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Decay of ^{76}As

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The level structure of ^{76}Se has been investigated by studying the γ-rays emitted following the β^- decay of ^{76}As. The energies and relative intensities of 45 γ-rays have been determined with a better overall precision than previously. Two new transitions with 528.2 and 1232.4 keV have been found and placed in the level scheme. A new level, at 1791.5 keV excitation energy, is proposed. Seven transitions and three levels previously attributed to this decay scheme were not confirmed. © 1998 Elsevier Science Ltd. All rights reserved

Introduction

A large number of investigations have been made in the past, to understand the low-energy excited states of the nucleus ^{76}Se through the β^- decay of ^{76}As, using NaI(T1) scintillation spectrometers (Lindqvist and Marklund, 1957; Funk and Wiedenbeck, 1958; Girgis and Vanloshbut, 1959). In the early '70s, various works (Iizawa *et al.*, 1970; Morcos *et al.*, 1971; Macmillan and Pate, 1971; Funel, 1972; Ardisson *et al.*, 1972; Nagahara, 1973; Kaur *et al.*, 1980) examined the γ-ray spectrum of ^{76}As in singles and coincidence experiments, with the help of Ge(Li) detectors and Ge(Li)–NaI(T1) coincidence spectrometers, respectively. The work of Peikun *et al.* (1982) was the first, and only, to study this decay with a two–Ge(Li) spectrometer. The authors, who did singles measurements as well, reported four new γ-rays in their singles data. Their coincidence study was done by performing five coincidence gates, at the following energies: 559, 657, 1212 + 1216, and 1228 keV. According to this work, there is controversy regarding the presence, and subsequent placement, of γ transitions in the level scheme of ^{76}Se. The presence of 466(1) keV γ-ray in ^{76}Se has been shown by Nagahara (1973) and Kaur *et al.* (1980) but was later discarded by Peikun *et al.* (1982). The γ-ray transitions of energies 776.5, 852.8, 857.0, 907.5, 957.6, 1060.6 and 1881.3 keV have been observed in the decay of ^{76}As by Kaur *et al.* (1980) but Peikun *et al.* (1982) could not confirm these transitions. Four new γ-rays at 437.3, 463.6, 602.5 and 921.6 keV have been proposed by Peikun *et al.* (1982). In the last compilation by King (1989) 10 transitions and two energy levels in the decay of ^{76}As still need verification.

The interest in solving these discrepancies motivated us to perform an investigation into the ^{76}As decay using γ spectroscopy.

Experimental Procedure

The radioactive sources of ^{76}As were prepared by neutron activation of 99.99%-pure natural As, in metal form, in the IEA-R1 reactor at São Paulo. Approximately 5 mg were irradiated in a flux of 10^{13} neutrons cm^{-2} s^{-1} for 3 min. For the singles measurements the source strength was chosen in order to provide $\approx$5000 cps when the source was placed 25 cm away from the detector. The coincidences were measured with stronger sources.

The singles spectra were taken with a 50 cm^3 HPGe coaxial detector and an Ortec 572 amplifier, in pile-up rejection mode. The FWHM was 1.8 keV for the 1333 keV γ-ray of ^{60}Co. The background radiation was reduced by employing the iron shield described by Vanin *et al.* (1985) in a previous paper.

The γ–γ coincidence experiment was carried out with a 89 cm^3 HPGe and a 60 cm^3 Ge(Li) detectors. The time resolution was 11 ns in the energy range 200 keV to 3 MeV. The axis of the detectors made an angle of 130% with the source placed at the intersection of the (vertical) rotation axis with the rotation plane. Each detector had a 1 cm thick lead shield, in order to prevent true coincidences arising from Compton-scattered γ-rays. Two equal-sized hardware gates were set on the timing spectrum, to tag the coincidence events either as "true" or "chance". At every master gate three parameters were recorded (the energies of both detectors and the coincidence tag) with the help of a CAMAC input register, assisted by an MBD-11 microprocessor connected to a PDP-11/84 computer. The method of analysis was the same one described in detail (Brown *et al.*, 1969).

Experimental Results

γ-Ray measurements

The singles spectrum recorded during 260 h of live counting time are shown in Fig. 1 and Fig. 2. Forty-five transitions were attributed to the decay of ^{76}As. The measured energies and relative intensities are listed in Table 1, confronted with the data from previous results (Kaur *et al.*, 1980; Peikun *et al.*, 1982).

The transition with energy 528.15 keV was observed for the first time and placed in the ^{76}As decay scheme. The 466.5, 639.5, 797.0, 1030.6, 1393, 1805, and 1881.3 keV transitions, summarized in Nuclear Data Sheets (King, 1989), were not confirmed. Upper limits for their intensities were calculated following Helene's prescription (Helene, 1983) for a 95% confidence level, and are presented in Table 1, showing that this experiment has achieved a better overall sensitivity.

Our data revealed no evidence for photopeaks at 463.6, 602.5, and 921.6 keV, reported solely by Peikun *et al.* (1982), nor were transitions at 852.8, 857, 907.5, 957.6, and 1060.6 keV observed, present only in Kaur *et al.* (1980) data. We thus do not place these transitions in the decay scheme.

The photopeaks at 665 and 1130 keV, previously reported as doublets (Nagahara, 1973; Kaur *et al.*, 1980), are here shown to be singlets. Software gates set on these energies showed no evidence for these transitions being in coincidence with the 657.0 and 1216.2 keV γ-rays, which depopulate the 1216.2 keV state (see Table 2). This removes the argument for the existence of two levels, at 1881.2 and 2346.9 keV excitation energies, as discussed below.

Funel (1972) pointed out that a weak transition of 1232.3 keV could be placed between the 2447.8 and 1216.1 keV levels or between 1791.1 and 558.9 keV levels. We examined the 1200 keV region in search of this transition. Our single spectrum clearly shows the resolved 1228.6 and 1232.4 keV photopeaks [see Fig. 2(a)], confirming its presence. The coincidence spectrum gated by the 1232 keV is shown in Fig. 3(a). The 1232.4 keV transition appears in coincidence with the 559.1 and 863.9 keV. These results allowed us to interpret it as transition depopulating a new level at 1791.5 keV.

Three transitions, with energies 358.2, 438.3, 954.7, each of these reported by one previous author (King, 1989) were definitely assigned to the ^{76}As decay in the present experiment.

γ–γ coincidence spectra

The counting time for the γ–γ coincidence experiment was 160 h. A summary of the transitions

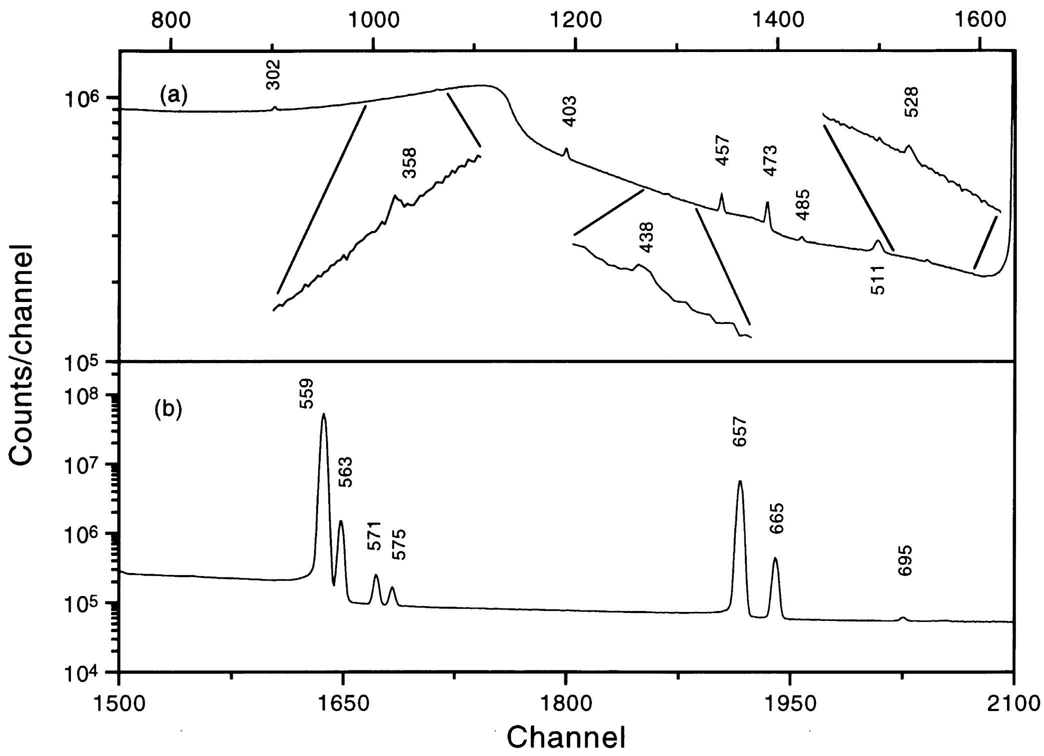

Fig. 1. Part of γ-ray spectrum, of ^{76}Se up to 700 keV. Energies are given in keV.

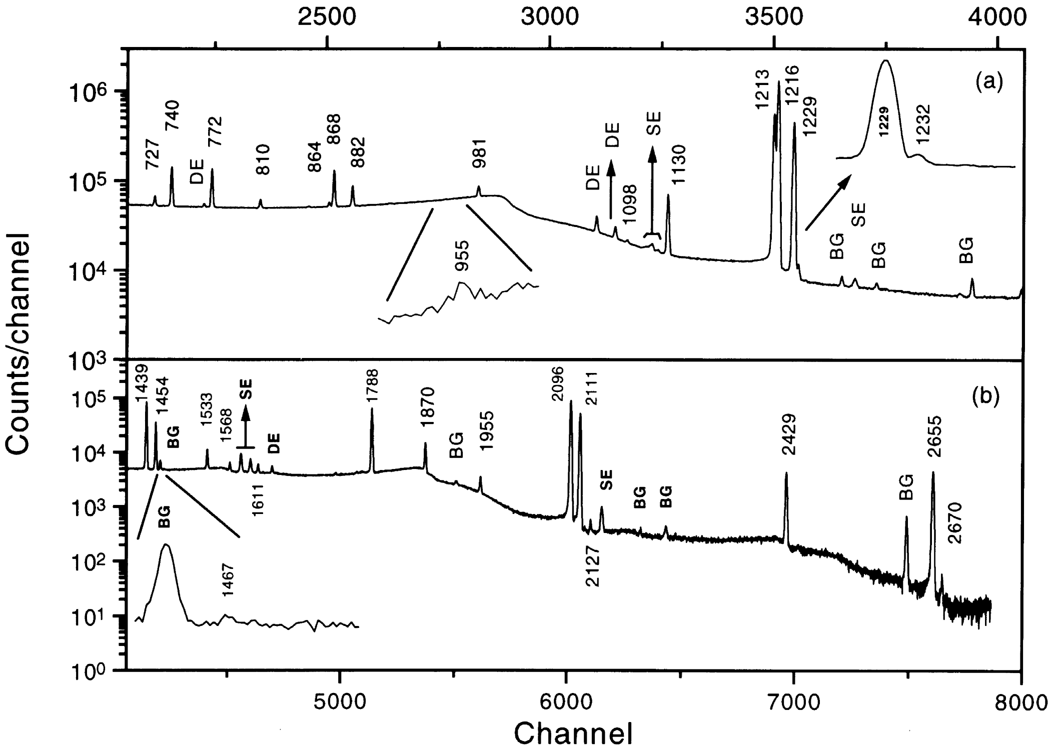

Fig. 2. Part of γ-ray spectrum of ^{76}Se from 700 up to 2700 keV. Energies are given in keV.

observed in coincidence with 43 software gates set on the data is shown in Table 2.

The existence of two new transitions at 528.2 and 1232.4 keV, observed in the singles spectra, was confirmed by gating the data at these energies and looking at the resulting spectra. Figure 3(a) and (b) show the γ-spectra in coincidence with gates at 1232 and 528 keV, respectively. The gate at 1568 keV is consistent with the feeding of the 2127.3 keV level by the 528.2 keV transition, observed here for the first time. The gate at 864 keV [see Fig. 3(c)] is consistent with the depopulation of the newly proposed 1791.5 keV level through the 1232.4 keV transition.

The 575.3 keV transition, observed by several authors (Iizawa *et al.*, 1970; Nagahara, 1973; Kaur *et al.*, 1980; Peikun *et al.*, 1982), has previously been attributed to the deexcitation from the 2362.9 keV level, which is classified as uncertain (King, 1989). Our coincidence results are in disagreement with this attribution. By setting a gate at 575 keV, this transition revealed itself as being in coincidence with the 559.1, 657.0, 863.9, and 1216.2 keV photons, as shown in Fig. 3(d) but not with the 1228.6 keV one, as suggested by the other experiments (Iizawa *et al.*, 1970; Nagahara, 1973; Kaur *et al.*, 1980; Peikun *et al.*, 1982). Funel's coincidence data (Funel, 1972) also suggest that the 575.1 (3) keV γ-ray is in coincidence with the 1215.9 (4) keV transition, and by using the $(p,p'\gamma)$ reaction (Muller *et al.*, 1974) revealed a level at 1791.4(3) keV which deexcites by the emission of the 575.0(2) keV γ-ray.

Our coincidence data and energy-sum analysis led us to suggest that the 575.3 and 1232.4 keV transitions could be placed in the current decay scheme of ^{76}As: we interpret them both as transitions depopulating a new level at 1791.5 keV, to well-known levels with 1216.2 and 559.1 keV excitation energies, respectively. The gates at 559, 657, 863, 1216, and 1232 keV also reinforce the argument towards this new level.

The 863.9 keV transition reported earlier (Funel, 1972; Ardisson *et al.*, 1972; Kaur *et al.*, 1980) but not placed in the level scheme showed up in our experiment. The coincidence data [Fig. 3(c)] allowed us to interpret it as a transition depopulating the 2655.3 keV level. Gates at 575 and 1232 keV are consistent with the feeding of the 1791.5 keV level by this transition.

Decay scheme

The ^{76}As decay scheme consistent with these measurements is shown in Fig. 4. All γ-rays observed were placed in this scheme. The spin assignments are based on the present log *ft* values, calculated according to Nuclear Data Table (Gove and Martin, 1971), and on the observed decay modes. The 49% intensity of the β-feeding to the ^{76}Se ground state and the 2362.9(11) keV *Q*-value were taken from Nuclear Data Sheets (King, 1989).

Table 1. Energy (Eγ) and relative intensity (Lγ) of the γ-rays following the ^{76}As decay

This work		Peikun *et al.*		Kaur *et al.*	
Eγ (keV)	Iγ	Eγ (keV)	Iγ	Eγ (keV)	Iγ
301.96(2)	0.0214(9)	302.2(2)	0.020(4)	302.0(3)	0.024(3)
358.21(6)	0.0112(4)	—	—	—	—
403.094(9)	0.59(2)	403.2(3)	0.050(4)	403.1(3)	0.057(3)
438.290(9)	0.0081(3)	437.3(10)	0.003(1)	—	—
456.777(6)	0.081(2)	457.0(1)	0.076(3)	456.8(3)	0.081(5)
—	—	463.6(7)	0.002(1)	—	—
466(1)*	0.018(5)*	—	—	467(1)	0.003(2)
	< 0.0052†				
472.838(6)	0.113(3)	472.89(8)	0.113(6)	472.80(30)	0.10(1)
484.69(2)	0.0148(5)	484.8(2)	0.011(4)	484.7(3)	0.013(2)
528.15(6)	0.0077(3)	—	—	—	—
559.086(2)	100.	559.13(3)	100.	559.07(5)	100
563.147(2)	2.71(6)	563.27(4)	2.72(4)	563.15(7)	2.73(13)
571.478(3)	0.311(7)	571.52(5)	0.28(1)	571.53(6)	0.32(1)
575.28(3)	0.149(3)	575.30(16)	0.146(7)	575.32(5)	0.15(1)
—	—	602.5(4)	0.002(1)	—	—
—	< 0.0007’	—	—	640(1)	0.008(3)
657.042(3)	14.1(3)	657.078(12)	13.70(29)	657.03(5)	3.63(33)
—	—	—	—	665(1)	—
665.358(3)	0.96(2)	665.37(4)	0.91(2)	665.31(5)	0.92(2)
695.17(2)	0.0193(8)	695.3(3)	0.019(,1)	695.2(1)	0.020(2)
727.003(9)	0.043(1)	726.99(7)	0.036(6)	727.0(1)	0.044(1)
740.132(4)	0.267(6)	740.09(4)	0.265(11)	740.11(8)	0.26(1)
—	—	—	—	754.9(5)	0.001(1)
771.762(4)	0.263(6)	771.68(5)	0.251(7)	771.77(8)	0.26(1)
—	—	—	—	776.5(5)	0.002(1)
—	< 0.001†	—	—	797.0(4)	0.004(1)
809.85(1)	0.0410(9)	809.71(14)	0.036(2)	809.8(1)	0.041(2)
—	—	—	—	852.8(10)	0.005(3)
—	—	—	—	857.0(8)	0.002(2)
863.88(2)	0.0224(8)	—	—	863.9(4)	0.025(2)
867.701(4)	0.293(6)	867.64(7)	0.28(2)	867.66(8)	0.29(1)
882.212(6)	0.130(3)	882.14(4)	0.121(5)	882.20(8)	0.14(1)
—	—	—	—	907.5(4)	0.004(3)
—	—	921.6(4)	0.002(1)	—	—
954.7(2)	0.0021(3)	—	—	954.6(5)	0.007(2)
—	—	—	—	957.6(5)	0.004(2)
980.921(8)	0.089(2)	980.87(16)	0.088(6)	980.9(1)	0.093(3)
—	< 0.0008†	—	—	1031(1)	0.002(1)
1029(2)*	0.003(1)*	—	—	—	—
—	—	—	—	1060.6(3)	0.004(1)
1098.323(7)	0.0071(5)	1098.2(10)	0.007(3)	1098.2(2)	0.009(1)
1129.909(5)	0.290(4)	1129.92(2)	0.289(7)	1129.82(8)	0.30(1)
—	—	—	—	1130(1)*	—
1212.986(3)	3.120(4)	1212.96(3)	3.15(6)	1212.94(8)	3.31(6)
1216.200(4)	7.48(9)	1216.160(11)	7.53(10)	1216.07(8)	7.74(13)
1228.589(3)	2.60(3)	1228.556(10)	2.60(4)	1228.50(8)	2.67(4)
1232.40(2)	0.0201(5)	—	—	—	—
1393(20)‡	< 0.00006†	—	—	—	—
1439.214(6)	0.593(5)	1439.09(3)	0.60(2)	1439.12(8)	0.63(1)
1453.713(6)	0.229(2)	1453.59(2)	0.23(2)	1453.67(8)	0.250(4)
1466.6(3)	0.0012(3)	—	—	1466.7(10)	0.001(1)
1533.07(1)	0.0518(7)	1532.61(22)	0.051(3)	1533.0(1)	0.055(1)
—	—	—	—	1564.3(10)	0.003(1)
1568.22(7)	0.0150(2)	1567.8(4)	0.015(2)	1568.0(1)	0.019(1)
1611.5(3)	0.0158(6)	1610.8(2)	0.028(4)	1611.6(1)	0.016(1)
1787.62(1)	0.621(4)	1787.66(2)	0.62(2)	1787.66(8)	0.63(2)
1805(2)*	0.003(2)*	—	—	—	—
	< 0.0004†	—	—	—	—
1870.01(2)	0.115(2)	1870.01(5)	0.11(1)	1870.01(10)	0.120(5)
—	< 0.0004†	—	—	1881.3(4)	0.002(1)
1955.48(3)	0.0228(6)	1955.8(3)	0.019(2)	1955.6(3)	0.023(1)
2096.16(1)	1.222(9)	2096.28(5)	1.19(2)	2096.31(14)	1.25(1)
2110.6(1)	0.708(5)	2110.75(5)	0.68(2)	2110.81(15)	0.73(2)
2127.0(1)	0.0027(2)	2126.5(5)	0.003(1)	2127.5(3)	0.004(1)
2429.07(3)	0.0768(11)	2428.99(8)	0.068(5)	2429.1(3)	0.074(2)
2655.43(8)	0.100(1)	2655.21(8)	0.090(3)	2655.4(3)	0.095(2)
2669.67(2)	0.0007(1)	2669.2(5)	0.003(1)	2669.9(3)	0.0006(1)

*Extracted from (Nagahara, 1973).

†A transition with an intensity larger than the quoted value has 95% probability of detection in our spectra but was not observed.

‡Extracted from (Ardisson *et al.*, 1972). According to the authors no intensity value was reported.

Table 2. Summary of the γ–γ coincidences in the ^{76}As decay

Gate (keV)	Gamma rays in coincidence (keV)
302	438 559 1130 1568 2127
358	772 740 981
403	559 657 695 772 810 1216 1467
438	302 473 559 1216 1130
457	772 868 882
473	559 657 740 981 1216
485	559 657 954 1216 1611
528	438 559 1568
559	302 358 403 457 473 485 563 571 657 665 695 727 740 772 810 868 981 1130 1213 1229 1439 1454 1568 1611 1870 1955 2096 2111
563	559 665 727 868 882 1533
571	559 657 727 867 882
575	559 657 1216 863
657	472 559 571 575 740 809 867 980 954 1212 1439 1453
665	559 563 867 882
695	403 553 771
727	559 563 571 657 665 1229 1787
740	358 472 559 657 772 1130 1216
772	358 403 457 559 695 740 868 981
810	403 559 657
864	559 575 657 1216 1232
868	457 571 657 665 1229 1788
882	559 563 571 657 665 1216 1788
981	473 559 657 1216
1098	559 772
1130	438 559 740 981
1213	559 657 1216
1216	473 571 575 740 810 1213 1439 1454
1229	559 727 868 882
1232	559 864
1439	559 657 1216
1454	559 657 1216
1533	559 563
1568	302 528 559
1611	485 559
1788	868 882
1870	559
1955	559
2096	559
2111	559
2127	302
2429	—
2655	—
2670	—

The level energies were obtained through a constrained least-squares fit of the 45 transitions that could be placed in the decay scheme.

Upper limits were calculated for all transitions that were previously reported but not seen (see Table 1), and they are not depicted in Fig. 1 and Fig. 2.

Most of the observed ^{76}Se levels are already known and discussions about them are found in studies of β^{-} ^{76}As (Nagahara, 1973; Kaur *et al.*, 1980) and, more recently, in the angular-correlation measurements (Zamboni and Saxena, 1989). Besides the addition of the new level at 1791.5 keV excitation energy, we do not place three levels, namely those at 1881.2, 2346.9, and 2362.9 keV, which already had uncertain classification (King, 1989), as discussed below.

The observation of two transitions, of 575.3 and 1232.4 keV in the singles and coincidence spectra permitted us to propose a level at 1791.5 keV. These transitions depopulate this level to known levels at 1216.2 and 559.1 keV. The log *ft* value of 10.27 favors a first-forbidden transition, which suggests a positive-parity assignment for this level. The ^{76}As ground state has spin 2, which limits the possible spins of the 1791.5 keV level to 0, 1, 2, or 3, but a $J^{\pi}=3^{+}$ assignment is less probable, since it would require the 863.9 keV transition to be of $M2$ character. This level is also established through nuclear reaction experiments (Muller *et al.*, 1974; Ardouin *et al.*, 1975).

The 2346.9 and 1881.2 keV levels are not placed in the scheme due to the non existence of the 466.5 and 1881.3 keV transitions, respectively, in both our data, singles and coincidence. If present, these transitions would happen in a cascade, starting from the 2346.9 keV level, depopulating it into the 1881.3 keV, and from the latter to the ^{76}Se ground state. The absence of these transitions drops one of the arguments for the existence of those levels. In addition, our coincidence data show that the 1130 and 665 keV transitions do not populate the 1216.2 keV state. If they did, these would be alternative ways for depopulating the 2346.9 and 1881.2 keV states, respectively. Evidence for these levels is not reported by Peikun *et al.* (1982), and neither from studies of ^{76}Br decay nor nuclear reazctions (King, 1989).

Previous experiments (Iizawa *et al.*, 1970; Nagahara, 1973) revealed a level at 2362.9 keV excitation energy, based on the 575–1229 keV coincidence relationship. According to Nagahara (1973) and Kaur *et al.* (1980), this level is also deexcited through the emission of two other γ rays, of energies 1030.6 and 1805 keV. The 575.3 keV transition is present in our singles spectra, but it does not appear in coincidence with the 1228.6 keV transition. In contrast, the observed 575–864 keV coincidence suggests that the former is a transition from the 1791.5 to the 1216.2 keV state. In addition, the photopeak of 1031 keV, reported by Kaur *et al.* (1980) and Nagahara (1973) and that at 1805 keV, reported only by the latter, did not show up in our singles data, nor in coincidence. Based on these facts, the level at 2362.9 keV is not placed in the decay scheme of ^{76}As. No evidence for it was seen in the work of Peikun *et al.* (1982) nor was it seen to be populated in the decay of ^{76}Br (King, 1989). This level was established in nuclear reaction studies which include, the ^{76}Se(n, γ) reaction (Borsaru *et al.*, 1977), reporting a level with 2363.95(2) keV excitation energy, and the ^{76}Se(p,t) reaction (Tokunaga *et al.*, 1983), reporting a level at 2347(25) keV.

The existence of the 2514.6 keV level is based on the previously observed 727–1229 and 1955–559 keV coincidence relationships (Iizawa *et al.*, 1970; Nagahara, 1973), confirmed from the 559, 563, 727, 1229, and 1955 keV gates, performed in the present work (see Table 2). By using a NaI(T1)–Ge(Li) coincidence spectrometer with a gate at 559(30) keV, Ardisson *et al.* (1972) suggested

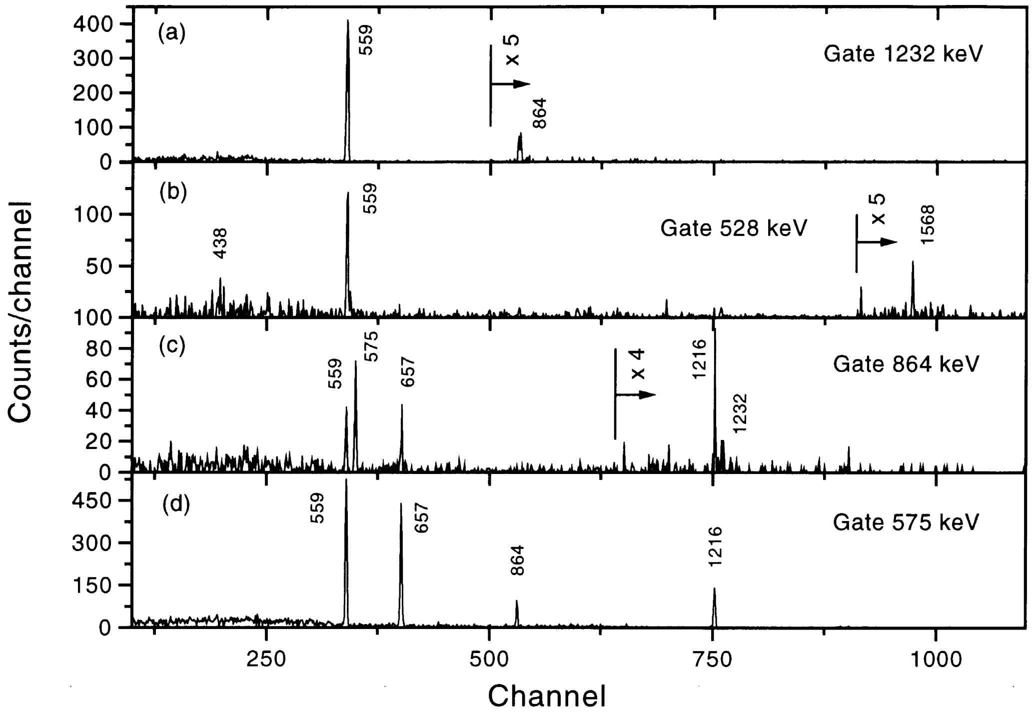

Fig. 3. γ-Ray coincidence spectrum with gate at: (a) 1232 keV, (b) 528 keV, (c) 864 keV and (d) 575 keV. Energies are given in keV.

that this level deexcites also by the emission of a 1393(20) keV γ-ray. The authors do not report an intensity for this transition, and their coincidence result was not corrected for random coincidences. The 1393 keV photopeak is not present in our singles spectra and is not observed in coincidence with other γ-rays as well. We thus set an upper limit for its presence in our data (see Table 1), and do not place it in the proposed level scheme, Fig. 4. A log *ft* value of 8.46 for the β^- decay to the 2514.6 keV level suggests an allowed or a first-forbidden transition, and a possible spin and parity

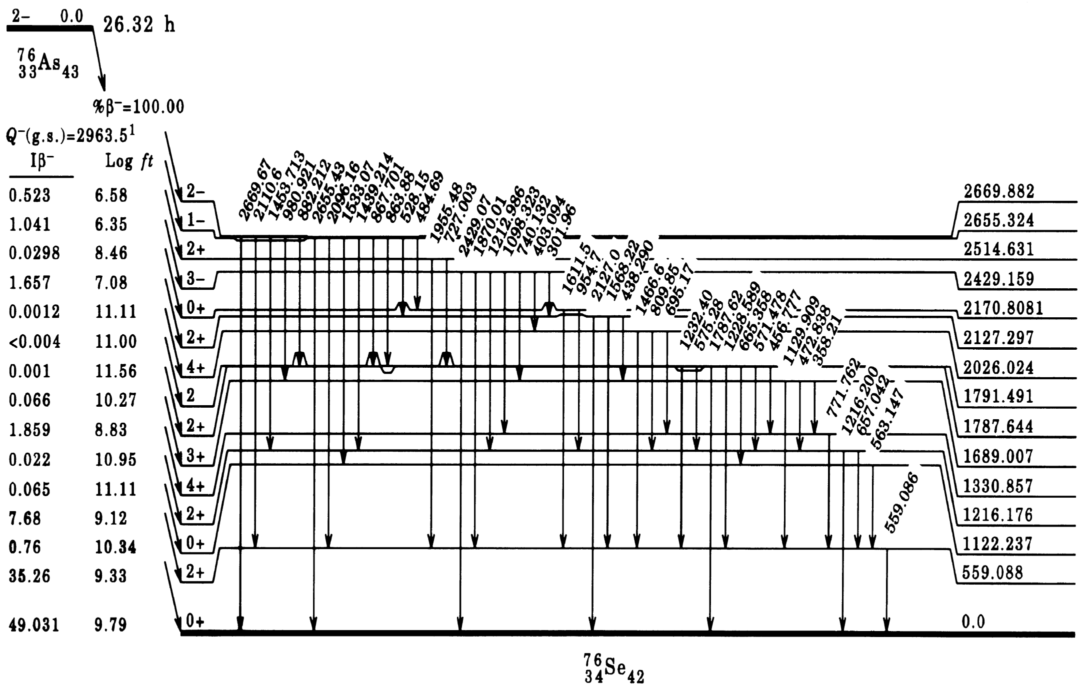

Fig. 4. Proposed level scheme for ^{76}Se. The energies are given in keV.

assignment of 2^+, 3^+ or 4^+ for this level. The 2^+ assignment is the only choice that satisfies the three kinds of experimental results: β^-, from this and previous works, β^+ data, summarized in ref. (King, 1989), and nuclear reactions data (Borsaru *et al.*, 1977; Tokunaga *et al.*, 1983).

The 2655.3 keV level is depopulated through the 484.7, 867.7, 1439.2, 1533.1, 2096.2, and 2655.4 keV transitions (King, 1989). It has spin and parity 1^-, established by angular correlation measurements on ^{76}As (Kaur *et al.*, 1980; Zamboni and Saxena, 1989). The 528.2 and 863.9 keV γ-rays, the former observed for the first time, were also found to depopulate this level. The 528.2 keV transition is seen in coincidence with the 438.3, 559.1 and 1568.2 keV photons [see Fig. 3(b)] and the 863.9 keV transition is coincident with the transitions at 559.1, 575.3, 657.0, 1216.2 and 1232.4 keV [see Fig. 3(c)]. Several other coincidence relationships listed in Table 2 also support the placements chosen. This level was also established in the decay of ^{76}Br (King, 1989) and nuclear orientation studies (Subber *et al.*, 1987; Barclay *et al.*, 1976), and all results agree with the spin 1 assignment for it.

Discussion

Investigation of the even–even stable isotopes of Se (A = 74–80) has shown that their low-lying states are amenable to a description as surface vibrations. In particular, some of the properties of the excited states in ^{76}Se in fact agree with the predictions of the vibrational model. In this context, the 2^+ state at 559 keV could be identified as the quadrupolar, one-phonon state, the 0^+, 2^+ and 4^+ levels at 1112, 1216 and 1331 keV respectively as the members of the two-phonon triplet, and some of the states belonging to the three-phonon quintuplet can be identified, namely the 3^+, 2^+ and 4^+ states at 1689, 1787 and 2026 keV respectively. Besides, there is a 3^- state at 2429 keV excitation energy that could be associated with the octupolar, one-phonon state. However, several investigations have revealed that many of the individual properties of ^{76}Se deviate considerably from the pure vibrational picture. Coulomb excitation studies (Barrette *et al.*, 1974) show no evidence for the population of the 1689 keV level and the weak population of the levels at 1787 and 2026 keV indicate that these states are probably not collective. The large negative experimental quadrupole moment of the first 2^+ state in ^{76}Se (Lecomte *et al.*, 1977) indicates a prolate deformation at low excitation energies. The results for the (p,p') reaction (Delaroche *et al.*, 1984) suggest a significant triaxial deformation for this isotope. The authors have used the rotation–vibration model and also the asymmetric rotational model to describe the properties of $^{76–82}$Se, suggesting that the 3^- level at 2429 keV in ^{76}Se might not be the octupole vibrational state.

Conversely, the nuclear structure of ^{76}Se studied by the in-beam γ-ray spectroscopy via the $(\alpha,2n\gamma)$ reaction (Matsuzaki and Taketani, 1982), has classified some of the ^{76}Se states into vibrational-like bands: a ground state band, a γ-band based on the 2^+ state at 1216 keV, an octupole band on the 3^- state at 2429 keV and a fourth band, built on a high-lying J = 4 state. They carried out calculations with the proton–neutron interacting boson model (IBM-2), finding good agreement of level energies and B(E2) ratios for some interband transitions between the γ and ground state bands. Subber *et al.* (1987) have calculated level energies and transition rates also using the IBM and the dynamic deformation model (DDM), achieving a satisfactory agreement with the experiment. They suggest the presence of shape coexistence in ^{76}Se, supported by the DDM calculation.

As just described, a number of experiments have been performed to explore the nuclear structure of this Se isotope and it has been shown that it is still not completely understood. In the present work we have performed precise measurement of energies, intensities and coincidence relations. A detailed level scheme has been constructed from the present data. Two new transitions have been found and placed and a new level was proposed. We believe that these results, together with the disproving of some of the previously report transitions and levels, represent a relevant change in the experimental picture of ^{76}Se, such that they are enough motivation for future calculations that might attempt to explain the level structure and electromagnetic transitions in ^{76}Se.

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