^{75}Se ε decay (119.78 d) 1990Me15,1991BaZS,2005Ra29

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Alexandru Negret, Balraj Singh	NDS 114, 841 (2013)	30-Jun-2013

Parent: ^{75}Se: E=0.0; J$^{\pi}$=5/2^{+}; $T_{1/2}$=119.78 d *5*; Q(ε)=864.7 *9*; %ε decay=100.0

^{75}Se-J$^{\pi}$,$T_{1/2}$: From Adopted Levels of ^{75}Se.

^{75}Se-Q(ε): From 2012Wa38.

Precise Eγ data: 2005Ra29, 1990Me15, 1985Ku26, 1984To11, 1978He21, 1977Pr08. 2000He14 is an evaluation of gamma-ray energies; when available, values are taken here from this work.

Precise Iγ measurements: 2005Ra29, 1997Lo10, 1994Ra28, 1994Bh07, 1994Mi22, 1992Sc09, 1990An07, 1990Wa03, 1990Me15, 1983Yo03, 1980Sc07, 1977Ge12, 1977Pr08, 1973Su10, 1971Pr07, 1970Pa25 (also 1969Pa05), and 13 measurements of ICRM (1991BaZS).

See also DDEP evaluations (2010BeZQ, 1999BeZS) for decay of ^{75}Se; also on DDEP webpage: www.nucleide.org/DDEP.htm. In the opinion of evaluators, the gamma-ray intensities and branching ratios given in the DDEP evaluation for the 821.8-keV level are incorrect. The DDEP evaluators took these data mainly from 2005Ra29.

Although 2005Ra29 is the most recent experiment, but due to many inconsistencies in this paper, the results are not used much in this evaluation. The authors also report ce measurements and give K-shell (also M- and N-shell in some cases) conversion coefficients, some of which are quoted to a precision of 1% or less, which does not seem realistic. No $\gamma\gamma$ coincidence study was done in this work. The 859.84, 1/2^{+} and 586.81, 1/2^{-} levels reported to be populated in this decay by 2005Ra29 only are omitted here since none of the γ rays associated with these levels have been seen in other studies. In addition, the 859.84 level is within 5 keV of the Q value and implied log *ft*=3.2 is impossible for a 5/2^{+} to 1/2^{+} β transition. Branching ratios of γ transitions reported in 2005Ra29 are in severe disagreement with those from (n,n′γ) study where this level is strongly populated.

γ (in some cases $\gamma\gamma$ coin also): 2005Ra29, 1997Lo10, 1996St16, 1994Ra28, 1994Mi22, 1994Bh07, 1994St25, 1994Jo14, 1992Sc09, 1991Jo02, 1990An07, 1990Wa03, 1985Ku26, 1984Si06 (also 1983Si25), 1984To11 (also 1982ToZT), 1983Yo03, 1982Ha37, 1978He21, 1977Ge12, 1977Pr08, 1977Pu04, 1974MeZA, 1974Ca29, 1973Th07, 1973In06, 1973Te06, 1972De67, 1972Bo64, 1971Bo56, 1971Pr07, 1971Ge07, 1970Ch24, 1970Na14, 1970Pa25 (also 1969Pa05), 1970Pr06, 1968Pr07, 1968Na10, 1967Jo02, 1966Ga13, 1966Ra09, 1961Ed02. Others: 1971Ba71, 1969Ho25, 1967Pa14, 1966La25, 1966Na02, 1965Br19, 1962Va02, 1960Pe05, 1959Vo30, 1958Va02, 1955Sc09.

Conversion electron measurements: 2005Ra29, 1970Pa25, 1965Br19, 1961Ed02, 1960Gr03, 1960De06, 1959Me76, 1955Sc09. Note that the uncertainties quoted by 2005Ra29 on measured K-shell conversion electron intensities are unrealistically low for several transitions. Also from Eγ, Iγ data in 2005Ra29, there seem several lines contributed by impurities, thus these data are not used for multipolarity and mixing ratio assignments.

Double dead-time method and correlation counting: 1996Hw02, 1994Iw04, 1994Ch56, 1992Ch46.

Absolute activity and standardization: 1994Sr04, 1994Sm09, 1994Ra28, 1994Mi22, 1992Sc09, 1992Ra07, 1992Pa10, 1990Wa03, 1990Me15, 1990Je01, 1990An07.

$\gamma\gamma(\theta)$, (ce)$\gamma(\theta)$: 1983Si25, 1977Pu04, 1973Su10, 1970Ch24, 1969Ra12, 1969Be23, 1968Sp02, 1968Vi02, 1958Va02, 1956Ke15, 1955Sc09. Other: 1996Ro16.

ce: particle parameters: 1971Va27, 1969Be23, 1968Sp02, 1968Vi02. Others: 1968Ja03, 1961Ed02, 1967Dr03, 1960Gr03, 1959Me76.

$\beta\gamma$ coin: 1980Sc07, 1972Gu03.

γ(lin pol,θ): 1958Va02.

$\gamma\gamma(\theta$,H,T): 1990Mo06, 1990Mo22, 1990Mo23, 1989Mo14, 1975Bo13.

γ circular polarization: 1971Va27, 1960Bo11 1974Ca23, 1966Ag01, 1960Ma03.

Fluorescence, x-ray yield, K-capture measurements: 1996Sa22, 1994Le29, 1994Bh07, 1993Be08, 1990Ja15, 1990An07, 1984Si02, 1984Si06, 1983Si25.

Theoretical fractional ε probabilities: 1998Sc28.

The total average radiation energy released by ^{75}Se is 864 keV *8* (calculated by evaluators using the computer code RADLST). This value agrees remarkably well with Q(ε)=864.7 keV *9* (2012Wa38), thus confirming the accuracy of the present decay scheme.

^{75}Se ε decay (119.78 d) 1990Me15,1991BaZS,2005Ra29 (continued)

^{75}As Levels

E(level)†	J$^\pi$‡	T$_{1/2}$‡	Comments
0.0	3/2$^-$	stable	
198.6063 *8*	1/2$^-$	885 ps *30*	J$^\pi$: isotropic result in $\gamma\gamma(\theta)$ consistent with J=1/2. T$_{1/2}$: average of 870 ps *30* (1969Ho25) and 900 ps *30* (1967Se01).
264.6581 *6*	3/2$^-$	11.2 ps *3*	J$^\pi$: anisotropic result in $\gamma\gamma(\theta)$ rules out J=1/2.
279.5428 *8*	5/2$^-$	273 ps *3*	μ=+0.918 *18* (1989Mo14); Q=0.30 *10* (1990Mo23) T$_{1/2}$: from $\gamma\gamma$(t) (1989Mo14,1990Mo06). Others: 280 ps *20* (1969Ho25), 1973Ch45, 1972Gu03, 1971Ba71, 1970Az01, 1969Sh12, 1968Go41, 1967Se01, 1962Va02, 1955Sc09.
303.9243 *8*	9/2$^+$	17.62 ms *23*	T$_{1/2}$: from 1998Hw05. Others: 15.6 ms *9* (1965La15), 17.0 ms *7* (1957Sc11). See also numerous other experimental values in Adopted Levels.
400.6583 *6*	5/2$^+$	1.67 ns *5*	T$_{1/2}$: from 1967Se01. Others: 1970Az01, 1.67 ns *14* (1969Ho25), 1.8 ns *4* (1959Ve22), 1.5 ns *4* (1958La10), <10 ns (1958Va02).
468.6 *4*	1/2$^-$		
572.41 *3*	5/2$^-$	2.9 ps *3*	
617.68 *4*	1/2$^-$,3/2$^-$		
821.73 *16*	7/2$^-$	3.0 ps *3*	The γ-ray branching ratios are used from Adopted Levels, Gammas dataset. The ratios in 2005Ra29 and 1977Pr08, where γ rays from this level are reported, are in severe disagreement with the ones obtained from Coulomb excitation, where this level is very strongly populated. Energies of 249, 542, and 558 gamma rays are also taken from Adopted Gammas, since the evaluators believe that gamma rays reported near these energies in 2005Ra29 and 1977Pr08 are contributed by impurities.

† Deduced from a least-squares fit to γ-ray energies.
‡ From Adopted Levels, unless otherwise stated.

ε radiations

ε subshell ratios measured in 1994Bh07, 1984Si06; and evaluated in 1995ScZY.

E(decay)	E(level)	Iε†	Log *ft*	Comments
(43.0 *9*)	821.73	0.000160 *10*	9.59 *4*	εK=0.8063 *24*; εL=0.1610 *20*; εM+=0.0327 *5*
(247.0 *9*)	617.68	0.0169 *3*	9.29 *1*	εK=0.8726; εL=0.10680 *3*; εM+=0.020583 *7*
(292.3 *9*)	572.41	0.0387 *5*	9.080 *7*	εK=0.8742; εL=0.10553 *3*; εM+=0.020306 *5*
(396.1 *10*)	468.6	0.00037 *6*	11.4 *1*	εK=0.8763; εL=0.10377 *2*; εM+=0.019919 *3*
(464.0 *9*)	400.6583	96.2 *6*	6.098 *4*	εK=0.8772; εL=0.1031; εM+=0.01976 ε subshell ratios are from 1995ScZY.
(585.2 *9*)	279.5428	2.1 *4*	8.0 *1*	εK=0.8782; εL=0.1022; εM+=0.01958
(600.0‡ *9*)	264.6581	0.5 *5*	>8.3	εK=0.8783; εL=0.1021; εM+=0.01956
(666.1 *9*)	198.6063	0.047 *18*	10.0^{1u} *2*	εK=0.8734; εL=0.10624 *2*; εM+=0.020369 *3*
(864.7 *9*)	0.0	1.1 *6*	8.6 *3*	εK=0.8795; εL=0.1012; εM+=0.01935 Iε: from 100−(sum I(γ+ce) of γ rays to g.s.). It is consistent with measured Iε<1.2 with 99% probability (1976Hu11) from (x ray)γ coin.

† Absolute intensity per 100 decays.
‡ Existence of this branch is questionable.

γ(^{75}As)

Iγ normalization: from an absolute intensity of 58.9% 3 for the 264-keV γ ray, weighted average (LWM) of the following values measured by 4 π $\beta\gamma$ coin: 59.44% 83 (1980Sc07), 57.96% 85 and 58.16% 85 (1983Yo03), 59.55% 90 (ICRM value), and 59.03% 32 (1994Mi22). These are values corrected by evaluators for the coincidence events of the 24-keV γ-ray transition missed in the measurements because of the 17 ms half-life of the 303.9-keV level. The correction factor (1.060 *5*), which equals unity plus the total absolute intensity of the 24-keV transition, is based on the weighted average (LWM) of the following results: 0.055 *5*, Szvrenyi et al., report to BIPM (1989) (correlation method); 0.065 *2* (1990Ja15, correlation method); 0.056 *2* (1994Sm09, correlation method); and 0.058 *5* (1994Ch56, double dead time method).

The following gamma rays with Eγ(Iγ) reported only in 2005Ra29 have been omitted by the evaluators since with the intensity listed in 2005Ra29, these should have been detected in previous experiments: 38.47 *8* (0.0038 *2*), 186.01 *5* (0.044 *1*), 234.79 *12* (0.0098 *2*), 242.22 *5* (0.023 *1*), 270.20 *4* (0.037 *1*), 282.92 *19* (0.0047 *2*), 292.74 *15* (0.00058 *1*), 388.31 *7* (0.00063 *7*), 459.32 *8* (0.0026 *2*), 555.76 *5* (0.0041 *2*), 586.82 *7* (0.0084 *3*), 661.19 *2* (0.0057 *3*), 859.83 *2* (0.117 *2*). In the opinion of the evaluators, the 859.8γ and some other γ rays may be contributed by room background from Th activity.

Other omitted γ rays: Eγ=201.98 *3*, Iγ=0.018 *1* (2005Ra29); Iγ=0.005 *2* (1996St16); Iγ=0.0002 (listed in 1978LeZA from priv comm 1974MeZA). Eγ=204.31 *17*, Iγ=0.018 *1* (2005Ra29); 0.0042 *16* (1996St16); 0.003 (listed in 1978LeZA from priv comm 1974MeZA). Eγ=307.92 *15*, Iγ=0.0039 *1* (2005Ra29), 0.007 *3* (1996St16). Eγ=338.27 *5*, Iγ=0.145 *1* (2005Ra29), 0.0042 *7* (1996St16), 0.0007 (listed in 1978LeZA from priv comm 1974MeZA).

Measured K x-ray relative intensities is 92.6 *18*, weighted average (LWM) of 94.0 *24* (1966Ra09), 91 *5* (1974Ca29), 90.3 *26* (1970Pa25), and 93.1 *18* (1992Sc09). Using a normalization factor Iγ normalization=0.589 *3*, the corresponding absolute intensity is 54.6% 11. This value compares with 56.5% 6, calculated by evaluators using the RADLST computer program and the nuclear and atomic data deduced in this evaluation. The agreement between these quantities constitutes a test for the self-consistency of the decay scheme.

Data details for the relative intensities of the γ rays used in the evaluation process; only data using Ge detectors is considered here. Minimum uncertainty assigned in the recommended value is 0.5% when the one given by the averaging procedure is lower than this.

The data from 2005Ra29 has been used sparingly in the present evaluation since many values seem to be outliers, which suggests large systematic errors in this study. In addition the authors have many gamma rays which have not been confirmed in other studies; these must be contributed from impurities which have remained unidentified in this work.

The 13 measurements from 1991BaZS are independent results from different laboratories which were performed as part of an IAEA CRP.

Note that in 2005Ra29, 1997Lo10, 1994Mi22, 1994Bh07, uncertainties reported for some of the values are below 1%, which seems unrealistic, in view of systematic uncertainties involved.

14.9γ:

Iγ≤0.002 adopted from <0.017 (1974Ca29), <0.002 (1984Si06), 0.003 *2* (1994Bh07). Others: 0.034 *6* (1973Th07), 0.035 *1* (2005Ra29). Spectral evidence is provided by 2005Ra29 and 1983Si25; line is close to intense K-x ray lines. Due to inconsistent intensities reported, lower value is adopted while this transition is considered as unconfirmed by the evaluators.

24.4γ:

Iγ=0.0473 *18* is the weighted average of 0.044 *6* (1970Pa25), 0.032 *10* (1970Pr06), 0.063 *8* (1973Th07), 0.065 *8* (1977Pr08), 0.052 *9* (1984Si06), 0.046 *4* (1990Me15), 0.045 *6* (1991BaZS-1), 0.045 *6* (1991BaZS-10), 0.0446 *20* (1992Sc09), 0.056 *6* (1994Bh07), 0.059 *10* (1994Ra28), 0.052 *5* (1996St16). χ^2=1.66. Others (omitted as outliers): 0.036 *4* (1974Ca29), 0.127 *12* (1991BaZS-2), 0.035 *1* (2005Ra29). Weighted averaged value of 0.0473 further reduced to 0.043 *2* so that ε feeding to 303-9-keV level is near zero as expected from ΔJ=2, ΔJ no.

66.1γ:

Iγ=1.887 *12* adopted from NRM average of: 1.40 *40* (1969Ra12), 2.0 *5* (1973Te06), 1.86 *9* (1977Ge12), 1.91 *3* (1984Si06), 1.87 *1* (1990Me15), 1.959 *40* (1990Wa03), 1.957 *11* (1990An07),1.85 *3* (1991BaZS-1), 1.91 *2* (1991BaZS-10), 1.94 *3* (1991BaZS-11), 1.88 *1* (1991BaZS-12), 1.85 *3* (1991BaZS-2), 1.76 *8* (1991BaZS-3), 1.95 *6* (1991BaZS-4), 1.78 *6* (1991BaZS-6), 2.00 *17* (1991BaZS-7), 1.86 *2* (1991BaZS-8), 1.96 *4* (1991BaZS-9), 1.95 *2* (1991BaZS-13), 1.91 *2* (1992Sc09),1.912 *12* (1994Bh07 with uncertainty increased by factor of 4 by evaluator), 1.929 *43* (1994Ra28), 1.86 *2* (1996St16), 1.79 *1* (2005Ra29). Others (omitted as outliers): 1.64 *5* (1966Ra09), 1.54 *8* (1970Na14), 1.72 *4* (1970Pa25), 0.97 *6* (1973Su10), 1.50 *15* (1973Th07), 1.46 *2* (1977Pr08). Superseded results: 1.77 *20* (1971Ge07) superseded by 1977Ge12, 1.93 *4* (1980Sc07) superseded by 1992Sc09.

80.9γ:

Iγ=0.0144 *11* adopted from weighted average of 0.015 *3* (1970Pa25), 0.011 *3* (1973Th07), 0.012 *4* (1977Pr08), 0.014 *4* (1984Si06), 0.019 *4* (1990Me15), 0.013 *4* (1994Bh07), 0.0135 *34* (1994Ra28), 0.016 *2* (1996St16), 0.017 *1* (2005Ra29). χ^2=0.54.

96.7γ:

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γ(^{75}As) (continued)

Iγ=5.855 *30* adopted from weighted average of: 5.9 *3* (1977Ge12), 5.78 *17* (1983Yo03), 5.917 *32* (1990An07), 5.72 *21* (1990Me15), 5.911 *91* (1990Wa03), 5.93 *8* (1991BaZS-1), 5.91 *5* (1991BaZS-10), 5.88 *6* (1991BaZS-11), 5.91 *5* (1991BaZS-13), 5.68 *15* (1991BaZS-2), 5.79 *3* (1991BaZS-8), 5.83 *4* (1991BaZS-12 with uncertainty increased by factor of 2), 5.91 *5* (1992Sc09), 5.779 *38* (1994Mi22), 5.89 *14* (1994Ra28); χ^2=1.4. Others (omitted as outliers): 5.33 *16* (1966Ra09), 4.83 *96* (1969Ra12), 5.43 *16* (1970Na14), 5.12 *10* (1970Pa25), 4.7 *2* (1973Su10), 5.0 *5* (1973Te06), 5.4 *4* (1973Th07), 5.22 *2* (1977Pr08), 6.13 *18* (1991BaZS-3), 6.47 *18* (1991BaZS-4), 5.41 *13* (1991BaZS-6), 5.13 *30* (1991BaZS-7), 5.63 *5* (1991BaZS-9), 5.65 *5* (1996St16), 5.10 *4* (2005Ra29). Superseded results: 5.60 *50* (1971Ge07) superseded by 1977Ge12, 5.89 *13* (1980Sc07) superseded by 1992Sc09.

121.1γ:

Iγ=29.21 *15* adopted from RT weighted average of: 27.8 *8* (1966Ra09), 29.2 *29* (1969Ra12), 28.49 *85* (1970Na14), 27.70 *50* (1970Pa25), 29.8 *9* (1977Ge12), 27.1 *40* (1977Pr08), 29.24 *29* (1983Yo03), 29.96 *26* (1984Si06), 29.17 *15* (1990An07), 29.8 *2* (1990Me15), 29.13 *45* (1990Wa03), 29.23 *15* (1991BaZS-1), 29.16 *23* (1991BaZS-10), 29.43 *22* (1991BaZS-11), 29.31 *10* (1991BaZS- 12), 29.24 *20* (1991BaZS-13), 29.1 *6* (1991BaZS-2), 29.2 *4* (1991BaZS-4), 29.3 *5* (1991BaZS-5), 28.5 *5* (1991BaZS-6), 30.0 *10* (1991BaZS-7), 28.96 *14* (1991BaZS-9), 27.9 *6* (1991BaZS-3), 28.65 *11* (1991BaZS-8), 29.16 *23* (1992Sc09), 30.10 *90* (1994Bh07), 29.27 *52* (1994Ra28), 29.76 *14* (1994Mi22), 28.05 *27* (1997Lo10). Others (omitted as outliers): 25.4 *12* (1973Su10), 25.8 *25* (1973Te06), 26.7 *30* (1973Th07), 27.620 *31* (1996St16), 27.40 *22* (2005Ra29). Superseded results: 28.2 *14* (1971Ge07) superseded by 1977Ge12, 29.3 *3* (1980Sc07) superseded by 1992Sc09.

136.0γ:

Iγ=99.4 *5* from weighted average of: 94.9 *20* (1966Ra09), 96.0 *96* (1969Ra12), 94.0 *28* (1970Na14), 95.0 *18* (1970Pa25), 94.6 *82* (1973Te06), 95.9 *70* (1973Th07), 102 *3* (1977Ge12), 95.5 *60* (1977Pr08), 99.2 *9* (1983Yo03), 102.5 *10* (1984Si06), 99.73 *62* (1990An07), 100 *3* (1990Me15), 99.5 *14* (1990Wa03), 99.9 *3* (1991BaZS-1), 94.6 *20* (1991BaZS-2), 94.6 *21* (1991BaZS-3), 99.7 *8* (1991BaZS-10), 100.4 *7* (1991BaZS-11), 99.4 *10* (1991BaZS-13), 99.9 *9* (1991BaZS-4), 99.9 *18* (1991BaZS-5), 95.9 *21* (1991BaZS-6), 99.5 *31* (1991BaZS-7), 99.9 *5* (1991BaZS-9), , 98.2 *4* (1991BaZS-8), 99.7 *8* (1992Sc09), 100.22 *45* (1994Mi22), 99.8 *19* (1994Ra28), 102.3 *11* (1994Bh07), 98.0 *10* (1996St16), 98.41 *36* (1997Lo10); χ^2=2.5. Others (omitted as outliers): 90.3 *28* (1973Su10), 101.2 *2* (1991BaZS-12), 94.05 *75* (2005Ra29). Superseded results: 98.3 *46* (1971Ge07) superseded by 1977Ge12, 99.8 *8* (1980Sc07) superseded by 1992Sc09.

198.6γ:

Iγ=2.540 *13* from NRM average of 2.25 *23* (1969Ra12), 2.79 *14* (1970Na14), 2.5 *1* (1973Su10), 2.59 *2* (1973Th07), 2.53 *8* (1977Ge12), 2.48 *4* (1977Pr08), 2.51 *4* (1983Yo03), 2.52 *6* (1984Si06), 2.54 *2* (1990Me15), 2.504 *43* (1990Wa03), 2.490 *18* (1990An07), 2.518 *13* (1991BaZS-1), 2.534 *23* (1991BaZS-10), 2.514 *20* (1991BaZS-11), 2.50 *3* (1991BaZS-13), 2.52 *7* (1991BaZS-2), 2.568 *21* (1991BaZS-4), 2.48 *5* (1991BaZS-5), 2.53 *7* (1991BaZS-7), 2.509 *16* (1991BaZS-8), 2.581 *12* (1991BaZS-9), 2.586 *10* (1991BaZS-12), 2.534 *20* (1992Sc09), 2.51 *8* (1994Bh07), 2.555 *17* (1994Mi22), 2.487 *48* (1994Ra28), 2.56 *2* (1996St16), 2.58 *7* (1997Lo10). Others (omitted as outliers): 2.28 *5* (1966Ra09), 2.38 *7* (1970Pa25), 2.2 *2* (1973Te06), 2.25 *8* (1991BaZS-3), 2.38 *4* (1991BaZS-6), 2.42 *2* (2005Ra29). Superseded results: 2.43 *12* (1971Ge07) superseded by 1977Ge12, 2.49 *5* (1980Sc07) superseded by 1992Sc09.

249.4γ:

Iγ=0.000015 *3* adopted from branching ratio in Adopted Gammas. Values of Iγ=0.00016 *4* (1977Pr08), and 0.0067 *2* (2005Ra29) are much too high as compared to those expected from Coulomb excitation data where the level is very strongly populated.

264.7γ:

Adopted Iγ=100.0 *5*, reference gamma ray.

279.5γ:

Iγ=42.48 *22* adopted from weighted average of: 43.0 *9* (1966Ra09), 41.3 *41* (1969Ra12), 41.9 *13* (1970Na14), 42.0 *8* (1970Pa25), 42.5 *15* (1973Su10), 40.0 *22* (1973Te06), 42.1 *8* (1973Th07), 42.4 *13* (1977Ge12), 42.6 *8* (1977Pr08), 42.43 *20* (1983Yo03), 42.42 *40* (1984Si06), 42.53 *16* (1991BaZS-1), 42.2 *9* (1991BaZS-3), 42.1 *3* (1991BaZS-4), 42.6 *6* (1991BaZS-5), 42.4 *5* (1991BaZS-6), 42.6 *11* (1991BaZS-7), 42.48 *23* (1991BaZS-8), 42.36 *14* (1991BaZS-9), 42.5 *3* (1991BaZS-10), 42.25 *16* (1991BaZS-12 with uncertainty increased by factor of 4), 42.4 *4* (1991BaZS-11), 42.69 *21* (1991BaZS-13), 42.60 *19* (1990An07), 42.2 *4* (1990Me15), 42.42 *67* (1990Wa03), 42.47 *34* (1992Sc09), 42.55 *12* (1994Bh07), 42.78 *18* (1994Mi22), 42.64 *89* 1994Ra28), 42.56 *31* (1996St16). χ^2=0.40. Others (excluded as outliers): 43.9 *9* (1991BaZS-2), 43.63 *29* (1997Lo10), 43.07 *34* (2005Ra29). Superseded results: 43.2 *22* (1971Ge07) superseded by 1977Ge12, 42.6 *4* (1980Sc07) superseded by 1992Sc09.

303.9γ:

Iγ=2.232 *12* adopted from weighted average of: 2.06 *21* (1969Ra12), 2.20 *11* (1970Na14), 2.19 *7* (1970Pa25), 2.20 *8* (1973Su10), 2.11 *30* (1973Th07), 2.21 *3* (1977Ge12), 2.26 *4* (1977Pr08), 2.234 *17* (1983Yo03), 2.234 *11* (1990An07), 2.23 *2* (1990Me15), 2.249 *41* (1990Wa03), 2.248 *9* (1991BaZS-1), 2.242 *18* (1991BaZS-10), 2.220 *22* (1991BaZS-11), 2.219 *8* (1991BaZS-12), 2.239 *16* (1991BaZS-13), 2.25 *5* (1991BaZS-2), 2.21 *6* (1991BaZS-3), 2.24 *4* (1991BaZS-5),

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γ(^{75}As) (continued)

2.23 *4* (1991BaZS-6), 2.24 *6* (1991BaZS-7), 2.234 *15* (1991BaZS-8), 2.224 *8* (1991BaZS-9), 2.242 *18* (1992Sc09), 2.239 *15* (1994Mi22), 2.267 *46* (1994Ra28), 2.24 *2* (1996St16), 2.27 *2* (2005Ra29). χ^2=0.46. Others (omitted as outliers): 2.39 *5* (1966Ra09), 2.091 *14* (1991BaZS-4), 2.199 *11* (1997Lo10). Superseded results: 2.31 *12* (1971Ge07) superseded by 1977Ge12, 2.27 *2* (1980Sc07) superseded by 1992Sc09.

373.5γ:
Iγ=0.0043 *2* adopted from weighted average of 0.0042 *4* (1977Pr08), 0.0032 *12* (1996St16), 0.0044 *2* (2005Ra29). Others: <0.005 (1973Th07), <0.006 (1970Pa25).

400.7γ:
Iγ=19.38 *10* adopted from weighted average of: 19.2 *19* (1969Ra12), 19.45 *58* (1970Na14), 19.0 *6* (1973Su10), 19.6 *17* (1973Te06), 19.1 *3* (1977Ge12), 18.8 *6* (1977Pr08), 19.38 *12* (1983Yo03), 19.461 *88* (1990An07), 19.5 *3* (1990Me15), 19.27 *11* (1991BaZS-1), 19.49 *16* (1991BaZS-10), 19.08 *17* (1991BaZS-11), 19.360 *25* (1991BaZS-12), 19.51 *10* (1991BaZS-13), 19.7 *4* (1991BaZS-2), 19.1 *4* (1991BaZS-3), 19.1 *4* (1991BaZS-4), 19.5 *3* (1991BaZS-5), 19.17 *21* (1991BaZS-6), 19.5 *5* (1991BaZS-7), 19.60 *10* (1991BaZS-8), 19.49 *16* (1992Sc09), 19.313 *88* (1994Mi22), 19.56 *27* (1994Ra28), 19.38 *4* (1996St16 with uncertainty increased by factor of 2). χ^2=0.80. Others (omitted as outliers): 22.3 *5* (1966Ra09), 20.40 *50* (1970Pa25), 18.0 *4* (1973Th07), 20.19 *32* (1990Wa03), 19.79 *6* (1991BaZS-9), 18.84 *16* (1997Lo10), 20.13 *16* (2005Ra29). Superseded results: 19.6 *12* (1971Ge07) superseded by 1977Ge12, 19.56 *16* (1980Sc07) superseded by 1992Sc09.

418.8γ:
Iγ=0.0210 *4* adopted from weighted average of: 0.020 *3* (1969Ra12), 0.023 *2* (1970Pa25), 0.017 *3* (1973Th07), 0.018 *4* (1977Pr08), 0.0231 *21* (1983Yo03), 0.018 *3* (1990Me15), 0.02095 *40* (1990Wa03), 0.0206 *7* (1991BaZS-1), 0.0196 *11* (1991BaZS-10), 0.0217 *5* (1991BaZS-11), 0.024 *9* (1991BaZS-2), 0.0196 *12* (1992Sc09), 0.022 *2* (1996St16). χ^2=0.97. Others (omitted as outliers): 0.0322 *6* (1966Ra09), 0.0140 *16* (1973Su10), 0.0247 *13* (1991BaZS-12), 0.0102 *32* (1991BaZS-6), 0.0154 *10* (1991BaZS-7), 0.035 *1* (2005Ra29).

468.6γ:
Iγ=0.00062 *10* adopted from 1977Pr08; 0.00054 *18* (1971Pr07) and 0.0010 *5* (1970Pa25) are in agreement but less precise. Others: 0.0028 *4* (1996St16), and 0.0036 *2* (2005Ra29) are much too high.

542.4γ:
Iγ=0.000022 *3* adopted from branching ratio in Adopted Gammas. Values of Iγ=0.00022 *4* (1977Pr08), and 0.00074 *1* (2005Ra29) are much too high as compared to those expected from Coulomb excitation data where the level is prominently populated.

557.8γ:
Iγ=0.0000016 *5* adopted from branching ratio in Adopted Gammas. Values of Iγ=0.00006 *2* (1977Pr08), and 0.0047 *2* (2005Ra29) are much too high as compared to those expected from Coulomb excitation data where the level is prominently populated.

572.2γ:
Iγ=0.0614 *7* adopted from weighted average of: 0.0636 *13* (1966Ra09), 0.053 *8* (1969Ra12), 0.063 *2* (1970Pa25), 0.054 *3* (1973Su10), 0.0634 *29* (1983Yo03), 0.0638 *16* (1990An07), 0.060 *3* (1990Me15), 0.05894 *91* (1990Wa03), 0.0602 *20* (1991BaZS-1), 0.0610 *10* (1991BaZS-10), 0.0603 *7* (1991BaZS-11), 0.064 *3* (1991BaZS-13), 0.0625 *22* (1991BaZS-2), 0.058 *4* (1991BaZS-6), 0.059 *3* (1991BaZS-7), 0.0610 *18* (1991BaZS-8), 0.0617 *14* (1991BaZS-9), 0.067 *2* (1991BaZS-12), 0.0610 *10* (1992Sc09), 0.063 *1* (1996St16). 0.066 *3* (1997Lo10), 0.062 *1* (2005Ra29). Others (omitted as outliers): 0.048 *5* (1973Th07), 0.050 *4* (1977Pr08).

617.8γ:
Iγ=0.00765 *15* adopted from weighted average of: 0.00777 *15* (1966Ra09), 0.0076 *10* (1969Ra12), 0.0075 *2* (1970Pa25), 0.0075 *31* (1973Su10), 0.0078 *21* (1983Yo03), 0.0062 *8* (1977Pr08), 0.0077 *4* (1990Me15), 0.00761 *23* (1990Wa03), 0.0072 *7* (1991BaZS-1), 0.0078 *5* (1991BaZS-10), 0.0077 *3* (1991BaZS-11),

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0.0067 *10* (1991BaZS-2), 0.0076 *6* (1991BaZS-6), 0.0080 *6* (1991BaZS-7), 0.0063 *6* (1991BaZS-9), 0.0078 *5* (1992Sc09), 0.0082 *7* (1996St16), 0.0078 *2* (2005Ra29). χ^2=0.8. Others (omitted as outliers): 0.0059 *7* (1973Th07), 0.0108 *12* (1991BaZS-12).

821.6γ:
Iγ=0.000233 *15* adopted from LWM average of: 0.000216 *10* (1971Pr07), 0.00028 *2* (1977Pr08), 0.00022 *2* (1990Me15), 0.00030 *15* (1991BaZS-6), 0.0016 *12* (1991BaZS-2). Others (omitted as outliers and/or too high values): 0.0013 *7* (1991BaZS-7), 0.0035 *6* (1996St16), 0.0015 *2* (2005Ra29).

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$\gamma(^{75}As)$ (continued)

E_γ	I_γ[c]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[b]	δ	α[†‡]	Comments
14.89[d]	≤0.002	279.5428	5/2⁻	264.6581	3/2⁻	[M1(+E2)]	0.15 *15*	50 *30*	α(K)=28 *9*; α(L)=20 *18*; α(M)=3 *3*; α(N)=0.15 *13* E_γ: from level-energy difference=14.885. Additional information 4. δ: from RUL(E2)<300.

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^{75}Se ε decay (119.78 d) 1990Me15,1991BaZS,2005Ra29 (continued)

γ(^{75}As) (continued)

E_γ	I_γ[c]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[b]	δ	α[†‡]	Comments
24.38	0.043 *2*	303.9243	9/2$^+$	279.5428	5/2$^-$	M2(+E3)	0.013 *13*	205 *5*	α(K)=165.6 *24*; α(L)=33.3 *22*; α(M)=5.2 *4*; α(N)=0.364 *17* E_γ: from level-energy difference. Eγ=24.34 *1* (2005Ra29) fits poorly. I_γ: weighted averaged value of 0.047 is reduced to 0.043, so that there is no ε feeding to 303.9, 9/2$^+$ level from 5/2$^+$ parent, as expected. δ: <0.026 from RUL(E3)<100. Others: 0.051 *12* (from α(K)exp=182 *24* and α(L)exp=45 *45*) and −0.18 *2* (from (24γ)(280γ)(θ): A_2=+0.009 *20*, A_4=−0.03 *4* (1977Pu04)) give B(E3)(W.u.)>100. α(K)exp=180 *5* (2005Ra29).
66.0518[#] *8*	1.887 *12*	264.6581	3/2$^-$	198.6063	1/2$^-$	M1+E2	+0.066 *19*	0.298 *11*	α(K)=0.264 *9*; α(L)=0.0296 *14*; α(M)=0.00452 *22*; α(N)=0.000336 *14* Additional information 2. δ: from $\gamma\gamma$(θ) (1983Si25). Others: 0.11 *6* (from α(K)exp=0.29 *3*), +0.18 *3* (from $\gamma\gamma$(θ) 1973Su10). δ=0.18 is unlikely since it gives B(E2)(W.u.) much larger than RUL(E2)=300. α(K)exp=0.308 *2*, α(L)exp=0.0287 *3* (2005Ra29). (136γ)(66γ)(θ): A_2=+0.038 *4*, A_4=+0.003 *3* (1983Si25).
81.15[&] *9*	0.0144 *11*	279.5428	5/2$^-$	198.6063	1/2$^-$	E2		1.72	α(K)=1.472 *21*; α(L)=0.213 *3*; α(M)=0.0322 *5*; α(N)=0.00211 *3* Mult.: from α(K)exp=1.477 *23* (2005Ra29); δ(E2/M1)>8.5.
96.7340[#] *9*	5.855 *30*	400.6583	5/2$^+$	303.9243	9/2$^+$	E2		0.893	α(K)=0.772 *11*; α(L)=0.1044 *15*; α(M)=0.01576 *22*; α(N)=0.001058 *15* Additional information 7. Mult.: from α(K)exp=0.86 *11*. Other: α(K)exp=0.613 *1* (2005Ra29).
121.1155[#] *11*	29.21 *15*	400.6583	5/2$^+$	279.5428	5/2$^-$	E1		0.0417	α(K)=0.0372 *6*; α(L)=0.00388 *6*; α(M)=0.000588 *9*; α(N)=4.37×10^{-5} *7* Additional information 8. Mult.: from α(K)exp (1960Gr03) and K-shell particle parameters from (121ce(K))(280γ)(θ)(1969Be23, 1968Sp02). Other: α(K)exp=0.0384 *3*, α(L)exp=0.00385 *4*, α(M)exp=0.00062 *1* (2005Ra29).
136.0001[#] *6*	99.4 *5*	400.6583	5/2$^+$	264.6581	3/2$^-$	E1		0.0295	α(K)=0.0263 *4*; α(L)=0.00274 *4*; α(M)=0.000415 *6*; α(N)=3.10×10^{-5} *5* Additional information 9. Mult.: from α(K)exp (1960Gr03) and K-shell particle

γ(^{75}As) (continued)

E_γ	I_γ[c]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[b]	δ	α[†‡]	Comments
									parameters from (136ce(K))(265γ)(θ)(1969Be23, 1968Sp02). Other: α(K)exp=0.0250 *2*, α(L)exp=0.00249 *2*, α(M)exp=0.000382 *4* (2005Ra29).
198.6060[#] *12*	2.540 *13*	198.6063	1/2⁻	0.0	3/2⁻	M1+E2	0.389 *17*	0.0208 *6*	α(K)=0.0184 *5*; α(L)=0.00202 *6*; α(M)=0.000307 *9*; α(N)=2.28×10^{-5} *7* Additional information 1. δ: from B(E2) and $T_{1/2}$(199 level). α(K)exp=0.0186 *11* gives 0.39 *5*. Other: α(K)exp=0.0166 *2*, α(L)exp=0.00122 *4* (2005Ra29). (66γ)(199γ)(θ): A_2=−0.013 *27*, A_4=+0.004 *5* (1973Su10).
249.4[a] *3*	0.000015[a] *3*	821.73	7/2⁻	572.41	5/2⁻	[M1,E2]		0.017 *10*	α(K)=0.015 *9*; α(L)=0.0017 *10*; α(M)=0.00026 *15*; α(N)=1.9×10^{-5} *11* Additional information 16.
264.6576[#] *9*	100.0 *5*	264.6581	3/2⁻	0.0	3/2⁻	M1+E2	−0.07 *2*	0.00718 *11*	α(K)=0.00639 *10*; α(L)=0.000675 *11*; α(M)=0.0001030 *16*; α(N)=7.83×10^{-6} *12* Additional information 3. δ: unweighted average of 0.16 *5* (from α(K)exp=0.0067 *2*), 0.0362 *15* (from $T_{1/2}$ and B(E2) 1967Ro14), −0.01 *4* (γ(θ) in (γ,γ′) 1967La07) and following δ values from (136γ)(265γ)(θ): −0.043 *6* (1968Sp02), −0.044 *17* (1968Vi02), −0.061 *18* (1969Be23), −0.043 *25* (1969Ra12), −0.15 *4* (1973Su10). α(K)exp=0.0062, α(L)exp=0.00054 *1* (2005Ra29). (136γ)(265γ)(θ): A_2=−0.033 *1*, A_4=+0.001 *2* (1968Sp02).
279.5422[#] *10*	42.48 *22*	279.5428	5/2⁻	0.0	3/2⁻	M1+E2	−0.49 *3*	0.0084 *3*	α(K)=0.00751 *23*; α(L)=0.000807 *25*; α(M)=0.000123 *4*; α(N)=9.2×10^{-6} *3* Additional information 5. δ: unweighted average of 0.61 *6* (from α(K)exp=0.0083 *4*), 0.60 *5* (from $T_{1/2}$ and B(E2) 1967Ro14), −0.42 *8* (from γ(θ) in (γ,γ′) 1967La07), −0.50 *14* (γ(θ) in Coul. ex.) and following values from (121γ)(280γ)(θ): −0.48 *3* (1968Sp02), −0.39 *1* (1969Be23), −0.45 *3* (1973Su10), −0.48 *4* (1989Mo14). Other: −0.250 *9* (1968Vi02). α(K)exp=0.0062 *1* (2005Ra29). (121γ)(280γ)(θ): A_2=−0.431 *10* (1989Mo14).
303.9236[#] *10*	2.232 *12*	303.9243	9/2⁺	0.0	3/2⁻	E3		0.0538	α(K)=0.0469 *7*; α(L)=0.00592 *9*; α(M)=0.000899 *13*; α(N)=6.30×10^{-5} *9* Additional information 6. Mult.: from α(K)exp=0.048 *3*. Other: α(K)exp=0.045 *2*, α(L)exp=0.00473 *8* (2005Ra29).

From ENSDF

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$\gamma(^{75}As)$ (continued)

E_γ	I_γ[c]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[b]	δ	α[†‡]	Comments
373.86[&] *6*	0.0043 *2*	572.41	5/2−	198.6063	1/2−	[E2]		0.00651	α(K)=0.00580 *9*; α(L)=0.000628 *9*; α(M)=9.54×10^{-5} *14*; α(N)=7.09×10^{-6} *11* Additional information 12.
400.6572[#] *8*	19.38 *10*	400.6583	5/2+	0.0	3/2−	E1		0.00135	α(K)=0.001202 *17*; α(L)=0.0001241 *18*; α(M)=1.89×10^{-5} *3*; α(N)=1.432×10^{-6} Additional information 10. Mult.: from α(K)exp=0.0013 *1*. Other: α(K)exp=0.00123 *2*, α(L)exp=0.000126 *4* (2005Ra29).
419.08[&] *4*	0.0210 *4*	617.68	1/2−,3/2−	198.6063	1/2−	M1(+E2)	<0.35	0.00258 *24*	α(K)=0.00230 *21*; α(L)=0.000241 *23*; α(M)=3.7×10^{-5} *4*; α(N)=2.8×10^{-6} *3* Additional information 14. Mult.,δ: from α(K)exp=0.0018 *4* (1970Pa25), 0.0020 *6* (2005Ra29).
468.6[@] *4*	0.00062 *10*	468.6	1/2−	0.0	3/2−	[M1,E2]		0.0025 *7*	α(K)=0.0022 *6*; α(L)=0.00023 *7*; α(M)=3.5×10^{-5} *10*; α(N)=2.7×10^{-6} *8* Additional information 11.
542.4[a] *4*	0.000022[a] *3*	821.73	7/2−	279.5428	5/2−	[M1,E2]		0.0016 *4*	α(K)=0.0015 *3*; α(L)=0.00015 *4*; α(M)=2.3×10^{-5} *6*; α(N)=1.8×10^{-6} *4* Additional information 17.
557.8[a] *9*	1.6×10^{-6}[a] *5*	821.73	7/2−	264.6581	3/2−	[E2]		0.00183	α(K)=0.001628 *25*; α(L)=0.000172 *3*; α(M)=2.62×10^{-5} *4*; α(N)=1.97×10^{-6} *3* Additional information 18.
572.40[&] *3*	0.0614 *6*	572.41	5/2−	0.0	3/2−	M1+E2	+0.39 *5*	0.00122 *3*	α(K)=0.001093 *22*; α(L)=0.0001138 *23*; α(M)=1.73×10^{-5} *4*; α(N)=1.32×10^{-6} Additional information 13. δ: from (γ(θ) in Coul. ex.,1967Ro14). α(K)exp=0.0010 *1* from 1970Pa25 and 0.0010 *3* from 2005Ra29 give M1+E2 with δ<1.
617.67[&] *7*	0.00765 *15*	617.68	1/2−,3/2−	0.0	3/2−	M1,E2		0.00116 *20*	α(K)=0.00103 *18*; α(L)=0.000108 *20*; α(M)=1.7×10^{-5} *3*; α(N)=1.25×10^{-6} *22* Additional information 15. Mult.: α(K)exp=0.00086 *33* (2005Ra29).
821.6[@] *2*	0.000233 *15*	821.73	7/2−	0.0	3/2−	[E2]		0.00063	α(K)=0.000558 *8*; α(L)=5.82×10^{-5} *9*; α(M)=8.87×10^{-6} *13*; α(N)=6.73×10^{-7} *10* Additional information 19.

† Additional information 20.
‡ Theoretical values from BrIcc code.

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γ(^{75}As) (continued)

[#] From 2000He14, based on a revised energy scale that uses the new fundamental constants and wave lengths from an updated value of the lattice spacing of silicon crystals (1987Co39). 2000He14 fitted the revised γ-ray energies to a level scheme. The values given here are their recommended level-energy differences.

[@] From 1977Pr08.

[&] From 2005Ra29.

[a] From Adopted Gammas. This γ ray was reported by 2005Ra29 and 1977Pr08 with an intensity much larger than expected from Adopted Gammas, where the branching ratio is taken from Coulomb excitation which populates 822 level strongly. The evaluators thus consider the observation of this γ ray in 2005Ra29 and 1977Pr08 as suspect.

[b] From measured conversion coefficients determined by evaluators from relative conversion electron and photon intensities, using α(K)(121γ)=0.0372 and α(K)(136γ)=0.0263 theoretical values (from BrIcc) for E1 multipolarity to normalize scales for the electron and photon intensities. The electron intensities used were weighted averages (LWM) from 1955Sc09, 1959Me76, 1960De06, 1960Gr03, and 1961Ed02. Intensities from 2005Ra29 were not included due to many inconsistencies in this paper. Only in a few cases their α(K)exp values have been used.

[c] For absolute intensity per 100 decays, multiply by 0.589 *3*.

[d] Placement of transition in the level scheme is uncertain.

^{75}Se ε decay (119.78 d) 1990Me15,1991BaZS,2005Ra29

Decay Scheme

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays