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DECAY OF ^{115}CD AND ITS ISOMER

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ABSTRACT

The paper considers the basic data on the energies and intensities of ß- and γ-transitions and of conversion electrons accompanying the decay of ^{115}Cd and its isomer, together with those on the internal-conversion coefficients, spins, level parities and multipolarities of transitions. It also discusses data on the lifetime of both ground and excited states of the parent ^{115}Cd and the daughter ^{115}In nucleus. The results of studies on nuclear reactions involving ^{115}In were used to refine the level scheme of the ^{115}In nucleus.

On the basis of studies known from the literature, the decay scheme of ^{115}Cd and the level scheme of the ^{115}In daughter nucleus have been prepared, and the evaluated nuclear data for these isotopes are given.

1. STUDIES ON RADIOACTIVE DECAY OF ^{115}Cd AND ^{115m}Cd

1.1. J. VARMA and C.E. MANDEVILLE. "Level Scheme of ^{115}In" Phys. Rev. 97 (1955) 977 [1].

RADIOACTIVITY: ^{115}Cd and ^{115m}Cd. Measured: E_γ, I_γ, E_β, I_β, γ-γ-coincidences, γ-γ-correlation.

Obtained: Energies of levels of ^{115}In, J, π, internal conversion coefficients and multipolarities of transitions.

The γ-ray spectrum was measured with an NaI(Tl) detector, and the calibration was performed on the basis of the 87-keV photopeak observed in ^{109}Cd decay. The β-spectrum was recorded with an anthracene counter calibrated with the 625-keV K-conversion line of ^{137}Cs. The results are given in Tables 1 and 2.

1.2. H.S. HANS and G.N. RAO. "Decay of ^{115}Cd (2.3d)" Nucl. Phys. A44 (1963) 320 [2].

RADIOACTIVITY: ^{115}Cd. Measured: E_γ, I_γ, γ-γ-coincidences, β-γ-coincidences, γ-γ-correlation.

Obtained: Energies of levels of ^{115}In, J, π and internal conversion coefficients. β- and γ-transitions were recorded with NaI(Tl) scintillation spectrometers. The results are given in Table 3.

1.3. G. GRAEFFE, C.-W. TANG, C.D. CORYELL and G.E. GORDON. "Decay Schemes of 43-Day ^{115m}Cd and 2.3-Day ^{115g}Cd" Phys. Rev. 149 (1966) 884 [3].

RADIOACTIVITY: ^{115}Cd and ^{115m}Cd. Measured: E_γ, I_γ, E_β, I_β, E_{ce}, I_{ce}, γ-γ-coincidences.

Obtained: Energies of levels of ^{115}In, J, π and internal conversion coefficients. The spectrum of γ-quanta was recorded with Ge(Li) and NaI(Tl) detectors, and the β-spectrum and conversion electron spectrum with an Si(Li) detector.

The calibration was performed on the basis of the 662-keV ^{137}Cs line. The Ge(Li) detector had a resolution of 3.0 keV at 662 keV and the Si(Li) detector 6 keV at 308 keV.

The results are given in Tables 4 and 5.

1.4. A. BÄKLIN, B. FOGELBERG, S.G. MALMSKOG. "Possible Deformed States in ^{115}In and ^{117}In" Nucl. Phys. A96 (1967) 539 [4].

RADIOACTIVITY: ^{115}Cd. Measured: E_{γ}, I_{γ}, E_{ce}, I_{ce}.

Obtained: Energies of levels of ^{115}In, J, π, internal conversion coefficients and multipolarities of transitions, the lifetime of excited states of ^{115}In with 828 and 864 keV energies. The γ-transition spectrum was recorded with a Ge(Li) detector with a resolution of 3.7 keV at 122 keV and the spectrum of internal conversion electrons with a magnetic double-focusing ß-spectrometer. The calibration was performed on the basis of the 661.59 keV ^{137}Ba K-conversion line.

The results are given in Tables 6, 7 and 8.

1.5. J.B. VAN DER KOOI, H.J. VAN DEN BOLD and P.M. ENDT. "The Decay of ^{115m}Cd" Physika 29 (1963) 140 [5].

RADIOACTIVITY: ^{115m}Cd. Measured: E_{γ}, I_{γ}, γ-γ-coincidences, γ-γ-correlations.

Obtained: Energies of levels of ^{115}In, J, π, and boundary values of $E_{ß}$ and $I_{ß}$. An NaI(Tl) crystal was used as detector.

The results are given in Table 9.

1.6. M. ISHII. "Internal Conversion Electrons in ^{115}In from the Decay ^{115m}Cd" J. Phys. Soc. Japan 32 (1972) 1450 [6].

RADIOACTIVITY: ^{115m}Cd. Measured: E_{γ}, I_{γ}, E_{ce}, I_{ce}.

Obtained: Conversion coefficients and multipolarities of transitions. Electrons were recorded with an Si(Li) detector and the gamma quanta with a Ge(Li) detector. The background due to ß-particles and Compton electrons was suppressed by the method of coincidences with X-ray quanta.

The results are given in Table 10.

1.7. V. SERGEEV, J. BECKER, L. ERIKSSON, L. GEDEFELDT, L. HOLMBERG. "Levels in ^{115}In Populated in the Decay of ^{115m}Cd" Nucl. Phys. A202 (1973) 383 [7].

RADIOACTIVITY: ^{115m}Cd. Measured: E_{γ}, I_{γ}, γ-γ-correlations.

Obtained: Energies of levels of ^{115}In, J, π, lifetime of 933- and 1418-keV levels and multipolarities of transitions. The results were obtained with a Ge(Li) detector, which was calibrated with the isotopes ^{22}Na,

^{40}K, ^{54}Mn, ^{57}Co, ^{60}Co, ^{88}Y, ^{137}Cs and ^{182}Ta. The detector had a resolution of 2.7 keV at 1.33 MeV. The results of the study are compared with those of Ref. [8]. The data obtained in Refs [7, 8] are given in Tables 11 and 12.

The above are the principal studies used in evaluating the nuclear data on ^{115}Cd, ^{115m}Cd and ^{115}In.

2. EXPERIMENTS ON NUCLEAR REACTIONS ON ^{115}In

In evaluating transition energies, we used not only studies on the ß-decay of ^{115}Cd and its isomer but also works on Coulomb excitation of ^{115}In [9] and inelastic scattering [10, 11] on this nucleus. In general, energy measurements are performed with great accuracy in such studies.

In Refs [9-11], the measurements were carried out with Ge(Li) detectors. The experimental results are in good agreement with data obtained from studies on ^{115}Cd and ^{115m}Cd decay.

In these reactions practically all the levels of ^{115}In are excited except the comparatively long-lived ones - 828, 864, 934 and 1418 keV (owing to their small widths).

The values obtained in Refs [9-11] and used in the evaluation are given in Table 13.

3. EVALUATED NUCLEAR DATA ON THE DECAY OF ^{115}Cd AND ITS ISOMER

3.1. Energy of γ-transitions

In order to evaluate the energies of γ-transitions in ^{115}Cd and ^{115m}Cd decays, we used the results of Refs [3, 4, 7, 9-11], which give the accuracy of transition energy determination. Thus, in determining the average value, each experimental result can be considered with its corresponding weight. In other words, we found the weighted average value [40] determined by the formula

$$\bar{x} = \frac{\sum_{i=1}^{n} p_i x_i}{\sum_{i=1}^{n} p_i}, \qquad (1)$$

where x_i is the value, obtained in the i-th experiment, of the quantity being averaged and $p_i = \frac{1}{\sigma_i^2}$ is the weight of the measurement, σ_i being the absolute measurement error for x_i.

The weighted rms deviation is found by the formula

$$\delta = \sqrt{\frac{\sum_{i=1}^{n} p_i (x_i - \bar{x})^2}{\sum_{i=1}^{n} p_i}} . \qquad (2)$$

The evaluated energies of γ-transitions for ^{115}Cd and ^{115m}Cd decays are given in Tables 15 and 16.

3.2. Intensities of γ-transitions in ^{115}Cd decay

The γ-transition intensities are given in most studies in relative units. The problem of conversion into absolute units (quantum/100 decays) was resolved in the following manner: we found the balance of intensities of γ-quanta and conversion electrons for one or more well-established levels, with allowance for the intensities of β-transitions to these levels which are given as percentages of the total number of decays (100%), and then determined the coefficient of conversion from relative to absolute units.

In order to evaluate the intensities of γ-transitions during decay of the ^{115}Cd ground state, we used the data of Refs [1-4, 44]. In Refs [1] and [2], the intensities of γ-quanta are given without indication of the error, and the average value was determined on the assumption that all measurements were independent and identical in weight. Thus, the evaluation was performed by the formula

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n} , \qquad (3)$$

where n is the number of quantities being averaged and x_i the i-th measurement.

The absolute error in this case is determined by the expression

$$\sigma = \sqrt{\frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{(n-1)n}} . \qquad (4)$$

This method of evaluation, however, is not perfect because of the fact that the measurements are taken with identical weight, regardless of what apparatus is used.

This may substantially affect the evaluation result, since the measurements performed on semiconductor detectors having higher resolution than scintillation detectors are correspondingly more accurate.

The inaccuracy due to this factor can be partially eliminated by qualitative analysis of the experimental results. In particular, if there is a scintillation spectrometer result differing widely from the others, the evaluation is performed without it.

After conversion of the intensity values from relative to absolute units, the evaluation was performed by formulae (3) and (4). The results are given in Table 15.

3.3. Intensities of γ-transitions in ^{115m}Cd decay

The intensity of γ-quanta emitted in the decay of the isomer ^{115m}Cd was evaluated on the basis of data of Refs [3, 5-7, 12]. A similar procedure was applied to convert the results of these studies into absolute units, and then the averaging was performed. Since all these studies indicate experimental errors, the evaluation can be performed with allowance for the weight of each result by formulae (1) and (2). The evaluated intensities are given in Table 16.

3.4. Internal conversion

In order to evaluate the internal conversion coefficients (ICC), we used mainly the data of Ref. [4]. However, in evaluating the ICC for the 35- and 336-keV transitions, the data of Refs [1-4, 13-17] were taken into account. In Refs [16] and [17], the measurements of ICC on the K-shell for the 35-keV transition sharply contradict all the others (see Table 14). Since they were obtained with a scintillation detector, these values were not taken into account in the evaluation.

The ICC calculated by formulae (1)-(4) are presented in Table 15.

The spectrum of internal conversion electrons during ^{115m}Cd decay was studied in Ref. [6], whose data can be used for evaluating the ICC on the K-shell for some lines. The results are given in Table 16.

3.5. ß-spectrum

The data of Refs [1–4] were used to evaluate the ß-particle energies and intensities during the decay of the ^{115}Cd ground state.

Moreover, the energies of the ß-groups were determined from the difference $(Q_ß - E_{\gamma p})$.

Here $Q_ß = (1452 \pm 9)$ keV, the maximum energy of ^{155}Cd ß-decay is taken from the atomic mass tables of A. Wapstra and N. Gove [18], and $E_{\gamma p}$ is the pre-evaluated energy of the level of the daughter nucleus, which is populated during ß-decay. The evaluation is given in Table 17.

The ß-spectrum of the isomer ^{115m}Cd was evaluated similarly. Here we used the data of Refs [1, 3, 5, 7, 18] and the level energy values. The evaluated ß-particle energies and intensities are given in Table 18.

Direct ß-transition from the 336-keV ^{115}In isomer state to the ^{115}Sn ground state occurs with a relative intensity of (3.7 ± 0.8)% [3]. With a probability of 96.3% this level decays to the ^{115}In ground state, emitting a γ-quantum.

3.6. Lifetimes of the states of ^{115}Cd and ^{115}In

In addition to the half-lives of the ^{115}Cd and ^{115}In ground states, we evaluated the lifetimes of the isomer levels of these nuclei and also those of some comparatively long-lived excited states of the ^{115}In nucleus. The data of Refs [1, 3, 4, 7, 9, 17, 19–30] were used in the evaluation. The results are given in Table 19.

LEVEL SCHEME OF ^{115}In

The decay schemes of ^{115}Cd and its isomer ^{115m}Cd could be prepared afresh from the evaluations performed (see Fig. 1). It should be noted that the ß-decay of ^{115m}Cd is predominantly to the ^{115}In ground state and only ~3% of the ß-particles populate the levels of the daughter nucleus; therefore several weak γ-lines occur here. They are not shown in the scheme but are given in Table 16.

The spin and parity of the ^{115}In ground state have been well studied and their values are $9/2^+$ [31–33]. From this state the $ß^-$-decay occurs to the ground state of ^{115}Sn $(\frac{1}{2}^+)$ with a half-life of 5×10^{14} years.

The 336-keV level is the isomer level with a lifetime of 4.4 h. This isomer decays to the ground state and also by $ß^-$-transition to the ^{115}Sn ground state. The relative intensities of these two decay branches amount respectively to 96.3 and 3.7% [3]. The value of spin $\frac{1}{2}^-$ [32, 33] for this level is in good agreement with that of the multipolarity of transition to the ground state -M4 + E5 [34].

The value $3/2^-$ is ascribed to the 597-keV level. This value is given in most of the studies considered and shows good agreement with the multipolarities of transitions associated with this level. The lifetime of the level is evaluated as $\leq$ 0.25 nsec in Ref. [22].

Because of the quantum characteristics of the levels with 828- and 863-keV excitation energies there are a large number of contradictory data: $\frac{1}{2}^+$, $3/2^+$ [4, 7, 35-38] and $\frac{1}{2}^-$, $3/2^-$, $5/2^-$ [1-3]. G. Graeffe and co-workers [3], in particular, ascribe the spin $5/2^-$ to the 828-keV level. This was justified by the following: the 105-keV transition occurs to this level from the 934-keV level which has a spin of 7/2 and positive parity (this is well established both from studies on the decay of the isomer ^{115m}Cd and from those on nuclear reactions). These authors ascribe multipolarity E1 to this transition. However, it is difficult to correlate the value $5/2^-$ with the 492- and 231-keV electric dipole transitions having a small M2 admixture to the well-established 336-keV isomer level ($\frac{1}{2}^-$). Recent measurements by V. Sergeev and co-workers [7] show that the 105-keV transition is an electric quadrupole transition. The same value is given in a study on photo-excitation of ^{115}In [37] and in Ref. [38], where the nature of the transition is determined by comparing the theoretical [34] and experimental values of the internal conversion coefficient.

Thus, the value of $3/2^+$ can be ascribed to the 828-keV level and $\frac{1}{2}^+$ to the 863-keV level, since it is from this latter level that the 35-keV transition having the nature M1 + $(3.0^{+0.5}_{-0.3})$% E2 [4, 34, 36] occurs to the 828-keV level.

The obtained values of spins and parities of the 828- and 863-keV levels are confirmed by measurements of the angular correlations of γ-quanta [35, 36].

Higher levels of ^{115}In have been investigated in studies on the decay of the isomer ^{115m}Cd [1, 3, 5, 7, 35, 43] and also in nuclear reactions [9-11, 37, 39, 41, 42]. The quantum characteristics given in these references do not contradict each other.

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Table 1

	E_β (keV)	I_β (%)
^{115m}Cd	1610	97
	680	2
	310	1
	190	0,3
^{115g}Cd	1110	61,5
	860	1,5
	630	12
	590	25

Table 2

E_γ (keV)	I_γ (rel. units)	E_{level} (keV)	Spin and parity
230	2,3	335	1/2
260	7	595	$5/2^-$
267	0,7	825	$3/2^-$
335	-	858	$3/2^-$
492	51	935	7/2
520	(100)	1300	$11/2^+$
		1420	$9/2^+$

Table 3

^{115}Cd decay				^{115}In	
E_β (keV)	I_β (%)	E_γ (keV)	I_γ (rel. units)	E_{level} (keV)	Spin and parity
590	27	528	(100)	597	$5/2^-$
630	10	492	39	827	$3/2^-$
860	1	265	$<$ 0,2	862	$1/2^-$, $3/2^-$
1110	61,6	262	7,6		
		230	2,2		
		35	2		

Table 4

^{115}Cd decay		^{115m}Cd decay		^{115}In	
E_γ, keV	I_γ, rel. units	E_γ, keV	I_γ, rel. units	E_{level}, keV	Spin and parity
35,6 ± 0,6	1,4 ± 0,3	105,6 ± 0,8	0,45 ± 0,15	0	$9/2^+$
231,5 ± 0,4	2,4 ± 0,3	130 ± 5	< 0,03	336	$1/2^-$
260,8 ± 0,4	6,5 ± 0,4	158,10 ± 0,04	0,9 ± 0,2	597	$3/2^-$
267,1 ± 0,6	0,13 ± 0,02	292 ± 5	< 0,1	829	$5/2^-$
336,3 ± 0,4	178 ± 7	336,3 ± 0,4	0,25 ± 0,10	864	$3/2^-$
492,6 ± 0,3	26 ± 1	485,0 ± 0,6	13,6 ± 1,0	934	$7/2^+$
527,9 ± 0,3	(100)	492,6 ± 0,3	0,45 ± 0,10	1078	$5/2^+$
		934,4 ± 0,6	(100)	1133	$(11/2)^+$
		1133,0 ± 0,6	4,2 ± 0,3	1291	$(9/2)^+$
		1291,2 ± 0,6	46 ± 2	1419	$(9/2)^+$
		1419,4 ± 1,0	0,11 ± 0,02	1450	$(7/2)^+$
		1450,1 ± 1,0	0,85 ± 0,10		

Table 5

	E_β, keV	I_β, %
^{115g}Cd	573	31,6
	608	10,9
	840	3,74
	1110	63,5
^{115m}Cd	160	0,017
	191	0,27
	319	0,93
	477	0,065
	675	1,72
	1610	97

Table 6

E_{ce}, keV	Electron shell	Transition energy, keV	I_γ, %	Relative error, %	I_{ce}, %
31,39	L_I	35,63 ± 0,05	0,36*		0,37 ± 0,04
31,69	L_{II}				0,19 ± 0,07
31,90	L_{III}				0,23 ± 0,035
34,96	M				0,21 ± 0,06
35,64	$N+O$				0,037 ± 0,018
203,53	K	231,47 ± 0,1	0,76	12	0,012 ± 0,004
232,86	K	260,80 ± 0,06	2,05	10	0,069 ± 0,007
		267 ± 2	0,06	+50	
308,29	K	336,23 ± 0,05	44,9	-25	39,3
332,21	L				8,70 ± 0,44
335,64	$M+N$				1,6 ± 0,16
464,20	K	492,14 ± 0,06	9,45	5	0,025 ± 0,003
492,76	K	527,70 ± 0,06	30,3	5	0,058 ± 0,006

*/ Calculated from theoretical α_k.

Table 7

E_{trans}, keV	α_k exp. (x 10^2)	Multipolarity
35,63		M1 + (3,0 $^{+0,5}_{-0,3}$) % E2
231,47	1,6 ± 0,5	E1 + < 3% M2
260,80	3,5 ± 0,5	M1 + < 50% E2
336,23	(87)	M4 + < 5 % E5
492,14	0,28 ± 0,04	E1 + (4±2)% M2
527,70	0,20 ± 0,03	E1 + 4 % M2

Table 8

E_{level}, keV	I_β to given level, %	Lifetime, nsec	Spin and parity
336,23 ± 0,05	58		$1/2^-$
597,03 ± 0,08	1,3		$3/2^-$
828,39 ± 0,08	10	5,4 ± 0,2	$3/2^+$
863,95 ± 0,09	31	1,1 ± 0,1	$1/2^+$, $3/2^+$

Table 9

E_γ, keV	I_γ, keV rel. intensity	E_β, keV	I_β, %	E_{level}, keV	Spin and parity
* 1420 ± 15	2,0 ± 1,5	205	0,4	935	$7/2^+$
1289 ± 5	45 ± 2	335	0,9	1129	$13/2^+$
* 1130 ±5	5,2 ± 1,0	496	0,07	1290	$11/2^+$
935 ± 4	100	690	1,6	1420	$9/2^+$
485 ± 4	16,0 ± 1,5	1625	97		
(355)	(⩽0,2)				
* 292 ± 5	0,20 ± 0,10				
* (206± 6)	(0,15±0,10)				
* 162 ± 3	1,3 ± 0,4				
* 130 ± 5	0,07 ± 0,04				

*/ New lines.

Table 10

E_{trans}, keV	I_γ (rel. units)	I_{ce} (rel. units)	α_K *	Multipolarity
106	0,91 ± 0,15	1,01 ± 0,13	0,97 ± 0,19	E2
158	3,60 ± 0,35	0,67 ± 0,10	0,16 ± 0,03	M1 + E2
336	1,0	1,0		M4
485	58,6 ± 5,0	0,41 ± 0,07	$(6,1 \pm 1,0).10^{-3}$	M1 + E2
934	389 ± 34	0,58 ± 0,07	$(1,24 \pm 0,20).10^{-3}$	M1 + E2

*/ The conversion coefficients for all transitions are normalized in relation to the theoretical value of α_k for the 336-keV transition.

Table 11

V. Sergeev [7]			R. Moret [8]	
E_γ, keV	I_γ (rel. units)	Multipolarity	E_γ, keV	I_γ (rel. units)
105,14 ± 0,07	0,24 ± 0,04	E2	106,0 ± 0,8	0,6 ± 0,1
158,05 ± 0,07	1,0 ± 0,1	M1 + 3% E2	158,0 ± 0,5	0,6 ± 0,1
231,35 ± 0,10*	0,05 ± 0,01			
260,8 ± 0,1*	0,05 ± 0,01			
316,1 ± 0,2	0,15 ± 0,02	M1 + 5% E2	317 ± 1	0,12 ± 0,03
336,2 ± 0,2	0,31 ± 0,03	M2	336,2 ± 0,2	0,35 ± 0,05
386,0 ± 0,5*	0,010 ± 0,005			
477,0 ± 0,5*	0,010 ± 0,005			
484,35 ± 0,15	15 ± 1	M1 + E2	484,8 ± 0,5	18,0 ± 0,5
492,2 ± 0,2	0,47 ± 0,05		492,2 ± 0,2	0,6 ± 0,1
507,6 ± 0,4*	0,02 ± 0,01			
933,6 ± 0,1	100		934,7 ± 0,5	100
941,2 ± 0,5*	0,03 ± 0,01			
1132,5 ± 0,1	4,1 ± 0,3	M1 + E2	1133 ± 0,5	4,2 ± 0,8
1290,5 ± 0,1	45 ± 3		1291,0 ± 0,5	41,0 ± 1,0
1418,1 ± 0,2	0,10 ± 0,01		1419,5 ± 1,0	0,15 ± 0,05
1448,7 ± 0,2	0,83 ± 0,07		1450 ± 1	0,90 ± 0,15
1462,5 ± 0,5*	0,05 ± 0,03			
14[illegible] ± 0,3*	0,025 ± 0,003			

*/ ines.

Table 12

E_{trans}, keV ^{115}In	Lifetime, nsec	Spin and parity	Intensity of β^--transition from ^{115m}Cd isomer state to given level, %
0		$9/2^+$	97
933,6	0,057 ± 0,005	$7/2^+$	1,7
941,2		$5/2^+$	$\leqslant 2.10^{-4}$
1078,0		$5/2^+$	$\leqslant$ 0,001
1132,5		$11/2^+$	0,06
1290,5		$13/2^+$	0,92
1418,0	$\leqslant$ 0,2	$9/2^+$	0,3
1448,7		$9/2^+$	0,02
1462,5		$7/2^+$	0,002
1485,8		$9/2^+$	0,001

Table 13

Data on nuclear reactions

[11]			[9]			[10]		
E_{trans}, keV	E_{level}, keV	Spin and parity	E_{trans}, keV	E_{level}, keV	Spin and parity	E_{trans}, keV	E_{level}, keV	Spin and parity
157,1 ± 0,5			158 ± 1			157,1 ± 0,5		
260,8 ± 0,5			260 ± 1			260,8 ± 0,5		
316,5 ± 0,5			317 ± 2			316,5 ± 0,5		
336,5 ± 0,5	336,3	$1/2^-$	335 ± 1	335	$1/2^-$	336,5 ± 0,5	336,5	
346,6 ± 0,5	597,1	$3/2^-$	342 ± 2	595	$3/2^-$	344,6 ± 0,5	597,3	
353,5 ± 0,5			351 ± 2					
385,5 ± 1,0						385,2 ± 0,5		
481,0 ± 0,5			481 ± 1			481,0 ± 0,5		
941,7 ± 0,5	941,7	$5/2^+$	944 ± 3	944		941,7 ± 0,5	941,7	$5/2^+$
1078,2 ± 0,5	1078,2	$5/2^+$	1076 ± 2	1076	$5/2^+$	1078,2 ± 0,5	1078,2	$5/2^+$
1133,1 ± 0,5	1133,1	$11/2^+$	1131 ± 2	1131		1133,1 ± 0,5	1133,1	$11/2^+$
1290,6 ± 0,5	1290,6	$13/2^+$	1289 ± 2	1289		1290,6 ± 0,5	1290,6	$13/2^+$
1449,4 ± 0,5	1449,4	$9/2^+$	1448 ± 2	1448		1449,4 ± 0,5	1449,4	$9/2^+$
1463,7 ± 1,2	1463,7	$7/2^+$						
1486,6 ± 0,7	1486,6	$9/2^+$				1485,4 ± 0,5	1485,4	

Table 14

Conversion coefficients

35-keV transition		336-keV transition	
α_K	Ref.	α_K	Ref.
7,6 ± 0,8	[2]	0,83	[1]
9,6 ± 1,2	[3]	0,84 ± 0,09	[2]
8,50 ± 0,35	[13]	0,91 ± 0,06	[3]
7,7 ± 0,8	[15]	0,87	[4]
3,43 ± 0,12	[16]	0,70 *	[14]
4,2 ± 0,6	[17]		

*/ Theoretical conversion coefficient.

Table 15

Energies and intensities of conversion electrons and gamma quanta accompanying ß⁻-decay of ^{115}Cd

Transition energy E_γ, keV	Intensity of γ-quanta, (quantum/100 decays)	Electron energy E_{ce}, keV	Electron shell	Electron intensity I_{ce} (n/100 decays)	Conversion coefficient α (exp.)	Conversion coefficient α (theor.)
35,628 (27)	0,40 (4)	7,69	K		8,34 (47)	
		31,39	L_I	0,37 (4)		
		31,69	L_{II}	0,19 (5)		
		31,90	L_{III}	0,23 (3)		
		34,96	M	0,21 (7)		
		35,64	N+O	0,037 (18)		
231,41 (6)	0,63 (10)	203,53	K	0,012 (4)	0,016 (5)	E1 : 0,0145 M2 : 0,23
260,80 (4)	1,85 (13)	232,86	K	0,069 (7)	0,035 (5)	M1 : 0,033 E2 : 0,046
267,09 (3)	0,08 (6)					
336,23 (8)	48,2 (3)	308,29	K	39,3 (20)	0,85 (2)	M1 : 0,87 E5 : 0,66
		332,21	L	8,7 (5)		
		335,64	M+N	1,6 (2)		
492,18 (12)	10,0 (19)	464,20	K	0,025 (3)	0,0028 (4)	E1 : 0,00197 M2 : 0,022
527,708 (14)	26,7 (31)	499,76	K	0,058 (6)	0,0020 (3)	E1 : 0,0017 M2 : 0,018

N.B. The absolute error is indicated in brackets. It is of the same order as the corresponding number of the last decimal places in the result, e.g. 48.2 (33) = 48.2 ± 3.3.

Table 16

Energies and intensities of conversion electrons and gamma quanta accompanying ß⁻-decay of ^{115m}Cd

Transition energy, E_γ, keV	Intensity of γ-quanta I_γ (quantum/ 100 decays)	Energy of K-conversion electrons E_{ce}, keV	Electron intensity I_{ce} (n/100 decays)	Internal conversion coefficient, α_K
105,14 (4)	0,0049 (8)	77,20	0,0053 (7)	0,97 (19); E2
130 (5)	0,0013 (8)			
158,08 (10)	0,0231 (25)	130,14	0,0035 (5)	0,16 (3); M1 + E2
231,41 (6)	0,0010 (2)			
260,80 (4)	0,0010 (2)			0,043 (8); M1 + E2
292 (5)	0,0038 (19)			
316,20 (18)	0,0030 (4)			M1 + E2
336,23 (8)	0,0056 (5)	308,29	0,0052 (7)	
385,59 (38)	0,0002 (1)			
477,0 (5)	0,0002 (1)			E2
484,39 (15)	0,292 (14)	456,45	0,0021 (4)	/6,1 (10)/.10^{-3}; M1 + E2
492,18 (12)	0,00932 (3)			0,0019 (3); E1
507,6 (4)	0,0004 (2)			
933,62 (13)	1,990 (33)	905,68	0,0030 (4)	/1,24 (20)/.10^{-3}; M1 + E2
941,56 (33)	0,0006 (2)			
1132,55 (19)	0,0838 (34)			M1 + E2
1290,55 (14)	0,888 (41)			
1418,2 (3)	0,00204 (9)			
1449,2 (5)	0,0167 (2)			
1485,8 (4)	0,00050 (6)			

Table 17

Energies and intensities of ß-particles emitted during ^{115}Cd decay

ß energy, keV	ß intensity, %
587 (9)	28,7 (28)
623 (9)	10,7 (7)
854 (9)	1,40 (8)
1115 (9)	61,2 (20)

Table 18

Energies and intensities of ß-particles emitted during ^{115m}Cd decay

ß energy, keV	ß intensity, %
139 (9)*	0,001*
161 (9)*	0,002*
168 (8)	0,018 (2)
198 (8)	0,32 (5)
324 (10)	0,94 (4)
488 (8)	0,065 (4)
546 (9)*	$\leqslant$ 0,001*
683 (9)*	$\leqslant 2.10^{-4}$*
684 (7)	1,76 (15)
1616 (7)	97

*/ Poorly established.

Table 19

Lifetimes of the levels of ^{115}Cd and ^{115}In

Isotope	Level, keV	$T_{\frac{1}{2}}$
^{115}Cd	0	(53,40 ± 0,05) h
	173	(44,59 ± 0,33) d
^{115}In	0	5×10^{14} a
	336	(4,4 ± 0,5) h
	597	⩽ 0,25 ns
	828	(5,65 ± 0,10) ns
	864	(1,40 ± 0,2) ns
	933	(0,057±0,005) ns
	1418	⩽ 0,2 ns

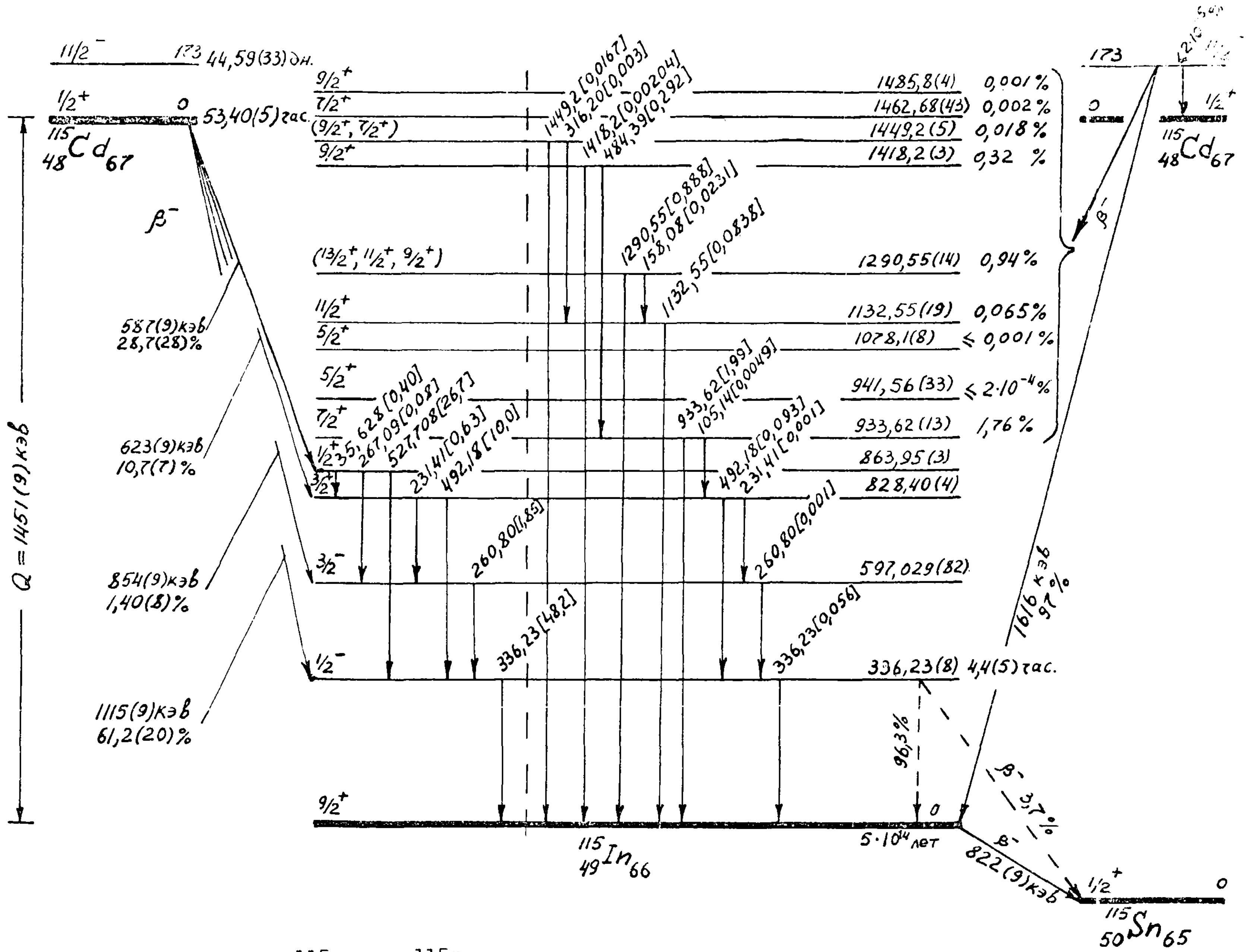

Fig. 1 Decay scheme of ^{115}Cd and ^{115m}Cd. The intensity of γ-quanta is indicated in square brackets (I_{ce}, see Tables 15 and 16).