 (6)	0,0106 (2)
$\gamma_{9,6}$(Tc)	249,03 (3)	0,0035 (4)					
$\gamma_{4,2}$(Tc)	366,422 (15)	1,21 (3)	M1	0,00802 (16)	0,00093 (2)	0,000170 (4)	0,00915 (18)
$\gamma_{13,7}$(Tc)	380,13 (8)	0,0092 (6)	M1+63(22)%E2	0,0091 (7)	0,00113 (8)	0,00021 (2)	0,0105 (8)
$\gamma_{5,2}$(Tc)	391,7 (4)	0,0025 (6)					
$\gamma_{14,7}$(Tc)	410,27 (10)	0,0016 (4)	M1+20%E2	0,0065 (6)	0,00076 (7)	0,00014 (1)	0,0074 (7)
$\gamma_{9,4}$(Tc)	411,492 (15)	0,0162 (15)	E1	0,00226 (6)	0,000256 (5)	0,0000467 (9)	0,00257 (5)
$\gamma_{12,6}$(Tc)	457,60 (3)	0,0075 (6)	M1+72%E2	0,0054 (4)	0,00066 (5)	0,00012 (1)	0,0063 (7)
$\gamma_{13,6}$(Tc)	469,63 (7)	0,0027 (5)					
$\gamma_{6,2}$(Tc)	528,790 (15)	0,0543 (21)	M1	0,00331 (7)	0,000379 (8)	0,00006930 (14)	0,00378 (8)
$\gamma_{11,5}$(Tc)	537,79 (15)	0,0015 (5)					
$\gamma_{7,3}$(Tc)	580,51 (5)	0,0036 (4)					
$\gamma_{8,3}$(Tc)	581,30 (12)	0,00010 (5)					
$\gamma_{12,4}$(Tc)	620,03 (5)	0,0024 (6)					
$\gamma_{8,1}$(Tc)	621,773 (24)	0,0263 (10)	M1(+E2)	0,00227 (7)	0,000259 (8)	0,0000473 (14)	0,00258 (8)
$\gamma_{15,4}$(Tc)	689,6 (9)	0,00042 (20)					
$\gamma_{9,3}$(Tc)	739,503 (17)	12,14 (15)	E2+7,6%M1	0,00151 (3)	0,000178 (5)	0,000032 (1)	0,00173 (4)
$\gamma_{7,0}$(Tc)	761,77 (8)	0,0023 (13)					
$\gamma_{9,2}$(Tc)	777,924 (20)	4,28 (8)	E1	0,000518 (10)	0,0000580 (12)	0,00001057 (2)	0,000589 (12)
$\gamma_{10,3}$(Tc)	822,976 (15)	0,1322 (30)	E1	0,000461 (9)	0,000052 (1)	0,0000094 (2)	0,000524 (11)
$\gamma_{10,2}$(Tc)	861,2 (9)	0,0007 (2)					
$\gamma_{13,3}$(Tc)	960,759 (20)	0,095 (3)	(M1)				0,0010 (1)
$\gamma_{12,2}$(Tc)	986,45 (4)	0,0014 (1)					
$\gamma_{13,1}$(Tc)	1001,348 (18)	0,0043 (4)	(E2)				0,0008 (1)
$\gamma_{15,3}$(Tc)	1017,0 (5)	0,0007 (2)					
$\gamma_{15,2}$(Tc)	1056,20 (5)	0,00103 (9)					
$\gamma_{11,0}$(Tc)	1072,2 (4)	0,0012 (5)					

3 Atomic Data

3.1 Tc

ω_K	:	0,782	(4)
$\bar{\omega}_L$	:	0,0415	(10)
$\bar{\omega}_M$	:	0,0010	(1)
n_{KL}	:	1,014	(4)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	Kα_2	18,251		52,59
	Kα_1	18,3672		100
	Kβ_3	20,599	}	
	Kβ_1	20,619	}	
	Kβ_5''	20,789	}	26,58
	Kβ_2	21,005	}	
	Kβ_4	21,042	}	4,2
X_L				
	Lα	2,424 –		
	Lβ	2,537 –		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	14,858 – 15,582	100
KLX	17,418 – 18,365	40,3
KXY	19,956 – 21,040	4,07
Auger L	1,60 – 3,04	736

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Tc)	1,60 - 3,04		15,87 (26)
e_{AK}	(Tc)			3,1 (1)
	KLL	14,858 - 15,582	}	
	KLX	17,418 - 18,365	}	
	KXY	19,956 - 21,040	}	
$ec_{2,1\ M}$	(Tc)	1,6286 - 1,9197		83 (2)
$ec_{2,1\ N}$	(Tc)	2,1046 - 2,1706		10,0 (4)
$ec_{3,1\ K}$	(Tc)	19,540	(3)	3,58 (12)
$ec_{3,1\ L}$	(Tc)	37,542 - 37,907		0,57 (2)
$ec_{3,1\ M}$	(Tc)	40,040 - 40,331		0,106 (4)
$ec_{1,0\ K}$	(Tc)	119,467	(1)	9,2 (3)
$ec_{2,0\ K}$	(Tc)	121,631	(25)	0,62 (5)
$ec_{1,0\ L}$	(Tc)	137,4685 - 137,8341		1,18 (4)
$ec_{2,0\ L}$	(Tc)	139,6325 - 139,9981		0,198 (17)
$ec_{1,0\ M}$	(Tc)	139,9670 - 140,2581		0,231 (7)
$ec_{3,0\ K}$	(Tc)	160,024	(8)	0,756 (28)
$ec_{3,0\ L}$	(Tc)	178,0255 - 178,3911		0,115 (4)
$\beta^-_{0,15}$	max:	158,3	(10)	0,0021 (3)
$\beta^-_{0,15}$	avg:	43,3	(4)	
$\beta^-_{0,14}$	max:	185,2	(10)	0,0016 (4)
$\beta^-_{0,14}$	avg:	51,0	(4)	
$\beta^-_{0,13}$	max:	215,3	(10)	0,111 (3)
$\beta^-_{0,13}$	avg:	59,8	(3)	
$\beta^-_{0,12}$	max:	228,1	(10)	0,011 (1)
$\beta^-_{0,12}$	avg:	69,3	(3)	
$\beta^-_{0,11}$	max:	285	(1)	0,0027 (7)
$\beta^-_{0,11}$	avg:	82	(1)	
$\beta^-_{0,10}$	max:	353,1	(10)	0,134 (5)
$\beta^-_{0,10}$	avg:	104,3	(3)	
$\beta^-_{0,9}$	max:	436,6	(10)	16,45 (30)
$\beta^-_{0,9}$	avg:	133,0	(3)	
$\beta^-_{0,6}$	max:	685,7	(10)	0,052 (5)
$\beta^-_{0,6}$	avg:	225,4	(4)	
$\beta^-_{0,5}$	max:	822,8	(10)	0,0010 (2)
$\beta^-_{0,5}$	avg:	279	(2)	
$\beta^-_{0,4}$	max:	848,1	(10)	1,18 (3)
$\beta^-_{0,4}$	avg:	289,7	(3)	
$\beta^-_{0,2}$	max:	1214,5	(10)	82,1 (15)
$\beta^-_{0,2}$	avg:	442,7	(3)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Tc)	2,424 — 2,537		0,697 (17)	
XKα_2	(Tc)	18,251		3,19 (9)	} Kα
XKα_1	(Tc)	18,3672		6,06 (16)	}
XKβ_3	(Tc)	20,599	}		
XKβ_1	(Tc)	20,619	}	1,61 (5)	Kβ_1'
XKβ_5''	(Tc)	20,789	}		
XKβ_2	(Tc)	21,005	}		
XKβ_4	(Tc)	21,042	}	0,254 (11)	Kβ_2'

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{2,1}$(Tc)	2,1726 (4)	7.10^{-9}
$\gamma_{3,1}$(Tc)	40,58323 (17)	1,022 (27)
$\gamma_{1,0}$(Tc)	140,511 (1)	89,6 (17)
$\gamma_{2,0}$(Tc)	142,675 (25)	0,0211 (17)
$\gamma_{9,7}$(Tc)	158,782 (15)	0,0145 (9)
$\gamma_{6,4}$(Tc)	162,370 (15)	0,0114 (6)
$\gamma_{3,0}$(Tc)	181,068 (8)	6,01 (11)
$\gamma_{10,7}$(Tc)	242,29 (8)	0,0014 (3)
$\gamma_{9,6}$(Tc)	249,03 (3)	0,0035 (4)
$\gamma_{4,2}$(Tc)	366,421 (15)	1,194 (23)
$\gamma_{13,7}$(Tc)	380,13 (8)	0,0091 (5)
$\gamma_{5,2}$(Tc)	391,7 (4)	0,0025 (6)
$\gamma_{14,7}$(Tc)	410,27 (10)	0,0016 (4)
$\gamma_{9,4}$(Tc)	411,491 (15)	0,0161 (12)
$\gamma_{12,6}$(Tc)	457,60 (3)	0,0074 (6)
$\gamma_{13,6}$(Tc)	469,63 (7)	0,0027 (5)
$\gamma_{6,2}$(Tc)	528,788 (15)	0,0541 (19)
$\gamma_{11,5}$(Tc)	537,79 (15)	0,0015 (5)
$\gamma_{7,3}$(Tc)	580,51 (5)	0,0036 (4)
$\gamma_{8,3}$(Tc)	581,30 (12)	0,00010 (5)
$\gamma_{12,4}$(Tc)	620,03 (5)	0,0024 (6)
$\gamma_{8,1}$(Tc)	621,773 (24)	0,0262 (10)
$\gamma_{15,4}$(Tc)	689,6 (9)	0,00042 (18)
$\gamma_{9,3}$(Tc)	739,500 (17)	12,12 (15)
$\gamma_{7,0}$(Tc)	761,77 (8)	0,0023 (13)

	Energy keV	Photons per 100 disint.
$\gamma_{9,2}$(Tc)	777,921 (20)	4,28 (8)
$\gamma_{10,3}$(Tc)	822,972 (15)	0,1321 (29)
$\gamma_{10,2}$(Tc)	861,2 (9)	0,0007 (2)
$\gamma_{13,3}$(Tc)	960,754 (20)	0,095 (3)
$\gamma_{12,2}$(Tc)	986,44 (4)	0,0014 (1)
$\gamma_{13,1}$(Tc)	1001,343 (18)	0,0043 (4)
$\gamma_{15,3}$(Tc)	1017,0 (5)	0,0007 (2)
$\gamma_{15,2}$(Tc)	1056,20 (5)	0,00103 (9)
$\gamma_{11,0}$(Tc)	1072,2 (4)	0,0012 (5)

6 Main Production Modes

Mo – 98(n,γ)Mo – 99 σ : 0,130 (6) barns
Possible impurities : Nb – 92m

Fission product
Possible impurities : None

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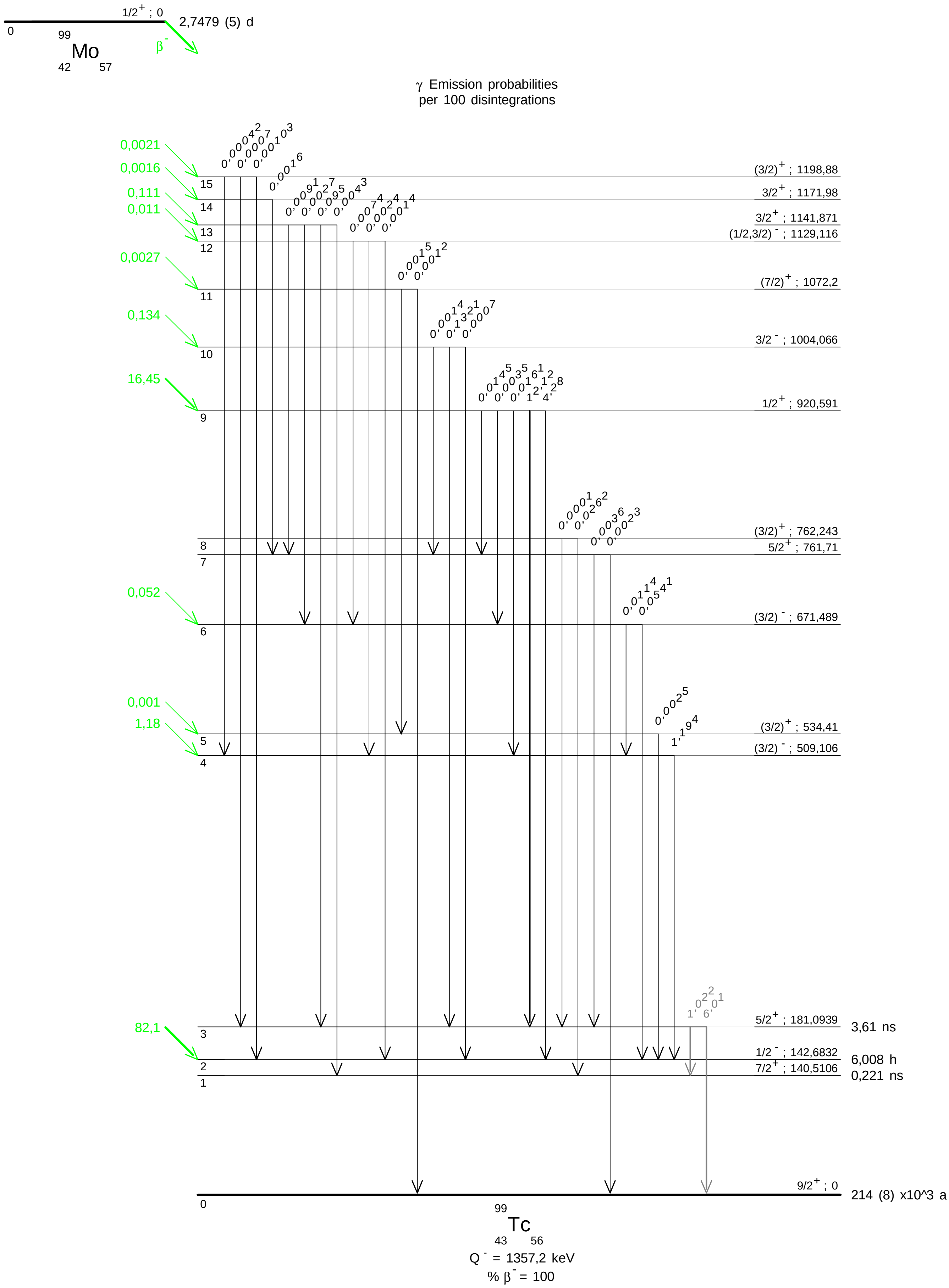
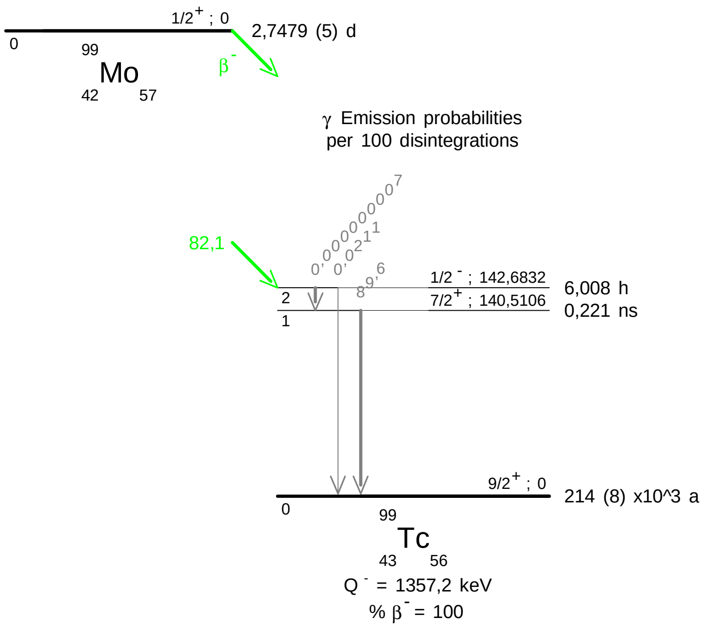

1/2+ ; 0
0
99 Mo 42 57
2,7479 (5) d
β-
γ Emission probabilities
per 100 disintegrations
0,0021
0,0016
0,111
0,011
0,0027
0,134
16,45
0,052
0,001
1,18
82,1
(3/2)+ ; 1198,88
3/2+ ; 1171,98
3/2+ ; 1141,871
(1/2,3/2) - ; 1129,116
(7/2)+ ; 1072,2
3/2 - ; 1004,066
1/2+ ; 920,591
(3/2)+ ; 762,243
5/2+ ; 761,71
(3/2) - ; 671,489
(3/2)+ ; 534,41
(3/2) - ; 509,106
5/2+ ; 181,0939
3,61 ns
1/2 - ; 142,6832
6,008 h
7/2+ ; 140,5106
0,221 ns
9/2+ ; 0
214 (8) x10^3 a
99 Tc 43 56
Q - = 1357,2 keV
% β- = 100



LNHB-KRI /C.Morillon, M.M.Bé,
V.Chechev, A.Egorov

$^{99}_{43}\mathrm{Tc}^{m}_{56}$

1 Decay Scheme

Tc-99m mainly disintegrates to Tc-99. Weak beta minus transitions have been observed to Ru-99 nuclear levels. Depending on the chemical environment, some changes can modify the value of the half-life.
Le technétium 99m se désexcite vers le niveau fondamental du technétium 99. Des changements dans la valeur de la période peuvent être obtenus par une modification de l'environnement extérieur, composition chimique par exemple qui influence la conversion interne de la transition de 2,17 keV dans les couches externes. Des transitions bêta moins de très faible intensité vers le niveau fondamental et les deux niveaux excités de ruthénium 99 ont été mises en évidence.

2 Nuclear Data

$T_{1/2}(^{99}\mathrm{Tc}^{m})$	:	6,0067	(10)	h
$T_{1/2}(^{99}\mathrm{Tc})$	:	214	(8)	10^3 a
$Q^-(^{99}\mathrm{Tc}^{m})$	:	436,2	(2)	keV

2.1 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,2}$	113,9 (2)	0,000106 (6)	1st Forbidden	8,5
$\beta^-_{0,1}$	346,7 (2)	0,0026 (5)	1st Forbidden	8,7
$\beta^-_{0,0}$	436,3 (2)	0,0010 (3)	Unique 1st Forbidden	9,4

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{2,1}$(Tc)	2,1726 (4)	99,0 (4)	E3			119 (3) 10^8	135 (4) 10^8
$\gamma_{1,0}$(Ru)	89,6 (3)	0,00259 (20)	29%M1+E2	1,17 (4)	0,27 (1)		1,49 (5)
$\gamma_{1,0}$(Tc)	140,511 (1)	99,0 (4)	M1+3,3%E2	0,104 (3)	0,01290 (39)	0,00236 (7)	0,119 (3)
$\gamma_{2,0}$(Tc)	142,675 (25)	1,0 (1)	M4	29,3 (6)	9,35 (20)	1,86 (6)	40,9 (8)
$\gamma_{2,1}$(Ru)	232,7 (2)	0,0000088 (15)		0,0412 (15)			0,048 (2)
$\gamma_{2,0}$(Ru)	322,4 (1)	0,000098 (6)		0,0152 (5)			0,0175 (5)

3 Atomic Data

3.1 Tc

ω_K	:	0,782	(4)
$\bar{\omega}_L$	:	0,0415	(10)
$\bar{\omega}_M$	:	0,0010	(1)
n_{KL}	:	1,014	(4)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	18,251		52,59
	$K\alpha_1$	18,3672		100
	$K\beta_3$	20,599	}	
	$K\beta_1$	20,619	}	
	$K\beta_5''$	20,789	}	26,58
	$K\beta_2$	21,005	}	
	$K\beta_4$	21,042	}	4,2
X_L				
	$L\ell$	2,134		
	$L\alpha$	2,42 – 2,425		
	$L\eta$	2,25		
	$L\beta$	2,456 – 2,788		
	$L\gamma$	2,726 – 3,002		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	14,86 – 15,58	100
KLX	17,43 – 18,33	40,3
KXY	19,93 – 21,00	4,1
Auger L	1,6 – 2,9	736

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Tc)	1,6 - 2,9		10,89 (9)
e_{AK}	(Tc)			2,15 (8)
	KLL	14,86 - 15,58	}	
	KLX	17,43 - 18,33	}	
	KXY	19,93 - 21,00	}	
$ec_{2,1\ T}$	(Tc)	1,628 - 2,170		99,9 (27)
$ec_{2,1\ M}$	(Tc)	1,628 - 1,919		88,0 (24)
$ec_{2,1\ N}$	(Tc)	2,104 - 2,170		11,7 (3)
$ec_{1,0\ T}$	(Tc)	119,467 - 140,510		10,53 (27)
$ec_{1,0\ K}$	(Tc)	119,467 (1)		9,20 (27)
$ec_{2,0\ K}$	(Tc)	121,631 (25)		0,67 (6)
$ec_{1,0\ L}$	(Tc)	137,468 - 137,834		1,142 (35)
$ec_{2,0\ L}$	(Tc)	139,632 - 139,998		0,215 (20)
$ec_{1,0\ M}$	(Tc)	139,967 - 140,258		0,209 (6)
$\beta^-_{0,2}$	max:	113,9 (2)		0,000106 (6)
$\beta^-_{0,2}$	avg:	37,8 (6)		
$\beta^-_{0,1}$	max:	346,7 (2)		0,0026 (5)
$\beta^-_{0,1}$	avg:	102,1 (5)		
$\beta^-_{0,0}$	max:	436,3 (2)		0,0010 (3)
$\beta^-_{0,0}$	avg:	152,3 (5)		

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Tc)	2,134 — 3,002		0,482 (12)	
XKα_2	(Tc)	18,251		2,22 (7)	} Kα
XKα_1	(Tc)	18,3672		4,21 (12)	}
XKβ_3	(Tc)	20,599	}		
XKβ_1	(Tc)	20,619	}	1,12 (4)	K$'\beta_1$
XKβ_5''	(Tc)	20,789	}		
XKβ_2	(Tc)	21,005	}		
XKβ_4	(Tc)	21,042	}	0,177 (8)	K$'\beta_2$

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{2,1}$(Tc)	2,1726 (4)	0,0000000074 (2)
$\gamma_{1,0}$(Ru)	89,6 (3)	0,00104 (20)
$\gamma_{1,0}$(Tc)	140,511 (1)	88,5 (2)
$\gamma_{2,0}$(Tc)	142,683 (1)	0,023 (2)
$\gamma_{2,1}$(Ru)	232,7 (2)	0,0000084 (15)
$\gamma_{2,0}$(Ru)	322,4 (1)	0,000096 (6)

6 Main Production Modes

Mo-99 Separation from Mo-99 + Tc-99m

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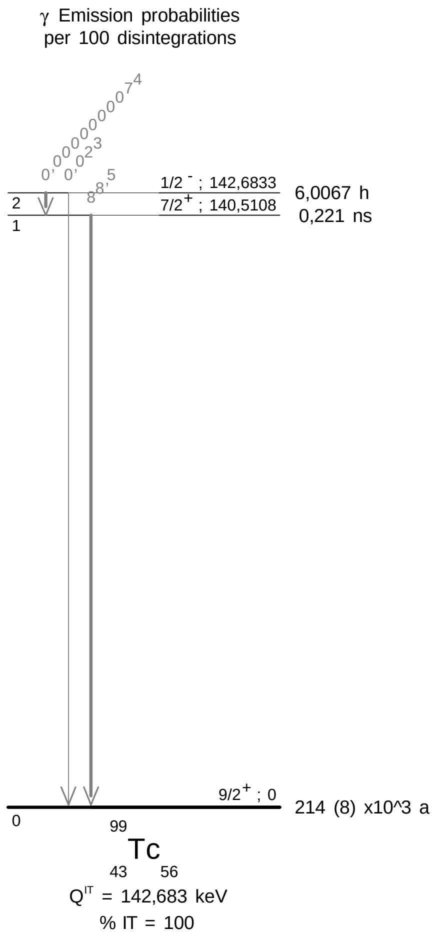
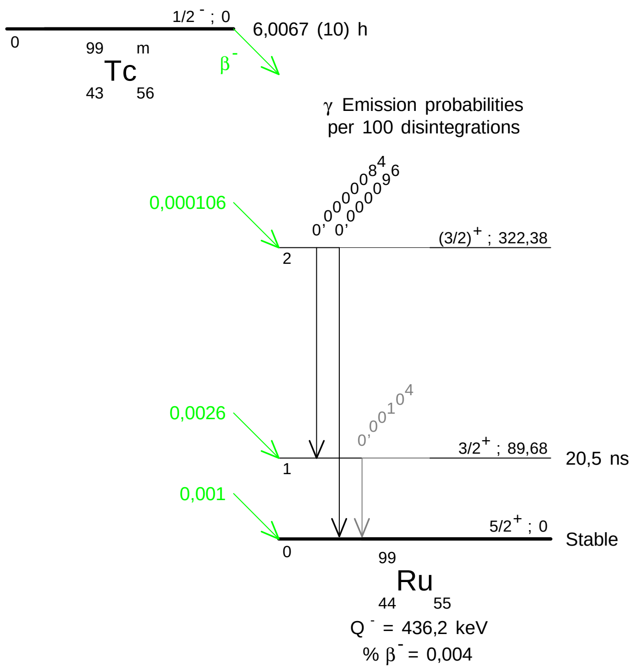

γ Emission probabilities
per 100 disintegrations
0,0000000074
0,023
88,5
1/2 - ; 142,6833
7/2+ ; 140,5108
6,0067 h
0,221 ns
2
1
9/2+ ; 0
214 (8) x10^3 a
0
99
Tc
43 56
QIT = 142,683 keV
% IT = 100


1/2 - ; 0
6,0067 (10) h
0
99 m
Tc
43 56
β-
γ Emission probabilities
per 100 disintegrations
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0,0000084
0,0000096
(3/2)+ ; 322,38
2
0,0026
0,00104
3/2+ ; 89,68
20,5 ns
1
0,001
5/2+ ; 0
Stable
0
99
Ru
44 55
Q - = 436,2 keV
% β- = 0,004

109 Cd
$^{109}_{48}$Cd$_{61}$

1 Decay Scheme

Cd-109 decays by electron capture to the isomeric state (88 keV) of Ag-109.
Le cadmium 109 se désintègre uniquement par capture électronique vers l'état isomérique de l'argent 109 (88 keV).

2 Nuclear Data

$T_{1/2}$(^{109}Cd)	:	461,4	(12)	d
Q^+(^{109}Cd)	:	213,8	(27)	keV

2.1 Electron Capture Transitions

	Energy keV	Probability × 100	Nature	lg ft	P_K	P_L	P_M
$\epsilon_{0,1}$	125,8 (27)	100	Allowed	5,1	0,8118 (23)	0,1497 (23)	0,0321 (8)
$\epsilon_{0,0}$	213,8 (27)	< 0,005	2nd Forbidden	11			

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{1,0}$(Ag)	88,0337 (1)	100	E3	11,28 (12)	12,34 (13)	2,70 (3)	26,58 (20)

3 Atomic Data

3.1 Ag

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

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	21,9906		53,05
	$K\alpha_1$	22,16317		100
	$K\beta_3$	24,9118	}	
	$K\beta_1$	24,9427	}	
	$K\beta_5''$	25,146	}	27,7
	$K\beta_2$	25,4567	}	
	$K\beta_4$	25,512	}	4,82
X_L				
	$L\ell$	2,63		
	$L\gamma$	– 3,75		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	17,79 – 18,69	100
KLX	20,945 – 22,160	42,5
KXY	24,079 – 25,507	4,51
Auger L	1,8 – 3,8	1194

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Ag)	1,8 - 3,8		167 (10)
e_{AK}	(Ag)			20,6 (5)
	KLL	17,79 - 18,69	}	
	KLX	20,945 - 22,160	}	
	KXY	24,079 - 25,507	}	
$ec_{1,0\ K}$	(Ag)	62,520 (2)		40,8 (5)
$ec_{1,0\ L}$	(Ag)	84,228 - 84,683		44,8 (5)
$ec_{1,0\ M}$	(Ag)	87,316 - 88,030		9,28 (29)

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Ag)	2,63 — 3,75		10,34 (26)	
$XK\alpha_2$	(Ag)	21,9906		29,00 (25)	} $K\alpha$
$XK\alpha_1$	(Ag)	22,16317		54,7 (4)	}
$XK\beta_3$	(Ag)	24,9118	}		
$XK\beta_1$	(Ag)	24,9427	}	15,14 (18)	$K'\beta_1$
$XK\beta_5''$	(Ag)	25,146	}		
$XK\beta_2$	(Ag)	25,4567	}		
$XK\beta_4$	(Ag)	25,512	}	2,64 (10)	$K'\beta_2$

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Ag)	88,0336 (1)	3,626 (26)

6 Main Production Modes

$\left\{ \begin{array}{l} \mathrm{Cd}-108(\mathrm{n},\gamma)\mathrm{Cd}-109 \qquad \sigma : 1{,}1\ (3)\ \mathrm{barns} \\ \text{Possible impurities : } \mathrm{Ag}-110\mathrm{m} \end{array} \right.$

$\left\{ \begin{array}{l} \mathrm{Ag}-109(\mathrm{p},\mathrm{n})\mathrm{Cd}-109 \\ \text{Possible impurities : None} \end{array} \right.$

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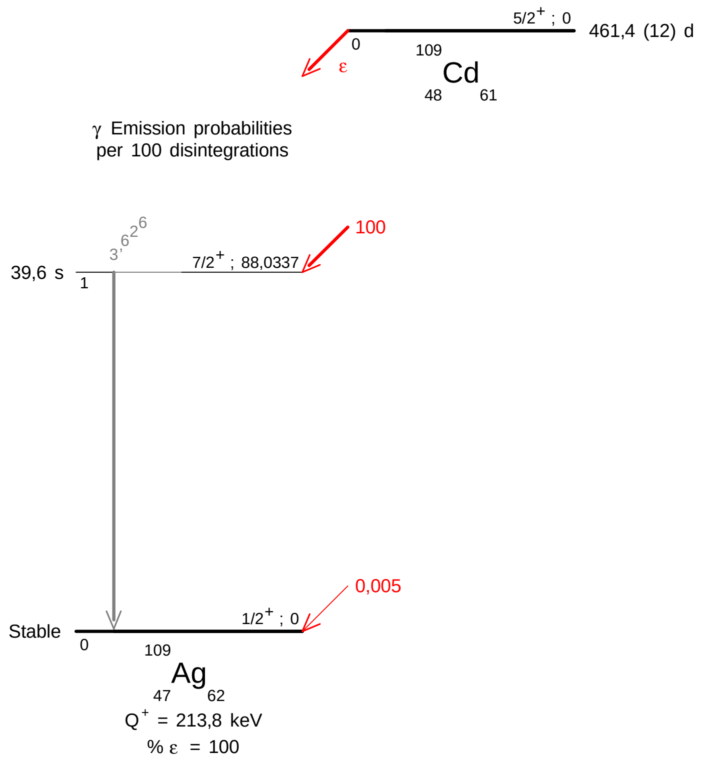
5/2+ ; 0
461,4 (12) d
0
ε
109
Cd
48
61
γ Emission probabilities
per 100 disintegrations
3'
6
2
6
100
7/2+ ; 88,0337
39,6 s
1
0,005
1/2+ ; 0
Stable
0
109
Ag
47
62
Q+ = 213,8 keV
% ε = 100

$^{110}_{47}$Ag $_{63}$

1 Decay Scheme

Ag-110 decays by beta minus emission to the Cd-110 fundamental level (99.70 (6)%) and by electron capture to the Pd-110 fundamental level (0.30 (6)%).
L'argent 110 se désintègre à 99,70(6)% par émission bêta moins principalement vers le niveau fondamental de cadmium 110 et à 0,30(6)% par capture électronique vers le niveau fondamental du palladium 110.

2 Nuclear Data

$T_{1/2}$(^{110}Ag)	:	24,56	(11)	s
Q^-(^{110}Ag)	:	2892,2	(16)	keV
Q^+(^{110}Ag)	:	892	(11)	keV

2.1 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,10}$	230,2 (17)	0,0063 (8)	Allowed	4,83
$\beta^-_{0,9}$	560,4 (17)	0,0072 (5)	Allowed	6,05
$\beta^-_{0,8}$	604,8 (17)	0,0022 (5)	Allowed	6,68
$\beta^-_{0,7}$	813,3 (17)	0,0022 (5)	Unique 1st forb.	7,54
$\beta^-_{0,6}$	813,6 (17)	0,0076 (14)	Allowed	6,6
$\beta^-_{0,5}$	1108,8 (17)	0,0121 (17)	Allowed	6,89
$\beta^-_{0,4}$	1160,7 (17)	0,0009 (5)	Allowed	8,1
$\beta^-_{0,3}$	1416,5 (16)	0,0099 (10)	Allowed	7,39
$\beta^-_{0,2}$	1419,2 (17)	0,038 (3)	Allowed	6,81
$\beta^-_{0,1}$	2234,4 (16)	4,4 (4)	Allowed	5,53
$\beta^-_{0,0}$	2892,2 (16)	95,2 (4)	Allowed	4,66

2.2 Electron Capture Transitions

	Energy keV	Probability × 100	Nature	lg ft	P_K	P_L	P_{M+}
$\epsilon_{0,0}$	892 (11)	0,30 (6)	Allowed	4,1	0,862	0,111	0,027

2.3 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K (10^{-3})	α_L (10^{-4})	α_M (10^{-4})	α_T (10^{-3})
$\gamma_{6,5}$(Cd)	295,3 (2)	0,0078 (16)	(E1)	7,03 (21)	8,3 (3)	1,6 (1)	8,05 (24)
$\gamma_{1,0}$(Cd)	657,7600 (11)	4,6 (4)	E2	2,72 (8)	0,34 (1)		3,18 (9)
$\gamma_{2,1}$(Cd)	815,50 (2)	0,039 (4)	E2	1,59 (5)	1,9 (1)		1,85 (6)
$\gamma_{3,1}$(Cd)	818,0277 (18)	0,0092 (9)	M1+E2	1,67 (5)	0,20 (1)		1,94 (6)
$\gamma_{4,1}$(Cd)	1074,0 (2)	0,0009 (5)	E2	8,5 (3)	1,0 (1)		9,8 (3)
$\gamma_{5,1}$(Cd)	1125,705 (20)	0,0156 (14)	M1+E2	0,89 (3)	1,0 (1)		1,05 (3)
$\gamma_{10,3}$(Cd)	1186,3 (2)	0,0028 (5)	[E2]	6,9 (2)	0,9 (1)		7,9 (2)
$\gamma_{7,1}$(Cd)	1421,5 (2)	0,0023 (5)		2,3 (1)	0,3 (1)		2,6 (1)
$\gamma_{3,0}$(Cd)	1475,7898 (23)	0,0037 (6)	E2	4,4 (1)	0,7		5,1 (2)
$\gamma_{8,1}$(Cd)	1629,9 (2)	0,0023 (5)	E2(+M1)				
$\gamma_{9,1}$(Cd)	1674,3 (2)	0,007 (1)					
$\gamma_{5,0}$(Cd)	1783,48 (3)	0,0046 (8)	E2				
$\gamma_{10,1}$(Cd)	2004,40 (2)	0,0037 (6)	E2				

3 Atomic Data

3.1 Pd

ω_K	:	0,820	(2)
$\bar{\omega}_L$	:	0,0536	(13)
n_{KL}	:	0,975	(4)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	21,0203		52,93
	$K\alpha_1$	21,1774		100
	$K\beta_3$	23,7914	}	
	$K\beta_1$	23,819	}	
	$K\beta_5''$	24,013	}	27,43
	$K\beta_2$	24,2994	}	
	$K\beta_4$	24,344	}	4,67

3.2 Cd

ω_K	:	0,842	(4)
$\bar{\omega}_L$	:	0,0632	(16)
n_{KL}	:	0,953	(4)

3.2.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	22,9843		53,17
	$K\alpha_1$	23,1738		100
	$K\beta_3$	26,0615	}	
	$K\beta_1$	26,0958	}	
	$K\beta_5''$		}	32,95
	$K\beta_5'$	26,304	}	
	$K\beta_2$	26,644	}	
	$K\beta_4$	26,702	}	

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
$ec_{6,5\ K}$	(Cd)	268,59	(20)	0,000055 (11)
$ec_{1,0\ K}$	(Cd)	631,049	(1)	0,0125 (12)
$ec_{1,0\ L}$	(Cd)	653,74 - 654,22		0,00156 (16)
$\beta^-_{0,10}$	max:	230,1	(16)	0,0063 (8)
$\beta^-_{0,10}$	avg:	64,2	(5)	
$\beta^-_{0,9}$	max:	560,4	(17)	0,0072 (5)
$\beta^-_{0,9}$	avg:	176,4	(6)	
$\beta^-_{0,8}$	max:	604,8	(17)	0,0022 (5)
$\beta^-_{0,8}$	avg:	192,8	(6)	
$\beta^-_{0,7}$	max:	813,3	(17)	0,0022 (5)
$\beta^-_{0,7}$	avg:	290,7	(7)	
$\beta^-_{0,6}$	max:	813,6	(17)	0,0076 (14)
$\beta^-_{0,6}$	avg:	273,3	(7)	
$\beta^-_{0,5}$	max:	1108,8	(17)	0,0121 (17)
$\beta^-_{0,5}$	avg:	394,1	(7)	

		Energy keV		Electrons per 100 disint.
$\beta^-_{0,4}$	max:	1160,7	(17)	0,0009 (5)
$\beta^-_{0,4}$	avg:	415,9	(7)	
$\beta^-_{0,3}$	max:	1416,5	(16)	0,0099 (10)
$\beta^-_{0,3}$	avg:	526,0	(7)	
$\beta^-_{0,2}$	max:	1419,2	(17)	0,038 (3)
$\beta^-_{0,2}$	avg:	527,1	(7)	
$\beta^-_{0,1}$	max:	2234,4	(16)	4,4 (4)
$\beta^-_{0,1}$	avg:	893,8	(8)	
$\beta^-_{0,0}$	max:	2892,2	(16)	95,2 (4)
$\beta^-_{0,0}$	avg:	1199,0	(8)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XKα_2	(Pd)	21,0203		0,060 (12)	} Kα
XKα_1	(Pd)	21,1774		0,114 (23)	}
XKβ_3	(Pd)	23,7914	}		
XKβ_1	(Pd)	23,819	}	0,032 (7)	K$'\beta_1$
XKβ_5''	(Pd)	24,013	}		
XKβ_2	(Pd)	24,2994	}		
XKβ_4	(Pd)	24,344	}	0,0054 (10)	K$'\beta_2$
XKα_2	(Cd)	22,9843		0,0032 (3)	} Kα
XKα_1	(Cd)	23,1738		0,0061 (6)	}
XKβ_3	(Cd)	26,0615	}		
XKβ_1	(Cd)	26,0958	}	0,00169 (15)	K$'\beta_1$
XKβ_5'	(Cd)	26,304	}		
XKβ_2	(Cd)	26,644	}		
XKβ_4	(Cd)	26,702	}	0,00031 (3)	K$'\beta_2$

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{6,5}$(Cd)	295,3 (2)	0,0078 (16)
$\gamma_{1,0}$(Cd)	657,7600 (11)	4,6 (4)
$\gamma_{2,1}$(Cd)	815,50 (2)	0,039 (4)
$\gamma_{3,1}$(Cd)	818,0244 (18)	0,0092 (9)
$\gamma_{4,1}$(Cd)	1074,0 (2)	0,0009 (5)
$\gamma_{5,1}$(Cd)	1125,699 (20)	0,0156 (14)
$\gamma_{10,3}$(Cd)	1186,3 (2)	0,0028 (5)
$\gamma_{7,1}$(Cd)	1421,5 (2)	0,0023 (5)
$\gamma_{3,0}$(Cd)	1475,7792 (23)	0,0037 (6)
$\gamma_{8,1}$(Cd)	1629,9 (2)	0,0023 (5)
$\gamma_{9,1}$(Cd)	1674,3 (2)	0,007 (1)
$\gamma_{5,0}$(Cd)	1783,46 (3)	0,0046 (8)
$\gamma_{10,1}$(Cd)	2004,40 (2)	0,0037 (6)

6 Main Production Modes

Ag – 109(n,γ)Ag – 110 σ : 86,3 (30) barns

{ Ag – 101(n,γ)Ag – 110m σ : 4,7 (2) barns
Possible impurities : Ag – 108, Ag – 110m

Ag – 110m(I.T.)Ag – 110

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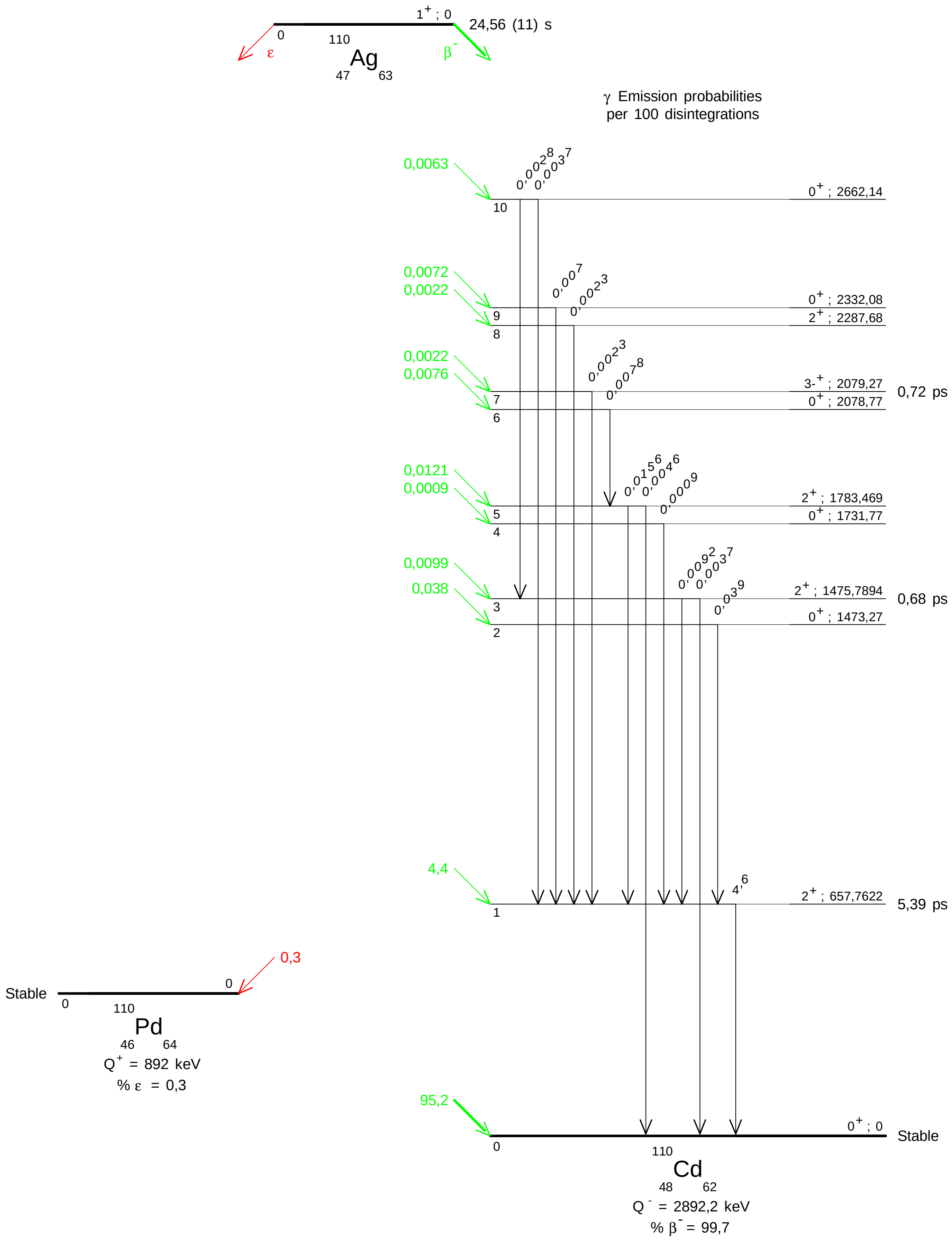

1+ ; 0
24,56 (11) s
0
110
Ag
47
63
ε
β-
γ Emission probabilities
per 100 disintegrations
0,0063
0,0072
0,0022
0,0022
0,0076
0,0121
0,0009
0,0099
0,038
4,4
95,2
0+ ; 2662,14
0+ ; 2332,08
2+ ; 2287,68
3- + ; 2079,27
0+ ; 2078,77
0,72 ps
2+ ; 1783,469
0+ ; 1731,77
2+ ; 1475,7894
0+ ; 1473,27
0,68 ps
2+ ; 657,7622
5,39 ps
0+ ; 0
Stable
110
Cd
48
62
Q- = 2892,2 keV
% β- = 99,7
0,3
Stable
0
110
Pd
46
64
Q+ = 892 keV
% ε = 0,3

$^{110}_{47}$ **Ag** $^{m}_{63}$

1 Decay Scheme

Ag-110m decays by beta minus emissions to Cd-110 excited levels for 98.64 (8) % and, with two gamma in cascade, to Ag-110 for 1.36 (8) %.
L'argent 110 métastable se désintègre pour 98,64 (8) %, par émission bêta moins, vers des niveaux excités de cadmium 110 et se désexcite dans une proportion de 1,36 (6) % vers le niveau fondamental d'argent 110 selon 2 transitions gamma en cascade.

2 Nuclear Data

$T_{1/2}(^{110}Ag^{m})$	:	249,78	(2)	d
$T_{1/2}(^{110}Ag)$	:	24,56	(11)	s
$Q^{-}(^{110}Ag^{m})$	:	3009,8	(16)	keV

2.1 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,22}$	83,1 (16)	67,5 (6)	Allowed	5,36
$\beta^-_{0,21}$	133,0 (16)	0,392 (18)	Allowed	8,2
$\beta^-_{0,20}$	167,3 (16)	0,0252 (10)	1st forbidden	9,7
$\beta^-_{0,15}$	349,9 (16)	0,031 (4)	1st forbidden	10,7
$\beta^-_{0,13}$	470,1 (16)	0,060 (4)	1st forbidden	10,8
$\beta^-_{0,12}$	529,9 (16)	30,8 (3)	Allowed	8,28
$\beta^-_{0,8}$	759,3 (16)	0,06 (5)	2nd forbidden	11,5

2.2 Gamma Transitions and Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K (10^{-1})	α_L (10^{-2})	α_M	α_T	α_π (10^{-4})
$\gamma_{1,0}$(Ag)	1,113		E1					
$\gamma_{2,1}$(Ag)	116,48 (5)	1,3520 (3)	M4	1050 (30)	5010 (150)	11	168 (5)	
$\gamma_{15,13}$(Cd)	120,23 (3)	0,0218 (18)	M1(+E2)	2,5 (6)	3,2 (18)	0,006 (4)	0,29 (8)	
$\gamma_{22,19}$(Cd)	133,333 (7)	0,0736 (16)						
$\gamma_{22,18}$(Cd)	219,348 (8)	0,072 (5)						
$\gamma_{22,17}$(Cd)	221,079 (10)	0,068 (10)						
$\gamma_{12,8}$(Cd)	229,423 (23)	0,0119 (14)						
$\gamma_{22,15}$(Cd)	266,913 (12)	0,041 (4)						
$\gamma_{14,7}$(Cd)	341,3 (2)	0,0022 (5)						
$\gamma_{19,11}$(Cd)	360,23 (8)	0,008 (5)						
$\gamma_{22,14}$(Cd)	365,448 (10)	0,092 (5)						
$\gamma_{22,13}$(Cd)	387,073 (9)	0,0518 (9)						
$\gamma_{21,12}$(Cd)	396,895 (23)	0,037 (4)						
$\gamma_{15,8}$(Cd)	409,4 (5)	0,0063	E1(+M2)	0,0303 (9)	0,036 (1)		0,00346 (10)	
$\gamma_{20,11}$(Cd)	409,4 (5)	0,0063	E1(+M2)	0,0303 (9)	0,036 (1)		0,00346 (10)	
$\gamma_{22,12}$(Cd)	446,812 (3)	3,68 (5)	M1+E2	0,0772 (23)	0,094 (3)	0,00018 (1)	0,0089 (3)	
$\gamma_{8,4}$(Cd)	467,03 (4)	0,0251 (19)	(E2)	0,0699 (21)	0,092 (3)	0,00018 (1)	0,00813 (24)	
$\gamma_{22,11}$(Cd)	493,43 (10)	0,0095 (11)						
$\gamma_{18,6}$(Cd)	544,55 (5)	0,018 (3)	M1+E2	0,0464 (19)	0,057 (2)		0,0054 (2)	
$\gamma_{19,7}$(Cd)	572,8 (2)	0,0173 (13)						
$\gamma_{5,2}$(Cd)	603,08 (10)	0,011 (8)	E1	0,0121 (4)	0,014 (10)		0,00139 (40)	
$\gamma_{6,3}$(Cd)	620,3572 (17)	2,73 (8)	M1+E2	0,0342 (10)	0,041 (1)		0,00397 (12)	
$\gamma_{21,8}$(Cd)	626,26 (1)	0,215 (17)	E2	0,0309 (9)	0,039 (1)		0,00361 (11)	
$\gamma_{19,6}$(Cd)	630,62 (6)	0,033 (5)						
$\gamma_{1,0}$(Cd)	657,7600 (11)	94,68 (8)	E2	0,0272 (8)	0,034 (1)		0,00318 (9)	
$\gamma_{7,3}$(Cd)	677,6239 (12)	10,59 (6)	M1+E2	0,0280 (8)	0,033 (1)		0,00324 (10)	
$\gamma_{6,2}$(Cd)	687,0114 (18)	6,47 (3)	M1+E2	0,0251 (8)	0,031 (1)		0,00292 (9)	
$\gamma_{22,7}$(Cd)	706,6780 (15)	16,53 (8)	M1+E2	0,0237 (7)	0,029 (1)		0,00275 (8)	
$\gamma_{8,3}$(Cd)	708,13 (2)	0,23 (5)	M1+E2	0,0255 (8)	0,030 (1)		0,00295 (9)	
$\gamma_{19,5}$(Cd)	714,9 (1)	0,0092 (24)						
$\gamma_{7,2}$(Cd)	744,2782 (18)	4,72 (3)	E2(+M3)	0,0199 (6)	0,025 (1)		0,00232 (7)	
$\gamma_{22,6}$(Cd)	763,9452 (17)	22,36 (9)	E2+M3	0,0198 (10)	0,024 (2)		0,00230 (9)	
$\gamma_{8,2}$(Cd)	774,7 (1)	0,006 (3)	(E2)	0,0180 (5)	0,022 (1)		0,00210 (6)	
$\gamma_{2,1}$(Cd)	818,0277 (18)	7,34 (4)	M1+E2	0,0167 (5)	0,020 (1)		0,00194 (6)	
$\gamma_{3,1}$(Cd)	884,6819 (13)	74,1 (12)	E2	0,0131 (4)	0,016 (1)		0,00152 (5)	
$\gamma_{12,3}$(Cd)	937,485 (3)	34,56 (27)	E2(+M3)	0,0115 (3)	0,014 (1)		0,00133 (4)	
$\gamma_{11,2}$(Cd)	957,35 (10)	0,0093 (19)	M1+E2	0,0120 (9)	0,014 (1)		0,00139 (10)	
$\gamma_{13,3}$(Cd)	997,248 (15)	0,128 (4)	E1(+M2)				0,0007 (9)	
$\gamma_{14,3}$(Cd)	1018,96 (8)	0,0141 (7)	M1+E2					
$\gamma_{14,2}$(Cd)	1085,453 (14)	0,072 (4)	E2	0,0083 (3)	0,010 (1)		0,00096 (3)	
$\gamma_{15,3}$(Cd)	1117,47 (3)	0,0488 (9)	E1(+M2)	0,0034 (1)			0,00040 (1)	
$\gamma_{4,1}$(Cd)	1125,705 (20)	0,0304 (14)	M1+E2	0,0089 (30)	0,010 (1)		0,00103 (3)	
$\gamma_{17,3}$(Cd)	1163,15 (8)	0,074 (24)	M1+E2	0,0084 (3)	0,0098 (3)		0,00097 (3)	
$\gamma_{18,3}$(Cd)	1164,95 (9)	0,043 (3)	M1+E2	0,0077 (7)			0,00090 (3)	
$\gamma_{16,2}$(Cd)	1186,7 (1)	0,00160 (5)						
$\gamma_{19,3}$(Cd)	1251,05 (4)	0,026 (3)						0,1
$\gamma_{20,3}$(Cd)	1300,06 (10)	0,0189 (7)	E1(+M2)	0,0026 (1)			0,00030 (1)	0,19
$\gamma_{21,3}$(Cd)	1334,335 (17)	0,141 (5)	E2	0,0054 (2)			0,00062 (2)	0,29
$\gamma_{22,3}$(Cd)	1384,3025 (20)	24,7 (5)	M1+E2	0,0056 (2)			0,00065 (2)	0,39
$\gamma_{5,1}$(Cd)	1420,08 (5)	0,026 (4)	E1	0,0023 (1)			0,00026 (1)	1,7
$\gamma_{2,0}$(Cd)	1475,7898 (23)	4,03 (5)	E2	0,0044 (1)			0,00051 (2)	0,67
$\gamma_{6,1}$(Cd)	1505,039 (2)	13,16 (16)	M1+E2	0,0045 (1)			0,00045 (1)	0,76
$\gamma_{7,1}$(Cd)	1562,2940 (18)	1,21 (3)	E2(+M3)					1,1
$\gamma_{8,1}$(Cd)	1592,80 (15)	0,0207 (8)	(E2)					1,2
$\gamma_{9,1}$(Cd)	1629,76 (15)	0,0040 (5)	M1+E2					1,3
$\gamma_{10,1}$(Cd)	1698,8 (2)	0,0017 (3)						1,4
$\gamma_{11,1}$(Cd)	1775,43 (4)	0,0065 (3)	M1+E2					2
$\gamma_{4,0}$(Cd)	1783,48 (3)	0,0101 (5)	E2					2

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K (10^{-1})	α_L (10^{-2})	α_M	α_T	α_π (10^{-4})
$\gamma_{14,1}$(Cd)	1903,54 (4)	0,0159 (7)						
$\gamma_{16,1}$(Cd)	2004,67 (10)	0,0012 (4)						3

3 Atomic Data

3.1 Cd

ω_K : 0,842 (4)
$\bar{\omega}_L$: 0,0632 (16)
n_{KL} : 0,953 (4)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	Kα_2	22,9843		53,17
	Kα_1	23,1738		100
	Kβ_3	26,0615	}	
	Kβ_1	26,0958	}	
	Kβ_5''	26,304	}	27,88
	Kβ_2	26,644	}	
	Kβ_4	26,702	}	5,07

3.2 Ag

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

3.2.1 X Radiations

		Energy keV		Relative probability
X_K				
	Kα_2	21,9906		53,05
	Kα_1	22,1632		100
	Kβ_3	24,9118	}	
	Kβ_1	24,9427	}	
	Kβ_5''	25,146	}	27,7
	Kβ_2	25,4567	}	
	Kβ_4	25,512	}	4,82

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
$ec_{22,12\ K}$	(Cd)	420,101	(3)	0,0282 (9)
$ec_{1,0\ K}$	(Cd)	631,0490	(11)	0,257 (8)
$ec_{7,3\ K}$	(Cd)	650,9130	(12)	0,0296 (9)
$ec_{1,0\ L}$	(Cd)	653,742 - 654,222		0,0321 (9)
$ec_{22,7\ K}$	(Cd)	679,9670	(15)	0,0391 (12)
$ec_{22,6\ K}$	(Cd)	737,2340	(17)	0,0442 (22)
$ec_{3,1\ K}$	(Cd)	857,9710	(13)	0,097 (3)
$ec_{3,1\ L}$	(Cd)	880,664 - 881,144		0,0118 (8)
$ec_{12,3\ K}$	(Cd)	910,774	(3)	0,0397 (11)
$\beta^-_{0,22}$	max:	83,1	(16)	67,5 (6)
$\beta^-_{0,22}$	avg:	21,6	(5)	
$\beta^-_{0,21}$	max:	133,0	(16)	0,392 (18)
$\beta^-_{0,21}$	avg:	35,5	(5)	
$\beta^-_{0,20}$	max:	167,3	(16)	0,0252 (10)
$\beta^-_{0,20}$	avg:	45,4	(5)	
$\beta^-_{0,15}$	max:	349,9	(16)	0,031 (4)
$\beta^-_{0,15}$	avg:	102,6	(6)	
$\beta^-_{0,13}$	max:	470,1	(16)	0,060 (4)
$\beta^-_{0,13}$	avg:	143,9	(6)	
$\beta^-_{0,12}$	max:	529,9	(16)	30,8 (3)
$\beta^-_{0,12}$	avg:	165,3	(6)	
$\beta^-_{0,8}$	max:	759,3	(16)	0,06 (5)
$\beta^-_{0,8}$	avg:	251,9	(7)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
$XK\alpha_2$	(Cd)	22,9843		0,153 (9)	} $K\alpha$
$XK\alpha_1$	(Cd)	23,1738		0,288 (16)	}
$XK\beta_3$	(Cd)	26,0615	}		
$XK\beta_1$	(Cd)	26,0958	}	0,080 (5)	$K'\beta_1$
$XK\beta''_5$	(Cd)	26,304	}		
$XK\beta_2$	(Cd)	26,644	}		
$XK\beta_4$	(Cd)	26,702	}	0,0146 (9)	$K'\beta_2$

		Energy keV		Photons per 100 disint.	
XKα_2	(Ag)	21,9906		0,198 (12)	} Kα
XKα_1	(Ag)	22,1632		0,372 (22)	}
XKβ_3	(Ag)	24,9118	}		
XKβ_1	(Ag)	24,9427	}	0,103 (7)	K$'\beta_1$
XKβ_5''	(Ag)	25,146	}		
XKβ_2	(Ag)	25,4567	}		
XKβ_4	(Ag)	25,512	}	0,0179 (12)	K$'\beta_2$

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{2,1}$(Ag)	116,48 (5)	0,0080 (3)
$\gamma_{15,13}$(Cd)	120,23 (3)	0,0169 (9)
$\gamma_{22,19}$(Cd)	133,333 (7)	0,0736 (16)
$\gamma_{22,18}$(Cd)	219,348 (8)	0,072 (5)
$\gamma_{22,17}$(Cd)	221,079 (10)	0,068 (10)
$\gamma_{12,8}$(Cd)	229,423 (23)	0,0119 (14)
$\gamma_{(-1,1)}$(Cd)	264,25 (6)	0,0060 (6)
$\gamma_{22,15}$(Cd)	266,913 (12)	0,041 (4)
$\gamma_{14,7}$(Cd)	341,3 (2)	0,0022 (5)
$\gamma_{(-1,2)}$(Cd)	356,43 (10)	0,00425 (30)
$\gamma_{19,11}$(Cd)	360,23 (8)	0,008 (5)
$\gamma_{22,14}$(Cd)	365,448 (10)	0,092 (5)
$\gamma_{22,13}$(Cd)	387,073 (9)	0,0518 (9)
$\gamma_{21,12}$(Cd)	396,895 (23)	0,037 (4)
$\gamma_{20,11}$(Cd)	409,4 (5)	0,0063
$\gamma_{15,8}$(Cd)	409,4 (5)	0,0063
$\gamma_{22,12}$(Cd)	446,812 (3)	3,65 (5)
$\gamma_{8,4}$(Cd)	467,03 (4)	0,0249 (19)
$\gamma_{22,11}$(Cd)	493,43 (10)	0,0095 (11)
$\gamma_{18,6}$(Cd)	544,55 (5)	0,018 (3)
$\gamma_{19,7}$(Cd)	572,8 (2)	0,0173 (13)
$\gamma_{5,2}$(Cd)	603,08 (10)	0,011 (8)
$\gamma_{6,3}$(Cd)	620,3553 (17)	2,72 (8)
$\gamma_{21,8}$(Cd)	626,258 (10)	0,214 (17)
$\gamma_{19,6}$(Cd)	630,62 (6)	0,033 (5)
$\gamma_{(-1,3)}$(Cd)	647,8 (4)	0,0175 (50)
$\gamma_{1,0}$(Cd)	657,7600 (11)	94,38 (8)
$\gamma_{(-1,4)}$(Cd)	666,6 (5)	0,028 (14)
$\gamma_{(-1,5)}$(Cd)	676,58 (10)	0,14 (1)
$\gamma_{7,3}$(Cd)	677,6217 (12)	10,56 (6)

	Energy keV	Photons per 100 disint.
$\gamma_{6,2}$(Cd)	687,0091 (18)	6,45 (3)
$\gamma_{22,7}$(Cd)	706,6760 (15)	16,48 (8)
$\gamma_{8,3}$(Cd)	708,128 (20)	0,23 (5)
$\gamma_{19,5}$(Cd)	714,9 (1)	0,0092 (24)
$\gamma_{7,2}$(Cd)	744,2755 (18)	4,71 (3)
$\gamma_{22,6}$(Cd)	763,9424 (17)	22,31 (9)
$\gamma_{8,2}$(Cd)	774,7 (1)	0,006 (3)
$\gamma_{2,1}$(Cd)	818,0244 (18)	7,33 (4)
$\gamma_{3,1}$(Cd)	884,6781 (13)	74,0 (12)
$\gamma_{12,3}$(Cd)	937,485 (3)	34,51 (27)
$\gamma_{11,2}$(Cd)	957,35 (10)	0,0093 (19)
$\gamma_{13,3}$(Cd)	997,243 (15)	0,128 (4)
$\gamma_{14,3}$(Cd)	1018,95 (8)	0,0141 (7)
$\gamma_{(-1,8)}$(Cd)	1050,5 (5)	0,0076 (10)
$\gamma_{14,2}$(Cd)	1085,447 (14)	0,072 (4)
$\gamma_{15,3}$(Cd)	1117,46 (3)	0,0488 (9)
$\gamma_{4,1}$(Cd)	1125,699 (20)	0,0304 (14)
$\gamma_{17,3}$(Cd)	1163,14 (8)	0,074 (24)
$\gamma_{18,3}$(Cd)	1164,94 (9)	0,043 (3)
$\gamma_{16,2}$(Cd)	1186,7 (1)	0,00160 (5)
$\gamma_{19,3}$(Cd)	1251,04 (4)	0,026 (3)
$\gamma_{20,3}$(Cd)	1300,05 (10)	0,0189 (7)
$\gamma_{21,3}$(Cd)	1334,326 (17)	0,141 (5)
$\gamma_{22,3}$(Cd)	1384,2931 (20)	24,7 (5)
$\gamma_{5,1}$(Cd)	1420,07 (5)	0,026 (4)
$\gamma_{(-1,9)}$(Cd)	1465,6 (1)	0,0018 (2)
$\gamma_{2,0}$(Cd)	1475,7792 (23)	4,03 (5)
$\gamma_{6,1}$(Cd)	1505,028 (2)	13,16 (16)
$\gamma_{7,1}$(Cd)	1562,2940 (18)	1,21 (3)
$\gamma_{(-1,10)}$(Cd)	1572,4 (2)	0,0011 (3)
$\gamma_{8,1}$(Cd)	1592,80 (15)	0,0207 (8)
$\gamma_{9,1}$(Cd)	1629,75 (15)	0,0040 (5)
$\gamma_{10,1}$(Cd)	1698,8 (2)	0,0017 (3)
$\gamma_{11,1}$(Cd)	1775,41 (4)	0,0065 (3)
$\gamma_{4,0}$(Cd)	1783,46 (3)	0,0101 (5)
$\gamma_{14,1}$(Cd)	1903,52 (4)	0,0159 (7)
$\gamma_{16,1}$(Cd)	2004,65 (10)	0,0012 (4)

6 Main Production Modes

Ag – 109(n,γ)Ag – 110m σ : 4,7 (2) barns
Possible impurities : Ag – 108m, Ag – 110

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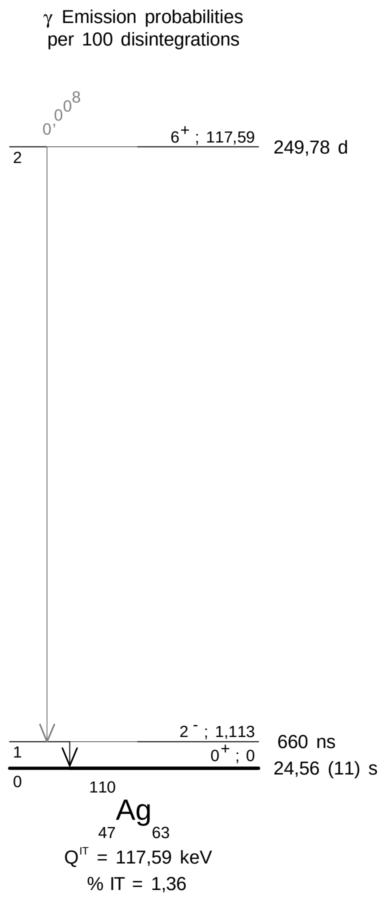
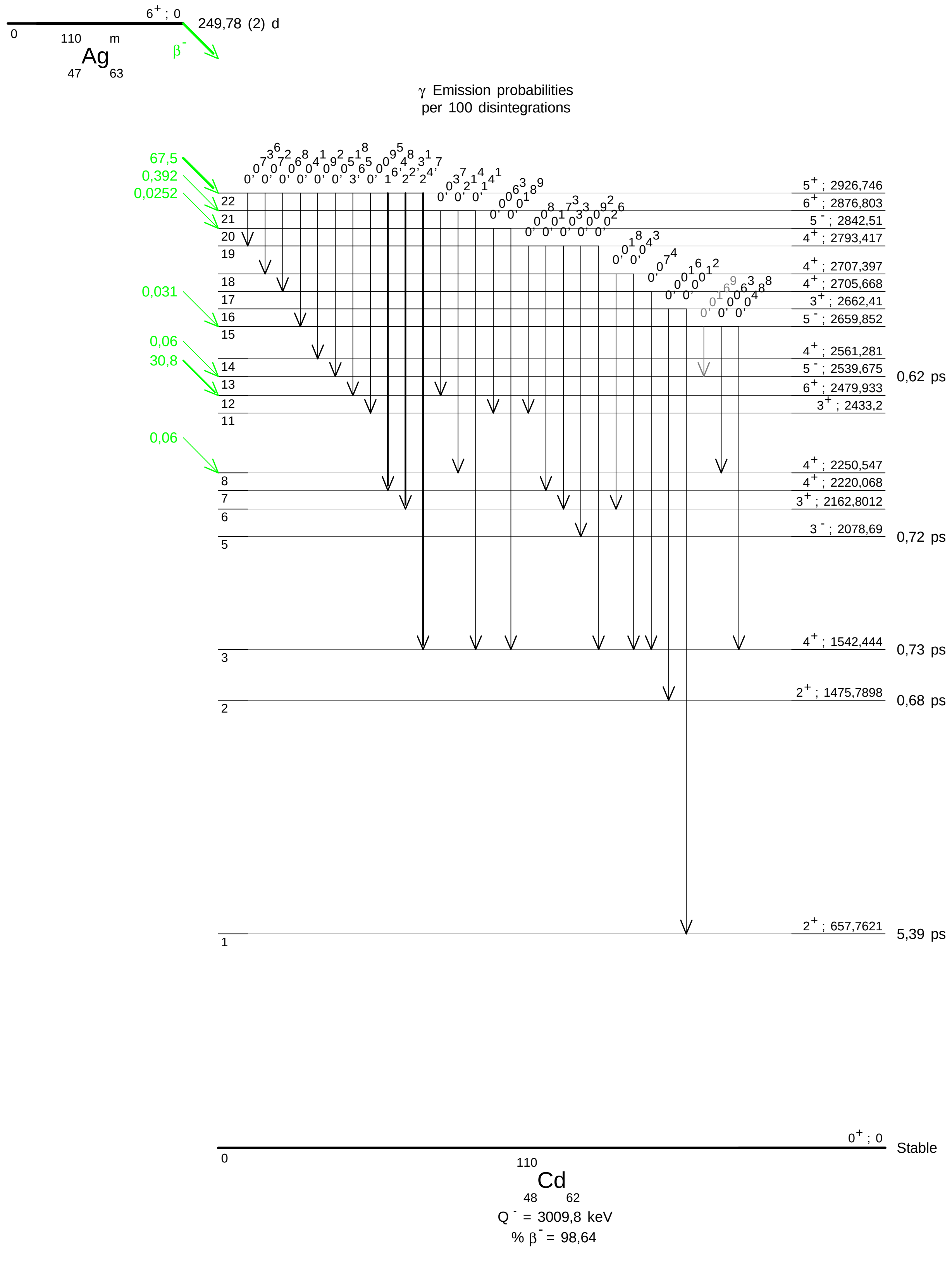
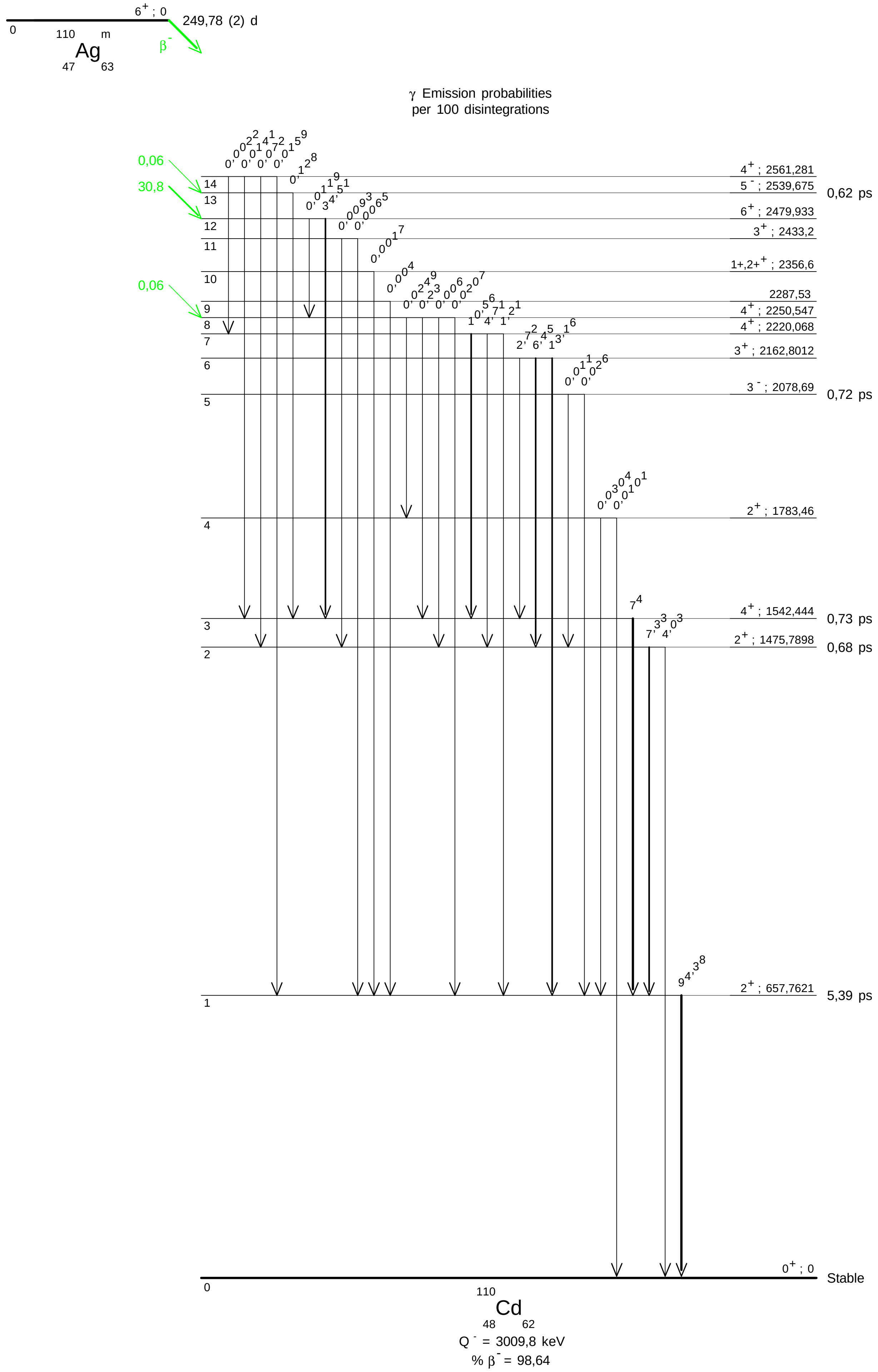
  (Jp, multipolarities, mixing ratio)


γ Emission probabilities
per 100 disintegrations
0,008
6+ ; 117,59
249,78 d
2
2- ; 1,113
660 ns
1
0+ ; 0
24,56 (11) s
0
110
Ag
47
63
QIT = 117,59 keV
% IT = 1,36



6+ ; 0
249,78 (2) d
0
110 m
Ag
47 63
β-
γ Emission probabilities
per 100 disintegrations
67,5
0,392
0,0252
0,031
0,06
30,8
0,06
5+ ; 2926,746
6+ ; 2876,803
5- ; 2842,51
4+ ; 2793,417
4+ ; 2707,397
4+ ; 2705,668
3+ ; 2662,41
5- ; 2659,852
4+ ; 2561,281
5- ; 2539,675
0,62 ps
6+ ; 2479,933
3+ ; 2433,2
4+ ; 2250,547
4+ ; 2220,068
3+ ; 2162,8012
3- ; 2078,69
0,72 ps
4+ ; 1542,444
0,73 ps
2+ ; 1475,7898
0,68 ps
2+ ; 657,7621
5,39 ps
0+ ; 0
Stable
110
Cd
48 62
Q- = 3009,8 keV
% β- = 98,64


6+ ; 0
249,78 (2) d
110 m Ag 47 63
β-
γ Emission probabilities
per 100 disintegrations
0,06
30,8
0,06
4+ ; 2561,281
5- ; 2539,675
0,62 ps
6+ ; 2479,933
3+ ; 2433,2
1+,2++ ; 2356,6
2287,53
4+ ; 2250,547
4+ ; 2220,068
3+ ; 2162,8012
3- ; 2078,69
0,72 ps
2+ ; 1783,46
4+ ; 1542,444
0,73 ps
2+ ; 1475,7898
0,68 ps
2+ ; 657,7621
5,39 ps
0+ ; 0
Stable
110 Cd 48 62
Q- = 3009,8 keV
% β- = 98,64

$^{123}_{53}I_{70}$

1 Decay Scheme

I-123 disintegrates by electron capture mainly via the 159 keV level of Te-123 (97%).
L' iode123 se désintègre par capture électronique principalement vers le niveau excité de 159 keV du tellure 123, avec une probabilité de 97%.

2 Nuclear Data

$T_{1/2}(^{123}I)$	:	13,2234	(37)	h
$T_{1/2}(^{123}Te)$	:	12		10^{12} a
$Q^+(^{123}I)$	:	1234	(3)	keV

2.1 Electron Capture Transitions

	Energy keV	Probability × 100	Nature	lg ft	P_K	P_L	P_M
$\epsilon_{0,13}$	165,8 (30)	0,0079 (4)	Allowed	7,59	0,8082 (21)	0,1503 (15)	0,0336 (7)
$\epsilon_{0,12}$	197,4 (30)	0,0025 (9)	Allowed	8,27	0,8182 (18)	0,1427 (13)	0,0316 (6)
$\epsilon_{0,11}$	237,9 (30)	0,0035 (3)	1st Forbidden	8,31	0,8266 (16)	0,1363 (12)	0,0300 (6)
$\epsilon_{0,10}$	339,3 (30)	0,0744 (13)	Allowed	7,32	0,8377 (15)	0,1283 (11)	0,0278 (5)
$\epsilon_{0,9}$	450,4 (30)	0,1461 (20)	Allowed	7,29	0,8436 (14)	0,1237 (10)	0,0267 (5)
$\epsilon_{0,8}$	464,7 (30)	0,0037 (6)	Allowed	8,92	0,8441 (14)	0,1233 (10)	0,0266 (5)
$\epsilon_{0,7}$	536,5 (30)	0,419 (13)	Allowed	6,98	0,8464 (14)	0,1216 (10)	0,0262 (5)
$\epsilon_{0,6}$	546 (3)	1,40 (12)	Allowed	6,49	0,8466 (14)	0,1214 (10)	0,0261 (5)
$\epsilon_{0,4}$	728,7 (30)	0,349 (42)	Allowed	7,35	0,8501 (14)	0,1187 (10)	0,0254 (5)
$\epsilon_{0,3}$	744,3 (30)	0,0025 (10)	Allowed	9,52	0,8503 (14)	0,1186 (10)	0,0254 (5)
$\epsilon_{0,2}$	794 (3)	0,419 (5)	Allowed	7,35	0,8510 (14)	0,1181 (10)	0,0253 (5)
$\epsilon_{0,1}$	1075 (3)	97,18 (32)	Allowed	5,26	0,8533 (14)	0,1163 (10)	0,0248 (5)

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_T
$\gamma_{1,0}$(Te)	158,99 (5)	99,22 (30)	M1 + 1,22%E2	0,1648 (16)	0,02160 (22)	0,1918 (19)
$\gamma_{13,10}$(Te)	174,2 (3)	0,00099 (30)	M1 + 50% E2	0,159 (32)	0,029 (12)	0,195 (47)
$\gamma_{6,4}$(Te)	182,61 (8)	0,021 (6)	M1 + 50% E2	0,138 (24)	0,024 (10)	0,168 (38)
$\gamma_{7,4}$(Te)	192,18 (9)	0,0227 (10)	M1 + 50% E2	0,118 (20)	0,020 (8)	0,143 (30)
$\gamma_{10,7}$(Te)	197,22 (11)	0,00037 (19)	M1 + 50% E2	0,109 (18)	0,018 (7)	0,132 (26)
$\gamma_{6,3}$(Te)	198,25 (12)	0,0040 (8)	M1 + 50% E2	0,107 (17)	0,018 (7)	0,130 (26)
$\gamma_{10,6}$(Te)	206,79 (10)	0,0037 (9)	M1 + 50% E2	0,094 (14)	0,016 (5)	0,114 (21)
$\gamma_{7,3}$(Te)	207,82 (13)	0,00125 (36)	M1 + 50% E2	0,093 (14)	0,015 (5)	0,119 (20)
$\gamma_{6,2}$(Te)	247,96 (8)	0,0743 (25)	M1 + 50% E2	0,054 (5)	0,0084 (21)	0,065 (8)
$\gamma_{7,2}$(Te)	257,52 (9)	0,0017 (2)	E2	0,0526 (16)	0,00917 (27)	0,0640 (19)
$\gamma_{9,4}$(Te)	278,26 (8)	0,0024 (4)	M1 + 50% E2	0,0387 (22)	0,0058 (11)	0,0459 (36)
$\gamma_{2,1}$(Te)	281,03 (7)	0,0822 (10)	M1 + 13,2% E2	0,0362 (20)	0,0048 (11)	0,0422 (33)
$\gamma_{10,5}$(Te)	295,17 (21)	0,001582 (4)				
$\gamma_{8,2}$(Te)	329,38 (18)	0,0026 (6)				
$\gamma_{3,1}$(Te)	330,71 (11)	0,01197 (34)	E2	0,0237 (7)	0,00376 (11)	0,0284 (9)
$\gamma_{9,2}$(Te)	343,73 (8)	0,0044 (3)				
$\gamma_{4,1}$(Te)	346,35 (7)	0,1287 (9)	M1 + 0,49% E2	0,02080 (14)	0,00262 (29)	0,02407 (23)
$\gamma_{10,3}$(Te)	405,04 (14)	0,00298 (23)				
$\gamma_{12,5}$(Te)	437,5 (3)	0,0007 (7)				
$\gamma_{2,0}$(Te)	440,02 (5)	0,4280 (44)	M1 + 81,5% E2	0,0103 (7)	0,001452 (18)	0,0121 (7)
$\gamma_{10,2}$(Te)	454,76 (15)	0,00412 (22)				
$\gamma_{4,0}$(Te)	505,34 (6)	0,268 (42)	M1 + 1% E2	0,0081 (7)	0,001063 (27)	0,0093 (7)
$\gamma_{6,1}$(Te)	528,96 (7)	1,28 (12)				
$\gamma_{7,1}$(Te)	538,54 (8)	0,393 (13)	E2 + 50% M3	0,032 (26)	0,0049 (41)	0,038 (31)
$\gamma_{11,2}$(Te)	556,06 (16)	0,0029 (3)				
$\gamma_{13,4}$(Te)	562,84 (12)	0,00115 (7)				
$\gamma_{13,3}$(Te)	578,48 (20)	0,00126 (8)				
$\gamma_{5,0}$(Te)	599,69 (16)	0,00266 (17)				
$\gamma_{8,1}$(Te)	610,27 (23)	0,0011 (3)				
$\gamma_{9,1}$(Te)	624,61 (7)	0,0802 (20)	M1 + 62,8% E2	0,0042 (5)	0,000549 (40)	0,0049 (6)
$\gamma_{13,2}$(Te)	628,26 (22)	0,00164 (14)				
$\gamma_{6,0}$(Te)	687,95 (10)	0,0269 (6)				
$\gamma_{10,1}$(Te)	735,78 (9)	0,0616 (8)				
$\gamma_{9,0}$(Te)	783,62 (6)	0,0591 (11)				
$\gamma_{11,1}$(Te)	837,1 (2)	0,000582 (8)				
$\gamma_{12,1}$(Te)	877,65 (17)	0,00083 (7)				
$\gamma_{10,0}$(Te)	894,8 (2)	0,00101 (7)				
$\gamma_{13,1}$(Te)	909,19 (12)	0,00141 (8)				
$\gamma_{12,0}$(Te)	1036,64 (17)	0,00097 (7)				
$\gamma_{13,0}$(Te)	1068,18 (15)	0,00142 (7)				

3 Atomic Data

3.1 Te

ω_K	:	0,875	(4)
$\bar{\omega}_L$	:	0,0862	(35)
n_{KL}	:	0,917	(4)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	27,202		53,7
	$K\alpha_1$	27,4726		100
	$K\beta_3$	30,9446	}	
	$K\beta_1$	30,996	}	
	$K\beta_5''$	31,236	}	28,6
	$K\beta_5'$	31,241	}	
	$K\beta_2$	31,7008	}	
	$K\beta_4$	31,774	}	6,2
	$KO_{2,3}$	31,812	}	
X_L				
	$L\ell$	3,336		
	$L\alpha$	3,76 – 3,77		
	$L\eta$	3,606		
	$L\beta$	4,02 – 4,37		
	$L\gamma$	4,44 – 4,82		

3.1.2 Auger Electrons

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

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Te)	2,3 - 4,8		95,3 (6)
e_{AK}	(Te)			12,4 (4)
	KLL	21,804 - 22,989	}	
	KLX	25,814 - 27,470	}	
	KXY	29,80 - 31,81	}	
$ec_{1,0\ K}$	(Te)	127,176 (5)		13,72 (14)
$ec_{1,0\ L}$	(Te)	154,051 - 154,649		1,798 (19)

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Te)	3,336 — 4,82		9,0 (4)	
$XK\alpha_2$	(Te)	27,202		24,69 (20)	} $K\alpha$
$XK\alpha_1$	(Te)	27,4726		45,98 (29)	}
$XK\beta_3$	(Te)	30,9446	}		
$XK\beta_1$	(Te)	30,996	}	13,16 (17)	$K'\beta_1$
$XK\beta_5''$	(Te)	31,236	}		
$XK\beta_5'$	(Te)	31,241	}		
$XK\beta_2$	(Te)	31,7008	}		
$XK\beta_4$	(Te)	31,774	}	2,86 (8)	$K'\beta_2$
$XKO_{2,3}$	(Te)	31,812	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Te)	158,97 (5)	83,25 (21)
$\gamma_{13,10}$(Te)	174,2 (3)	0,00083 (25)

	Energy keV	Photons per 100 disint.
$\gamma_{6,4}$(Te)	182,61 (6)	0,018 (5)
$\gamma_{7,4}$(Te)	192,17 (7)	0,0199 (7)
$\gamma_{10,7}$(Te)	197,22	0,00033 (17)
$\gamma_{6,3}$(Te)	198,23	0,0035 (7)
$\gamma_{10,6}$(Te)	206,79	0,0033 (8)
$\gamma_{7,3}$(Te)	207,8	0,00112 (32)
$\gamma_{6,2}$(Te)	247,96 (5)	0,0698 (23)
$\gamma_{7,2}$(Te)	257,51 (15)	0,0016 (2)
$\gamma_{9,4}$(Te)	278,36 (12)	0,0023 (4)
$\gamma_{2,1}$(Te)	281,03 (5)	0,0789 (9)
$\gamma_{10,5}$(Te)	295,17	0,001582 (4)
$\gamma_{8,2}$(Te)	329,38 (17)	0,0026 (6)
$\gamma_{3,1}$(Te)	330,70 (8)	0,01164 (33)
$\gamma_{9,2}$(Te)	343,73 (14)	0,0044 (3)
$\gamma_{4,1}$(Te)	346,35 (5)	0,1257 (9)
$\gamma_{10,3}$(Te)	405,02 (13)	0,00298 (23)
$\gamma_{12,5}$(Te)	437,5 (3)	0,0007 (7)
$\gamma_{2,0}$(Te)	440,02 (5)	0,4229 (43)
$\gamma_{10,2}$(Te)	454,76 (15)	0,00412 (22)
$\gamma_{4,0}$(Te)	505,33 (5)	0,266 (42)
$\gamma_{6,1}$(Te)	528,96 (5)	1,28 (12)
$\gamma_{7,1}$(Te)	538,54 (5)	0,3788 (43)
$\gamma_{11,2}$(Te)	556,05 (13)	0,0029 (3)
$\gamma_{13,4}$(Te)	562,79 (12)	0,00115 (7)
$\gamma_{13,3}$(Te)	578,26 (20)	0,00126 (8)
$\gamma_{5,0}$(Te)	599,69 (16)	0,00266 (17)
$\gamma_{8,1}$(Te)	610,05 (23)	0,0011 (3)
$\gamma_{9,1}$(Te)	624,57 (5)	0,0798 (20)
$\gamma_{13,2}$(Te)	628,26 (22)	0,00164 (14)
$\gamma_{6,0}$(Te)	687,95 (10)	0,0269 (6)
$\gamma_{10,1}$(Te)	735,78 (7)	0,0616 (8)
$\gamma_{9,0}$(Te)	783,59 (6)	0,0591 (11)
$\gamma_{11,1}$(Te)	837,1 (2)	0,000582 (8)
$\gamma_{12,1}$(Te)	877,52 (17)	0,00083 (7)
$\gamma_{10,0}$(Te)	894,8 (2)	0,00101 (7)
$\gamma_{13,1}$(Te)	909,12 (12)	0,00141 (8)
$\gamma_{12,0}$(Te)	1036,63 (17)	0,00097 (7)
$\gamma_{13,0}$(Te)	1068,12 (15)	0,00142 (7)

6 Main Production Modes

Sb – 121(α,2n)I – 123
Possible impurities : I – 121, I – 124, I – 125, I – 126

I – 127(p,5n)Xe – 123
Te – 124(p,2n)I – 123
Possible impurities : I – 124, I – 126, I – 125

Te – 123(p,n)I – 123
Possible impurities : I – 124, I – 126, I – 130, I – 125

Te – 122(α,3n)Xe – 123
Possible impurities : I – 125

Te – 123(He – 3,3n)Xe – 123
Possible impurities : I – 125

Te – 124(He – 3,4n)Xe – 123
Possible impurities : I – 125

Te – 122(d,n)I – 123
Possible impurities : I – 124, I – 126, I – 131, I – 125

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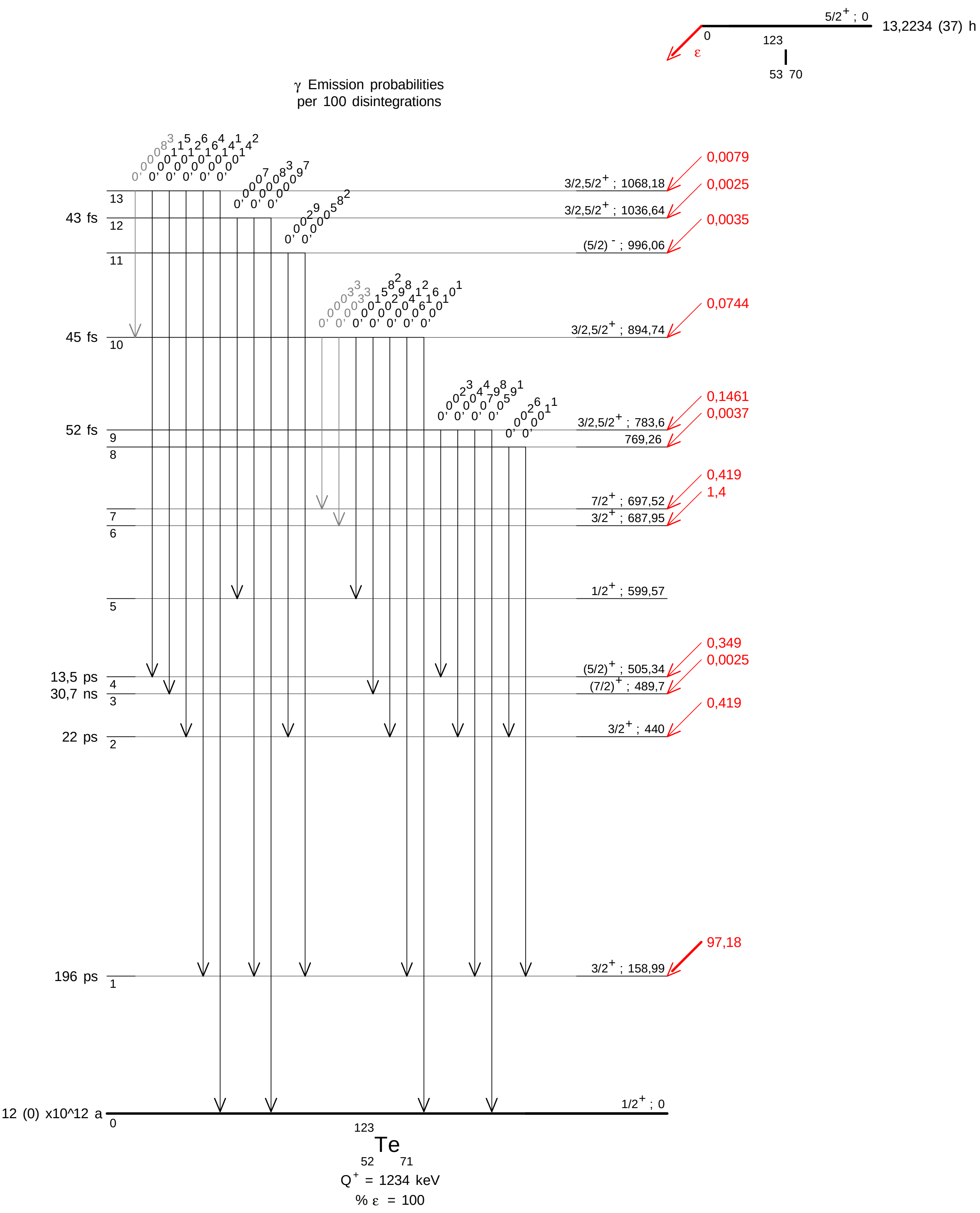
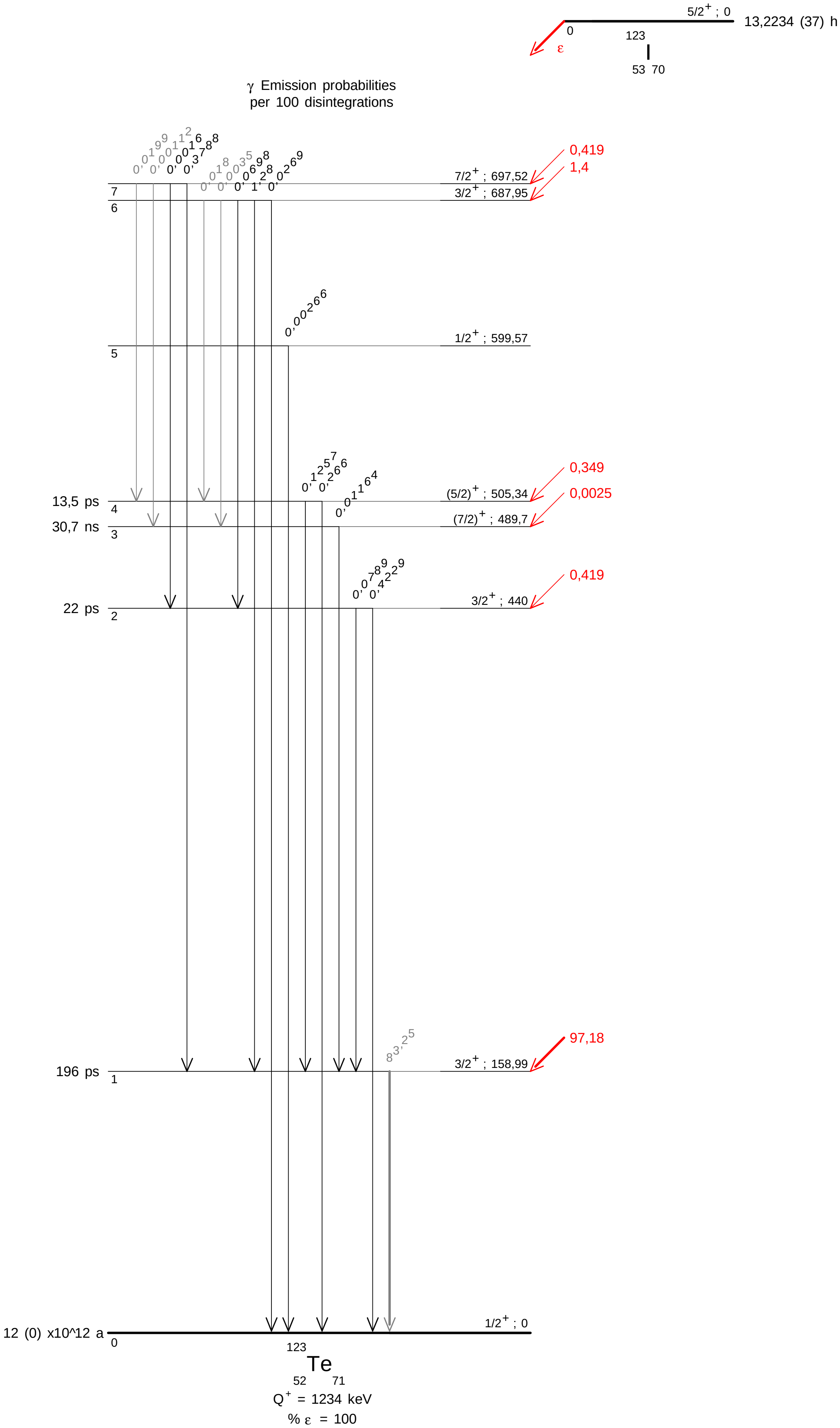

5/2+ ; 0
13,2234 (37) h
0
ε
123
53 70
γ Emission probabilities
per 100 disintegrations
3/2,5/2+ ; 1068,18
0,0079
3/2,5/2+ ; 1036,64
0,0025
(5/2) - ; 996,06
0,0035
3/2,5/2+ ; 894,74
0,0744
3/2,5/2+ ; 783,6
0,1461
769,26
0,0037
7/2+ ; 697,52
0,419
3/2+ ; 687,95
1,4
1/2+ ; 599,57
(5/2)+ ; 505,34
0,349
(7/2)+ ; 489,7
0,0025
3/2+ ; 440
0,419
3/2+ ; 158,99
97,18
1/2+ ; 0
43 fs
45 fs
52 fs
13,5 ps
30,7 ns
22 ps
196 ps
12 (0) x10^12 a
13
12
11
10
9
8
7
6
5
4
3
2
1
0
123
Te
52 71
Q+ = 1234 keV
% ε = 100


5/2+ ; 0
13,2234 (37) h
ε
123
53 70
γ Emission probabilities
per 100 disintegrations
7/2+ ; 697,52
3/2+ ; 687,95
0,419
1,4
1/2+ ; 599,57
13,5 ps
30,7 ns
(5/2)+ ; 505,34
(7/2)+ ; 489,7
0,349
0,0025
22 ps
3/2+ ; 440
0,419
196 ps
3/2+ ; 158,99
97,18
12 (0) x10^12 a
1/2+ ; 0
123
Te
52 71
Q+ = 1234 keV
% ε = 100

123		m
52	**Te**	71

1 Decay Scheme

Te-123m decays via two successive gamma transitions.
A gamma transition with a small probability and an energy of 247 keV has been observed.
Te-123m se désintègre via deux transitions gamma en cascade. Une transition de 247 keV et de faible probabilité a été observée.

2 Nuclear Data

$T_{1/2}(^{123}\mathrm{Te}^{m})$	:	119,3	(1)	d
$T_{1/2}(^{123}\mathrm{Te})$	:	12		10^{12} a

2.1 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{2,1}$(Te)	88,46 (7)	100,0 (1)	M4	463 (14)	493 (15)	118,0 (35)	1099 (33)
$\gamma_{1,0}$(Te)	158,99 (5)	100,0 (1)	M1+1,22%E2	0,1648 (16)	0,02160 (22)	0,00433 (13)	0,1918 (19)
$\gamma_{2,0}$(Te)	247,4 (2)	0,0030 (3)	E5	3,0 (1)	3,75 (21)	0,84 (3)	7,75 (30)

3 Atomic Data

3.1 Te

ω_K	:	0,875	(4)
$\bar{\omega}_L$	:	0,0862	(35)
n_{KL}	:	0,917	(4)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	27,202		53,7
	$K\alpha_1$	27,4726		100
	$K\beta_3$	30,9446	}	
	$K\beta_1$	30,996	}	
	$K\beta_5''$	31,236	}	28,6
	$K\beta_5'$	31,241	}	
	$K\beta_2$	31,7008	}	
	$K\beta_4$	31,774	}	6,2
	$KO_{2,3}$	31,812	}	
X_L				
	$L\ell$	3,336		
	$L\alpha$	3,76 – 3,77		
	$L\eta$	3,606		
	$L\beta$	4,02 – 4,37		
	$L\gamma$	4,44 – 4,82		

3.1.2 Auger Electrons

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

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Te)	2,3 - 4,8		89,7 (7)
e_{AK}	(Te)			7,0 (4)
	KLL	21,804 - 22,989	}	
	KLX	25,814 - 27,470	}	
	KXY	29,80 - 31,81	}	
$ec_{2,1\ K}$	(Te)	56,65 (7)		42,1 (18)
$ec_{2,1\ L}$	(Te)	83,52 - 84,12		44,8 (19)
$ec_{2,1\ M}$	(Te)	87,45 - 87,89		10,73 (45)
$ec_{2,1\ N}$	(Te)	88,29 - 88,42		2,07 (9)
$ec_{1,0\ K}$	(Te)	127,18 (5)		13,84 (14)
$ec_{1,0\ L}$	(Te)	154,05 - 154,69		1,81 (2)
$ec_{1,0\ M}$	(Te)	157,98 - 158,42		0,364 (11)
$ec_{1,0\ N}$	(Te)	158,82 - 158,95		0,0769 (23)

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Te)	3,336 — 4,82		8,25 (21)	
$XK\alpha_2$	(Te)	27,202		13,9 (5)	} $K\alpha$
$XK\alpha_1$	(Te)	27,4726		26,0 (9)	}
$XK\beta_3$	(Te)	30,9446	}		
$XK\beta_1$	(Te)	30,996	}	7,43 (26)	$K'\beta_1$
$XK\beta_5''$	(Te)	31,236	}		
$XK\beta_5'$	(Te)	31,241	}		
$XK\beta_2$	(Te)	31,7008	}		
$XK\beta_4$	(Te)	31,774	}	1,61 (7)	$K'\beta_2$
$XKO_{2,3}$	(Te)	31,812	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{2,1}$(Te)	88,46 (7)	0,0909 (27)
$\gamma_{1,0}$(Te)	158,97 (5)	83,99 (8)
$\gamma_{2,0}$(Te)	247,4 (2)	0,000344 (34)

6 Main Production Modes

Te – 122(n,γ)Te – 123m   σ : 3,4 (5) barns
Possible impurities : Te – 121,Te – 125m,Te – 129m

Sb – 123(p,n)Te – 123m
Possible impurities : Te – 121,Te – 121m

Sb – 123(d,2n)Te – 123m
Possible impurities : Te – 121,Te – 121m

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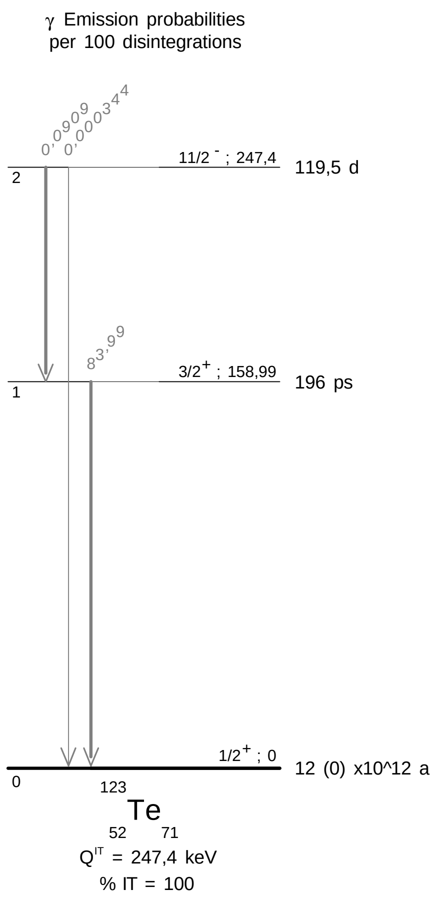
γ Emission probabilities
per 100 disintegrations
0,0909
0,000344
83,99
11/2 - ; 247,4
119,5 d
2
3/2+ ; 158,99
196 ps
1
1/2+ ; 0
12 (0) x10^12 a
0
123
Te
52
71
QIT = 247,4 keV
% IT = 100

$^{125}_{51}$Sb $_{74}$

1 Decay Scheme

Sb-125 decays by beta minus emission to levels in Te-125. The percentage of disintegrations to the Te-125m (T1/2 : 57 d) is p = (23.9 (9))%.
L'antimoine 125 se désintègre par émissions bêta moins vers des niveaux excités de tellure 125. Le pourcentage de désintégrations conduisant à l'isomère de Te-125 de 57 jours de période est p = (23,9 (9)) % . Le rapport au temps t des activités Te-125m / Sb-125 dans le Sb-125 initialement pur est :
$p \times T1/(T1 - T2) \times (1 - \exp^{-\lg 2 \times t \times (T1-T2)/(T1T2)})$
T1 et T2 étant respectivement les périodes de Sb-125 et Te-125m.
Pour t > 1,6 a, ce qui correspond à dix fois la période de Te-125m, ce rapport est égal à :
$p \times T1/(T1 - T2) = 0{,}253(10)$
avec p = 0,239 (9).

2 Nuclear Data

$T_{1/2}(^{125}\text{Sb})$	:	2,75855	(25)	a
$Q^-(^{125}\text{Sb})$	:	766,7	(21)	keV

2.1 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,12}$	95,3 (21)	13,42 (15)	Allowed	6,93
$\beta^-_{0,10}$	124,5 (21)	5,75 (6)	Allowed	7,66
$\beta^-_{0,9}$	130,6 (21)	17,95 (22)	Allowed	7,23
$\beta^-_{0,7}$	241,5 (21)	1,585 (24)	1st forbidden	9,12
$\beta^-_{0,6}$	303,3 (21)	39,8 (4)	Allowed	8,04
$\beta^-_{0,5}$	323,1 (21)	0,087 (10)	2nd forbidden	11,06
$\beta^-_{0,3}$	444,0 (21)	7,1 (1)	1st forbidden	934
$\beta^-_{0,2}$	621,0 (21)	15,2 (9)	Unique 1st forbidden	9,77

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{6,5}$(Te)	19,80 (6)	0,2448 (5)	[M1]		9,1 (3)	1,82 (5)	11,3 (3)
$\gamma_{1,0}$(Te)	35,489 (5)	89,4 (26)	M1+E2	12,1 (4)	1,64 (5)	0,329 (10)	14,3 (4)
$\gamma_{2,1}$(Te)	109,276 (15)	24,6375 (14)	M4	186 (5)	138 (4)	32,3 (9)	364 (11)
$\gamma_{9,7}$(Te)	110,895 (12)	0,00124 (9)	[E1]	0,127 (4)	0,0165 (5)	0,00328 (11)	0,147 (4)
$\gamma_{10,7}$(Te)	116,955 (11)	0,293 (4)	E1	0,109 (3)	0,0141 (4)	0,00281 (8)	0,127 (4)
$\gamma_{9,6}$(Te)	172,719 (8)	0,219 (9)	M1	0,129 (4)	0,0168 (5)	0,00337 (11)	0,151 (5)
$\gamma_{3,2}$(Te)	176,314 (2)	7,87 (8)	M1+E2	0,139 (4)	0,0221 (7)	0,00449 (13)	0,167 (5)
$\gamma_{10,6}$(Te)	178,842 (5)	0,0400 (15)	M1+E2	0,147 (26)	0,026 (11)	0,0054 (21)	0,18 (4)
$\gamma_{10,5}$(Te)	198,654 (11)	0,0151 (7)	[E2]	0,123 (4)	0,0245 (8)	0,00504 (15)	0,154 (5)
$\gamma_{7,3}$(Te)	204,138 (10)	0,350 (15)	M1+E2	0,104 (3)	0,0189 (6)	0,00386 (11)	0,128 (4)
$\gamma_{12,6}$(Te)	208,077 (5)	0,265 (8)	M1+E2	0,0791 (24)	0,0102 (3)	0,00205 (6)	0,092 (3)
$\gamma_{12,5}$(Te)	227,891 (10)	0,140 (3)	M1+E2	0,070 (11)	0,011 (4)	0,0023 (6)	0,084 (13)
$\gamma_{9,3}$(Te)	314,95 (11)	0,0042 (3)	(E1)	0,00726 (22)	0,00089 (3)		0,00839 (30)
$\gamma_{10,3}$(Te)	321,040 (4)	0,414 (5)	E1	0,00691 (21)	0,000856 (30)		0,00798 (24)
$\gamma_{7,2}$(Te)	380,452 (8)	1,5295 (15)	E2	0,0154 (5)	0,00233 (7)	0,000473 (15)	0,0183 (5)
$\gamma_{5,1}$(Te)	408,065 (10)	0,1829 (24)	M1+E2	0,01290 (4)	0,00181 (5)	0,00036 (1)	0,0152 (5)
$\gamma_{6,1}$(Te)	427,874 (4)	29,6 (3)	M1+E2	0,0119 (4)	0,00154 (5)	0,00031 (1)	0,0138 (4)
$\gamma_{5,0}$(Te)	443,555 (9)	0,306 (4)	M1+E2	0,0100 (3)	0,00142 (4)	0,00029 (1)	0,0118 (4)
$\gamma_{6,0}$(Te)	463,365 (4)	10,47 (10)	E2	0,0086 (3)	0,00124 (4)	0,00025 (1)	0,0102 (3)
$\gamma_{10,2}$(Te)	497,37 (12)	0,0033 (3)	[M2]	0,0271 (8)	0,00373 (11)	0,00075 (2)	0,0318 (10)
$\gamma_{9,1}$(Te)	600,599 (2)	17,64 (21)	E2	0,00421 (13)	0,00058 (2)		0,00498 (15)
$\gamma_{10,1}$(Te)	606,715 (3)	4,98 (5)	E2	0,00415 (13)	0,00056 (2)		0,00485 (15)
$\gamma_{12,1}$(Te)	635,950 (3)	11,25 (12)	M1+E2	0,00455 (14)	0,00057 (2)		0,00526 (16)
$\gamma_{12,0}$(Te)	671,443 (6)	1,770 (19)	E2	0,00319 (10)	0,00043 (1)		0,00373 (11)

3 Atomic Data

3.1 Te

ω_K : 0,875 (4)
$\bar{\omega}_L$: 0,0862 (35)
n_{KL} : 0,917 (4)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	27,202		53,7
	$K\alpha_1$	27,473		100
	$K\beta_3$	30,945	}	
	$K\beta_1$	30,996	}	
	$K\beta_5''$	31,236	}	28,6
	$K\beta_2$	31,701	}	
	$K\beta_4$	31,774	}	6,2

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	21,804 – 22,989	100
KLX	25,814 – 27,470	45,5
KXY	29,80 – 31,81	5,1

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AK}	(Te)			0,098 (5)
	KLL	21,804 - 22,989	}	
	KLX	25,814 - 27,470	}	
	KXY	29,80 - 31,81	}	
$ec_{1,0\ T}$	(Te)	3,675 - 35,379		84 (3)
$ec_{1,0\ K}$	(Te)	3,675 (5)		71 (3)
$ec_{6,5\ L}$	(Te)	14,86 - 15,46		0,180 (7)
$ec_{1,0\ L}$	(Te)	30,550 - 31,148		9,6 (4)
$ec_{1,0\ M}$	(Te)	34,483 - 34,670		1,93 (9)
$ec_{1,0\ N}$	(Te)	35,321 - 35,379		0,406 (16)
$ec_{2,1\ K}$	(Te)	77,462 (15)		12,6 (5)
$ec_{2,1\ T}$	(Te)	77,462 - 109,166		24,6 (9)
$ec_{2,1\ L}$	(Te)	104,337 - 104,935		9,3 (5)
$ec_{2,1\ M}$	(Te)	108,270 - 108,457		2,18 (8)
$ec_{2,1\ N}$	(Te)	109,108 - 109,166		0,451 (18)
$ec_{3,2\ K}$	(Te)	144,500 (2)		0,94 (4)
$ec_{3,2\ L}$	(Te)	171,375 - 171,973		0,149 (6)
$ec_{6,1\ K}$	(Te)	396,060 (4)		0,347 (14)
$ec_{6,0\ K}$	(Te)	431,551 (4)		0,090 (4)
$ec_{9,1\ K}$	(Te)	568,783 (2)		0,074 (3)
$ec_{12,1\ K}$	(Te)	604,136 (3)		0,051 (2)
$\beta^-_{0,12}$	max:	95,3 (21)		13,42 (15)
$\beta^-_{0,12}$	avg:	24,9 (6)		
$\beta^-_{0,10}$	max:	124,5 (21)		5,75 (6)
$\beta^-_{0,10}$	avg:	33,0 (6)		
$\beta^-_{0,9}$	max:	130,6 (21)		17,95 (22)
$\beta^-_{0,9}$	avg:	34,7 (6)		
$\beta^-_{0,7}$	max:	241,5 (21)		1,585 (24)
$\beta^-_{0,7}$	avg:	67,5 (7)		
$\beta^-_{0,6}$	max:	303,3 (21)		39,8 (4)

		Energy keV		Electrons per 100 disint.
$\beta^-_{0,6}$	avg:	86,9	(7)	
$\beta^-_{0,5}$	max:	323,1	(21)	0,087 (10)
$\beta^-_{0,5}$	avg:	93,3	(7)	
$\beta^-_{0,3}$	max:	444,0	(21)	7,1 (1)
$\beta^-_{0,3}$	avg:	134,5	(8)	
$\beta^-_{0,2}$	max:	621,0	(21)	15,2 (9)
$\beta^-_{0,2}$	avg:	215,5	(8)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
$XK\alpha_2$	(Te)	27,202		19,5 (6)	} $K\alpha$
$XK\alpha_1$	(Te)	27,473		36,3 (11)	}
$XK\beta_3$	(Te)	30,945	}		
$XK\beta_1$	(Te)	30,996	}	10,4 (4)	$K'\beta_1$
$XK\beta''_5$	(Te)	31,236	}		
$XK\beta_2$	(Te)	31,701	}		
$XK\beta_4$	(Te)	31,774	}	2,26 (9)	$K'\beta_2$

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{6,5}$(Te)	19,80 (6)	0,0199 (5)
$\gamma_{1,0}$(Te)	35,489 (5)	5,84 (8)
$\gamma_{2,1}$(Te)	109,276 (15)	0,0675 (14)
$\gamma_{9,7}$(Te)	110,895 (12)	0,00108 (9)
$\gamma_{10,7}$(Te)	116,955 (11)	0,260 (4)
$\gamma_{9,6}$(Te)	172,719 (8)	0,190 (9)
$\gamma_{3,2}$(Te)	176,314 (2)	6,74 (8)
$\gamma_{10,6}$(Te)	178,842 (5)	0,0339 (15)
$\gamma_{10,5}$(Te)	198,654 (11)	0,0131 (7)
$\gamma_{7,3}$(Te)	204,138 (10)	0,310 (15)
$\gamma_{12,6}$(Te)	208,077 (5)	0,243 (8)

	Energy keV	Photons per 100 disint.
$\gamma_{12,5}$(Te)	227,891 (10)	0,129 (3)
$\gamma_{9,3}$(Te)	314,95 (11)	0,0042 (3)
$\gamma_{10,3}$(Te)	321,040 (4)	0,411 (5)
$\gamma_{7,2}$(Te)	380,452 (8)	1,5020 (15)
$\gamma_{5,1}$(Te)	408,065 (10)	0,1802 (24)
$\gamma_{6,1}$(Te)	427,874 (4)	29,2 (3)
$\gamma_{5,0}$(Te)	443,555 (9)	0,302 (4)
$\gamma_{6,0}$(Te)	463,365 (4)	10,36 (10)
$\gamma_{10,2}$(Te)	497,37 (12)	0,0032 (3)
$\gamma_{9,1}$(Te)	600,597 (2)	17,55 (21)
$\gamma_{10,1}$(Te)	606,713 (3)	4,96 (5)
$\gamma_{12,1}$(Te)	635,950 (3)	11,19 (12)
$\gamma_{12,0}$(Te)	671,441 (6)	1,763 (19)

6 Main Production Modes

Sn – 124(n,γ)Sn – 125m σ : 0,130 (5) barns

Sn – 125m(β^-)Sb – 125
Possible impurities : Half – life = 9,7 min

Sn – 124(n,γ)Sn – 125 σ : 0,004 (2) barns
Possible impurities : Half – life = 9,5 d

Sn – 125(β^-)Sb – 125
Possible impurities : Sn – 113, Sn – 117m, Sn – 119m, Sn – 121m, Sn – 123m, Sn – 125

Fission product
Possible impurities : Sb – 121m, Sn – 125

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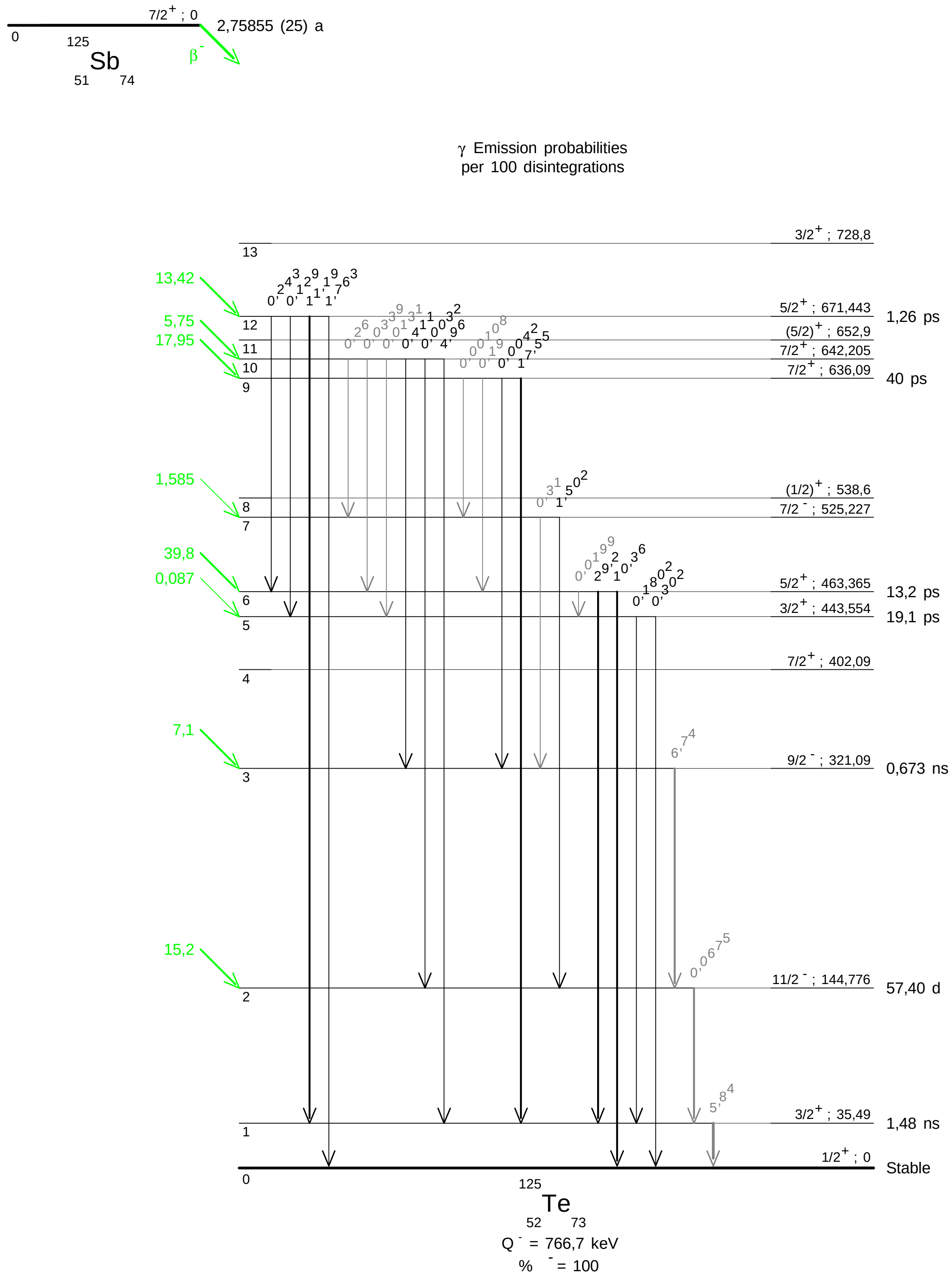
7/2+ ; 0
2,75855 (25) a
125 Sb 51 74
β-
γ Emission probabilities
per 100 disintegrations
3/2+ ; 728,8
5/2+ ; 671,443
(5/2)+ ; 652,9
7/2+ ; 642,205
7/2+ ; 636,09
(1/2)+ ; 538,6
7/2 - ; 525,227
5/2+ ; 463,365
3/2+ ; 443,554
7/2+ ; 402,09
9/2 - ; 321,09
11/2 - ; 144,776
3/2+ ; 35,49
1/2+ ; 0
1,26 ps
40 ps
13,2 ps
19,1 ps
0,673 ns
57,40 d
1,48 ns
Stable
13,42
5,75
17,95
1,585
39,8
0,087
7,1
15,2
125 Te 52 73
Q - = 766,7 keV
% - = 100

$$^{129}_{53}\mathrm{I}_{76}$$

1 Decay Scheme

I-129 disintegrates by 100 % beta minus decay to the excited level of 39.58 keV in Xe-129. The transition to the Xe-129 ground state was not observed.
L'iode 129 se désintègre par émission bêta moins vers le niveau excité de 39,58 keV du xenon 129. La transition vers le niveau fondamental du xenon 129 n'a pas été observée expérimentalement.

2 Nuclear Data

$T_{1/2}(^{129}\mathrm{I})$	:	16,1	(7)	10^6 a
$Q^-(^{129}\mathrm{I})$	:	190,8	(11)	keV

2.1 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,1}$	151,2 (11)	99,5 (5)	2nd Forbidden	13,49
$\beta^-_{0,0}$	190,8 (11)	0,5 (5)	2nd Unique Forbidden	>14,9

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{1,0}$(Xe)	39,578 (4)	99,5 (5)	M1+0,07%E2	10,59 (11)	1,45 (5)	0,296 (10)	12,41 (13)

3 Atomic Data

3.1 Xe

ω_K	:	0,888	(5)
$\bar{\omega}_L$	:	0,097	(5)
n_{KL}	:	0,905	(4)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	29,459		53,98
	$K\alpha_1$	29,779		100
	$K\beta_3$	33,562	}	
	$K\beta_1$	33,625	}	
	$K\beta_5''$	33,881	}	27,7
	$K\beta_2$	34,415	}	
	$K\beta_4$	34,496	}	6,2
	$KO_{2,3}$	34,552	}	
X_L				
	$L\ell$	3,6		
	$L\gamma$	– 5,4		

3.1.2 Auger Electrons

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

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Xe)	2,4 - 5,4		73,9 (12)
e_{AK}	(Xe)			8,8 (4)
	KLL	23,512 - 24,842	}	
	KLX	27,897 - 29,770	}	
	KXY	32,27 - 34,54	}	
$ec_{1,0\ K}$	(Xe)	5,017 (4)		78,6 (12)
$ec_{1,0\ L}$	(Xe)	34,126 - 34,796		10,8 (4)
$ec_{1,0\ M}$	(Xe)	38,43 - 38,90		2,20 (8)
$ec_{1,0\ N}$	(Xe)	39,37 - 39,56		0,55 (1)
$\beta^-_{0,1}$	max:	151,2 (11)		99,5 (5)
$\beta^-_{0,1}$	avg:	37 (1)		
$\beta^-_{0,0}$	max:	190,8 (11)		0,5 (5)

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Xe)	3,6 — 5,4		7,9 (4)	
$XK\alpha_2$	(Xe)	29,459		20,1 (3)	} $K\alpha$
$XK\alpha_1$	(Xe)	29,779		37,2 (6)	}
$XK\beta_3$	(Xe)	33,562	}		
$XK\beta_1$	(Xe)	33,625	}	10,3 (4)	$K'\beta_1$
$XK\beta_5''$	(Xe)	33,881	}		
$XK\beta_2$	(Xe)	34,415	}		
$XK\beta_4$	(Xe)	34,496	}	2,30 (13)	$K'\beta_2$
$XKO_{2,3}$	(Xe)	34,552	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Xe)	39,578 (4)	7,42 (8)

6 Main Production Modes

Fission product
Possible impurities : I – 131, I – 132, I – 133, I – 135

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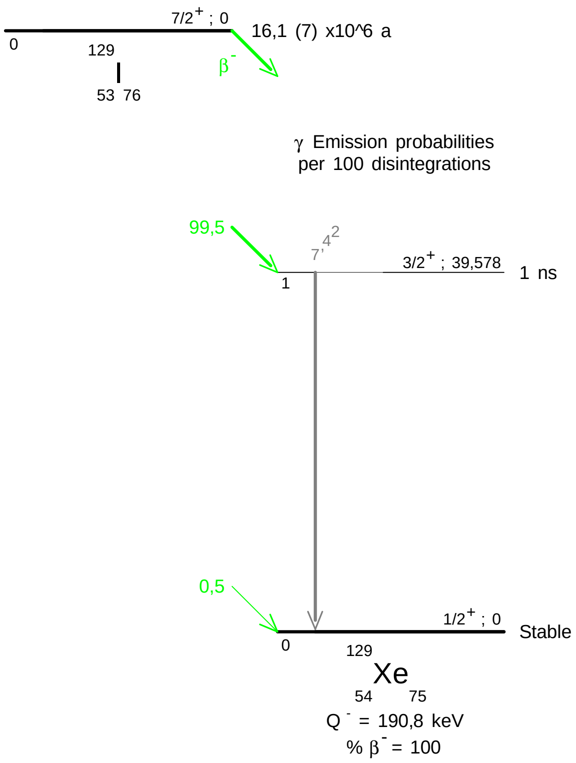
7/2+ ; 0
0
129
I
53 76
16,1 (7) x10^6 a
β-
γ Emission probabilities
per 100 disintegrations
99,5
4
2
7'
3/2+ ; 39,578
1 ns
1
0,5
1/2+ ; 0
Stable
0
129
Xe
54 75
Q - = 190,8 keV
% β- = 100

131	I	
53		78

1 Decay Scheme

L'I-131 se désintègre par émission beta moins vers les niveaux excités de Xe-131, incluant l'isomère Xe-131M de 11,930(16) jours de période. L'état d'équilibre idéal, c'est à dire l'activité de I-131 étant égale à l'activité de Xe-131m, est obtenu après 13,994(1) jours.
I-131 disintegrates through beta minus emission to the excited levels of Xe-131, the isomeric state Xe-131m (half-life = 11.930(16) d) included. The radioactive equilibrium, i.e. the activity of I-131 is equal to the activity of Xe-131m, is obtained after 13.994(1) days.
Pour cette évaluation, l'intensité de la raie gamma de 163,9 keV est donnée pour I-131 et Xe-131m étant à l'équilibre.
For this evaluation, the intensity of the 163.9 keV gamma ray is given for I-131 and Xe-131 to be in radioactive equilibrium.

2 Nuclear Data

$T_{1/2}(^{131}\text{I})$	:	8,0233	(19)	d
$Q^-(^{131}\text{I})$	:	970,8	(6)	keV

2.1 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,8}$	247,9 (6)	2,114 (20)	Allowed	6,98
$\beta^-_{0,7}$	303,9 (6)	0,643 (27)	1st Forbidden	7,79
$\beta^-_{0,6}$	333,8 (6)	7,36 (8)	Allowed	6,86
$\beta^-_{0,4}$	606,3 (6)	89,4 (8)	Allowed	6,64
$\beta^-_{0,3}$	629,7 (6)	0,053 (29)	1st Forbidden	9,8
$\beta^-_{0,2}$	806,9 (6)	0,396 (14)	1st Forbidden Unique	10,03

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{1,0}$(Xe)	80,1853 (19)	6,72 (14)	M1[+E2]	1,353 (41)	0,180 (5)	0,0367 (11)	1,579 (47)
$\gamma_{8,6}$(Xe)	85,918 (8)	0,00029 (16)	[M1, E2]	1,508 (31)	0,558 (15)		2,21 (5)
$\gamma_{2,0}$(Xe)	163,930 (8)	1,086 (7)	M4	30,8 (9)	14,66 (44)	3,38 (10)	49,6 (15)
$\gamma_{3,2}$(Xe)	177,214 (17)	0,3294 (44)	M1+94,87%E2	0,187 (6)	0,0427 (13)	0,00901 (27)	0,241 (7)
$\gamma_{6,5}$(Xe)	232,175 (8)	0,00282 (42)	[E2]	0,0782 (23)	0,01534 (46)		0,0976 (29)
$\gamma_{6,4}$(Xe)	272,501 (8)	0,0603 (10)	M1+12,62%E2	0,04613 (36)	0,0063 (13)		0,054 (2)
$\gamma_{4,1}$(Xe)	284,305 (5)	6,36 (6)	E2	0,0409 (12)	0,00725 (22)		0,0500 (15)
$\gamma_{6,3}$(Xe)	295,848 (13)	0,00084 (27)	[E1]	0,00937 (28)	0,001185 (36)		0,01086 (33)
$\gamma_{7,4}$(Xe)	302,444 (13)	0,0046 (5)	[E1]	0,00885 (27)	0,001118 (34)		0,01025 (31)
$\gamma_{8,5}$(Xe)	318,093 (8)	0,0824 (16)	M1+1,19%E2	0,0307 (9)	0,00397 (12)	0,000808 (24)	0,0357 (11)
$\gamma_{5,1}$(Xe)	324,651 (6)	0,0225 (27)	M1+39,02%E2	0,0283 (8)	0,00406 (12)	0,000832 (25)	0,0334 (10)
$\gamma_{7,3}$(Xe)	325,791 (18)	0,276 (27)	M1+5,02%E2	0,0288 (9)	0,00376 (11)	0,000765 (23)	0,0335 (10)
$\gamma_{8,4}$(Xe)	358,419 (8)	0,0100 (23)	[M1, E2]	0,02130 (45)	0,00307 (7)		0,0252 (5)
$\gamma_{4,0}$(Xe)	364,490 (4)	83,1 (8)	M1+95,35%E2	0,0191 (6)	0,00304 (9)	0,000628 (19)	0,0229 (7)
$\gamma_{5,0}$(Xe)	404,816 (4)	0,0561 (13)	M1+50%E2	0,0153 (14)	0,002140 (18)		0,0179 (13)
$\gamma_{7,2}$(Xe)	503,005 (17)	0,3621 (43)	E2	0,00751 (23)	0,001096 (33)	0,000225 (7)	0,00889 (27)
$\gamma_{6,0}$(Xe)	636,991 (4)	7,29 (8)	E2	0,00404 (12)	0,000558 (17)	0,0001141 (34)	0,00474 (14)
$\gamma_{8,1}$(Xe)	642,724 (6)	0,2203 (28)	[E2]	0,00395 (12)	0,000545 (16)		0,00463 (14)
$\gamma_{8,0}$(Xe)	722,909 (4)	1,804 (20)	M1+4,11%E2	0,00399 (12)	0,000500 (15)	0,0001014 (30)	0,00461 (14)

3 Atomic Data

3.1 Xe

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

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	29,459		53,98
	$K\alpha_1$	29,779		100
	$K\beta_3$	33,562	}	
	$K\beta_1$	33,625	}	
	$K\beta_5''$	33,881	}	28,99
	$K\beta_2$	34,415	}	
	$K\beta_4$	34,496	}	6,84
	$KO_{2,3}$	34,552	}	
X_L				
	$L\ell$	3,64		
	$L\gamma$	– 5,30		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	23,512 – 24,842	100
KLX	27,897 – 29,770	46,5
KXY	32,27 – 34,54	5,41
Auger L	0,140 – 5,316	

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Xe)	0,140 - 5,316		5,91 (4)
e_{AK}	(Xe)			0,68 (4)
	KLL	23,512 - 24,842	}	
	KLX	27,897 - 29,770	}	
	KXY	32,27 - 34,54	}	
$ec_{1,0\ K}$	(Xe)	45,621 (2)		3,53 (11)
$ec_{1,0\ L}$	(Xe)	74,732 - 75,403		0,469 (14)
$ec_{1,0\ M}$	(Xe)	79,036 - 79,508		0,0957 (30)
$ec_{1,0\ N}$	(Xe)	79,972 - 80,118		0,0210 (7)
$ec_{2,0\ K}$	(Xe)	129,366 (8)		0,662 (29)
$ec_{2,0\ L}$	(Xe)	158,477 - 159,148		0,315 (14)
$ec_{2,0\ M}$	(Xe)	162,781 - 163,253		0,0727 (32)
$ec_{4,0\ K}$	(Xe)	329,926 (4)		1,55 (5)
$ec_{4,0\ L}$	(Xe)	359,037 - 359,708		0,247 (8)
$ec_{4,0\ M}$	(Xe)	363,341 - 363,813		0,0510 (16)
$\beta^-_{0,8}$	max:	247,9 (6)		2,114 (20)
$\beta^-_{0,8}$	avg:	69,35 (19)		
$\beta^-_{0,7}$	max:	303,9 (6)		0,643 (27)
$\beta^-_{0,7}$	avg:	86,94 (19)		
$\beta^-_{0,6}$	max:	333,8 (6)		7,36 (8)
$\beta^-_{0,6}$	avg:	96,61 (19)		
$\beta^-_{0,4}$	max:	606,3 (6)		89,4 (8)
$\beta^-_{0,4}$	avg:	191,59 (22)		
$\beta^-_{0,3}$	max:	629,7 (6)		0,053 (29)
$\beta^-_{0,3}$	avg:	200,23 (22)		
$\beta^-_{0,2}$	max:	806,9 (6)		0,396 (14)
$\beta^-_{0,2}$	avg:	267,91 (23)		

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Xe)	3,64 — 5,30		0,635 (13)	
$XK\alpha_2$	(Xe)	29,459		1,54 (4)	} $K\alpha$
$XK\alpha_1$	(Xe)	29,779		2,85 (7)	}
$XK\beta_3$	(Xe)	33,562	}		
$XK\beta_1$	(Xe)	33,625	}	0,826 (21)	$K'\beta_1$
$XK\beta_5''$	(Xe)	33,881	}		
$XK\beta_2$	(Xe)	34,415	}		
$XK\beta_4$	(Xe)	34,496	}	0,195 (7)	$K'\beta_2$
$XKO_{2,3}$	(Xe)	34,552	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Xe)	80,1850 (19)	2,607 (27)
$\gamma_{8,6}$(Xe)	85,9 (2)	0,000089 (49)
$\gamma_{2,0}$(Xe)	163,930 (8)	0,0215 (7)
$\gamma_{3,2}$(Xe)	177,214 (2)	0,2654 (32)
$\gamma_{6,5}$(Xe)	232,18 (15)	0,00257 (38)
$\gamma_{6,4}$(Xe)	272,498 (17)	0,0572 (9)
$\gamma_{4,1}$(Xe)	284,305 (5)	6,06 (6)
$\gamma_{6,3}$(Xe)	295,8 (2)	0,00083 (27)
$\gamma_{7,4}$(Xe)	302,4 (2)	0,00455 (49)
$\gamma_{8,5}$(Xe)	318,088 (16)	0,0796 (15)
$\gamma_{5,1}$(Xe)	324,651 (25)	0,0218 (26)
$\gamma_{7,3}$(Xe)	325,789 (4)	0,267 (26)
$\gamma_{8,4}$(Xe)	358,4 (2)	0,0098 (22)
$\gamma_{4,0}$(Xe)	364,489 (5)	81,2 (8)
$\gamma_{5,0}$(Xe)	404,814 (4)	0,0551 (13)
$\gamma_{7,2}$(Xe)	503,004 (4)	0,3589 (43)
$\gamma_{6,0}$(Xe)	636,989 (4)	7,26 (8)
$\gamma_{8,1}$(Xe)	642,719 (5)	0,2193 (28)
$\gamma_{8,0}$(Xe)	722,911 (5)	1,796 (20)

6 Main Production Modes

{ Fission product
Possible impurities : None

{ $Te-130(n,\gamma)Te-131m$
Possible impurities : $T_{1/2}(Te-131m) = 30$ h

{ $Te-131m(\beta^-)I-131$ σ : 0,02 (1) barns
Possible impurities : Te – 121m, Te – 121, Te – 123m, Te – 125m, Te – 127, Te – 129m

{ $Te-130(n,\gamma)Te-131$
Possible impurities : $T_{1/2}(Te-131) = 25$min

{ $Te-131(\beta^-)I-131$ σ : 0,27 (6) barns
Possible impurities : Te – 121m, Te – 121, Te – 123m, Te – 125m, Te – 127, Te – 129m

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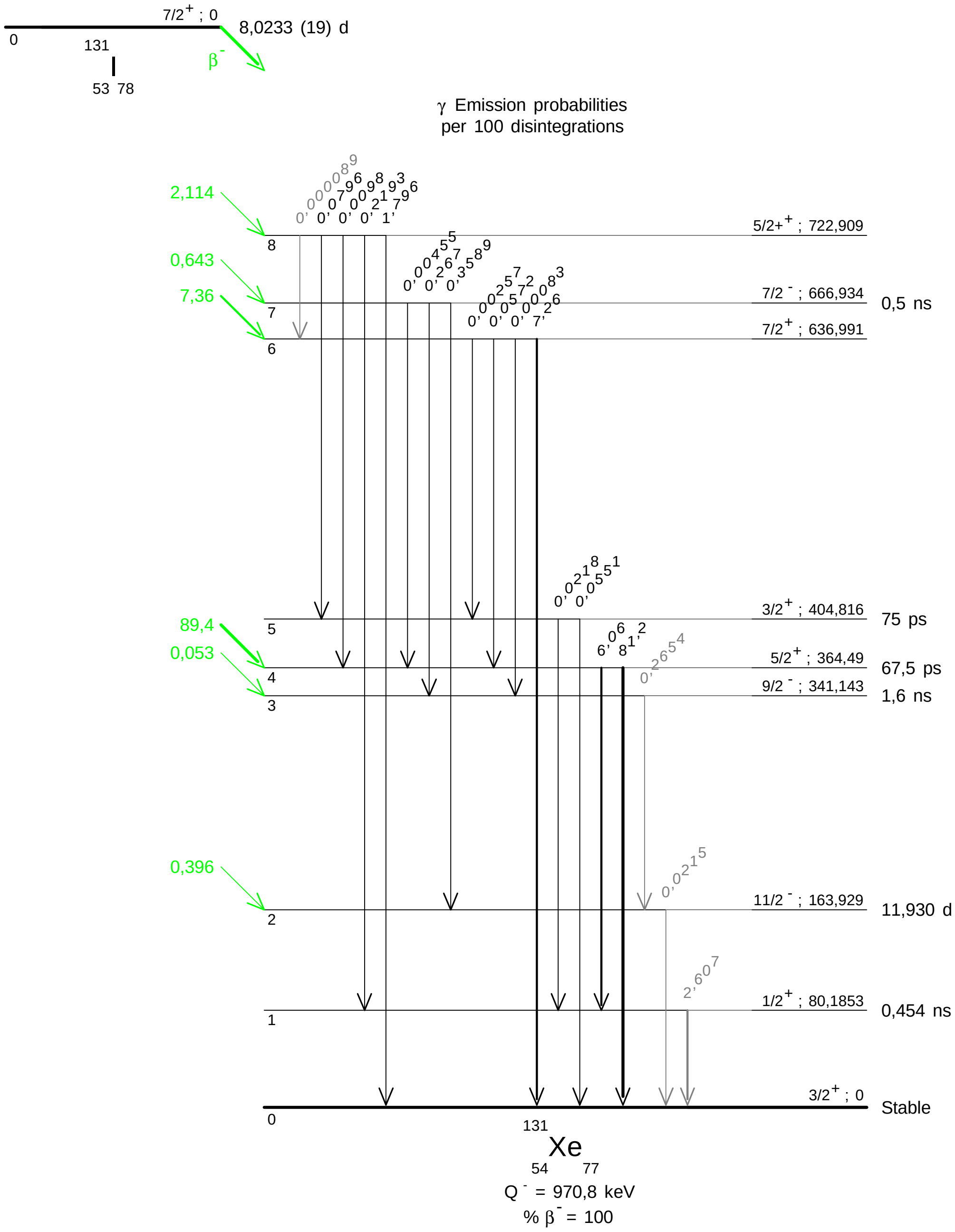
7/2+ ; 0
8,0233 (19) d
0
131
53 78
β-
γ Emission probabilities
per 100 disintegrations
2,114
0,643
7,36
89,4
0,053
0,396
5/2+ ; 722,909
7/2 - ; 666,934
0,5 ns
7/2+ ; 636,991
3/2+ ; 404,816
75 ps
5/2+ ; 364,49
67,5 ps
9/2 - ; 341,143
1,6 ns
11/2 - ; 163,929
11,930 d
1/2+ ; 80,1853
0,454 ns
3/2+ ; 0
Stable
131
Xe
54 77
Q - = 970,8 keV
% β- = 100

$^{131}_{54}$Xe $^{m}_{77}$

1 Decay Scheme

Le xenon 131m se désexcite par une transition gamma (163,930 keV) fortement convertie.
Xe-131m decays by a strongly converted gamma transition.

2 Nuclear Data

$T_{1/2}(^{131}Xe^{m})$: 11,930 (16) d

2.1 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{1,0}$(Xe)	163,930 (8)	100	M4	30,8 (9)	14,66 (44)	3,38 (10)	49,6 (15)

3 Atomic Data

3.1 Xe

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

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	29,459		53,98
	$K\alpha_1$	29,779		100
	$K\beta_3$	33,562	}	
	$K\beta_1$	33,625	}	
	$K\beta_5''$	33,881	}	28,99
	$K\beta_2$	34,415	}	
	$K\beta_4$	34,496	}	6,84
	$KO_{2,3}$	34,552	}	
X_L				
	$L\ell$	3,64		
	$L\alpha$	4,1 – 4,11		
	$L\eta$	3,96		
	$L\beta$	4,42 – 4,78		
	$L\gamma$	4,89 – 5,30		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	23,512 – 24,842	100
KLX	27,897 – 29,770	46,5
KXY	32,27 – 34,54	5,41
Auger L	0,14 – 5,30	

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e_{AL}	(Xe)	0,14 - 5,30		75,9 (8)
e_{AK}	(Xe)			6,8 (5)
	KLL	23,512 - 24,842	}	
	KLX	27,897 - 29,770	}	
	KXY	32,27 - 34,54	}	
$ec_{1,0\ T}$	(Xe)	129,3656 - 163,9179		98,02 (6)
$ec_{1,0\ K}$	(Xe)	129,366 (8)		61,0 (26)
$ec_{1,0\ L}$	(Xe)	158,477 - 159,148		29,0 (12)
$ec_{1,0\ M}$	(Xe)	162,781 - 163,253		6,69 (28)

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Xe)	3,64 — 5,30		8,13 (21)	
$XK\alpha_2$	(Xe)	29,459		15,4 (7)	} $K\alpha$
$XK\alpha_1$	(Xe)	29,779		28,5 (13)	}
$XK\beta_3$	(Xe)	33,562	}		
$XK\beta_1$	(Xe)	33,625	}	8,3 (4)	$K'\beta_1$
$XK\beta_5''$	(Xe)	33,881	}		
$XK\beta_2$	(Xe)	34,415	}		
$XK\beta_4$	(Xe)	34,496	}	1,95 (10)	$K'\beta_2$
$XKO_{2,3}$	(Xe)	34,552	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Xe)	163,930 (8)	1,98 (6)

6 Main Production Modes

{ Fission products
Possible impurities : Xe – 127, Xe – 129m, Xe – 133, Xe – 133m, Xe – 135

I – 129(n,γ)I – 130 σ : 9 (1) barns
{ I – 130(β^-)Xe – 130
Possible impurities : $T_{1/2}$ = 12,3 h

I – 129(n,γ)I – 130m
{ I – 130m(β^-)Xe – 130 σ : 18 (2) barns
Possible impurities : $T_{1/2}$ = 9,2 min

{ I – 130m(I.T.)I – 130
Possible impurities : $T_{1/2}$ = 9,2 min

{ Xe – 130(n,γ)Xe – 131m σ : 0,45 (10) barns
Possible impurities : Xe – 129m

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  (Spin, Parity, Level Energy, Gamma Transition Energy)
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- V.M.Gorozhankin, N.Coursol, E.A.Yakushev, T.S.Vylov, C.Briançon. Appl. Rad. Isotopes 56 (2002) 189
  (M4 transition)


γ Emission probabilities
per 100 disintegrations
1,98
11/2 - ; 163,93
11,930 d
1
3/2+ ; 0
Stable
0
131 Xe 54 77
QIT = 163,93 keV
% IT = 100

$^{133}_{56}$Ba $_{77}$

1 Decay Scheme

Ba-133 disintegrates by electron capture to Cs-133 via the excited states of 437 keV (86.1%) and of 383 keV (13.9%).
Le baryum 133 se désintègre par capture électronique vers des niveaux excités de 437 et 383 keV du césium 133.

2 Nuclear Data

$T_{1/2}$(^{133}Ba)	:	10,540	(6)	a
Q^+(^{133}Ba)	:	517,4	(10)	keV

2.1 Electron Capture Transitions

	Energy keV	Probability × 100	Nature	lg ft	P_K	P_L	P_M
$\epsilon_{0,4}$	80,4 (10)	86,2 (5)	Allowed	6,68	0,672 (5)	0,252 (4)	0,0612 (13)
$\epsilon_{0,3}$	133,6 (10)	13,7 (4)	Allowed	8,07	0,7734 (21)	0,1761 (15)	0,0408 (8)
$\epsilon_{0,2}$	356,8 (10)	< 0,3	2nd Forbidden	> 10,6	0,79 (3)		
$\epsilon_{0,1}$	436,4 (10)	< 0,7	2nd Forbidden	> 10,6	0,88 (4)		
$\epsilon_{0,0}$	517,4 (10)	< 0,0005	Uniq. 2ndForbidden	> 13,9			

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_{MNO}	α_T
$\gamma_{4,3}$(Cs)	53,1622 (6)	15,0 (4)	M1+2,2(13)%E2	4,93 (10)	0,86 (3)	0,226 (8)	6,02 (18)
$\gamma_{2,1}$(Cs)	79,6142 (12)	7,34 (17)	M1+0,09(9)%E2	1,515 (30)	0,204 (5)	0,0530 (11)	1,77 (4)
$\gamma_{1,0}$(Cs)	80,9979 (11)	90,1 (16)	M1+2,23(4)%E2	1,46 (3)	0,220 (5)	0,0570 (14)	1,74 (4)
$\gamma_{2,0}$(Cs)	160,6121 (16)	0,84 (3)	M1+62(12)%E2	0,24 (3)	0,054 (7)	0,014 (3)	0,31 (4)

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_{MNO}	α_T
$\gamma_{3,2}$(Cs)	223,2370 (13)	0,498 (6)	M1+1,3(2)%E2	0,0853 (20)	0,0113 (3)	0,00292 (6)	0,0995 (30)
$\gamma_{4,2}$(Cs)	276,3992 (12)	7,57 (5)	E2	0,0461 (9)	0,00855 (17)	0,00225 (5)	0,0569 (12)
$\gamma_{3,1}$(Cs)	302,8512 (5)	19,15 (14)	M1+0,05(6)%E2	0,0381 (8)	0,00496 (10)	0,00128 (3)	0,0443 (9)
$\gamma_{4,1}$(Cs)	356,0134 (7)	63,64 (20)	E2	0,0211 (4)	0,00351 (7)	0,00092 (30)	0,0256 (5)
$\gamma_{3,0}$(Cs)	383,8491 (12)	9,12 (6)	E2	0,0169 (3)	0,00273 (5)	0,00071 (2)	0,0203 (4)

3 Atomic Data

3.1 Cs

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

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	30,625		54,13
	$K\alpha_1$	30,973		100
	$K\beta_3$	34,92	}	
	$K\beta_1$	34,987	}	
	$K\beta_5''$	35,245	}	29
	$K\beta_5'$	35,259	}	
	$K\beta_2$	35,818	}	
	$K\beta_4$	35,907	}	7,33
	$KO_{2,3}$	35,972	}	
X_L				
	$L\ell$	3,8		
	$L\gamma$	– 5,7		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	24,41 – 25,80	100
KLX	29,00 – 30,96	47,2
KXY	33,51 – 35,95	5,56
Auger L	2,5 – 5,6	

4 Electron Emissions

		Energy keV			Electrons per 100 disint.
e_{AL}	(Cs)	2,5 - 5,6			138,0 (15)
e_{AK}	(Cs)				14,2 (6)
	KLL	24,41 - 25,80		}	
	KLX	29,00 - 30,96		}	
	KXY	33,51 - 35,95		}	
$ec_{4,3\ K}$	(Cs)	17,1776	(6)		10,6 (3)
$ec_{2,1\ K}$	(Cs)	43,6296	(12)		4,01 (9)
$ec_{1,0\ K}$	(Cs)	45,0133	(11)		48,1 (11)
$ec_{4,3\ L}$	(Cs)	47,45 - 48,15			1,84 (7)
$ec_{4,3\ MNO}$	(Cs)	51,94 - 53,08			0,484 (18)
$ec_{2,1\ L}$	(Cs)	73,9 - 74,6			0,541 (17)
$ec_{1,0\ L}$	(Cs)	75,29 - 75,79			7,25 (18)
$ec_{2,1\ MNO}$	(Cs)	78,40 - 79,53			0,140 (5)
$ec_{1,0\ MNO}$	(Cs)	79,78 - 80,92			1,88 (5)
$ec_{2,0\ K}$	(Cs)	124,6274	(16)		0,15 (2)
$ec_{4,2\ K}$	(Cs)	240,4143	(12)		0,330 (7)
$ec_{3,1\ K}$	(Cs)	266,8862	(5)		0,70 (2)
$ec_{4,2\ L}$	(Cs)	270,69 - 271,39			0,0612 (13)
$ec_{3,1\ L}$	(Cs)	297,14 - 297,85			0,091 (2)
$ec_{4,1\ K}$	(Cs)	320,0283	(7)		1,31 (3)
$ec_{3,0\ K}$	(Cs)	347,8639	(12)		0,151 (3)
$ec_{4,1\ L}$	(Cs)	350,30 - 351,01			0,218 (4)
$ec_{4,1\ MNO}$	(Cs)	354,80 - 355,93			0,57 (1)

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Cs)	3,8 — 5,7		16,0 (8)	
XKα_2	(Cs)	30,625		34,0 (4)	} Kα
XKα_1	(Cs)	30,973		62,8 (7)	}
XKβ_3	(Cs)	34,92	}		
XKβ_1	(Cs)	34,987	}	18,2 (2)	K$'\beta_1$
XKβ_5''	(Cs)	35,245	}		
XKβ_5'	(Cs)	35,259	}		

		Energy keV	Photons per 100 disint.	
$XK\beta_2$	(Cs)	35,818 }		
$XK\beta_4$	(Cs)	35,907 }	4,6 (1)	$K'\beta_2$
$XKO_{2,3}$	(Cs)	35,972 }		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{4,3}$(Cs)	53,1622 (6)	2,14 (3)
$\gamma_{2,1}$(Cs)	79,6142 (12)	2,65 (5)
$\gamma_{1,0}$(Cs)	80,9979 (11)	32,9 (3)
$\gamma_{2,0}$(Cs)	160,6121 (16)	0,638 (4)
$\gamma_{3,2}$(Cs)	223,2368 (13)	0,453 (3)
$\gamma_{4,2}$(Cs)	276,3989 (12)	7,16 (5)
$\gamma_{3,1}$(Cs)	302,8508 (5)	18,34 (13)
$\gamma_{4,1}$(Cs)	356,0129 (7)	62,05 (19)
$\gamma_{3,0}$(Cs)	383,8485 (12)	8,94 (6)

6 Main Production Modes

$\begin{cases} \text{Ba} - 132(\text{n},\gamma)\text{Ba} - 133 \quad \sigma : 6{,}5\ (8)\ \text{barns} \\ \text{Possible impurities : Ba} - 131, \text{Ba} - 140 \end{cases}$

$\begin{cases} \text{Ba} - 132(\text{n},\gamma)\text{Ba} - 133\text{m} \quad \sigma : 0{,}5\ \text{barns} \\ \text{Possible impurities : Ba} - 131, \text{Ba} - 140 \end{cases}$

$\begin{cases} \text{Cs} - 133(\text{p,n})\text{Ba} - 133 \\ \text{Possible impurities : Cs} - 132 \end{cases}$

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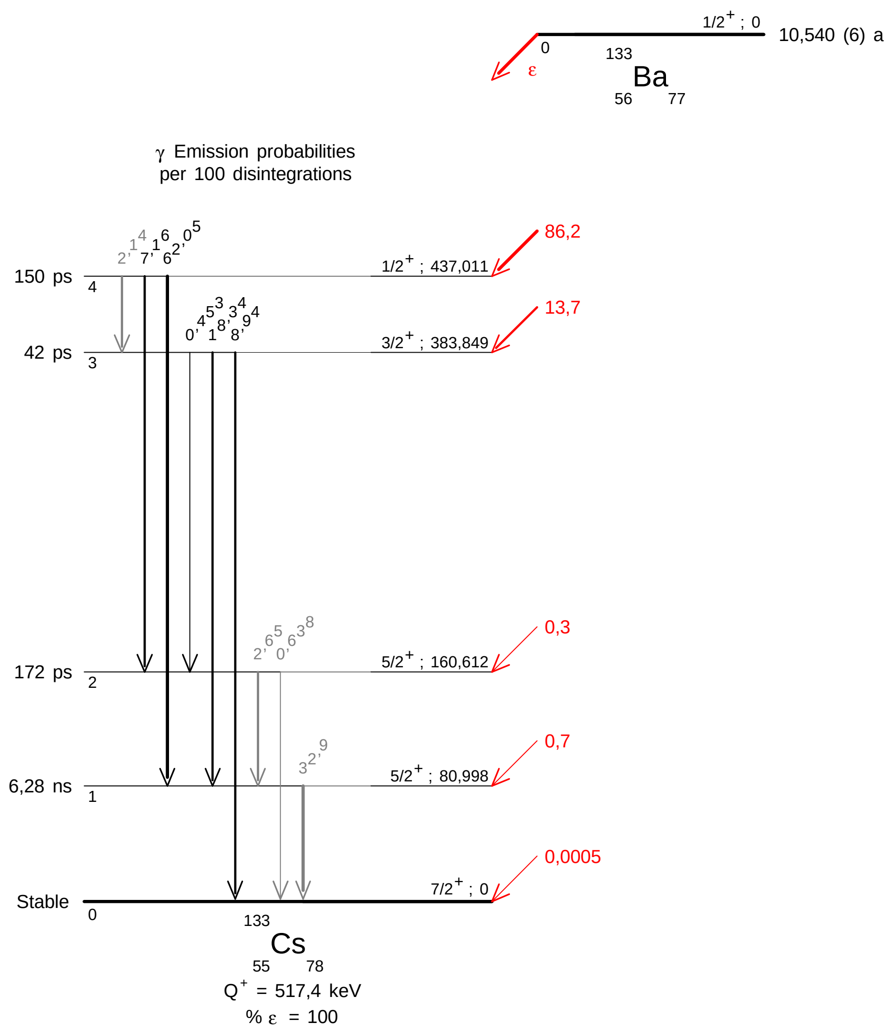
1/2+ ; 0
10,540 (6) a
0
ε
133
Ba
56 77
γ Emission probabilities
per 100 disintegrations
150 ps
4
1/2+ ; 437,011
86,2
42 ps
3
3/2+ ; 383,849
13,7
172 ps
2
5/2+ ; 160,612
0,3
6,28 ns
1
5/2+ ; 80,998
0,7
Stable
0
7/2+ ; 0
0,0005
133
Cs
55 78
Q+ = 517,4 keV
% ε = 100

$^{\mathbf{140}}_{56}$ Ba $_{84}$

1 Decay Scheme

Le baryum 140 se désintègre par émissions bêta moins vers des niveaux excités de lanthane 140.
Le rapport au temps t des activités La-140/Ba-140 dans le Ba-140 initialement pur s'écrit :
$T1/(T1-T2)(1-e^{t\times(-ln2\,(T1-T2)/T1\times T2})$
T1 et T2 étant respectivement les périodes de Ba-140 et de La-140
A l'équilibre (t $\geq$ 19 jours), ce rapport est égal à : T1/(T1-T2) = 1,1516 $\pm$ 0,0007.
The Ba-140 disintegrates by beta minus emissions to La-140 excited levels.
At equilibrium (t $\geq$ 19 d), with T1 : Ba-140 half-life and, T2 : La-140 half-Life, the activity ratio is : T1/(T1-T2) = 1.1516 $\pm$ 0.0007.

2 Nuclear Data

$T_{1/2}(^{140}$Ba)	:	12,753	(4)	d
$T_{1/2}(^{140}$La)	:	1,67850	(17)	d
$Q^{-}(^{140}$Ba)	:	1047	(8)	keV

2.1 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,6}$	469 (8)	24,73 (23)	1st forbidden	7,05
$\beta^-_{0,5}$	582 (8)	9,63 (10)	1st forbidden	7,78
$\beta^-_{0,4}$	887 (8)	3,9000 (11)	Unique 1st forbidden	9,2
$\beta^-_{0,3}$	987 (8)	<0,00000001	Unique 3rd forbidden	>18
$\beta^-_{0,2}$	1006 (8)	39 (4)	1st forbidden	8
$\beta^-_{0,1}$	1020 (8)	23 (4)	Unique 1st forbidden	8,8
$\beta^-_{0,0}$	1050 (8)	≤0,00001	3rd forbidden	≥15

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{2,1}$(La)	13,849 (4)	66,24 (3)	M1+E2		44,7 (9)	9,7 (20)	56,6 (11)
$\gamma_{1,0}$(La)	29,9656 (15)	93,80 (25)	M1+E2		4,4 (9)	0,9 (2)	5,55 (11)
$\gamma_{3,0}$(La)	63,184 (13)	0,000232 (15)	[M1,E2]	4,0 (2)	3 (2)		7 (3)
$\gamma_{4,3}$(La)	99,479 (13)	0,000061 (12)	[E2]	1,230 (25)	0,635 (13)	0,17 (2)	2,04 (4)
$\gamma_{6,5}$(La)	113,582 (7)	0,0303 (7)	E0	0,658 (13)	0,0893 (18)	0,027 (3)	0,771 (15)
$\gamma_{4,2}$(La)	118,849 (4)	0,1015 (18)	M1	0,587 (18)	0,0785 (18)	0,024 (2)	0,678 (14)
$\gamma_{4,1}$(La)	132,6972 (25)	0,301 (4)	M1	0,424 (8)	0,0575 (11)	0,017 (2)	0,497 (10)
$\gamma_{4,0}$(La)	162,6628 (24)	8,03 (9)	M1(+E2)	0,241 (5)	0,0325 (7)	0,0082 (8)	0,282 (6)
$\gamma_{5,4}$(La)	304,872 (4)	4,52 (4)	M1(+E2)	0,0444 (9)	0,00589 (12)	0,0016 (2)	0,0519 (10)
$\gamma_{5,2}$(La)	423,721 (4)	3,18 (3)	M1	0,0190 (4)	0,0027 (2)		0,0222 (4)
$\gamma_{5,1}$(La)	437,569 (3)	1,967 (19)	M1	0,0176 (4)	0,00230 (5)	0,0007 (1)	0,0205 (4)
$\gamma_{6,2}$(La)	537,304 (6)	24,69 (22)	M1	0,0105 (2)	0,00137 (3)		0,0122 (2)
$\gamma_{6,1}$(La)	551,153 (8)	0,0049 (20)	[E2]	0,00671 (13)	0,00101 (2)		0,00799 (16)

3 Atomic Data

3.1 La

ω_K	:	0,905	(4)
$\bar{\omega}_L$	:	0,117	(5)
n_{KL}	:	0,888	(4)
$\bar{n}_{LM}$	:	1,574	

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	33,0344		54,44
	$K\alpha_1$	33,4421		100
	$K\beta_3$	37,7206	}	
	$K\beta_1$	37,8015	}	
	$K\beta_5''$	38,075	}	29,8
	$K\beta_5'$	39,095	}	
	$K\beta_2$	38,7303	}	
	$K\beta_4$	38,828	}	7,5
	$KO_{2,3}$	39,91	}	

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
$ec_{2,1}$ L	(La)	7,560 - 8,363		51,4 (13)
$ec_{2,1}$ M	(La)	12,485 - 12,743		11,2 (23)
$ec_{2,1}$ N	(La)	13,576 - 13,655		2,9 (5)
$ec_{1,0}$ L	(La)	23,702 - 24,485		63 (13)
$ec_{1,0}$ M	(La)	28,606 - 28,844		13 (3)
$ec_{1,0}$ N	(La)	29,697 - 29,776		3,2 (7)
$ec_{6,5}$ K	(La)	74,657	(7)	0,0113 (5)
$ec_{4,2}$ K	(La)	79,922	(4)	0,0355 (14)
$ec_{4,1}$ K	(La)	93,767	(5)	0,0852 (23)
$ec_{6,5}$ L	(La)	107,316 - 108,099		0,00153 (7)
$ec_{6,5}$ M	(La)	112,221 - 112,459		0,00046 (2)
$ec_{4,0}$ K	(La)	123,735	(2)	1,51 (4)
$ec_{4,0}$ L	(La)	156,394 - 157,177		0,203 (5)
$ec_{4,0}$ M	(La)	161,299 - 161,537		0,051 (5)
$ec_{5,4}$ K	(La)	265,950	(4)	0,191 (19)
$ec_{5,4}$ L	(La)	298,609 - 299,392		0,025 (3)
$ec_{5,4}$ M	(La)	303,514 - 303,752		0,007 (1)
$ec_{5,2}$ K	(La)	384,7979	(23)	0,0591 (14)
$ec_{5,1}$ K	(La)	398,643	(4)	0,0339 (7)
$ec_{5,2}$ L	(La)	417,456 - 418,239		0,0084 (8)
$ec_{5,1}$ L	(La)	431,501 - 432,084		0,0044 (1)
$ec_{6,2}$ K	(La)	498,379	(7)	0,256 (6)
$ec_{6,2}$ L	(La)	531,038 - 531,821		0,0334 (7)
$\beta^-_{0,6}$	max:	469	(8)	24,73 (23)
$\beta^-_{0,6}$	avg:	136	(4)	
$\beta^-_{0,5}$	max:	582	(8)	9,63 (10)
$\beta^-_{0,5}$	avg:	176	(4)	
$\beta^-_{0,4}$	max:	887	(8)	3,9000 (11)
$\beta^-_{0,4}$	avg:	305	(4)	
$\beta^-_{0,3}$	max:	987	(8)	<0,00000001
$\beta^-_{0,3}$	avg:			
$\beta^-_{0,2}$	max:	1006	(8)	39 (4)
$\beta^-_{0,2}$	avg:	339	(4)	
$\beta^-_{0,1}$	max:	1020	(8)	23 (4)
$\beta^-_{0,1}$	avg:	357	(4)	
$\beta^-_{0,0}$	max:	1050	(8)	≤0,00001
$\beta^-_{0,0}$	avg:			

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XKα_2	(La)	33,0344		0,535 (11)	} Kα
XKα_1	(La)	33,4421		0,982 (20)	}
XKβ_3	(La)	37,7206	}		
XKβ_1	(La)	37,8015	}	0,292 (7)	K$'\beta_1$
XKβ_5''	(La)	38,075	}		
XKβ_5'	(La)	39,095	}		
XKβ_2	(La)	38,7303	}		
XKβ_4	(La)	38,828	}	0,074 (2)	K$'\beta_2$
XKO$_{2,3}$	(La)	39,91	}		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{2,1}$(La)	13,849 (4)	1,15 (3)
$\gamma_{1,0}$(La)	29,9656 (15)	14,32 (25)
$\gamma_{3,0}$(La)	63,184 (13)	0,000029 (15)
$\gamma_{4,3}$(La)	99,479 (13)	0,000020 (12)
$\gamma_{6,5}$(La)	113,582 (7)	0,0171 (7)
$\gamma_{4,2}$(La)	118,849 (4)	0,0605 (18)
$\gamma_{4,1}$(La)	132,6972 (25)	0,201 (4)
$\gamma_{4,0}$(La)	162,6628 (24)	6,26 (9)
$\gamma_{5,4}$(La)	304,872 (4)	4,30 (4)
$\gamma_{5,2}$(La)	423,721 (4)	3,11 (3)
$\gamma_{5,1}$(La)	437,569 (3)	1,927 (19)
$\gamma_{6,2}$(La)	537,303 (6)	24,39 (22)
$\gamma_{6,1}$(La)	551,152 (8)	0,0049 (20)

6 Main Production Modes

Fission product
Possible impurities : None

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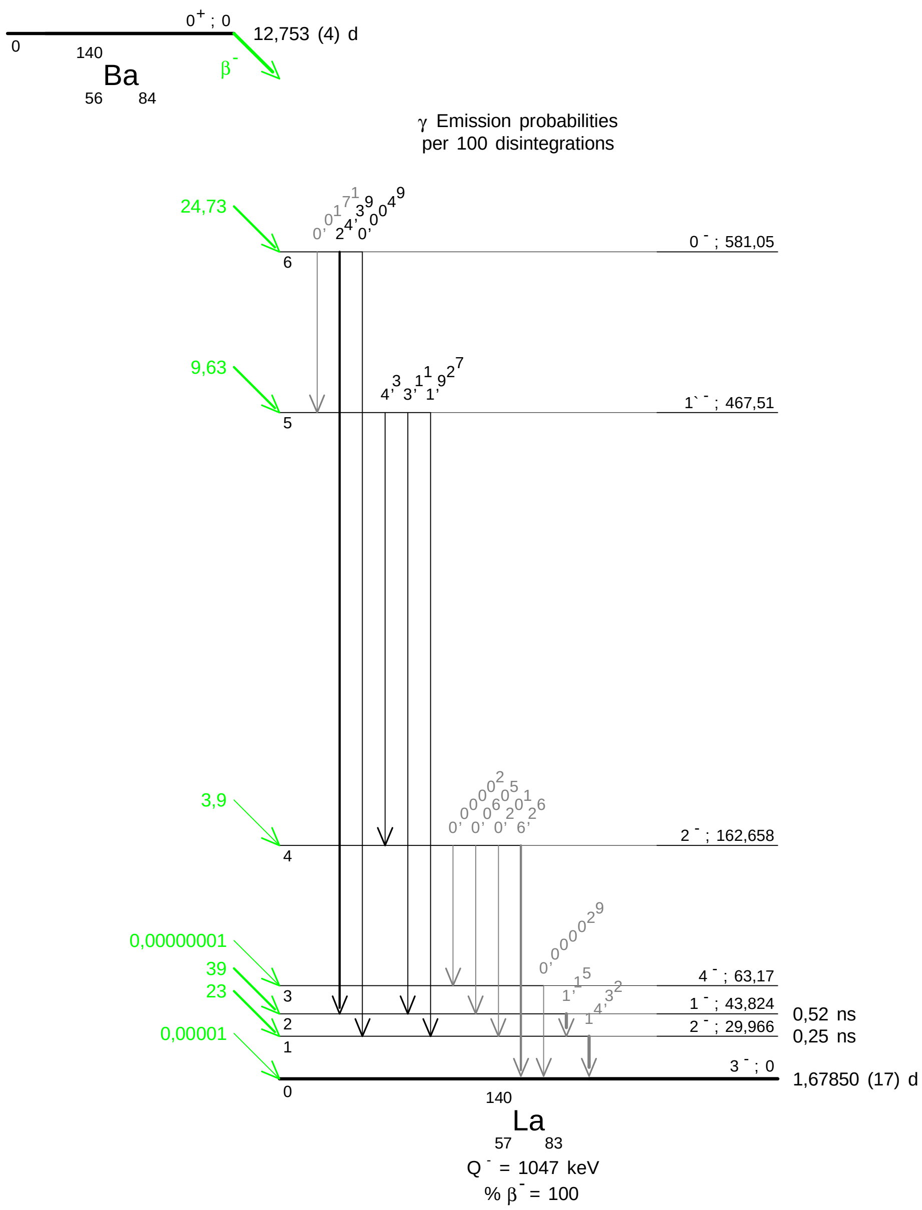
0+ ; 0
12,753 (4) d
0
140
Ba
56 84
β-
γ Emission probabilities
per 100 disintegrations
24,73
9,63
3,9
0,00000001
39
23
0,00001
6
5
4
3
2
1
0
0 - ; 581,05
1` - ; 467,51
2 - ; 162,658
4 - ; 63,17
1 - ; 43,824
2 - ; 29,966
3 - ; 0
0,52 ns
0,25 ns
1,67850 (17) d
140
La
57 83
Q - = 1047 keV
% β- = 100

$^{140}_{57}La_{83}$

1 Decay Scheme

La-140 decays by beta minus emission to the Ce-140 excited levels.
Le lanthane 140 se désintègre par émission bêta moins vers des niveaux excités de cerium 140. La transition bêta moins vers le niveau fondamental n' a pas été mise en évidence d'une manière significative (0,0008 %).

2 Nuclear Data

$T_{1/2}$(^{140}La)	:	1,67850	(17)	d
Q^-(^{140}La)	:	3761,9	(19)	keV

2.1 β^- Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^-_{0,19}$	241,1 (19)	0,0102 (13)	1st forbidden	8,66
$\beta^-_{0,18}$	288,3 (19)	0,051 (4)	Allowed	8,21
$\beta^-_{0,17}$	367,1 (10)	0,019 (3)	Allowed	8,98
$\beta^-_{0,16}$	442,3 (20)	0,00392 (19)	1st forbidden	9,94
$\beta^-_{0,15}$	643,4 (19)	0,0256 (5)	1st forbidden	9,68
$\beta^-_{0,14}$	761,0 (19)	0,084 (6)	1st forbidden	9,42
$\beta^-_{0,13}$	862,2 (19)	0,111 (4)	1st forbidden	9,49
$\beta^-_{0,12}$	1214,7 (19)	0,635 (5)	Unique 1st forbidden	9,96
$\beta^-_{0,11}$	1240,5 (19)	11,12 (6)	1st forbidden	8,07
$\beta^-_{0,10}$	1246,2 (19)	5,79 (3)	1st forbidden	8,36
$\beta^-_{0,9}$	1281,0 (19)	1,15 (3)	1st forbidden	9,11
$\beta^-_{0,8}$	1297,8 (19)	5,59 (3)	Allowed	8,44
$\beta^-_{0,7}$	1349,9 (19)	44,9 (4)	1st forbidden	7,6
$\beta^-_{0,6}$	1412,1 (19)	0,25 (3)	Unique 1st forbidden	10,72
$\beta^-_{0,5}$	1414,0 (19)	5,03 (4)	1st forbidden	8,63
$\beta^-_{0,3}$	1678,7 (19)	20,7 (20)	1st forbidden	8,3
$\beta^-_{0,1}$	2165,7 (19)	4,5 (20)	1st forbidden	9,4

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T	α_π (10^{-4})
$\gamma_{4,3}$(Ce)	24,595 (4)	0,52 (3)	E2		560 (18)	114 (4)	712 (21)	
$\gamma_{7,5}$(Ce)	64,129 (4)	0,0746 (17)	M1	3,72 (11)	0,514 (16)	0,11	4,37 (13)	
$\gamma_{9,7}$(Ce)	68,923 (5)	0,3499 (18)	M1	3,02 (9)	0,417 (13)	0,08	3,55 (11)	
$\gamma_{11,7}$(Ce)	109,417 (4)	0,421 (6)	M1	0,799 (24)	0,110 (3)	0,03	0,939 (28)	
$\gamma_{9,6}$(Ce)	131,121 (4)	0,734 (14)	M1+E2	0,480 (14)	0,068 (2)	0,004	0,566 (18)	
$\gamma_{11,5}$(Ce)	173,546 (5)	0,159 (5)	M1	0,220 (7)	0,0299 (9)	0,008	0,258 (8)	
$\gamma_{6,4}$(Ce)	241,959 (6)	0,481 (10)	M1+E2	0,0892 (27)	0,0120 (4)	0,003	0,104 (3)	
$\gamma_{6,3}$(Ce)	266,554 (5)	0,527 (9)	M1+E2	0,0564 (17)	0,0118 (4)	0,0033	0,0715 (22)	
$\gamma_{2,1}$(Ce)	307,08 (4)	0,023 (3)	E2	0,0365 (11)	0,0071 (2)	0,002	0,0456 (14)	
$\gamma_{7,3}$(Ce)	328,761 (4)	21,8 (3)	M1+E2	0,0396 (12)	0,0053 (2)	0,0015	0,0464 (14)	
$\gamma_{9,3}$(Ce)	397,674 (6)	0,0764 (24)	E2	0,0170 (5)	0,0029 (1)	0,0009	0,0208 (6)	
$\gamma_{10,3}$(Ce)	432,513 (8)	3,059 (16)	M1+E2	0,0182 (5)	0,0025 (1)	0,0007	0,0214 (7)	
$\gamma_{11,3}$(Ce)	438,178 (6)	0,017 (10)	M1	0,0129 (4)	0,00214 (6)	0,0006	0,0156 (5)	
$\gamma_{5,2}$(Ce)	444,57 (4)	0,0033 (7)	[E2]	0,0124 (4)	0,00205 (6)	0,0006	0,0150 (5)	
$\gamma_{3,1}$(Ce)	487,022 (6)	46,6 (4)	E2	0,00970 (29)	0,00155 (5)	0,0004	0,0117 (4)	
$\gamma_{11,2}$(Ce)	618,12 (4)	0,041 (3)	[E2]	0,00524 (16)	0,00078 (2)	0,00021	0,00623 (19)	
$\gamma_{5,1}$(Ce)	751,655 (7)	4,417 (24)	M1+E2	0,00484 (15)	0,00063 (2)	0,00017 (1)	0,00564 (17)	
$\gamma_{7,1}$(Ce)	815,784 (6)	23,83 (12)	M1+E2	0,00415 (12)	0,00054 (2)	0,00013	0,00482 (14)	
$\gamma_{8,1}$(Ce)	867,842 (16)	5,59 (3)	E1+M2	0,00098 (3)	0,00012	0,00004	0,00114 (4)	
$\gamma_{10,1}$(Ce)	919,536 (10)	2,801 (23)	M1+E2	0,00211 (8)	0,00030 (1)	0,00008	0,02590 (9)	
$\gamma_{11,1}$(Ce)	925,201 (7)	7,07 (4)	M1+E2	0,00307 (9)	0,00040 (1)	0,0001	0,00357 (11)	
$\gamma_{12,1}$(Ce)	950,991 (20)	0,532 (5)	[M1,E2]	0,0024 (5)	0,00032 (6)	0,0001	0,0028 (6)	
$\gamma_{18,9}$(Ce)	992,64 (18)	0,0100 (25)	[E1]	0,000744 (22)	0,000093 (3)	0,000024	0,000861 (25)	
$\gamma_{17,6}$(Ce)	1045,02 (9)	0,020 (3)	[E1]	0,000676 (20)	0,000084 (2)	0,000022	0,000782 (23)	
$\gamma_{14,2}$(Ce)	1097,58 (9)	0,023 (5)	[E2]	0,00143 (3)	0,00019 (1)	0,00005	0,00167 (5)	
$\gamma_{13,1}$(Ce)	1303,35 (7)	0,045 (4)	[M1,E2,E0]	0,0012 (2)	0,00016 (1)		0,00140 (23)	
$\gamma_{14,1}$(Ce)	1404,67 (9)	0,062 (5)	M1,E2	0,00108 (3)	0,00017 (1)		0,00125 (4)	
$\gamma_{1,0}$(Ce)	1596,213 (13)	95,49 (8)	E2	0,00068 (2)	0,00009	0,00002	0,00079 (2)	1,06 (1)
$\gamma_{18,1}$(Ce)	1877,34 (18)	0,041 (3)	[E1]	0,000247 (8)	0,000038 (1)		0,000285 (8)	
$\gamma_{2,0}$(Ce)	1903,29 (4)	0,0146 (15)	E0					
$\gamma_{19,1}$(Ce)	1924,5 (2)	0,011 (3)	[E2]	0,00481 (15)	0,000072 (2)		0,000553 (16)	
$\gamma_{3,0}$(Ce)	2083,236 (14)	0,036 (7)	E4	0,00117 (4)	0,00020 (1)		0,00137 (4)	
$\gamma_{5,0}$(Ce)	2347,868 (14)	0,845 (7)	E2	0,000335 (10)	0,000050 (2)		0,000385 (11)	
$\gamma_{8,0}$(Ce)	2464,054 (20)	0,0097 (13)	[E3]	0,00044	0,00007		0,00051	
$\gamma_{11,0}$(Ce)	2521,410 (14)	3,413 (24)	E2	0,000295 (9)	0,000042 (1)		0,000337 (10)	
$\gamma_{12,0}$(Ce)	2547,200 (23)	0,1017 (12)	M1	0,000327 (10)	0,000052 (2)		0,000379 (11)	
$\gamma_{13,0}$(Ce)	2899,56 (7)	0,0660 (6)	E2	0,000232 (7)	0,000032 (1)		0,000264 (80)	
$\gamma_{15,0}$(Ce)	3118,53 (10)	0,0256 (5)	(E2)	0,000205 (6)	0,000026 (1)		0,000231 (7)	
$\gamma_{16,0}$(Ce)	3319,56 (24)	0,00392 (18)	(E2)	0,000184 (5)	0,000024 (1)		0,000208 (6)	

3 Atomic Data

3.1 Ce

ω_K	:	0,910	(4)
$\bar{\omega}_L$	:	0,125	(5)
n_{KL}	:	0,876	(4)
$\bar{n}_{LM}$	:	1,57	(3)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	34,2793		54,6
	$K\alpha_1$	34,72		100
	$K\beta_3$	39,1705	}	
	$K\beta_1$	39,2578	}	
	$K\beta_5''$	39,549	}	30,31
	$K\beta_2$	40,233	}	
	$K\beta_4$	40,337	}	9,8

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
$ec_{4,3\ L}$	(Ce)	18,046	- 18,872	0,39 (2)
$ec_{4,3\ M}$	(Ce)	23,16	- 23,41	0,081 (5)
$ec_{7,5\ K}$	(Ce)	23,686	(4)	0,052 (6)
$ec_{9,7\ K}$	(Ce)	28,480	(5)	0,232 (9)
$ec_{11,7\ K}$	(Ce)	68,974	(4)	0,173 (7)
$ec_{9,6\ K}$	(Ce)	90,678	(4)	0,225 (9)
$ec_{7,3\ K}$	(Ce)	288,318	(4)	0,80 (3)
$ec_{7,3\ L}$	(Ce)	322,212	- 322,597	0,100 (4)
$ec_{10,3\ K}$	(Ce)	392,070	(8)	0,055 (3)
$ec_{3,1\ K}$	(Ce)	446,579	(6)	0,447 (14)
$ec_{3,1\ L}$	(Ce)	480,473	- 481,299	0,071 (2)
$ec_{7,1\ K}$	(Ce)	775,341	(6)	0,100 (3)
$ec_{1,0\ K}$	(Ce)	1555,760	(13)	0,065 (2)
$\beta^-_{0,19}$	max:	241,1	(19)	0,0102 (13)
$\beta^-_{0,19}$	avg:	67,1	(6)	
$\beta^-_{0,18}$	max:	288,3	(19)	0,051 (4)
$\beta^-_{0,18}$	avg:	81,7	(8)	
$\beta^-_{0,17}$	max:	367,1	(10)	0,019 (3)
$\beta^-_{0,17}$	avg:	107,1	(7)	
$\beta^-_{0,16}$	max:	442,3	(20)	0,00392 (19)
$\beta^-_{0,16}$	avg:	132,4	(7)	
$\beta^-_{0,15}$	max:	643,4	(19)	0,0256 (5)
$\beta^-_{0,15}$	avg:	204,1	(7)	

		Energy keV		Electrons per 100 disint.
$\beta^-_{0,14}$	max:	761,0	(19)	0,084 (6)
$\beta^-_{0,14}$	avg:	248,4	(8)	
$\beta^-_{0,13}$	max:	862,2	(19)	0,111 (4)
$\beta^-_{0,13}$	avg:	287,8	(8)	
$\beta^-_{0,12}$	max:	1214,7	(19)	0,635 (5)
$\beta^-_{0,12}$	avg:	438,9	(8)	
$\beta^-_{0,11}$	max:	1240,5	(19)	11,12 (6)
$\beta^-_{0,11}$	avg:	441,9	(8)	
$\beta^-_{0,10}$	max:	1246,2	(19)	5,79 (3)
$\beta^-_{0,10}$	avg:	444,3	(8)	
$\beta^-_{0,9}$	max:	1281,0	(19)	1,15 (3)
$\beta^-_{0,9}$	avg:	458,9	(8)	
$\beta^-_{0,8}$	max:	1297,8	(19)	5,59 (3)
$\beta^-_{0,8}$	avg:	466,1	(8)	
$\beta^-_{0,7}$	max:	1349,9	(19)	44,9 (4)
$\beta^-_{0,7}$	avg:	488,1	(8)	
$\beta^-_{0,6}$	max:	1412,1	(19)	0,25 (3)
$\beta^-_{0,6}$	avg:	519,3	(8)	
$\beta^-_{0,5}$	max:	1414,0	(19)	5,03 (4)
$\beta^-_{0,5}$	avg:	515,5	(9)	
$\beta^-_{0,3}$	max:	1678,7	(19)	20,7 (20)
$\beta^-_{0,3}$	avg:	630,2	(9)	
$\beta^-_{0,1}$	max:	2165,7	(19)	4,5 (20)
$\beta^-_{0,1}$	avg:	846,9	(9)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XKα_2	(Ce)	34,2793		0,60 (1)	} Kα
XKα_1	(Ce)	34,72		1,11 (2)	}
XKβ_3	(Ce)	39,1705	}		
XKβ_1	(Ce)	39,2578	}	0,301 (13)	K$'\beta_1$
XKβ_5''	(Ce)	39,549	}		
XKβ_2	(Ce)	40,233	}		
XKβ_4	(Ce)	40,337	}	0,098 (2)	K$'\beta_2$

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{4,3}$(Ce)	24,595 (4)	0,001
$\gamma_{7,5}$(Ce)	64,129 (4)	0,0139 (17)
$\gamma_{9,7}$(Ce)	68,923 (5)	0,0769 (18)
$\gamma_{11,7}$(Ce)	109,417 (4)	0,217 (6)
$\gamma_{9,6}$(Ce)	131,121 (4)	0,469 (14)
$\gamma_{11,5}$(Ce)	173,546 (5)	0,126 (5)
$\gamma_{6,4}$(Ce)	241,959 (6)	0,436 (10)
$\gamma_{6,3}$(Ce)	266,554 (5)	0,492 (9)
$\gamma_{2,1}$(Ce)	307,08 (4)	0,022 (3)
$\gamma_{7,3}$(Ce)	328,761 (4)	20,8 (3)
$\gamma_{9,3}$(Ce)	397,674 (6)	0,0748 (24)
$\gamma_{10,3}$(Ce)	432,513 (8)	2,995 (16)
$\gamma_{11,3}$(Ce)	438,178 (6)	0,017 (10)
$\gamma_{5,2}$(Ce)	444,57 (4)	0,0033 (7)
$\gamma_{3,1}$(Ce)	487,022 (6)	46,1 (4)
$\gamma_{11,2}$(Ce)	618,12 (4)	0,041 (3)
$\gamma_{5,1}$(Ce)	751,653 (7)	4,392 (24)
$\gamma_{7,1}$(Ce)	815,781 (6)	23,72 (12)
$\gamma_{8,1}$(Ce)	867,839 (16)	5,58 (3)
$\gamma_{10,1}$(Ce)	919,533 (10)	2,730 (23)
$\gamma_{11,1}$(Ce)	925,198 (7)	7,04 (4)
$\gamma_{12,1}$(Ce)	950,988 (20)	0,531 (5)
$\gamma_{18,9}$(Ce)	992,64 (18)	0,0100 (25)
$\gamma_{17,6}$(Ce)	1045,02 (9)	0,020 (3)
$\gamma_{14,2}$(Ce)	1097,58 (9)	0,023 (5)
$\gamma_{13,1}$(Ce)	1303,34 (7)	0,045 (4)
$\gamma_{14,1}$(Ce)	1404,66 (9)	0,062 (5)
$\gamma_{1,0}$(Ce)	1596,203 (13)	95,40 (8)
$\gamma_{18,1}$(Ce)	1877,33 (18)	0,041 (3)
$\gamma_{19,1}$(Ce)	1924,5 (2)	0,011 (3)
$\gamma_{3,0}$(Ce)	2083,219 (14)	0,036 (7)
$\gamma_{5,0}$(Ce)	2347,847 (14)	0,845 (7)
$\gamma_{8,0}$(Ce)	2464,031 (20)	0,0097 (13)
$\gamma_{11,0}$(Ce)	2521,390 (14)	3,412 (24)
$\gamma_{12,0}$(Ce)	2547,180 (23)	0,1017 (12)
$\gamma_{13,0}$(Ce)	2899,53 (7)	0,0660 (6)
$\gamma_{15,0}$(Ce)	3118,49 (10)	0,0256 (5)
$\gamma_{16,0}$(Ce)	3319,52 (24)	0,00392 (18)

6 Main Production Modes

$\begin{cases} \text{Separate from Ba} - 140 + \text{La} - 140 \\ \text{Possible impurities : Ba} - 140 \end{cases}$

$\begin{cases} \text{La} - 139(\text{n},\gamma)\text{La} - 140 \quad \sigma : 8{,}93\ (4)\ \text{barns} \\ \text{Possible impurities : La} - 141 \end{cases}$

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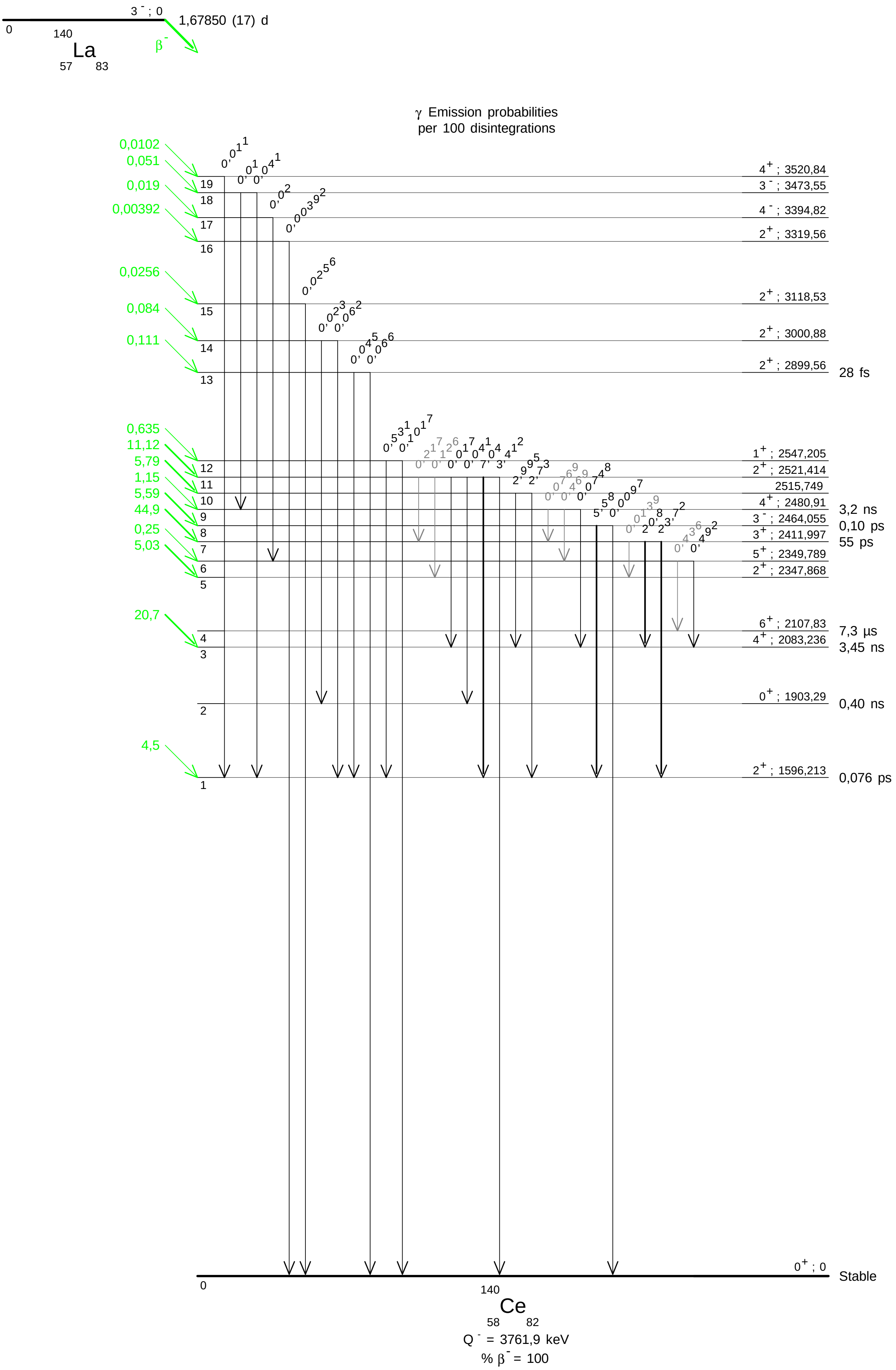
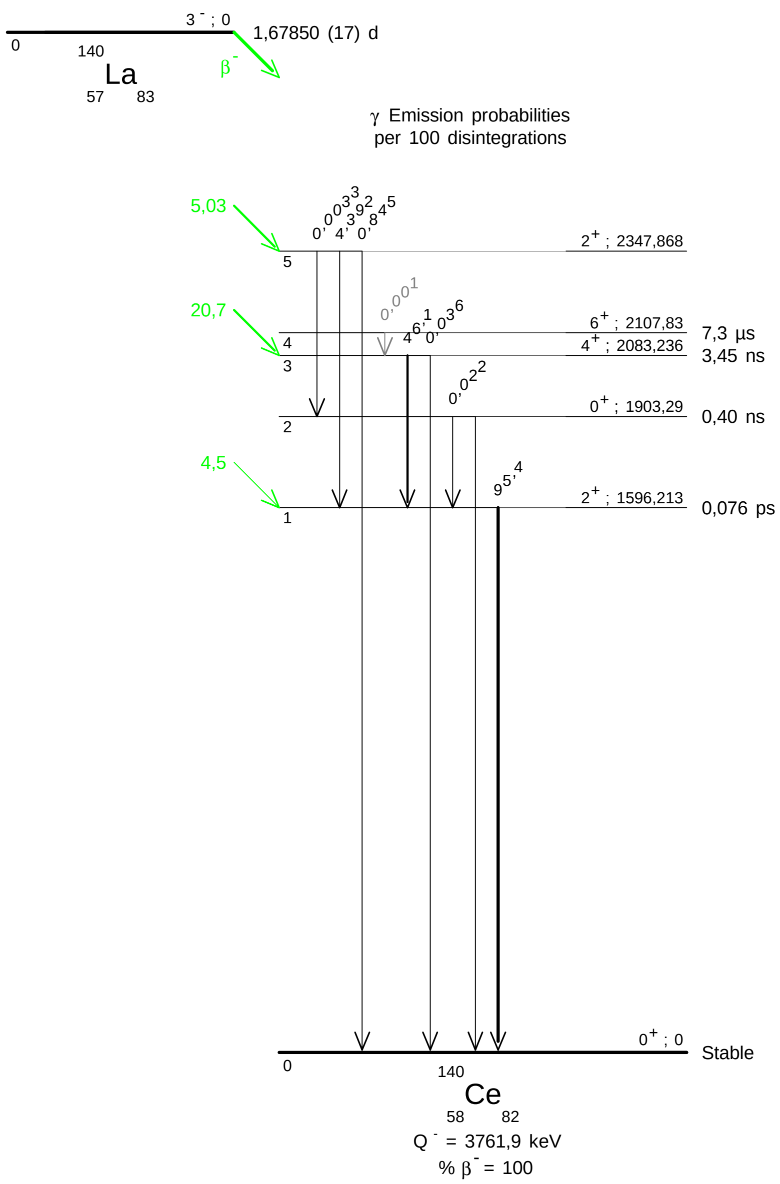

3⁻ ; 0
1,67850 (17) d
0
140 La 57 83
β⁻
γ Emission probabilities
per 100 disintegrations
4⁺ ; 3520,84
3⁻ ; 3473,55
4⁻ ; 3394,82
2⁺ ; 3319,56
2⁺ ; 3118,53
2⁺ ; 3000,88
2⁺ ; 2899,56
28 fs
1⁺ ; 2547,205
2⁺ ; 2521,414
2515,749
4⁺ ; 2480,91
3,2 ns
3⁻ ; 2464,055
0,10 ps
3⁺ ; 2411,997
55 ps
5⁺ ; 2349,789
2⁺ ; 2347,868
6⁺ ; 2107,83
7,3 µs
4⁺ ; 2083,236
3,45 ns
0⁺ ; 1903,29
0,40 ns
2⁺ ; 1596,213
0,076 ps
0⁺ ; 0
Stable
0,0102
0,051
0,019
0,00392
0,0256
0,084
0,111
0,635
11,12
5,79
1,15
5,59
44,9
0,25
5,03
20,7
4,5
140 Ce 58 82
Q⁻ = 3761,9 keV
% β⁻ = 100


3 - ; 0
1,67850 (17) d
140 La 57 83
β-
γ Emission probabilities
per 100 disintegrations
5,03
20,7
4,5
2+ ; 2347,868
6+ ; 2107,83
7,3 µs
4+ ; 2083,236
3,45 ns
0+ ; 1903,29
0,40 ns
2+ ; 1596,213
0,076 ps
0+ ; 0
Stable
140 Ce 58 82
Q - = 3761,9 keV
% β- = 100

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