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Ge(Li)-Ge(Li) COINCIDENCE MEASUREMENTS IN ^{132}Xe

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Résumé. — On a effectué des mesures en coïncidence gamma-gamma au cours de la désintégration de ^{132}I avec deux détecteurs Ge(Li) et un système à deux paramètres. On a observé plusieurs nouvelles transitions. A partir de ces résultats, 18 nouveaux niveaux à 2 167,3, 2 187,4, 2 303,6, 2 916,9, 2 935,6, 2 959,1, 3 076,4, 3 112,1, 3 122,3, 3 155,4, 3 192,8, 3 214,3, 3 226,8, 3 237,4, 3 260,0, 3 319,6, 3 354,0 et à 3 385,1 keV ont été placés dans le schéma des niveaux de ^{132}Xe , ils comprennent 113 des 119 raies gamma définitivement établies et peuvent inclure 5 des 16 transitions supplémentaires qui ont été parfois avancées.

Abstract. — Gamma-gamma coincidence measurements were carried out on the decay of ^{132}I with two Ge(Li) detectors and a two parameter system. Several new transitions were observed. From these results, 18 new levels at 2 167.3, 2 187.4, 2 303.6, 2 916.9, 2 935.6, 2 959.1, 3 076.4, 3 112.1, 3 122.3, 3 155.4, 3 192.8, 3 214.3, 3 226.8, 3 237.4, 3 260.0, 3 319.6, 3 354.0, and 3 385.1 keV were placed in the ^{132}Xe level scheme which incorporates 113 of the 119 definitely established gamma rays in this decay and can incorporate 5 of 16 additional tentatively reported transitions.

1. **Introduction.** — The level structure of ^{132}Xe has been studied rather extensively from the radioactive decays [1]-[8] of ^{132}Cs and ^{132}I . Of the 128 γ -rays assigned to the ^{132}I decay, only 63 were fitted into 20 levels in ^{132}Xe from Ge(Li)-NaI coincidence measurements. Hamilton *et al.* [1] discussed that ^{132}Xe is one of the few nuclei with good candidates for 3-phonon levels in the vibrational model. However, the placement of all of the unplaced transitions could change that interpretation. To obtain a more complete level scheme for ^{132}Xe and to decide about the placement of the remaining γ -rays, γ - γ coincidence measurements were performed with two Ge(Li) detectors. From the results of these coincidence measurements, 18 new levels are deduced in ^{132}Xe .

2. **Experimental procedures.** — Equilibrium sources of ^{132}Te - ^{132}I (as described earlier [2]) were used since the ^{132}Te has $T_{1/2} = 78$ hr compared with ^{132}I (2.38 hr) and has a well known low energy decay. Coincidence measurements were performed with two, 35 cm³ Ge(Li) detectors with resolutions

of 2.8 keV (FWHM) at 1 332.5 keV. The Ge(Li) detectors were arranged in 180° geometry for maximum coincidence efficiency and 8 mm of lead covered each detector face to eliminate backscatter between them. An ORTEC fast coincidence system ($2\tau = 60$ ns) provided an external gate for a Nuclear Data two dimensional analyser with buffer memory and magnetic tape unit [9]. The source strength was chosen such that chance coincidences were negligible as seen by the absence of a 667.7 keV chance coincidence peak in the 667 keV gate. A total of 12 million coincidence events were recorded over 80 hr.

Digital band selector gates, usually 6-8 keV wide, were set on the photopeaks and on the background, either above or just below the photopeaks, in order to correct for the Compton background coincidences. The spectra in coincidence with 30 energy gates were analysed. Table I gives the coincidence relationships established from these spectra. Some of the gates which are important in the establishment of new levels are shown in figures 1-4. Coincidence information was obtained even on very weak transitions, for example, the 1 049 keV transition intensity is only 0.045 compared to 100 for the 667 keV one. The present data confirm unequivocally the earlier placements [1] of the 63 γ -rays into 20 levels of ^{132}Xe . The level scheme based on our coincidence

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FIG. 1. — γ -ray spectrum in coincidence with the 522 keV gate. The presence of 621.0 keV γ -ray is clearly indicated.

FIG. 2. — γ -ray spectra in coincidence with the (727 + 729), 812 and 1442 keV gates.

FIG. 3. — γ -ray spectra in coincidence with 863 and 1 049 keV gates.

FIG. 4. — γ -ray spectra in coincidence with 1 136 and 1 272 keV gates. The presence of 772.6 keV γ -ray in 1 272 keV gate is not well understood. It may be due to the Compton edge of 1 398.6 keV γ -ray falling under 1 272.7 keV peak.

measurements is shown in figure 5. The 18 new levels included are discussed below along with some additions to the previous level scheme. The β -ray intensities and log ft values in the decay of ^{132}I are presented in table II. These values were calculated from the γ -ray intensities and the decay scheme of figure 5. The log ft values were computed from published nomographs [10] for a half-life of 2.38 hr.

3. Results and discussion. — **3.1 NEW TRANSITIONS.** — Previous coincidence work [1] (505 and 1 136 keV gates) placed the 621.0 keV γ -ray between the 2 424.8 and 1 803.3 keV levels. Our work confirms this assignment but in addition show that second 621 keV γ -ray of 0.4 ± 0.1 units is clearly seen (Fig. 1). This second γ -ray is further supported by the 505 and 1 136 keV gates where the 621.0 keV γ -ray intensity in both spectra is only 1.5 ± 0.3 units (normalized to the 809.8 keV γ -ray) compared to 2.0 ± 0.1 units expected. Thus γ -rays of 620.8 keV (0.4 units of intensity) and 621.2 keV (1.6 units) are assigned to depopulate known levels at 2 583.75 and 2 424.89 keV, respectively.

A 727.1 and 729.2 keV doublet was first reported

by Boyd and Hamilton [11] and later by Henck and Gizon [4]. From their studies of different sources, Carter *et al.* [2] concluded that a 729.2 keV γ -ray did not belong to the decay of ^{132}I but rather was an impurity. However their data only show that the 729 keV transition is *primarily* an impurity. The present coincidence data conclusively show that a 729.2 keV γ -ray belongs to ^{132}I though an impurity at this energy also exists. This evidence is as follows: *a)* In the 772 keV gate, a 727 keV γ -ray is very strong and also in the (727 + 729) keV gate the 772.6, 671.6 and 667.7 keV γ -rays are very strong. The 671.6 keV transition in the latter gate confirms that at least a sizable fraction of the 727 keV γ -ray intensity populates the 2 112.0 keV level, but not all as discussed below. *b)* In the (727 + 729) keV gate (Fig. 2), the 630.2, 812.3 and 1 442.6 keV γ -rays are observed. Also a 729 keV transition is seen in the 630, 812 and 1 442 keV gates (for example see Fig. 2). These coincidence relationships are consistent with a 729 keV γ -ray feeding the 2 110.2 keV level.

In the 630 keV gate, the intensity of the 729 keV γ -ray is 1.1 ± 0.3 from a comparison with the 812.2 keV γ -ray (5.7 ± 0.6). This value is consistent with the

FIG. 5a.

TABLE II

Intensities and comparative half-lives of ^{132}I β -ray transitions which populate levels in ^{132}Xe . A parenthesis on the spins or parities indicates the values found but not definitely established.

Terminating level	Spin and parity	Calculated β -ray intensity (^a)	Log ft
667	2 ⁺	—	—
1 297	2 ⁺	—	—
1 440	4 ⁺	16.1 $\pm$ 2.1	7.6
1 803	3 ⁺	—	—
1 963	3, 4 ⁺	12.7 $\pm$ 0.7	7.1
1 985	2 (+)	0.1 $\pm$ 0.2	9.2
2 110	3, 4 ⁺	11.1 $\pm$ 1.0	7.1
2 112	(5, 6) ⁺	0.0 $\pm$ 0.5	—
2 167	(5 ⁺)	1.7 $\pm$ 0.3	7.8
2 187	(1, 2 ⁺)	0.1 $\pm$ 0.05	9.0
2 303	(5, 6 ⁺)	0.0 $\pm$ 0.1	—
2 350	3-5	0.9 $\pm$ 0.2	8.1
2 394	4 ⁺	19.0 $\pm$ 1.0	6.5
2 494	(3, 4) ⁺	2.6 $\pm$ 0.2	7.2
2 583	(5) ⁺	3.4 $\pm$ 0.1	7.0
2 588	3, 4	2.9 $\pm$ 0.2	6.9
2 613	(5) ⁺	8.1 $\pm$ 0.5	6.4
2 669	3, 4 ⁺	3.6 $\pm$ 0.2	6.7
2 754	3, 4	0.4 $\pm$ 0.1	7.4
2 838	(5) ⁺	12.8 $\pm$ 0.4	5.8
2 840	3, 4 ⁺	1.8 $\pm$ 0.2	6.7
2 890	3, 4	0.8 $\pm$ 0.2	6.9
2 917	3, 4 ⁺	0.04 $\pm$ 0.04	8.2
2 935	3, 4	0.06 $\pm$ 0.02	7.7
2 959	3, 4	0.03 $\pm$ 0.02	7.8
3 058	3, 4	0.32 $\pm$ 0.06	6.9
3 076	3, 4	0.10 $\pm$ 0.05	7.4
3 112	(3, 4)	0.05 $\pm$ 0.02	7.7
3 123	(3, 4)	$\leq$ 0.22	$\geq$ 6.7
3 155	(3, 4)	0.22 $\pm$ 0.05	6.7
3 193	3, 4	$\geq$ 0.067	$\leq$ 7.0
3 214	3, 4	0.15 $\pm$ 0.04	6.7
3 227	3-5	0.12 $\pm$ 0.04	6.7
3 237	3, 4	0.003	8.3
3 260	3-5	0.26 $\pm$ 0.04	6.1
3 319	3-5	0.07 $\pm$ 0.04	6.5
3 354	3-5	0.18 $\pm$ 0.05	6.0
3 385	3, 4	0.003 $\pm$ 0.001	7.4

(^a) Based on the decay scheme of figure 5.

spectrum [8] revealed transitions of $1\,752.5 \pm 1.5$ (0.03 ± 0.01), $1\,760.8 \pm 1.5$ (0.02 ± 0.01) and $1\,768.5 \pm 1.5$ keV (0.03 ± 0.01) (I_γ given relative to 100 for the 667.7 keV transition). The 1620.6 keV transition reported earlier [2] was shown from the singles spectrum to be a doublet, $1\,618.5 \pm 1.0$ (0.015 ± 0.003) and $1\,620.0 \pm 1.0$ (0.008 ± 0.003), plus a 1 621 keV transition from an impurity.

3.2 NEW LEVELS IN THE ^{132}I DECAY. — The new features in the level structure of ^{132}Xe based on the present coincidence measurements are discussed below.

The $2\,167.3 \pm 0.3$ keV level (5⁺). — This level is based on the analysis of the 727-729 keV gate, discussed earlier, which confirmed a second 727 keV transition. Since the 727.1 keV photopeak is not broadened in the high resolution studies [2], the two energies are within about 0.3 keV of one another. The weaker member of the doublet directly feeds the 1 440.3 keV level. This level is confirmed in recent (α , $2\,n\gamma$) work [12] where a 727.0 keV transition is seen to populate the 1 440.3 keV level. The tentative spin-parity assignment [12] of 5⁺ is consistent with the present work. From an energy fit, the previously unplaced 416.8 keV transition feeds this level from the 2 583.75 keV level.

The $2\,187.4 \pm 0.3$ keV level 1[±], 2⁺. — This level is established from the 1 519.7 and 889.0 keV gates. In the 1 519 keV gate only the 667.7 keV γ -ray is seen with very weak indication of a 772 keV γ -ray. In the 889 keV gate, only 630.2 and 667.7 keV transitions are observed. The 2 186.9 keV γ -ray is assigned as the ground state transition from this level.

$$\begin{aligned} 889.0 \pm 2.0 + 1\,297.83 \pm 0.09 &= 2\,186.8 \pm 2.0 \\ 1\,519.7 \pm 0.2 + 667.67 \pm 0.06 &= 2\,187.4 \pm 0.2 \\ 2\,186.9 \pm 2.0 &= 2\,186.9 \pm 2.0. \end{aligned}$$

Decay to the ground state indicates a spin and parity of 1[±], 2⁺. From (n , γ) work [13] a level of spin 1 or 2 is assigned at $2\,187.2 \pm 0.8$ keV depopulated by 2 188.9, 1 519.4 and 889.2 keV transitions. This is undoubtedly the same level reported here. The 1 519 keV gate indicates feeding of this level by a weak 771.7 keV γ -ray (0.02 %) from the 2 959.1 keV level.

The $2\,303.6 \pm 0.2$ keV level (5, 6). — This level is based primarily on the observed coincidences of the 863.3 keV transition with the 1 049.9, 772.6, 667.7 and 535.5 keV γ -rays (Fig. 3). The 1 049.9 keV γ -ray is in coincidence with the 863.3 keV γ -ray but not with the 535.5 keV one and its intensity in the 863 keV gate is very weak compared with the 772.6 keV γ -ray. In the 1 049 keV gate, however, the 667.7, 772.6 and 863.3 keV transitions are essentially of the same intensity. Thus, the 1 049.9 keV γ -ray is on the top of the 863.3 keV one which must feed the 1 440.3 keV level to establish a new level at $1\,440.27 \pm 0.10 + 863.3 \pm 0.2 = 2\,303.57 \pm 0.24$. Placing the 535.5 keV γ -ray from the known 2 838.7 keV level to the new 2 303.6 keV one explains the 863.3-535.5 keV coincidence. The γ -ray intensities into and out of this level balance, so there is little or no β feeding to the 2 303.6 keV level. Absence of transitions to the lower 2⁺ states suggests a spin of 5 or 6.

The $2\,916.9 \pm 0.2$ keV level 3, 4. — This level is established from the 1 476.8 keV gate and rather

weak 2 249.1-667.7 keV and 1 620.0-630.2 keV coincidences. The energy sums are in good agreement.

$$\begin{aligned} 1\,476.8 \pm 0.2 + 1\,440.27 \pm 0.10 &= 2\,917.1 \pm 0.2 \\ 1\,620.0 \pm 1.0 + 1\,297.84 \pm 0.09 &= 2\,917.8 \pm 1.0 \\ 2\,249.1 \pm 0.2 + 667.67 \pm 0.06 &= 2\,916.8 \pm 0.3. \end{aligned}$$

From an energy sum the 1 112.5 keV transition can feed the 1 803.7 keV level,

$$1\,112.5 \pm 0.4 + 1\,803.7 \pm 0.09 \rightarrow 2\,916.2 \pm 0.4.$$

A log *ft* of 8.2 for β decay to this level is consistent with an allowed or first forbidden, nonunique decay to limit the spin to 3-5. Decays to lower 2^+ levels, rule out spins and parities of $5^{\pm}$ and 4^{-} .

The 2 935.6 $\pm$ 0.4 keV level 3, 4. — This level is based on a weak 1 637.8-630.0 keV coincidence and no indication of a 1 637.8 keV γ -ray in the 772 keV gate. The 351.8 keV γ -ray is placed to feed the 2 583.8 keV level from an energy sum.

$$\begin{aligned} 351.8 \pm 0.4 + 2\,583.8 \pm 0.2 &= 2\,935.6 \pm 0.45 \\ 1\,637.8 \pm 0.7 + 1\,297.84 \pm 0.09 &= 2\,935.6 \pm 0.7. \end{aligned}$$

A log *ft* of 7.7 and decay to the 1 297.8 keV, 2^+ level limit the spin assignment to 3, 4 for this level.

The 2 959.1 $\pm$ 0.7 keV level 3, 4. — The 2 290.4-667.7 keV coincidences establish this level. The 1 661.6 keV feed the 1 297.8 keV level from an energy sum.

$$\begin{aligned} 1\,661.6 \pm 0.7 + 1\,297.84 \pm 0.09 &= 2\,959.4 \pm 0.7 \\ 2\,290.4 \pm 1.3 + 667.67 \pm 0.06 &= 2\,958.1 \pm 1.3. \end{aligned}$$

A log *ft* of 7.8 and decay to the 1 297.8 keV 2^+ level limit the spin assignment to 3, 4.

The 3 076.4 $\pm$ 0.2 keV level 3, 4. — The 1 272.7 keV γ -ray is in coincidence with 505.9 and 1 136.0 keV γ -rays but not with the 522.7 keV γ -ray (Fig. 1). The 1 778.4 keV γ -ray is in coincidence with the 630.2 and 667.7 keV γ -rays only and not with the 772.6 keV γ -ray. These coincidence relationships establish this level. There is also a very weak 2 408.9-667.7 keV coincidence and a 487.5 keV γ -ray placed on energy fit along with a possible weak depopulating 889.0 keV transition (in addition to the one placed elsewhere by coincidence data). The energy sums are in excellent agreement.

$$\begin{aligned} 487.5 \pm 0.7 + 2\,588.66 \pm 0.11 &= 3\,076.2 \pm 0.7 \\ 1\,272.7 \pm 0.4 + 1\,803.66 \pm 0.09 &= 3\,076.4 \pm 0.4 \\ 1\,778.4 + 1\,297.84 &= 3\,076.2 \\ 2\,408.9 \pm 0.6 + 667.67 \pm 0.06 &= 3\,076.6 \pm 0.6. \end{aligned}$$

With a log *ft* of 6.9 and decays to the 1 803.7 keV, 3^+ and 1 297.8 keV, 2^+ levels, the level spin is 3, 4.

The 3 112.1 $\pm$ 0.5 keV level (3, 4). — This level is based on the very weak coincidences of 1 002.1 keV transition with 667.7 and 812.2 keV γ -rays. This level also allows placement of the 1 814.4 and 2 444.1 keV γ -rays. The 2 444.1 keV one either feeds

the 667.7 keV level or the ground state. A low spin state that can decay to the ground state, but be unobserved in the (n, γ) work [10] is most unlikely.

$$\begin{aligned} 1\,002.1 \pm 0.5 + 2\,110.18 \pm 0.08 &= 3\,112.3 \pm 0.5 \\ 1\,814.4 \pm 0.7 + 1\,297.84 \pm 0.09 &= 3\,112.2 \pm 0.7 \\ 2\,444.1 \pm 0.7 + 667.67 \pm 0.06 &= 3\,111.8 \pm 0.7. \end{aligned}$$

The 2 444.1 keV is from the work of Carter *et al.* [2] and not their adopted energy. Energy-fit decays to two 2^+ levels yield tentative spins of (3, 4).

The 3 122.3 $\pm$ 0.5 keV level (3, 4). — This level is proposed primarily on the basis of energy sum relationships although there is weak evidence of a 1 009.8 keV γ -ray in the (671.6 + 667.7) keV gate. The energy sums are :

$$\begin{aligned} 1\,009.8 \pm 0.5 + 2\,111.8 \pm 0.3 &= 3\,121.6 \pm 0.5 \\ 1\,138 \pm 1 + 1\,985.3 \pm 0.2 &= 3\,123.3 \pm 1.0 \\ 2\,455.2 \pm 0.6 + 667.67 \pm 0.09 &= 3\,122.9 \pm 0.6. \end{aligned}$$

A log *ft* of 6.7 limits the spin to 3-5. Decay to a 2^+ level tentatively indicates a spin of (3, 4). The 1 138 keV γ -ray is assigned [2] only tentatively to ^{132}I .

The 3 155.5 $\pm$ 0.3 keV level 3-5. — This level is based on the 1 715.5 keV γ -ray in the 772 keV gate and not in the 630 keV gate. This level allows placement of the 316.5 and 2 487.7 keV γ -rays. The energy sums are in good agreement.

$$\begin{aligned} 316.5 \pm 0.4 + 2\,838.70 \pm 0.10 &= 3\,155.2 \pm 0.4 \\ 1\,715.5 \pm 0.5 + 1\,440.27 \pm 0.10 &= 3\,155.8 \pm 0.5 \\ 2\,487 \pm 3 + 667.67 \pm 0.06 &= 3\,154.7 \pm 3.0. \end{aligned}$$

A log *ft* of 6.7 first limits the spin to 3-5. The 2 487 keV transition is assigned tentatively since only an upper limit is reported [2].

The 3 192.8 $\pm$ 0.3 keV level 3, 4. — This level is established by the 2 525.1 keV transition in the integrated 667 keV gate. Also the 302 keV transition (2 890.7 + 302 = 3 192.7 keV) and the 1 752.5 keV transition (1 297.8 + 1 752.5 = 3 192.8 keV) are placed by energy fits. The log *ft* of < 7.0 and decay to the first 2^+ level restrict the spin to 3, 4.

The 3 214.3 $\pm$ 0.3 keV level (3, 4). — This level is proposed only on the basis of the following energy sums :

$$\begin{aligned} 278.9 \pm 0.4 + 2\,935.6 \pm 0.6 &= 3\,214.5 \pm 0.7 \\ 600.5 \pm 0.4 + 2\,935.6 \pm 0.6 &= 3\,214.0 \pm 2.0 \\ 1\,410.5 \pm 0.4 + 1\,803.66 \pm 0.09 &= 3\,214.2 \pm 0.4 \\ 2\,546.6 \pm 1.5 + 667.67 \pm 0.06 &= 3\,214.3 \pm 1.5. \end{aligned}$$

The log *ft* of 6.7 and decay to the first 2^+ level indicate a spin of 3, 4, which are tentative because the transitions are all energy fits. There is an alternative placement of the 600.5 keV transition as discussed later in the text.

The $3\,226.8 \pm 0.3$ keV level 3-5. — This level is proposed on the basis of the following energy sums :

$$\begin{aligned} 310.0 \pm 0.4 + 2\,916.9 \pm 0.2 &= 3\,226.9 \pm 0.5 \\ 1\,263.7 \pm 0.7 + 1\,962.93 \pm 0.12 &= 3\,226.6 \pm 0.7 \\ 1\,786.8 \pm 1.0 + 1\,440.27 \pm 0.10 &= 3\,227.1 \pm 1.0. \end{aligned}$$

A log ft of 6.7 limits the spin to 3-5.

The $3\,237.4 \pm 0.7$ keV level 3, 4. — This level is based on the weak coincidence relationship established between the 2 569.7 keV transition and the 667.7 keV one in the integrated gate (gate width : 50-670 keV). The log ft and decay to the 2^+ state limit the spin to 3, 4.

The $3\,260.0 \pm 0.3$ keV level 3-5. — A level at this energy is proposed on the basis of the following energy sums :

$$\begin{aligned} 183.3 \pm 0.3 + 3\,076.4 \pm 0.2 &= 3\,259.7 \pm 0.4 \\ 343.6 \pm 0.4 + 2\,916.9 \pm 0.2 &= 3\,260.5 \pm 0.5 \\ 2\,591 \pm 3 + 667.67 \pm 0.06 &= 3\,258.7 \pm 3. \end{aligned}$$

The log ft of 6.2 indicates a spin of 3-5. Since the 2 591 keV transition is only tentatively assigned [2] to ^{132}I , this level is tentative.

The $3\,319.6 \pm 0.7$ keV level 3-5. — The 1 879.2 keV transition is observed weakly in coincidence with the 772.6 keV γ -ray and not with the 630.2 keV γ -ray to establish this level. Transitions of 2 652 and 1 016.2 keV are placed from energy sums, however the 2 652 keV one is only tentatively assigned [2].

$$\begin{aligned} 1\,016.2 \pm 2.0 + 2\,303.6 \pm 0.2 &= 3\,319.8 \pm 2.0 \\ 1\,879.2 \pm 0.7 + 1\,440.27 \pm 0.10 &= 3\,319.5 \pm 0.7 \\ 2\,652 \pm 3 + 667.67 \pm 0.06 &= 3\,319.7 \pm 3. \end{aligned}$$

The log ft of 6.4 limits the spin to 3-5.

The $3\,354.0 \pm 0.5$ keV level 3-5. — The 1 049.9 keV transition is observed in coincidence with 863.3 and 772.6 keV γ -rays only to establish this level. The 1 914.3 and 1 392.5 keV γ -rays are placed only on the basis of energy sums.

$$\begin{aligned} 1\,049.9 \pm 0.7 + 2\,303.6 \pm 0.2 &= 3\,353.7 \pm 0.7 \\ 1\,390.7 \pm 1.0 + 1\,962.93 \pm 0.12 &= 3\,353.6 \pm 1.0 \\ 1\,914.3 \pm 0.7 + 1\,440.27 \pm 0.10 &= 3\,354.6 \pm 0.7. \end{aligned}$$

The energy and intensity (0.08 ± 0.03) of the 1 390.7 keV transition are taken from the Compton suppressed data [8]. A log ft of 6.0 limits the spin to 3-5.

The $3\,385.1$ keV level 3, 4. — This level is established by the very weak coincidence relationship between the 2 717.4 keV transition and the 667.7 keV γ -ray from the 667.7 keV integrated gate. The log ft of 7.4 and decay to the first 2^+ level limits the spin assignment to 3, 4.

Of the 119 γ -rays which are positively assigned to the decay of ^{132}I , 113 have been fitted in the decay scheme of figure 5. Gamma rays at 771.7, 1 138, 2 487, 2 591.0 and 2 652.1 keV, which are placed in

TABLE III

Energies of γ -rays definitely assigned to ^{132}I decay but not placed in the proposed decay scheme are in Column 1. In Column 3 are given transitions which were seen in one of the earlier experiments but were not observed in Compton-suppressed spectra⁸ or in the most recent spectrum taken with a Ge(Li) detector². The upper limits on these transition intensities from the latter experiments^{2,8} are given in Column 4. These are thus questionable transitions. (See ref. [2] for a comparison of all results.) The 667.68 keV transition intensity is 100 units.

Assigned		Tentative	
Energy (keV)	Intensity	Energy (keV)	Intensity
659.0	0.4	652.1	< 0.3
764.5	0.4	771.7	0.02 ± 0.02 (a)
1 503.6	0.009	861.7	< 0.06
1 720.8	0.05	1 138 (b)	≤ 0.3 (c)
1 768.5	0.02	1 324	< 0.01
1 830.0	0.02	1 738.0	< 0.018
		1 747.0	< 0.018
		2 204.1	< 0.002
		2 487 (b)	< 0.002
		2 591.0 (b)	< 0.000 5
		2 605.0	< 0.000 5
		2 614.8	< 0.006
		2 652.1 (b)	< 0.000 5
		2 689.9	< 0.000 5
		2 764.2	< 0.001
		2 838.6	< 0.004

(a) Based on present coincidence data which indicated a weak transition of this energy.

(b) Can be placed between known levels in the present day scheme.

(c) If correctly placed in the decay scheme, $I_\gamma \leq 0.16$ based on intensity balance.

the decay scheme of figure 5 are assigned to ^{132}I decay only tentatively [2]. The remaining 6 definite but unplaced γ -rays are listed in table III, along with 15 others which have been suggested in some earlier work but not definitely observed in the most recent work [2]. The 1 065.5 keV transition is not listed in table III although it was assigned [2] to the decay of ^{132}I . In the 1 065.5 keV gate, we observe only the 822.6 and 915.5 keV γ -rays which are identified with the long-lived 9.4 day ^{125}Sn decay whose most intense cascades are 1 065.5-822.6 and 1 065.5-915.5 keV. Assigning the 1 065.5 keV γ -ray to the ^{125}Sn decay agrees with the Compton-suppression data [8] where a 1 065.5 keV γ -ray was not observed.

A 2 040.6 keV, spin 5 state is observed [12], [14] in (α , xn γ) studies and should be seen in the ^{132}I decay. The only transition out of this level is at

600.2 keV and is too weak to be observed in coincidence. In addition to β decay, a 263.0 keV transition from the 2 303.6 keV, spin 5, 6 level could feed the level. Such a 263.0 keV transition would be masked by the relatively strong 262.8 keV one. There is also an alternate placement for the 600.2 keV transition out of the 3 214.3 keV level.

The recent (n, γ) studies by Gelletly *et al.* [13] complement the work presented here in the establishment of the low spin levels in ^{132}Xe . The combination of the present studies along with the (n, γ) work provides the most detailed information on an even-even nucleus in this mass region. These data do not change energy levels below 2.1 MeV in ^{132}Xe have been interpreted rather well in terms of a vibrational model [1]. This is one of the few nuclei with good candidates for three phonon states.

Recently Krane and Steffen [15] have carried out γ - $\gamma(\theta)$ studies in ^{132}Xe from the decay of ^{132}I with two Ge(Li) detectors to yield new information on the spins of several levels. Their interpretations based on a 727 keV transition are presumably not correct since we have shown now that the 727 keV transition is a doublet with a weaker 729 keV member to form a triplet. There are too many parameters with such a triplet to obtain meaningful results in this case. Also the 621 keV transition they studied is a doublet. Their results are incorporated into our decay scheme except for the spin of the 2 111.8 keV level where the 727 keV transition was involved. We are somewhat more conservative on several levels where the spins of 5 were put in parenthesis though we also feel the assignments are strongly favored.

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