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Decay study of $^{104}\mathrm{In}^{m,g}$

J. Vanhorenbeeck
Université Libre de Bruxelles, B-1050 Bruxelles, Belgium

E. Coenen, P. Decrock, P. Dendooven, K. Deneffe, M. Huyse, G. Reusen,
P. Van Duppen, and J. Wauters
Leuven Isotope Separator On Line Katholieke Universiteit Leuven, B-3030 Leuven, Belgium

P. del Marmol
Centre d'Etudes Nucléaires, Studiecentrum voor Kernenergie, B-2400 Mol, Belgium
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The $^{104}\mathrm{In}^{g}$ and $^{104}\mathrm{In}^{m}$ nuclei have been produced by means of the following reactions: $^{106}\mathrm{Cd}(p,3n)$, $^{92}\mathrm{Mo}(^{14}\mathrm{N},2n)$, $^{92}\mathrm{Mo}(^{16}\mathrm{O},p3n)$, $^{92}\mathrm{Mo}(^{20}\mathrm{Ne},3p5n)$. Their decay has been investigated after mass separation. From β^{+}, γ, and x direct spectra and γ-γ-T, γ-x-T, and β-γ-T coincidences, a $^{104}\mathrm{Cd}$ level scheme has been constructed. The observation of an intense background of statistical γ rays, emitted after strong β decay to high energy levels, resolves the problems of previously published work concerning β-ray intensities, spin determinations, and Q_{EC} value.

I. INTRODUCTION

The nucleus $^{104}\mathrm{Cd}$ has been scarcely studied with respect to higher even-mass isotopes. The only other known results from the $^{104}\mathrm{In}^{g}$ decay show a very partial decay scheme up to excitation energies of about 3 MeV (Ref. 1) while the expected Q_{EC} value is 8.0 ± 0.2 MeV.[2] On the other hand, levels of high angular momenta have been previously studied through the $^{102}\mathrm{Pd}(^{4}\mathrm{He},2n)$ reaction[3] up to energies of about 5 MeV. The observed scheme compares well with those of $^{106}\mathrm{Cd}$ and $^{108}\mathrm{Cd}$ obtained by heavy-ion reactions[4] and decay of the indium isobars.[5]

Recent work on the $^{104}\mathrm{In}$ level scheme[6] as well as the magnetic- and quadrupolar-moment measurements of the ground state of $^{104}\mathrm{In}$ (Ref. 7) show evidence that $^{104}\mathrm{In}$ differs from $^{106}\mathrm{In}$ and $^{108}\mathrm{In}$. The low-spin isomeric state deexcites mostly by internal transition to the ground state.[6] The angular momentum of the latter appears to be different of the one observed for both $^{106}\mathrm{In}$ and $^{108}\mathrm{In}$.[7,8] The experimental values for Q_{EC} show an unexpected behavior for the decay of this nucleus (see Ref. 9 and references therein).

The nucleus $^{104}\mathrm{Cd}$ should appear as a transition nucleus between a semimagic $^{98}\mathrm{Cd}$ nucleus and a soft nucleus where two shapes can coexist. While the first excited states of $^{102}\mathrm{Cd}$ (Ref. 10) and $^{100}\mathrm{Cd}$ (Ref. 11) disclose already a more individual structure it would be interesting to study in detail the transitional nucleus $^{104}\mathrm{Cd}$: the high Q_{EC} value allowes, in principle, the feeding of a large quantity of levels.

II. EXPERIMENTAL PROCEDURES

A. Reaction

The choice of the nuclear reaction depends on which isomer of $^{104}\mathrm{In}$ one plans to favor.

1. Heavy-ion reactions

To obtain the ground state, with a presumed angular momentum equal to or higher than 5, the following reactions were used: $^{92}\mathrm{Mo}(^{14}\mathrm{N},2n)$, $^{92}\mathrm{Mo}(^{16}\mathrm{O},p3n)$, and $^{92}\mathrm{Mo}(^{20}\mathrm{Ne},3p5n)$. These heavy-ion beams were produced by the CYCLONE cyclotron at Louvain-la-Neuve. The beam intensities varied between 2 and 4 $e\mu$A. Mass 104 was selected by means of the LISOL separator.[12] The enriched $^{92}\mathrm{Mo}$ foil was mounted directly in the Febiad ion source.

2. Light-ion reactions

To obtain the low-spin isomer, a different reaction was chosen: $^{106}\mathrm{Cd}(p,3n)$ at a Leuven ion guide isotope separator on line (LIGISOL) 40 MeV incident energy. On this occasion the LIGISOL setup[13] was used to guide the ionized reaction products towards the separator.

B. Activity transfer

In both cases the mass-separated ions were caught on a system consisting of an aluminized Mylar band which placed them in front of the various counting devices.

C. Detection method

Spectra in singles and coincidences were taken with thick intrinsic germanium detectors, a 3 in. by 3 in. NaI detector, a planar x-ray detector, and a plastic detector, 5 cm thick, to measure β^{+} spectra up to about 10 MeV.

D. Timing

Irradiation and counting times for partial spectra and the number of spectra measured per irradiation depends on which isomer one wishes to study. These limitations are necessary to avoid parasitic effects due to the decay of $^{104}\mathrm{Cd}$ and $^{104}\mathrm{Ag}$ formed directly in the source or through the decay of ^{104}In. The different direct spectra and coincidence spectra are written directly in list mode on magnetic tapes.

III. EXPERIMENTAL RESULTS

A. Deexcitation of the isomeric state formed by light-ion reactions

The low-energy γ spectra show besides a 93.5 ± 0.5 keV γ line, x rays from silver, cadmium, and indium. These spectra are registered every 5 s during a total time of 50 s between each implantation cycle.

Figure 1 compares the characteristic K x rays of the first and last time units of this cycle. The half-life obtained from the 93.5 keV ray and the In K x rays is 15.2 ± 2.0 s in agreement with the result of Barden *et al.*[6]

One can directly deduce the conversion coefficient α_K by means of the $N_x(\text{indium})/N_\gamma$ (93.5 keV) ratio, corrected for the fluorescence yield. One finds $\alpha_K=45\pm5$ in agreement with the theoretical coefficient for a $M3$ transition (43.3) although a $E4$ multipolarity (53.6) cannot be excluded. This result is in agreement with that of Ref. 6.

The measurement of the relative intensities of the x-ray spectra of cadmium and indium and the evolution of the

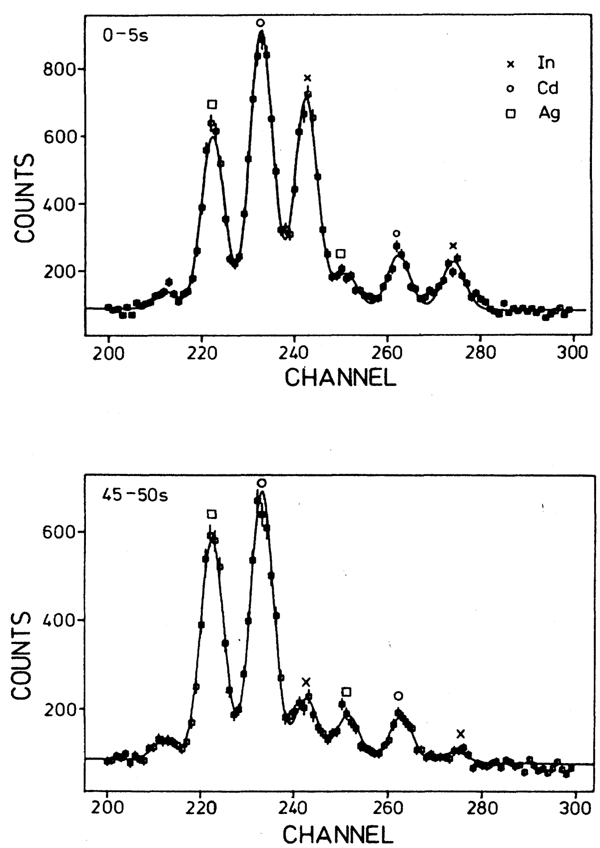

FIG. 1. Comparison of x-ray spectra of mass 104 taken at the decay station in the first and last time unit of a 10×5 s cycle.

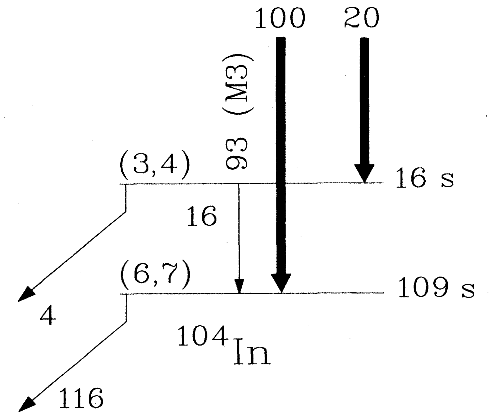

FIG. 2. Decay scheme of $^{104}In^m$.

decay of the 658 keV γ ray of ^{104}Cd give for the short-lived isomer the ratio between the isomeric decay and its β^+/EC decay. Supposing that $\sum\beta^+/\sum\text{EC}=1$ for both the fundamental and isomeric levels,[9] one finds (see Fig. 2),

$$\frac{N_{\beta^+,\text{EC}}}{N_{\text{IT}}+N_{\beta^+,\text{EC}}}=0.20\pm0.05 .$$

In this proton-induced reaction the direct production of the isomer relative to the ground state is 20% (see Fig. 2).

B. Deexcitation of the fundamental state formed in a heavy-ion reaction

The partial decay spectra of each implantation cycle (6×60 s) were summed up. Any contribution from the 15.7 s low-spin in this heavy-ion reaction isomer was found to be negligible. The half-life was measured to be 108 ± 12 s. The γ transitions and their relative intensities are given in Table I.

A total of 14×10^6 Ge-Ge and 10×10^6 Ge-NaI coincidences made is possible to observe transitions with intensities down to about 1%. Figure 3 shows the γ spectrum coincident with the 658 keV γ ray. If a few discrete γ rays are detectable at low energy, one observes mostly an intense continuum up to 5.0 MeV. The results of broad windows on the high-energy part of the γ-γ coin-

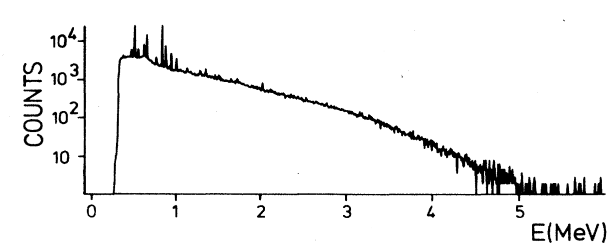

FIG. 3. A projection out of the Ge-Ge coincidence projection, gating on the 658 keV 2^+-0^+ transition in ^{104}Cd.

TABLE I. List of γ rays attributed to the decay of $^{104}In^{g}$ (X represents placed).

Energy	Intensity	Placed in the decay scheme	Energy	Intensity	Placed in the decay scheme
173.2±0.8	0.22±0.12		1408.3±0.6	0.54±0.24	
292.5±1.2	0.29±0.18	X	1416.5±0.5	1.23±0.31	X
321.5±0.2	3.25±0.38	X	1456.2±0.7	0.63±0.27	X
330.5±0.5	0.46±0.18		1460.5±0.3	0.84±0.38	
337.4±0.6	0.42±0.18		1467.6±1.1	0.31±0.23	
342.3±0.8	0.41±0.19		1491.9±0.4	1.13±0.31	
378.3±0.3	0.98±0.20	X	1496.5±0.3	0.82±0.39	X
403.2±0.3	0.77±0.17	X	1514.4±0.5	1.57±0.35	X
419.8±1.0	0.40±0.20		1539.5±0.7	0.81±0.28	
424.4±0.6	0.64±0.20	X	1573.4±0.9	0.48±0.25	
467.7±0.4	0.70±0.21	X	1578.7±0.7	0.57±0.26	X
473.9±0.1	5.20±0.35	X	1618.4±0.3	1.95±0.71	X
481.9±0.6	0.50±0.21		1638.2±0.6	0.69±0.28	X
499.7±0.2	2.42±0.27	X	1644.6±0.2	1.19±0.50	X
533.2±0.1	2.76±0.23	X	1654.7±1.4	0.34±0.23	
548.4±0.6	0.50±0.22	X	1667.0±0.5	0.64±0.24	
614.3±0.5	1.00±0.25		1674.5±0.3	2.0±0.4	X
622.1±0.1	14.5±0.4	X	1701.2±0.8	0.58±0.29	X
631.0±0.3	0.76±0.22		1715.6±0.5	0.71±0.27	X
636.0±0.7	0.57±0.24		1723.8±0.9	0.38±0.24	
658.0±0.1	100±0	X	1730.8	0.10±0.05	
710.2±0.3	1.26±0.30	X	1736.7±0.7	0.59±0.27	
760.5±0.5	0.65±0.23	X	1747.8±0.5	0.65±0.25	X
767.4±0.3	1.98±0.34	X	1752.9±0.9	0.39±0.23	
772.4±0.3	0.59±0.26	X	1771.0±1.1	0.52±0.28	
775.9±0.4	1.20±0.50	X	1800.7±1.2	0.35±0.24	
793.8±0.3	1.12±0.21		1818.2±0.3	0.88±0.47	X
804.1±0.6	0.68±0.23	X	1855.0±0.9	0.45±0.24	
817.2±0.3	1.61±0.26	X	1881.3±0.5	1.06±0.31	X
834.1±0.1	99.3±3.2	X	1940.8±0.8	0.67±0.28	X
841.1±0.2	1.38±0.23	X	1998.0±0.5	0.98±0.29	
862.1±0.5	0.77±0.24		2006.2±0.3	1.80±0.40	X
878.2±0.1	29.4±1.2	X	2074.0±0.4	0.74±0.24	
927.6±0.2	1.97±0.26	X	2100.7±0.8	0.60±0.28	X
943.6±0.1	14.9±0.8	X	2110.4±2.1	0.33±0.25	
956.7±0.5	0.81±0.22		2131.5±1.1	0.27±0.21	
1000.5±0.1	9.75±0.63	X	2152.2±1.1	0.37±0.23	
1021.4±0.2	1.27±0.20	X	2163.9±0.9	0.54±0.25	
1039.6±0.3	1.34±0.25		2206.4±0.9	0.45±0.24	
1047.7±0.4	1.03±0.26	X	2220.9±0.4	0.68±0.29	
1115.2±0.3	0.54±0.22	X	2252.8±0.6	0.94±0.30	
1125.4±0.5	1.03±0.29	X	2422.1±1.0	0.46±0.25	
1138.6±0.9	0.38±0.23		2480.6±0.8	0.52±0.23	
1146.4±0.9	0.48±0.25		2498.3±0.7	0.60±0.23	
1164.9±0.6	0.68±0.25		2655.7±1.3	0.25±0.20	
1211.5±1.0	0.32±0.23		2667.6±0.8	0.51±0.22	
1229.0±1.9	0.31±0.24		2702.3±0.6	0.55±0.22	
1231.5±0.3	0.38±0.18	X	2712.2±1.1	0.26±0.18	
1245.4±0.7	0.49±0.24	X	2758.8±1.4	0.24±0.20	
1268.1±1.6	0.39±0.27		2923.6±0.8	0.40±0.19	
1275.3±1.0	0.40±0.24		2934.6±1.1	0.31±0.18	
1281.9±0.3	2.43±0.39	X	3139.2±0.9	0.31±0.18	
1316.9±0.4	1.27±0.31	X	3150.0±0.6	0.62±0.21	
1328.2±1.1	0.30±0.23		3316.5±1.2	0.22±0.15	
1338.0±0.7	0.52±0.24	X	3351.5±1.0	0.25±0.15	
1344.0±0.5	1.15±0.31		3380.0±1.4	0.17±0.13	
1353.3±0.6	0.99±0.30	X	3547.3±1.7	0.17±0.14	
1360.8±1.3	0.35±0.24		3707.5±0.9	0.26±0.13	
1382.1±1.3	0.48±0.29		3733.7±1.2	0.13±0.10	

TABLE I. (*Continued*).

Energy	Intensity	Placed in the decay scheme	Energy	Intensity	Placed in the decay scheme
3740.7±0.8	0.26±0.12		3937.3±1.4	0.14±0.11	
3839.1±0.9	0.31±0.13		3943.6±1.2	0.21±0.12	
3850.7±1.2	0.17±0.12		3965.1±1.2	0.18±0.11	

cidences are shown in Fig. 4. As, e.g., the 622.1, 943.6, 878.2, and 1000.5 keV lines are still visible and with relative intensities comparable to the singles spectrum we can conclude that these high-energy γ rays (up to 5.0 MeV) are not Compton events from one or two higher-lying γ rays. As they feed levels up to 2.5 MeV they must originate from the "statistical" deexcitation of a group of levels above 5 MeV.

The β-γ coincidences show that the maximum energy of the β^+ spectrum in coincidence with the 622.1, 658, 834.1, and 943.6 keV transitions does not exceed 4.0±0.3 MeV. The resulting decay scheme is given in Fig. 5.

IV. DISCUSSION

A. ^{104}Cd levels

The observed results for ^{104}Cd can be compared to those compiled by Blachot *et al.*,[1] to the level scheme resulting from the deexcitation of the compound nucleus formed in the ^{102}Pd(^{4}He,2nγ) reaction[3] and to the known results of the adjacent even isotopes ^{106}Cd and ^{108}Cd.[4,5]

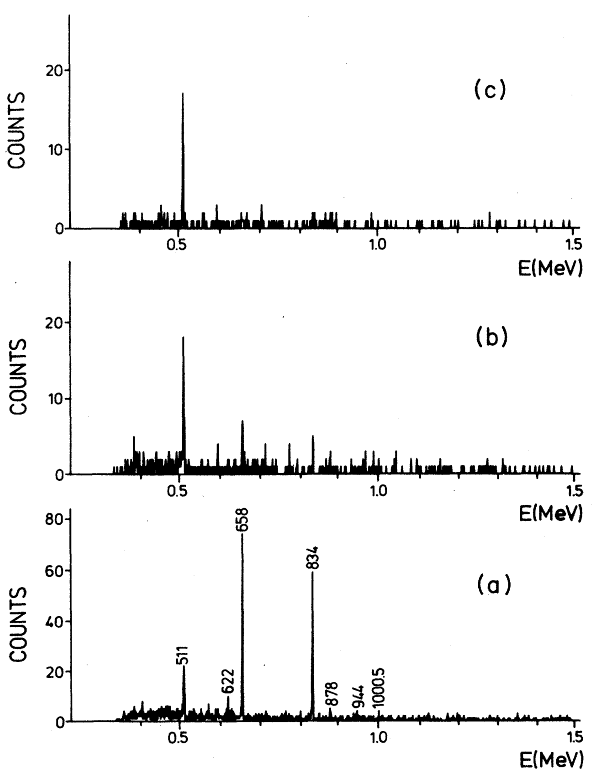

FIG. 4. Three projections out of the Ge-NaI coincidence matrix with energy windows on the NaI: (a) 4.2–4.8 MeV; (b) 4.8–5.4; (c) 5.4–6.0 MeV. The energy of the γ lines is given in keV.

With respect to the compilation of Blachot *et al.* we extend the level scheme, from 15 to 38 levels but still the ^{104}Cd level scheme from the ^{104}In^g decay is quite incomplete. Although most of the intensity of the discrete γ rays (see Table I) is accounted for by the level scheme (90%), the total intensity balance is out of order due to the large amount of statistical γ rays. To ignore this would lead to an overestimation of the various β^+/EC branching ratios feeding the energy levels below 3 MeV. As a consequence, a direct β feeding of the 4_1^+ level at 1492.1 keV has been assumed by Blachot *et al.*[1] resulting in a spin value of 5 for ^{104}In^g.

Bom *et al.*[9] have measured (also at the LISOL facility) the β^+ and γ spectrum emitted during the ^{104}In^g decay with a solid-state β telescope. They conclude that about 60% of the β^+/EC decay feeds levels lying between 5 and 5.7 MeV. Out of the β spectrum a β-end-point energy of 4302±56 keV was measured; the analysis of the β and γ spectrum made it possible to obtain a Q_{EC} value of 7.80±0.25 MeV, independent of the decay scheme.

The end-point energy is in agreement with our β-γ coincidence measurements and the difference between the Q_{EC} value and the end-point energy makes the β feeding to the 4^+ level at 1492.1 keV impossible, removing the arguments for a 5^+ for spin and parity of the ground state of ^{104}In. Finally a 5^+ level for ^{104}In^g would feed directly other 4^+ levels above 2 MeV and of different nature, these would deexcite as well to the 4_1^+ level (1492.1 keV) as to the 2_1^+ (658 keV) so the $I_{4_1^+ \to 2_1^+}/I_{2_1^+ \to 0^+}$ branching ratio would differ from 1 which is contrary to experiment.

In conclusion, the spin of the ground state of ^{104}In should be 6^+ or 7^+ and the various levels of ^{104}Cd fed directly by β^+/EC should have spins between 5 and 8. The results of Ref. 9 show that only the high-energy levels are fed with weak logft values. These levels then deexcite by simple or double cascade (with low ΔI transitions) towards levels located around 3 MeV. They then deexcite essentially towards the 4_1^+ level at 1492.1 keV. More details on the β-strength function of ^{104}In can be found in Ref. 14.

The results obtained by ^{4}He reactions give evidence of levels with high angular momenta ($I \sim 10$) deexciting by stretched transitions towards low-spin levels.[3] One notices that up to 3 MeV the observed levels are identical to those found in the decay of ^{104}In^g. This confirms the spins proposed for some of these levels. One should notice that the 8^+ level at 3210.7 keV is seen in both cases.

The level schemes of ^{106}Cd and ^{108}Cd have been studied both by β^+, EC (Ref. 4) decay and by heavy-ion reactions.[5] One observes many similarities for the levels below 3 MeV. The ground and isomeric states of ^{106}In and ^{108}In have spin and parity 7^+ and 2^+ (for ^{106}In^m the

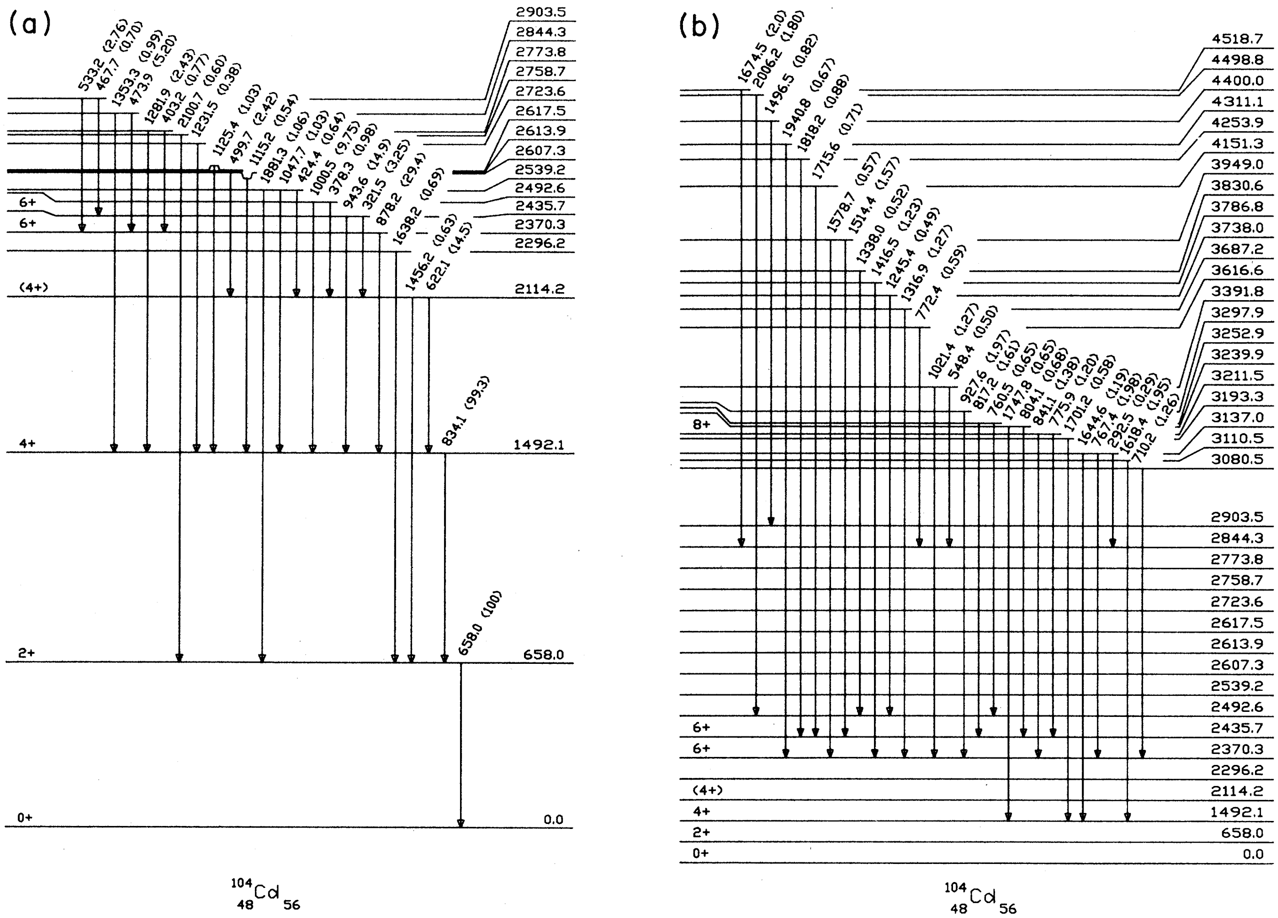

FIG. 5. Level scheme of ^{104}Cd.

spin is not measured).[7,8] Both states are only β-decaying and it is thus rather difficult to isolate totally the respective decay channels of In^g and In^n which explains why the $I_{4_1^+ \to 2_1^+}/I_{2_1^+ \to 0^+}$ ratio differs from unity contrarily to what is observed for the decay of ^{104}In^g. Moreover, a level at 3044.4 keV in ^{106}Cd, identified as a particle state, is copiously fed. No such state was, observed for ^{104}Cd.

Another 8^+ level is seen in ^{104,106,108}Cd isotopes; it is not directly fed in the decay of In^g but via higher-energy states [this is clearly observed in ^{106}Cd (Ref. 4)]. This state could be of a collective nature and belong to the vibrational band observed in the cadmium isotopes of higher mass number.

The various low-energy levels identified in ^{104}Cd can be classified as follows: a vibrational sequence build on the ground state; levels of individual character resulting essentially from proton $(g_{9/2}^{-2})$ or neutron $(g_{7/2}^2)(d_{5/2}^2)(g_{7/2} x d_{5/2})$ coupling; it is also not excluded to have negative-parity levels of type $(\pi h_{11/2} x \nu g_{7/2})$.

Figure 6 shows the systematic trends of the low-energy levels for isotopes of mass number 100–108: the first 2^+ level rises as the isotopes become more deficient in neutrons; the 8^+ level of collective nature decreases with A; there are several levels (5^+, 6^+, 8^+) staying constant with A.

All this shows clearly that the levels become more and more degenerate as one approaches the semimagic nucleus ^{98}Cd; the collective and individual particle modes change as the number of particles increases above the $N=50$ level.

The collective states can be compared to those calculated by different models: the rotator-particle coupling model described by Alaga *et al.*[15] and Lopac;[16] the model based on a slightly deformed rotator with axial symmetry to which two proton holes are coupled;[17] the interacting-boson approximation (IBA) model developed by Arima and Iachello who consider a group of bosons consisting of pairs of nucleons coupled with $L=0,2$ around a ^{100}Sn core within the formalism of the SU(5) subgroup.[18] If the last mode reproduces correctly the general trend of the excited levels of various nuclei (the different parameters included in the model are extracted from experimental spectra), it is less efficient in reproducing some detailed results. For all these models no detailed calculations are available for mass 104. Deformation calculations show that if ^{98}Cd has a very pronounced minimum for a zero

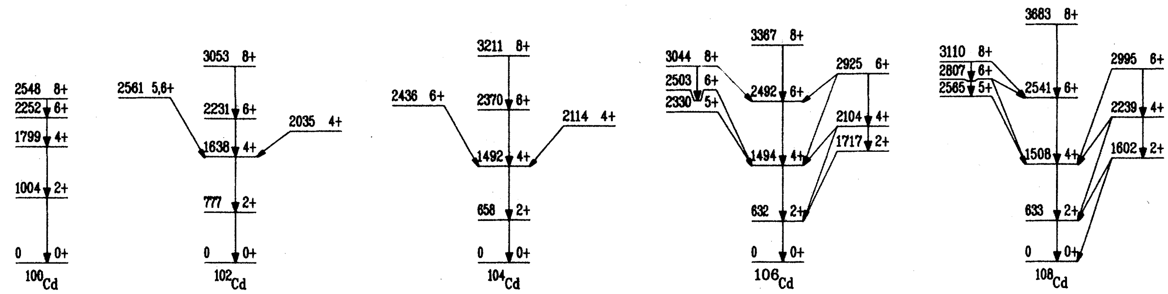

FIG. 6. Systematics of the low-energy levels of ^{100}Cd to ^{108}Cd.

deformation, ^{102}Cd and ^{104}Cd should take place among the soft nuclei with a weak prolate deformation.[19] The experimental quadrupole-moment values (Q_{2+}) measured by Esat *et al.*[20] confirm this prediction.

Between 3 and 6 MeV it seems that the levels are more of individual character based on similar configurations: they are connected by transitions of preferentially low ΔI. The configurations around 5.5 MeV for the levels fed through the giant Gamow-Teller resonance could be of the seniority 2 type (for both neutrons and protons)

$$[(\pi g_{9/2} x \nu d_{5/2})_{5^+,6^+,7^+} x (\pi g_{9/2} x \nu g_{7/2})_{1^+}]_{5,6,7}$$

and would then deexcite to the levels grouped around 3 MeV (Ref. 14) of the seniority 2 type, but only for neutrons *or* protons. The difference in energy is essentially due to the breaking of a proton pair or neutron pair giving roughly the observed 2.5 MeV. The multitude of configurations and the multitude of interconnecting transitions lead to the high number of unresolved γ rays.

B. Ground and isomeric states of ^{104}In

As discussed above, the decay of $^{104}\mathrm{In}^{g}$ is compatible with a spin 6^+ or 7^+. From the $M3$ multipolarity measurement of the 93.5 keV isomeric transition of 15.7 s half-life one should have a spin of 3^+ or 4^+ for the isomeric state. As the branching of this transition to the ground state is 80% one finds as partial half-life,

$$T_{1/2} = 15.7 \times (1+63.6)/0.8 = 1268 \text{ s},$$

while

$$T_{1/2}(\text{Moszkowski}) = 261 \text{ s for } M3,$$

$$= 4.82 \times 10^{8} \text{ s for } E4,$$

in a fair agreement with the Moszkowski predictions for a $M3$ multipolarity.

Spins of 5 or 6 are in agreement with direct measurements of the electric and magnetic moments of the ground state of ^{104}In and with an empirical calculation using the measured magnetic moments for the $\pi g_{9/2}$ and $\nu d_{5/2}$ states (π close to 48 and ν close to 56).[7] The decay scheme work on ^{104}Sn (Ref. 6) suggests 6 for the spin of the ground state of ^{104}In.

From these three measurements the most probable spin is 6 but only a direct spin measurement, such as has been

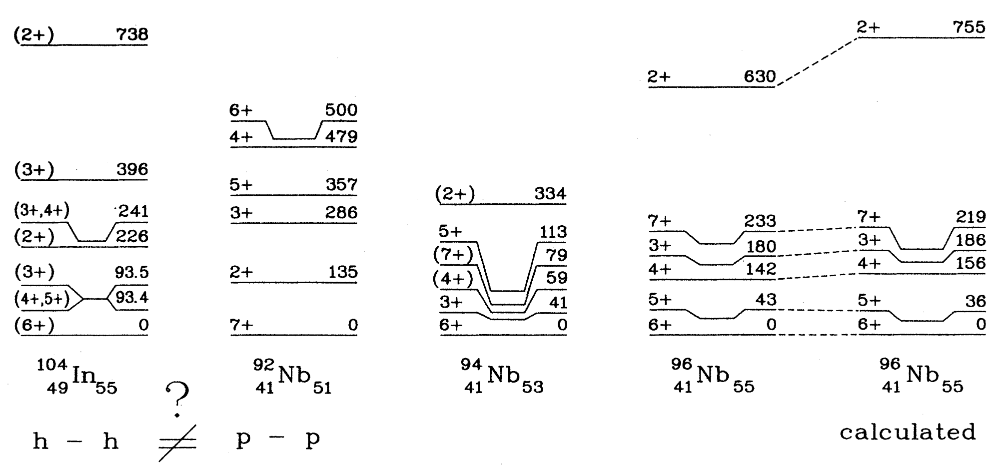

FIG. 7. The experimental level schemes of ^{104}In and ^{92,94,96}Nb. The experimental level scheme of the *p-h* nucleus ^{96}Nb compares well with the calculated level scheme, deduced out of the Pandya transformation of ^{92}Nb (*p-p* nucleus). In this formalism the experimental level scheme of ^{104}In (*h-h*) should be identical to the experimental level scheme of ^{92}Nb (*p-p*).

done by Vandeplassche *et al.*[8] for ^{106}In and ^{108}In, should remove the ambiguity on the spin assignment for ^{104}In.

For all odd A neighboring nuclei with neutron number 53, 55, and 57 the ground-state spin is 5/2 suggesting that the odd neutron occupies the $d_{5/2}$ shell. The simplest configuration for the ground state would then be $[\pi g_{9/2}^{-1} x \nu d_{5/2}^{n}]_{6^+7^+}$. The weak rule of Brennan and Bernstein[21] implies for spin 6 a coupling of the particle-hole type $(j_\pi + j_\nu - 1)$ and for spin 7 of the hole-hole type $(j_\pi - j_\nu)$.

The parabolic rules of Paar[22] do not easily predict the ground-state spin of ^{104}In. They depend on the values of ν ($+1$ for particle-particle or hole-hole coupling, -1 in the other cases) and on the filling of the various sublevels (u and v). The uncertainty on these parameters is rather large for ^{104}In; probably the neutrons have filled halfway the $d_{5/2}$ subshell.

The filling of the neutron sublevels can be calculated using the Pandya transformation.[23] One knows experimentally the low-energy spectra of $^{92}_{41}Nb_{51}$, $^{94}_{41}Nb_{53}$, and $^{96}_{41}Nb_{55}$ having each a $(g_{9/2^+})$ proton state and a $(d_{5/2^+})$ neutron state. If ^{96}Nb has a neutron hole in the $d_{5/2}$ subshell, its spectrum can be inferred by transforming the ^{92}Nb spectrum where one jumps from $d_{5/2}^{1}$ to $d_{5/2}^{-1}$. Actually this is observed and one can conclude that the filling of the $d_{5/2}$ subshell grows normally from mass 92 to mass 96.

Figure 7 gives the Pandya transformation from Nb to In: the $M3$ isomerism in ^{104}In cannot be reproduced, although surprisingly such isomerism is observed in ^{94}Nb.

V. CONCLUSION

This decay study of ^{104}In gave evidence that, contrarily to previous work, most of the β^+/EC feeding goes to high-lying levels in ^{104}Cd. The subsequent γ decay, by single or double cascade towards levels around 3 MeV is of statistical character and forms a γ continuum with an upper energy of about 5 MeV. As a consequence, it becomes impossible to make a proper γ-ray intensity balance. Combining this with our Q_{EC} measurements,[9] we can conclude that the low-energy 4^+ levels are not directly fed and that a spin 6 or 7 for the ground state of ^{104}In should be assigned. The decay of the isomeric state in ^{104}In suggests for the latter a spin of 3 or 4. The strong influence of the Gamow-Teller resonance on the β decay in the region around ^{100}Sn is seen here for the first time but should also be present in the neighboring isotopes.

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