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Possible Odd Parity State in ^{128}Xe

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POSSIBLE ODD PARITY STATE IN ^{128}Xe

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ABSTRACT

Gamma lines in the decay of ^{128}I have been measured by means of a Ge(Li) detector. The following gamma ray energies have been obtained: 442.5 ± 0.05, 526.5 ± 0.5, 742.4 ± 1.0, 969.0 ± 1.0, and 1136.5 ± 2.0 keV. The 1136.5 keV transition defines a level in ^{128}Xe at 1579 ± 2 keV. From the log ft = 7.8 ± 0.3 of the β^- feeding, this level is believed to have an odd parity. Upper limits of gamma ray intensities for transitions around 530 keV are used to set a limit for the population of the expected 0^+ level originating from the two-phonon quadrupole vibration.

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1. INTRODUCTION

Several groups [1-6] have measured the 25-min. decay of ^{128}I with NaI crystals. Even though the decay scheme is very simple, there exists a surprisingly large disagreement in the measured energy values. Sund et al. [5] remeasured the ^{128}I decay using NaI crystals and a semi-circular β-spectrometer for conversion electron measurements. They report energy values which are quite different from the other γ-ray measurements. Furthermore they found two new conversion lines which they interpreted as the decay of the 0^+ member of the second phonon vibrational triplet at an energy of 1016 keV. Such a 0^+ state is expected to be populated by an allowed β-transition from the 1^+ ground state in ^{128}I. Jha et al. [7] also found evidence of the corresponding 0^+ level in ^{128}Xe at an energy of 950 keV from a study of the γ-transitions following the decay of ^{128}Cs.

Recently another two contradictory reports concerning higher levels in ^{128}Xe have appeared in the literature. Fearn and French [8] have concluded from their γ - γ coincidence measurements that there is no evidence of population of any higher levels in ^{128}Xe from the decay of ^{128}I. Pilione and Pratt [6], however, in a sum coincidence experiment, detected a weak γ-transition of about 1120 keV which they found to be in coincidence with the 442.5 keV γ-transition from the first excited level in ^{128}Xe. Such a transition has also been reported to follow the decay of ^{128}Cs to ^{128}Xe [9]. In order to solve the existing descrepancies we have remeasured the ^{128}I decay with a high resolution Ge(Li) detector.

2. EXPERIMENTAL

2.1 Source preparation

Approximately 2 mg of spectroscopically pure iodine oxide was enclosed in a lucite holder and irradiated for 5 minutes in a thermal neutron flux of 2×10^{11} cm^{-2} $sec.^{-1}$. Since iodine has only one isotope, the total γ-ray activity from the source was expected to originate from the decay of ^{128}I. This source was studied with a Ge(Li) detector for about one hour and then reactivated. This cycle had to be repeated several times for each spectrum to obtain good statistics. A stronger source would be of no help since too high activity would only broaden the peaks in the γ-ray spectra.

2.2 Detector equipment

The γ-ray detector used was a horizontally mounted lithium-drifted germanium solid state detector (obtained from RCA) with an area of 2.8 cm^2 and a sensitive depth of 2 mm. An RC-shaping bias amplifier system was used together with a 400-channel Intertechnique pulse height analyser. The threshold amplifier made it possible to analyze different parts of the γ-ray energy region under optimum conditions. When cooling the detector to 77 °K, the resolution of the system was 3.5 keV at a γ-ray energy of 122 keV (^{57}Co), and 6.0 keV at the 1114 keV γ-ray from ^{65}Zn. For the energy calibration we used the 479.4 ± 0.4 keV, 551.7 ± 0.7 keV, 618.2 ± 0.6 keV, 686.1 ± 0.4 keV, and 773 ± 1 keV γ-lines in the 24-hour decay of ^{187}W, together with the 1114.5 ± 1.0 keV line in ^{65}Zn and the 1173.2 ± 0.1 keV and 1333.5 ± 0.1 keV lines in ^{60}Co. A very slight deviation from a straight calibration line was observed and is presumed to originate mainly from the amplifier system. No effect on the calibration line was observed for moderate variations in the γ-ray intensity.

The photo peak efficiency curve of the detector was obtained in close time connection with the measurements from a set of absolutely calibrated standard sources.

2.3 Performance

γ-ray spectra were measured covering different energy intervals. The total time of measurement for all spectra was 5 hours, with the iodine sample reirradiated every hour. Fig. 1 shows a combination of two spectra from different energy regions and together covering the energy interval 400-1200 keV. The energy attached to each peak is the mean value from two or more runs. All peaks have the expected half width, and hence they are looked upon as single. γ-lines closer than two keV apart will, however, not cause any detectable broadening of the peaks.

From the spectrum in Fig. 1 and other similar spectra, the γ-ray energies and intensities were measured. All the experimental data concerning the γ-lines are found in Table 1, in which results from earlier measurements are included for comparison. The errors in the intensities are not given by these other authors. Our values are presumed to be correct within 10 per cent except for the 1136.5 keV line, for which the error in the intensity is 50 per cent.

There is no doubt that most of the γ-lines are associated with the decay of ^{128}I. The weakness of the 1136.5 keV line, however, made it important to definitely establish its origin, which was done by measuring its lifetime. Four spectra of 15 minutes each were measured 0, 15, 30, and 45 minutes after irradiation. This measurement was repeated several times and the corresponding spectra were added until sufficient statistics were obtained. Although no special attempt was made to measure an accurate value of the lifetime (no deadtime correction was made), the 1136.5 keV line showed a decay pattern in very close agreement with those from the other lines. This information, together with the coincidence measurement by Pilione and Pratt [6], completely establishes that also this line is associated with the decay of ^{128}I.

3. DECAY SCHEME

The experimental results are collected in a decay scheme (Fig. 2) and are also set out in Table 1. Feedings of the levels at 442.5 keV and 969 keV in ^{128}Xe and at 742.4 keV in ^{128}Te have earlier been investigated by several authors and their results concerning excitation energies and branching ratios have varied a lot (Table 1). The energies and errors given in the decay scheme are those obtained in this work. Starting from the branching ratios to the ground state levels taken from NDS, the branchings to the other levels in ^{128}Xe and ^{128}Te have been calculated from the relative gamma ray intensities. The corresponding log ft values are attached to each β^- branching in Fig. 2.

Concerning the 1136.5 keV line, its association with the decay of ^{128}I is discussed above. Giving a much too low log ft value, the intensity of the line excludes the possibility of it being a transition between levels in ^{128}Te, and hence it must feed one of the three lowest lying levels in ^{128}Xe. Even if energetically possible, the intensity also excludes the possibility of the gamma ray feeding the second excited level in ^{128}Xe (log ft = 3.3). The choice between the ground and the first excited levels was made on the basis of the mentioned coincidence experiment by Pilione and Pratt [6]. Thus the 1136.5 keV level defines a level in ^{128}Xe at the energy 1579.0 ± 2.0 keV.

4. DISCUSSION

From the intensity of the 1136 keV transition we obtain a log ft value of 7.8 ± 0.3 for the population of the 1579 keV level in ^{128}Xe. This is consistent with a first forbidden β^- transition [10] from the 1^+ ground state in ^{128}I and thus requires a negative parity for the 1579 keV level in ^{128}Xe. Such a negative parity state is actually also expected as a result of the one-phonon octupole vibration which in this mass region is predicted to give the lowest odd parity state. If we identify the 1579 keV level with this 3^- octupole vibrational state, the feeding β^- transition is a unique first forbidden transition with a log ft ~ 8.5 ± 0.5 [10] to be compared with the experimental log ft value 7.8 ± 0.3. Furthermore, Morinaga [11] has found from a systematic of known 3^- levels that this level energy has a decreasing tendency with mass number. For the ^{128}Xe isotope the proposed semi-empirical formula $E_\gamma = 67\ A^{-3/4}$ MeV gives 1.76 MeV, which shows that 1.58 MeV is not an extraordinarily low energy value for a 3^- level in ^{128}Xe. Such a level would then be expected to populate 2^+ but not 0^+ levels, which is also the case for the 1579 keV level. It therefore seems reasonable to suppose that the 1579 keV level in ^{128}Xe might be the expected one-phonon octupole vibrational state with spin and parity 3^-.

It should also be pointed out that these collective 3^- states are strongly excited by the inelastic scattering of neutrons or charged particles. To our knowledge, however, no such experiments have been done in ^{128}Xe.

From the Ge(Li) gamma ray spectrum we have also the possibility to put an upper limit for the gamma ray proposed to depopulate an excited 0^+ level in ^{128}Xe [5, 7]. Using upper limits for the actual γ-rays gives a log ft ≥ 8.5 for the population of the proposed 0^+ levels at 1016 keV [5] or 950 keV [7]. In this estimate we have disregarded the influence from the completing $0^+ \rightarrow 0^+$ electron transition, which is expected to be small as this two-phonon transition is forbidden. Such a high log ft value is not consistent with the expected allowed β^- transition between the 1^+ and 0^+ states. We therefore conclude that the energy difference between the 0^+ and 2^+ members of the two-phonon triplet is less than our energy resolution (≤ 3 keV).

5. REFERENCES

1. BENCZER N., FARRELLY B. et al.,
   Investigations of I^{128}.
   Phys. Rev. 101 (1956) 1027

2. GUPTA R.K. and JHA S.,
   Studies with the scintillation spectrometer.
   Nuclear Phys. 1 (1956) 2

3. BOSCH H., RADICELLA R. et al.,
   Gamma rays from I^{128}.
   Phys. Rev. 111 (1958) 898

4. GIRGIS R.K.,
   Investigations on some even-even nucleides. Properties of the second excited state.
   Thesis, University of Amsterdam, 1959

5. SUND R.E., ARNS R.G. et al.,
   Excited states in Xe^{128}. 1961.
   (TID-13920)

6. PILIONE L.J. and PRATT W.W.,
   Low-energy beta-ray transition in the decay of I^{128}.
   Phys. Rev. 138 (1965) B38

7. JHA S., de SOUZA BARROS F. and NAINAN T.D.,
   On the low-lying levels in Xe^{128} and Xe^{126}.
   Bull. Am. Phys. Soc. Ser. 2, 8 (1963) 386

8. FEARN R.L. and FRENCH J.D.,
   Decay of I^{128}.
   Bull. Am. Phys. Soc. Ser. 2, 7 (1962) 581

9. JHA S., GUPTA R.K. et al.,
   On the decay scheme of ^{128}Cs.
   Nuovo Cimento Ser. 10, 20 (1961) 76

10. WAPSTRA A.H., NIJGH G.J. and van LIESHOUT P.,
    Nuclear spectroscopy tables.
    North Holland publ. Amsterdam 1959

11. MORINAGA H.,
    Lowest odd-parity states in even-even nuclei.
    Phys. Rev. 103 (1956) 503

Table 1.

Gamma ray energies and intensities in the decay of ^{128}Xe

	E_γ (keV) I_γ	E_γ (keV) I_γ	E_γ (keV) I_γ	E_γ (keV) I_γ	E_γ (keV) I_γ	E_γ (keV) I_γ
Benczer et al. [1] 1956	455 ± 5 100	540 ± 5 9.7		750 ± 7 1.7	990 ± 10 1.8	
Gupta et al. [2] 1956	440 ± 5 100	520 < 1.5		750 0.5	960 ± 15 3	
Bosch et al. [3] 1958	445 ± 5 100	530 ± 5 9.3		740 ± 10 0.9	975 ± 15 1.8	
Grigis [4] 1959	447 ± 5 100	530 ± 5 10.2		755 ± 10 0.9	975 ± 10 2.5	
Arns et al. [5] 1961	439 100	567 8.7	577 1.2	750 1.9	1008 1.7	
Pilione and Pratt [6] 1965	- 100				975 ± 15 -	1120 ± 30 0.03
This work	442.5±0.5 100	526.5±0.5 8.0	~577 <0.1	742.4±1.0 0.8	969.0±1.0 3.0	1136.5±2.0 0.05

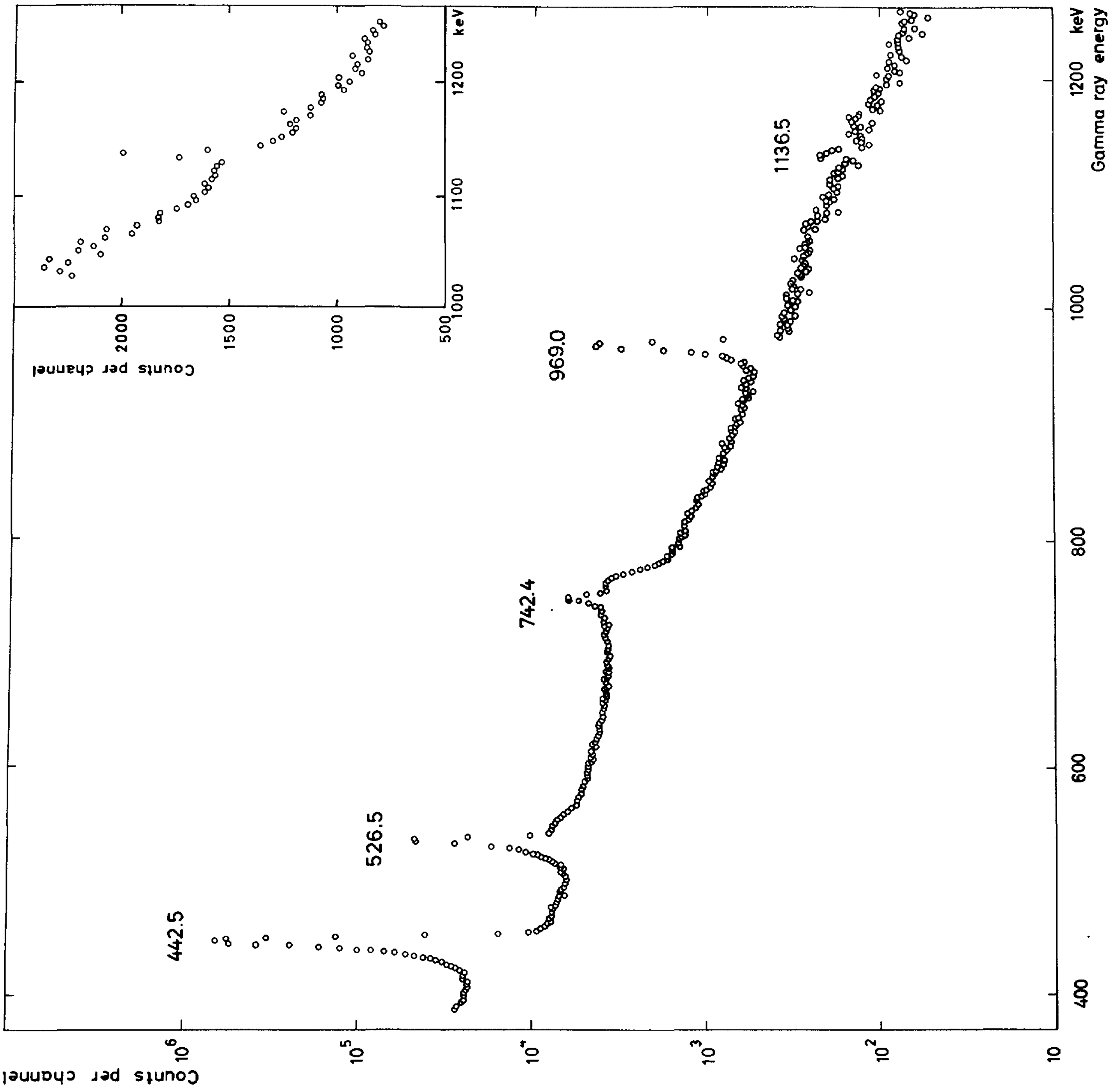

Fig. 1 Gamma ray single spectrum from a ^{128}I source taken with a 2 mm Ge(Li) detector. The figures attached to each peak are the corresponding gamma ray energies in keV. The inset shows a typical run covering the 1136.5 keV peak.

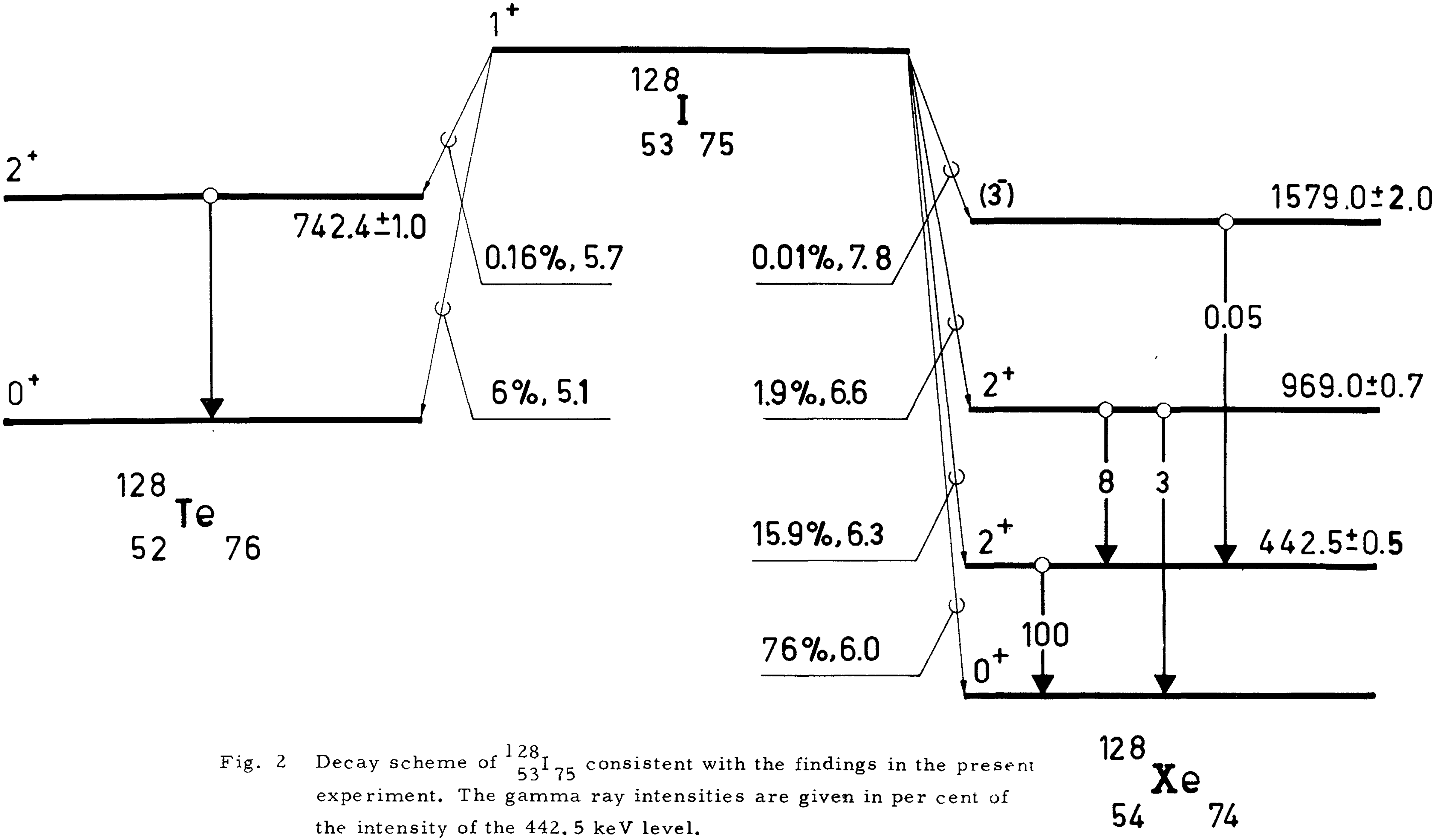

Fig. 2 Decay scheme of $^{128}_{53}I_{75}$ consistent with the findings in the present experiment. The gamma ray intensities are given in per cent of the intensity of the 442.5 keV level.

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