Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Ameenah R. Farhan, Balraj Singh	NDS 110,1917 (2009)	30-Jun-2009

Q(β^-)=−3574 *4*; S(n)=10497.74 *17*; S(p)=10398.6 *18*; Q(α)=−6028.38 *18* 2012Wa38
Note: Current evaluation has used the following Q record −3574 4 *10497*.7317 *10398*.418-6028.4 *5* 2009AuZZ,2003Au03.
S(2n)=17916.59 *18*, s(2p)=18390.90 *19* (2009AuZZ,2003Au03). Values in 2003Au03 are within ≈0.1 keV of those in 2009AuZZ.
Additional information 1.
Mass measurements: 1985El01, 1982Zu04, 1977De20.
Nuclear structure calculations: 2008Yo07 (high-spin levels, B(E2), shell-model); 2008Ah03 (levels, B(E2), g factor, projected shell model).
^{78}Se(e,e): 1988Kh02, 1987Ku21, 1986Kh07.
See ^{77}Se(n,n),(n,γ):resonances dataset for 38 resonances between 41.2 eV to 3.91 keV.

^{78}Se Levels

Cross Reference (XREF) Flags

A	^{78}As β^- decay (90.7 min)	H	^{77}Se(n,γ) E=112.0 eV	O	^{78}Se(p,p′γ),(α,$\alpha'\gamma$)
B	Muonic atom	I	^{77}Se(n,γ) E=211.6 eV	P	^{78}Se(α,α')
C	^{78}Br ε decay (6.45 min)	J	^{77}Se(n,γ) E=340.8 eV	Q	^{78}Se(d,d′)
D	^{76}Ge(α,2nγ)	K	^{77}Se(n,γ) E=864.0 eV	R	Coulomb excitation
E	^{76}Ge(^{16}O,^{14}C)	L	^{77}Se(d,p)	S	^{80}Se(p,t)
F	^{76}Se(t,p)	M	^{78}Se(n,n′γ)		
G	^{77}Se(n,γ) E=thermal	N	^{78}Se(p,p′),(pol p,p′)		

E(level)[†]	J$^\pi$[‡]	T$_{1/2}$	XREF	Comments
0.0[#]	0$^+$	stable	ABCDEFG LMNOPQRS	
613.727[#] *3*	2$^+$	9.79 ps *21*	ABCDEFG J LMNOPQR	μ=+0.77 *5* (1998Sp03) Q=−0.20 *7* (2003Ha15) B(E2)↑=0.332 *7* <r^2>$^{1/2}$=4.1407 fm *18* (2004An14 evaluation). B(E2)↑: weighted average of 0.325 *45* (2003Ha15), 0.392 *66* (deduced from T$_{1/2}$=8.3 ps *14* (1987Sc07),RDM measurement in (α,2nγ)), 0.327 *7* (1977Le11), 0.385 *35* (1962St02), 0.35 *3* (1962Ga13), 0.36 *7* (1960Le07) and 0.36 *5* (1956Te26). All values, except for 1987Sc07, are from cross sections and yields in Coulomb excitation. Other: 0.335 *9* (2001Ra27 evaluation). T$_{1/2}$: from B(E2)=0.332 *7*. Other: 9.69 ps *26* (2001Ra27 evaluation). J$^\pi$: from L(t,p)=2. Also, L=2 and vector analyzing power in (p,p′). μ: from transient-field technique in Coul. ex. (1998Sp03), sign from 1969He11. Other: +0.78 *22* (1969He11,IMPAC technique). See also 1989Ra17 evaluation and 2005St24 compilation. Q: from Coulomb excitation (2003Ha15). Others:−0.26 *9* (1977Le11), −0.30 *11* (1976VoZY). See also 1989Ra17 evaluation and 2005St24 compilation.
1308.644[@] *5*	2$^+$	4.2 ps *3*	A CD FG KLMNOPQR	μ=0.66 *22* (1998Sp03) Q=+0.17 *9* (2003Ha15) μ: from transient-field technique in Coul. ex. (1998Sp03). See also 2005St24 compilation. Q: from Coulomb excitation (2003Ha15). T$_{1/2}$: from B(E2) in Coulomb excitation. Other: 3.8 ps *10* from recoil-distance method in (α,2nγ) (1987Sc07). Weighted

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Adopted Levels, Gammas (continued)

^{78}Se Levels (continued)

E(level)†	J^{π}‡	$T_{1/2}$	XREF	Comments
				average of the two values is also 4.2 ps *3*. J^{π}: from L(t,p)=2. Also, L=2 and vector analyzing power in (p,p′) and J=2 from circular polarization in (n,γ).
1498.599 *9*	0^+	45 ps *8*	A C FG LMNO qR	XREF: L(1510)q(1510). $T_{1/2}$: from B(E2)(↑) in Coul. ex. J^{π}: 0 from $\gamma\gamma(\theta)$ in (n,γ); L(d,p)=1.
1502.825# *13*	4^+	1.04 ps *5*	A D G MNOPqR	μ=1.6 *5* (1998Sp03) Q=−0.68 *15* (2003Ha15) XREF: q(1510). μ: from transient-field technique in Coul. ex. (1998Sp03). See also 2005St24 compilation. J^{π}: $\gamma(\theta)$ and linear polarization in (α,2nγ). $T_{1/2}$: weighted average of 1.05 ps *5* from B(E2) in Coul. ex. and 0.9 ps *2* from DSA in (α,2nγ) (1987Sc07).
1758.689 *17*	0^+		A C G MNO Q	J^{π}: J=0 from $\gamma\gamma(\theta)$ in (n,γ); γ′s to 2^+.
1853.927@ *12*	3^+	1.2 ps *4*	A D G LMNO	XREF: L(1880). J^{π}: $\gamma(\theta)$ and polarization measurements in (α,2nγ). $T_{1/2}$: DSA in (α,2nγ) (1987Sc07).
1995.897 *8*	2^+	4.6 ps *+32−14*	A C FGH MNO QR	XREF: Q(2030). J^{π}: L(t,p)=2; L(p,p′)=2; J=2 from circular polarization in (n,γ). $T_{1/2}$: from B(E2)(↑) in Coulomb excitation.
2190.65@ *18*	4^+	0.7 ps *3*	D MN Q	XREF: Q(2220). J^{π}: $\gamma(\theta)$ and polarization measurements in (α,2nγ). $T_{1/2}$: DSA in (α,2nγ) (1987Sc07).
2267.07 *12*			G	J^{π}: γ to 2^+ suggests 0^+ to 4^+.
2299.8 *5*	$1,2^{(+)}$		M	J^{π}: γ to 0^+.
2327.329 *19*	2^+	0.28 ps *+13−8*	A C G MNO	J^{π}: M1+E2 γ to 2^+; J=2 from $\gamma\gamma(\theta)$ in (n,γ). $T_{1/2}$: DSA in (n,n′γ).
2335.24 *5*	0^+		A C G M	J^{π}: log *ft*=5.91 from 1^+; J=0 from $\gamma\gamma(\theta)$ in (n,γ).
2361.85 *14*	(0^+)		FG L	J^{π}: L(t,p)=0. But L(d,p)=1 for E=2360. It is possible that the (t,p) and (d,p) reactions correspond to the 2335 level.
2507.32& *5*	3^-	6.2 ps *14*	A DEFG MNOP R	B(E3)↑=0.027 *3* (2002Ki06,1974Ba80) B(E3)↑: from Coul. ex. J^{π}: L(p,p′) and vector analyzing power in (p,p′). $T_{1/2}$: recoil-distance method in (α,2nγ) (1987Sc07).
2536.94 *4*	2^+	0.055 ps *7*	A C FG MNO	J^{π}: L(t,p)=2. $T_{1/2}$: DSA in (n,n′γ).
2546.3 *3*			G	J^{π}: γ to 4^+ suggests 2^+ to 6^+.
2546.51# *15*	6^+	0.49 ps *14*	D M	J^{π}: $\gamma(\theta)$ and polarization in (α,2nγ). $T_{1/2}$: DSA in (α,2nγ).
2560?	$(1^-,2^-,3^-)$		L	E(level): no uncertainty available. May correspond to adjacent level. J^{π}: L(d,p)=(2).
2629.6 *5*			D	J^{π}: γ to 4^+.
2647.472 *13*	$(1,2)^+$		A C G MNO	J^{π}: log *ft*=6.24 from 1^+; γ′s to 2^+ and 3^+.
2682.110 *16*	4^+		A FG MNO	J^{π}: L(t,p)=4, L(p,p′)=4. J^{π} inconsistent with possible primary transition in (n,γ) and log $f^{1u}t$ from 2^- small, but decay mode of 2682 level is consistent in (n,γ), β^-, and (p,p′γ); so only one level appears to Be involved.

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Adopted Levels, Gammas (continued)

^{78}Se Levels (continued)

E(level)[†]	J^π[‡]	$T_{1/2}$	XREF	Comments
2719.3 *5*			M	
2735.0[@] *6*	(5$^+$)	0.62 ps *21*	D M	J^π: $\gamma(\theta)$ and band assignment in (α,2nγ). $T_{1/2}$: DSA in (α,2nγ) (1987Sc07).
2742.52[&] *14*	4$^-$	0.42 ns *14*	D N	J^π: $\gamma(\theta)$ and polarization in (α,2nγ) (1987Sc07). E2 γ from 6$^-$ and E1 γ to 4$^+$. $T_{1/2}$: recoil-distance method in (α,2nγ) (1987Sc07).
2753.03 *18*	0$^+$		F	J^π: L(t,p)=0.
2754.46 *17*	2$^+$		G M O	J^π: γ(circ pol) in (n,γ); γ to 0$^+$. E(level): from primary transition in (n,γ). The 757 and 2140 γ's are not seen in (n,γ), and the 2156γ is not seen in (n,n'γ) or (p,p'γ). It is possible that the γ transitions define more than one level, in particular, the 2753 *10*+ level reported in (t,p) is perhaps being excited. Transitions from the 2754.46 level are both included in the least-squares fit for determining the energies of other levels.
2838.49 *7*	(2$^+$)		A G MN	J^π: γ's to 0$^+$ and 4$^+$.
2864.12 *7*			G N	J^π: γ to 3$^+$ suggests 1$^+$:5$^+$.
2889.90[&] *11*	5$^-$	18 ps *5*	D F M O	XREF: F(2893). $T_{1/2}$: recoil-distance method in (α,2nγ) (1987Sc07). J^π: L(t,p)=5; $\gamma(\theta)$ and polarization measurements in (α,2nγ).
2898.13 *6*	2		C G MN	J^π: $\gamma\gamma(\theta)$ in (n,γ).
2914.7 *5*	4$^+$	0.24 ns *+15−8*	F MNO	$T_{1/2}$: DSA in (n,n'γ) (1989Do14). J^π: L(t,p)=4.
2949.19 *16*	4$^-$	>1.4 ps	D LMNO	J^π: $\gamma(\theta)$ in (α,2nγ); L(d,p)=4. $T_{1/2}$: DSA in (α,2nγ).
3003 *9*	3$^-$		F	J^π: L(t,p)=3.
3005.70 *17*	1,2$^+$		C G J MNO	J^π: log *ft*=6.28 from 1$^+$; γ to 0$^+$.
3013.96[a] *13*	6$^-$	3.0 ns *5*	D F	J^π: $\gamma(\theta)$ and polarization data in (α,2nγ). $T_{1/2}$: $\gamma\gamma$(t) in (α,2nγ) (1987Sc07).
3039.81 *6*	(1$^+$ to 4$^+$)		G	J^π: γ's to 2$^+$ and 3$^+$.
3048.6 *10*	(3$^-$)		NO	J^π: L(p,p')=(3); γ to 4$^+$.
3061 *12*	0$^+$&5$^-$		F	J^π: L(t,p)=0+5.
3088.7 *21*	(5$^-$)		f N	J^π: L(p,p')=5. L(t,p)=0+4 for a doublet.
3089.73 *15*	(0$^+$)		C fG M	J^π: L(t,p)=0+4 for a doublet; γ to 2$^+$.
3130?	0$^+$,1$^+$,2$^+$		L	E(level): may Be same as 3090 level. J^π: L(d,p)=1.
3133.3 *5*	3$^-$		F M	J^π: L(t,p)=3.
3139.7 *15*	4$^+$		NO	J^π: L(p,p')=4.
3140.2[@] *4*	(6$^+$)	0.28 ps *+14−7*	D	J^π: $\gamma(\theta)$ and band assignment in (α,2nγ). $T_{1/2}$: DSA in (α,2nγ) (1987Sc07).
3144.46 *11*	3$^-$		A FG M	J^π: L(t,p)=3; γ's to 2$^+$ and 4$^+$.
3181.9 *5*	(2)$^+$		f MN	J^π: L(d,p)=1; γ to 0$^+$; L(t,p)=2.
3186.37 *14*	2$^+$		fG	J^π: L(t,p)=2; γ to 2$^+$.
3229.71 *13*	(1$^-$,2,3)		A M	J^π: γ's to 3$^-$ and 2$^+$; log *ft*=6.5 from 2$^-$.
3242.68 *7*	2$^+$		G MN	J^π: L(p,p')=2. E(level): from primary transition in (n,γ). Deexciting transitions 3241.8 and 2627.87 (doubly placed) are placed by 1979BrZE, with additional transitions reported and placed by 1987Su05 (all from (n,γ)), and give excitation energies of 3242.8 *3*, 3242.8 *2*, 3241.5 *2*, 3243.3 *3* and 3243.4 *1*. The spread in

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Adopted Levels, Gammas (continued)

^{78}Se Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$	XREF	Comments
				excitation energies suggests that either one or more transitions are misplaced, or that there is more than one level at this energy. Transitions of energy 2629 and 3243 are reported also in (n,n′γ) and placed from a 3242 level. The 1484γ is not reported in (n,n′γ). Transitions from this level are not used in the least-squares fit for determining the energies of the other levels.
3254.83 *20*	$(0,1,2)^+$		C G M	J^{π}: γ to 2^+; log *ft*=5.93 from 1^+.
3288.27 *6*	1^-		FG M	J^{π}: L(t,p)=1.
3294.35 *23*	4^+		A F N	XREF: N(3288). J^{π}: L(t,p)=4; L(p,p′)=4.
3306.79[&] *16*	6^-	11 ps *4*	D	J^{π}: γ(θ) and polarization data in (α,2nγ). $T_{1/2}$: recoil-distance method in (α,2nγ) (1987Sc07).
3309.9 *20*			N	E(level): multiplet.
3329 *10*			F L	J^{π}: L(d,p)=1+4 suggests a doublet, with opposite parities.
3372.6 *3*	3^-		A N	J^{π}: L(p,p′)=3.
3383.69 *13*	0^+ to 4^+		C G	J^{π}: γ to 2^+.
3386.0 *5*	(2^+)		f M	J^{π}: γ′s to 2^+ and 0^+; L(t,p)=2+5 for doublet.
3391? *8*	(5^-)		f	J^{π}: L(t,p)=2+5 for a doublet.
3411.29 *18*	3^-		A F N	J^{π}: L(p,p′)=3. L(t,p)=(4) is inconsistent.
3439.6 *4*	(1)		G I M	J^{π}: γ to 0^+; γ from 0^- resonance.
3450.94 *14*	0^+		FG	J^{π}: L(t,p)=0; γ to 2^+.
3453 *4*	3^-		L N	J^{π}: L(p,p′)=3.
3488.2? *6*		0.12 ps *4*	D	J^{π}: γ to 6^+ and population in (α,2nγ) suggests $6,7,8^+$. $T_{1/2}$: DSA in (α,2nγ) (1987Sc07).
3494.40 *8*	$1,2^{(+)}$		G	J^{π}: γ to 0^+.
3496.26 *11*			A	J^{π}: γ′s to 2^+ and 3^-.
3522.91[&] *22*	7^-	1.4 ps *+7 −4*	D	J^{π}: γ(θ) in (α,2nγ); M1 γ to 6^-. $T_{1/2}$: from DSA in (α,2nγ).
3523.5 *5*	$1,2^{(+)}$		G	J^{π}: γ to 0^+.
3527 *14*	1^-		F	J^{π}: L(t,p)=1.
3546 *4*	$(2^-,3^-,4^-)$		F L N	J^{π}: L(d,p)=(3).
3550.15[a] *24*	(7^-)	3.5 ps *21*	D	J^{π}: band assignment in (α,2nγ). $T_{1/2}$: DSA and recoil-distance methods in (α,2nγ).
3585.0[#] *3*	8^+	0.42 ps *14*	D	J^{π}: γ(θ) and polarization data in (α,2nγ). $T_{1/2}$: DSA in (α,2nγ).
3591.64 *15*	(1^-)		FG	J^{π}: L(t,p)=1, assuming 3598 *9* corresponds to 3591.6 level and not 3603.8; γ to 2^+.
3603.8 *10*	2^+		MN	J^{π}: L(p,p′)=2; γ to 2^+.
3624.2 *4*	$1,2^{(+)}$		fG	J^{π}: L(t,p)=2 for a possible doublet; γ to 0^+.
3628.1 *5*			fG	J^{π}: γ to 2^+.
3632.2 *4*	$(1^+,2^+)$		M	J^{π}: γ′s to 0^+ and 3^+.
3686.50 *16*	3^-		FG LMN	J^{π}: L(t,p)=3; L(d,p)=2.
3704.0[@] *8*	(7^+)	0.83 ps *21*	D	J^{π}: γ(θ) and band assignment in (α,2nγ). $T_{1/2}$: DSA in (α,2nγ).
3711.3 *5*	(1,2,3)		A N	J^{π}: log *ft*=7.0 from 2^-; γ to 2^+.
3735.03 *17*	0^+ to 4^+		G	J^{π}: γ to 2^+.
3754 *15*			F	
3774 *4*	3^-		F N	E(level): from (p,p′). J^{π}: L(t,p)=3; L(p,p′)=3.
3830	$1^-,2^-,3^-$		L	J^{π}: L(d,p)=2.
3830.7[@] *3*	8^+	0.55 ps *14*	D	J^{π}: γ(θ) and polarization measurements in (α,2nγ). E(level): the 8^+ member of β band is either 3831 or 4121 level. $T_{1/2}$: DSA in (α,2nγ).

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Adopted Levels, Gammas (continued)

^{78}Se Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$	XREF	Comments
3881 *4*	3^-		N	J^{π}: L(p,p′)=3.
3894.55 *15*	2^+		FG	J^{π}: L(t,p)=2.
3933 *9*	2^+		F	J^{π}: L(t,p)=2.
3959.93 *24*	$1,2^{(+)}$		G	J^{π}: γ to 0^+.
3995 *4*	5^-		N	J^{π}: L(p,p′)=5.
3999.33 *15*	1^-		FG	J^{π}: L(t,p)=1.
4037.01 *21*	$(1^-,3^-)$		fG	J^{π}: L(t,p)=1+3 for a doublet; γ to 2^+.
4038 *10*	$(1^-,3^-)$		f	J^{π}: L(t,p)=1+3 for a doublet.
4048.0[&] *6*	8^-	0.9 ps *3*	D	J^{π}: $\gamma(\theta)$ and polarization data in (α,2nγ). $T_{1/2}$: DSA in (α,2nγ).
4050 *4*	(5^-)		N	J^{π}: L(p,p′)=(5).
4079.7 *3*	$1,2^{(+)}$		G	J^{π}: γ to 0^+.
4106 *12*	1^-		F	J^{π}: L(t,p)=1.
4120?	$0^-,1^-$		L	J^{π}: L(d,p)=0.
4121.2 *3*	8^+	>0.7 ps	D	J^{π}: $\gamma(\theta)$ and polarization data in (α,2nγ). E(level): this level may Be the 8^+ member of β band, although, 3831 level is presently assigned as the 8^+ member. $T_{1/2}$: DSA in (α,2nγ). Upper limit is <0.35 ns from pulsed-beam γ-timing in (α,2nγ).
4122 *4*	4^+		F N	E(level): weighted average from (p,p′) and (t,p). J^{π}: L(t,p)=4; L(p,p′)=4.
4153.10 *16*	(1)		G I	J^{π}: γ from 0^- resonance.
4155 *4*	3^-		F N	J^{π}: L(p,p′)=3. E(level): weighted average from (p,p′) and (t,p).
4181.85 *14*	0^+		FG	J^{π}: L(t,p)=0.
4190?	$0^-,1^-$		L	J^{π}: L(d,p)=0.
4214.1[a] *4*	(8^-)	>1.4 ps	D	J^{π}: $\gamma(\theta)$ and band assignment in (α,2nγ). $T_{1/2}$: DSA in (α,2nγ).
4224 *10*	3^-		F	E(level): an unplaced 6274.40 *16* transition in (n,γ), if a primary, would define a level at 4222.75 *17*, but the transition would Be 1^- to 3^-. J^{π}: L(t,p)=3.
4245.4 *5*	(1)		I	J^{π}: γ from 0^- resonance.
4253.11 *12*	(2^+)		fG	J^{π}: L(t,p)=5+2 for a doublet; γ′s to 2^+.
4253.64 *17*	(5^-)		f N	E(level): from (p,p′). J^{π}: L(t,p)=5+2 for a doublet; L(p,p′)=(4) seems inconsistent unless S=1 is involved.
4265 *10*	0^+		F	J^{π}: L(t,p)=0.
4297.38 *15*	2^+		FG	J^{π}: L(t,p)=2.
4341.61 *13*	$1,2^{(+)}$		G	J^{π}: γ to 0^+.
4345 *11*	3^-		F	J^{π}: L(t,p)=3.
4366.61 *15*	$(1)^-$		fG I L	J^{π}: L(t,p)=3+1 for a doublet; L(d,p)=2; γ′s to 0^+ and 2^+; γ from 0^- resonance.
4369 *11*	(3^-)		f	J^{π}: L(t,p)=3+1 for a doublet.
4386.68 *13*	$(1,2^+)$		G	J^{π}: γ to 0^+. Doubly-placed γ to 0^+.
4409 *11*	2^+		F	E(level): an unplaced 6091.81 *18* transition in (n,γ), if a primary, would define a level at 4405.65 *19*. J^{π}: L(t,p)=2.
4412.02[&] *24*	(9^-)		D	J^{π}: band assignment in (α,2nγ).
4424 *4*	(2^+)		N	E(level): an unplaced 6077.24 *18* transition in (n,γ), if a primary, would define a level at 4420.22 *19*. J^{π}: L(p,p′)=(2).
4448.24 *15*	$1,2^{(+)}$		G	J^{π}: γ′s to 0^+ and 2^+.
4451 *11*	$(0^+\&3^-)$		F	J^{π}: L(t,p)=0+3.
4468.6 *4*	$1,2^{(+)}$		G	J^{π}: γ to 0^+.

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Adopted Levels, Gammas (continued)

^{78}Se Levels (continued)

E(level)†	Jπ‡	$T_{1/2}$	XREF	Comments
4483 *11*	4^+		F	Jπ: L(t,p)=4.
4493 *4*	$(3)^-$		L N	Jπ: L(d,p)=2. L(p,p′)=(3).
4509 *11*	2^+		F	Jπ: L(t,p)=2.
4528.8 *4*			G	Jπ: 0^+ to 4^+ from possible γ to 2^+.
4557 *4*			N	
4569 *11*	$(0^+\&4^+)$		F	E(level): an unplaced 5932.03 *21* transition in (n,γ), if a primary, would define a level at 4565.45 *22*. Jπ: L(t,p)=0+4.
4591 *11*	$(3)^-$		F L	E(level): from (t,p). Jπ: L(t,p)=(3); L(d,p)=2.
4616 *11*	4^+		F	Jπ: L(t,p)=4.
4622 *4*	5^-		N	Jπ: L(p,p′)=5.
4625.1[#] *5*	(10^+)		D	Jπ: band assignment in (α,2nγ).
4639 *11*	3^-		F	Jπ: L(t,p)=3.
4672.8 *3*			G	
4684.30 *17*			G	
4689.8 *3*	(2^+)		fG	Jπ: γ to 0^+; L(t,p)=2.
4697.07 *13*	(2^+)		fG	Jπ: γ to 0^+; L(t,p)=2.
4723.21 *18*	2^+		FG	Jπ: L(t,p)=2.
4758 *11*	$4^+\&1^-$		F N	XREF: N(4741). E(level): doublet from mixed L-transfer. Jπ: L(p,p′)=4; L(t,p)=4+1.
4786.9[@] *5*	(10^+)	>1.4 ps	D	Jπ: γ(θ), pol in (α,2nγ). $T_{1/2}$: DSA in (α,2nγ).
4787.93 *21*	$(1)^-$		G L	Jπ: L(d,p)=0; γ to 2^+.
4791.5 *5*	0^+		FG	Jπ: L(t,p)=0.
4811.5 *3*	2^+		FG	Jπ: L(t,p)=2.
4819.2[a] *6*	(9^-)	0.9 ps *3*	D	Jπ: band assignment in (α,2nγ). $T_{1/2}$: DSA in (α,2nγ).
4857.0[@] *9*	(9^+)	1.1 ps *4*	D	Jπ: γ(θ) and band assignment in (α,2nγ). $T_{1/2}$: DSA in (α,2nγ).
4857 *11*	1^-		F	Jπ: L(t,p)=1.
4879 *11*	3^-		F	Jπ: L(t,p)=3.
4902 *4*	3^-		L N	Jπ: L(p,p′)=3; L(d,p)=2.
4904 *10*	2^+		F	Jπ: L(t,p)=2.
4944 *11*	2^+		F	Jπ: L(t,p)=2.
4957.3 *3*	$1,2^{(+)}$		G	Jπ: γ to 0^+.
4972.3 *3*	1^-		FG L	XREF: F(4980)L(4970). Jπ: L(t,p)=1; L(d,p)=2.
4998.3 *5*			G	
5004.65 *23*	$1,2^{(+)}$		G	Jπ: γ′s to 0^+ and 2^+.
5022.14 *17*			G	
5029.63 *24*	2^+		FG	Jπ: L(t,p)=2.
5055 *12*			F	
5090.8 *3*			FG	XREF: F(5081).
5094.8 *8*			D	
5101.9 *5*			FG	
5120?	$0^-,1^-$		L	Jπ: L(d,p)=0.
5126.52 *16*	(2,3,4)		FG	Jπ: γ′s to 2^+ and 3^+; multiply-placed γ to 4^+.
5136? *15*			F	E(level): may Be same as 5126 level.
5164.05 *16*			FG	XREF: F(5169). Jπ: doubly-placed γ′s to 2^+.
5180.75 *22*	$1^{(+)},2^{(+)}$		FG	Jπ: γ′s to 0^+ and 3^+.
5205 *15*	$1^-,2^-,3^-$		F L	XREF: L(5210). Jπ: L(d,p)=2.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{78}Se Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$	XREF	Comments
5235 *15*			F	
5247 *15*			F	
5290.22 *18*	$1,2^{(+)}$		G	J^{π}: γ's to 0^+ and 2^+.
5295.2 *3*	3^-		FG N	J^{π}: L(p,p′)=3.
5339.7 *3*	$1,2^{(+)}$		G	J^{π}: γ's to 0^+ and 2^+.
5356.51 *17*	(2^+)		G L	J^{π}: L(d,p)=(2); γ to 2^+.
5391.0 *3*			FG	
5422 *15*			F	
5440.3 *3*			G	
5451.2 *4*	$1,2^{(+)}$		G	J^{π}: γ to 0^+.
5480?	$(1^+,2^+,3^+)$		L	J^{π}: L(d,p)=(2).
5513.26 *19*	$1,2^{(+)}$		G	J^{π}: γ to 0^+; multiply-placed γ to (4^+).
5580 *15*			F	
5610?	2^+		L	J^{π}: L(d,p)=2.
5689.1 *8*			D	
5709 *15*			F	
5783.8[#] *7*	(12^+)	>0.6 ps	D	J^{π}: band assignment. $T_{1/2}$: DSA in (α,2nγ).
5837 *15*			F	
6161 *15*			F	

[†] From (n,γ), (α,2nγ) or other γ-ray studies if populated in these sets. In addition to the states shown, broad peaks are reported at 1450, 1790, and 3560 in (^{16}O,^{14}C), and at 2360, 2550, 2730, 2830, 2990, 3170, 3270, 3370, 3500, and 3560 in (d,d′).

[‡] Target J^{π}=1/2$^-$ for L(d,p) and 0^+ for L(t,p).

[#] Band(A): g.s. band.

[@] Band(B): Probable β band.

[&] Band(C): Probable octupole band.

[a] Band(D): ΔJ=1 band based on 6^-.

Adopted Levels, Gammas (continued)

$\gamma(^{78}Se)$

E_i(level)	J^π_i	E_γ†	I_γ†	E_f	J^π_f	Mult.‡	δ‡	Comments
613.727	2^+	613.725 3	100	0.0	0^+	E2		B(E2)(W.u.)=33.5 8 Mult.: from $\gamma(\theta)$ and γ(pol) in (α,2nγ).
1308.644	2^+	694.916 4	100.0 20	613.727	2^+	E0+M1+E2	+3.5 5	B(M1)(W.u.)=0.00067 19; B(E2)(W.u.)=22.2 18 Mult.,δ: mult from $\gamma(\theta)$ in Coul. ex., δ from (n,γ). Others: +4.0 7 in (α,2nγ), +2.7 +9−6 in Coulomb excitation. X(E0/E2)=0.10 1 in (n,γ).
		1308.59 4	75.0 7	0.0	0^+	E2		B(E2)(W.u.)=0.76 6
1498.599	0^+	884.861 15	100	613.727	2^+	E2		B(E2)(W.u.)=1.17 21
		1498[b]		0.0	0^+	[E0]		X(E0/E2)$\leq$0.07 in (n,γ).
1502.825	4^+	889.099 12	100	613.727	2^+	E2		B(E2)(W.u.)=49.5 24 Mult.: from $\gamma(\theta)$ in (α,2nγ) and Coul. ex.
1758.689	0^+	260.1[b]		1498.599	0^+	[E0]		X(E0/E2)$\leq$1.36 in (n,γ).
		449.94 6	3.7 4	1308.644	2^+			
		1144.959 17	100 4	613.727	2^+	(E2)		Mult.: Q from $\gamma\gamma(\theta)$. $\Delta\pi$=no from level scheme.
		1758[b]		0.0	0^+	[E0]		X(E0/E2)$\leq$0.27 in (n,γ).
1853.927	3^+	351.49 17	2.7 4	1502.825	4^+			
		545.300 13	51 7	1308.644	2^+	M1+E2	+0.42 4	B(M1)(W.u.)=0.032 12; B(E2)(W.u.)=25 10 δ: from $\gamma(\theta)$ in (n,n′γ). Others: +0.45 10 in (α,2nγ). Mult.: from angular distribution and polarization measurements in 1987Sc07 and 1982Ma45.
		1240.13 3	100 10	613.727	2^+	M1+E2	−0.41 +13−31	B(M1)(W.u.)=(0.0054 20); B(E2)(W.u.)=(0.8 5) Mult.,δ: M1+E2 from $\gamma(\theta$,pol) in (α,2nγ); δ from $\gamma\gamma(\theta)$ in (n,γ).
1995.897	2^+	497.294 7	11 2	1498.599	0^+	[E2]		B(E2)(W.u.)=10 +4−8
		687.254 7	57 5	1308.644	2^+	M1+E2(+E0)	−0.30 19	B(M1)(W.u.)=0.0034 +12−25; B(E2)(W.u.)=0.8 +10−8 Mult.,δ: from α(K)exp and $\gamma\gamma(\theta)$ (1987Su05) in (n,γ); δ=0.12 to 0.49; sign is negative. X(E0/E2)=0.26 to 9.5 in (n,γ).
		1382.16 3	58 5	613.727	2^+	E0+M1+E2	+0.44 10	B(M1)(W.u.)=0.00039 +13−28; B(E2)(W.u.)=0.05 +3−4 X(E0/E2)=11 4 in (n,γ). Mult.,δ: from α(K)exp and $\gamma\gamma(\theta)$ (1987Su05) in (n,γ).
		1995.87 8	100 4	0.0	0^+	[E2]		B(E2)(W.u.)=0.09 +3−6
2190.65	4^+	688.0 3	100 7	1502.825	4^+	(M1)		B(M1)(W.u.)=0.04 3
		881.7	<276	1308.644	2^+	[E2]		B(E2)(W.u.)=40 +50−40 E_γ: from (n,n′γ).
		1576 1	24 7	613.727	2^+			
2267.07		271.1 8	24 8	1995.897	2^+			
		958.37 19	40 6	1308.644	2^+			
		1653.28 15	100 9	613.727	2^+			
2299.8	$1,2^{(+)}$	2299.8 5	100	0.0	0^+			
2327.329	2^+	331.2 3	1.6 3	1995.897	2^+			

$^{78}_{34}Se_{44}$-8

$\gamma(^{78}$Se) (continued)

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.[‡]	δ[‡]	Comments
2327.329	2^+	568.7 *4*	2.2 *3*	1758.689	0^+	[E2]		B(E2)(W.u.)=32 +*11*−*16*
		824.8[#] *4*	2.0 *5*	1502.825	4^+			
		1018.65 *5*	6.1 *3*	1308.644	2^+			
		1713.55 *3*	100 *6*	613.727	2^+	E0+M1+E2	−1.8 *5*	B(M1)(W.u.)=0.0031 +*17*−*20*; B(E2)(W.u.)=4.5 +*15*−*22* Mult.: from α(K)exp in (n,γ) (1987Su05). X(E0/E2)=1.21 *23* in (n,γ).
		2327.26 *6*	8 *4*	0.0	0^+	[E2]		B(E2)(W.u.)=0.10 +*6*−*7*
2335.24	0^+	575.0[#b] *10*	<41	1758.689	0^+			
		1026.59 *20*	10.8 *8*	1308.644	2^+			
		1721.50 *5*	100 *6*	613.727	2^+	E2		Mult.: from α(K)exp=0.00015 *5* in (n,γ) (1987Su05).
2361.85	(0^+)	1748.21 *15*	100	613.727	2^+			
2507.32	3^-	1004.73 *20*	20 *4*	1502.825	4^+	[E1]		B(E1)(W.u.)=9.E−6 *3*
		1198.6 *3*	100 *4*	1308.644	2^+	(E1(+M2))	+0.09 *5*	B(E1)(W.u.)=2.5×10^{-5} *6*; B(M2)(W.u.)=(0.6 +*8*−*6*) Mult.: from $\gamma(\theta)$ in (α,2nγ) (1987Sc07) and γ from 3^- to 2^+. δ: from $\gamma(\theta)$ in (n,n$'\gamma$).
		1893.46 *6*	18 *6*	613.727	2^+	(E1)		B(E1)(W.u.)=1.1×10^{-6} *5* Mult.: D+Q, $-0.05<\delta<-3.0$ from $\gamma\gamma(\theta)$ in (n,γ). $\Delta\pi$=yes from level scheme.
2536.94	2^+	203.3[#] *5*	4.1 *10*	2335.24	0^+			
		1039.3 *3*	3 *1*	1498.599	0^+	[E2]		B(E2)(W.u.)=10 *4*
		1228.25 *17*	28 *2*	1308.644	2^+			
		1923.15 *4*	100 *6*	613.727	2^+	(M1+E2)	−1.1 *11*	Mult.: D+Q, $\delta<2.2$, sign=− from $\gamma\gamma(\theta)$ in (n,γ). $\Delta\pi$=no from level scheme.
2546.3		279.0 *8*	100 *17*	2267.07				
		1043.6[&] *4*	10[&] *4*	1502.825	4^+			
2546.51	6^+	1043.9 *3*	100	1502.825	4^+	E2		B(E2)(W.u.)=47 *14* Mult.: from ce measurements in (α,2nγ).
2629.6		1126.8 *5*	100	1502.825	4^+			
2647.472	$(1,2)^+$	286.4 *4*	15 *5*	2361.85	(0^+)			
		320.3 *3*	11 *4*	2327.329	2^+			
		651.573 *11*	43 *3*	1995.897	2^+			
		793.5 *3*	14.2 *20*	1853.927	3^+			
		1338.78 *5*	100 *7*	1308.644	2^+			
2682.110	4^+	174.2 *3*	2.2 *5*	2507.32	3^-			E_γ: from β^- decay.
		354.735 *25*	21 *4*	2327.329	2^+			
		686.3 *2*	12 *2*	1995.897	2^+			E_γ: from β^- decay.
		828.189 *13*	100 *8*	1853.927	3^+	(M1+E2)	+1.0 *7*	Mult.: D+Q, δ=+0.32 to +1.63 from $\gamma\gamma(\theta)$ in (n,γ). $\Delta\pi$=no from level scheme.
		1373.48 *6*	54 *4*	1308.644	2^+			
		2068.4 *4*	6.5 *14*	613.727	2^+			
2719.3		1410.6 *5*	100	1308.644	2^+			

$^{78}_{34}$Se$_{44}$-9

$\gamma(^{78}Se)$ (continued)

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.[‡]	δ[‡]	α[@]	Comments
2735.0	(5^+)	1232.2 *6*	100 *14*	1502.825	4^+				
2742.52	4^-	551.9 *2*	100 *6*	2190.65	4^+	E1			B(E1)(W.u.)=3.1×10^{-6} *11*
		889[b] *1*	10	1853.927	3^+	[E1]			B(E1)(W.u.)=7.4×10^{-8} *25* I_γ: from coin. No uncertainty given.
		1239.4 *3*	59	1502.825	4^+	[E1]			B(E1)(W.u.)=1.6×10^{-7} *6* I_γ: from coin. No uncertainty given.
2754.46	2^+	757.2 *5*	35 *8*	1995.897	2^+				E_γ: from (n,n′γ). Observed only in (n,n′γ) and (p,p′γ).
		1256.7 *4*	38 *8*	1498.599	0^+				E_γ: reported only in (n,γ).
		1445.8 *2*	100 *15*	1308.644	2^+				
		2140.8 *9*	35 *11*	613.727	2^+				E_γ: from (n,n′γ). Observed only in (n,n′γ) and (p,p′γ).
2838.49	(2^+)	156.6 *3*	3.7 *9*	2682.110	4^+				E_γ: from ^{78}As β^- decay only.
		503.7 *2*	16.7 *16*	2335.24	0^+				E_γ: from ^{78}As β^- decay only.
		842.36 *19*	32 *4*	1995.897	2^+				
		1079.67 *22*	46 *4*	1758.689	0^+				I_γ: Iγ(842γ):Iγ(1080γ):Iγ(1530γ) from (n,γ). Values from (n,n′γ) are 233 *67*:100 *33*:100 *33* and from β^- decay are 43 *5*:65 *5*: 100 *7*.
		1529.60 *17*	100 *6*	1308.644	2^+				
		2224.7 *3*	37 *5*	613.727	2^+				E_γ: from ^{78}As β^- decay only.
		2839.0 *3*	2.2 *11*	0.0	0^+				E_γ: from ^{78}As β^- decay only.
2864.12		504.4[b] *2*	43 *10*	2361.85	(0^+)				E_γ: very poor fit in level scheme. Level-energy difference=502.3. Placement is suspect.
		1010.19 *6*	100 *10*	1853.927	3^+				
2889.90	5^-	343.5 *2*	15.9 *8*	2546.51	6^+	E1			B(E1)(W.u.)=5.4×10^{-5} *16* Mult.: from $\gamma(\theta)$ and polarization data in (α,2nγ).
		382.42 *17*	33.3 *15*	2507.32	3^-	E2		0.00650	B(E2)(W.u.)=43 *13*
		1387.4 *2*	100 *5*	1502.825	4^+	E1			B(E1)(W.u.)=5.2×10^{-6} *15* Mult.: from $\gamma(\theta)$ and polarization data in (α,2nγ).
2898.13	2	391.3[#] *5*	5 *2*	2507.32	3^-				
		902.3[#] *3*	11 *3*	1995.897	2^+				
		2284.37 *6*	100 *12*	613.727	2^+	D+Q	−0.9 *8*		Mult.: from $\gamma\gamma(\theta)$ in (n,γ), δ=0.11 to 1.69; sign=negative.
2914.7	4^+	1411.9 *5*	100	1502.825	4^+				
2949.19	4^-	441.7 *2*	100 *11*	2507.32	3^-	M1+E2	−0.6 *3*		B(M1)(W.u.)<0.076; B(E2)(W.u.)<250 Mult.,δ: from (α,2nγ).
		1095.2 *5*	56	1853.927	3^+	[E1]			B(E1)(W.u.)<5.1×10^{-5}
		1446.7 *5*	67	1502.825	4^+	[E1]			B(E1)(W.u.)<2.6×10^{-5}
3005.70	$1,2^+$	2391.93[&] *17*	100[&] *11*	613.727	2^+				
		3005.9 *10*	13 *2*	0.0	0^+				E_γ: observed only in ^{78}Br ε decay.
3013.96	6^-	124.1 *1*	32.3 *16*	2889.90	5^-	M1		0.0566	B(M1)(W.u.)=0.00077 *14* Mult.: from (α,2nγ).
		271.4 *1*	100 *3*	2742.52	4^-	(E2)		0.0211	B(E2)(W.u.)=4.0 *7* Mult.: from (α,2nγ).

$^{78}_{34}Se_{44}$-10

Adopted Levels, Gammas (continued)

$\gamma(^{78}$Se) (continued)

E_i(level)	J^{π}_i	E_{γ}[†]	I_{γ}[†]	E_f	J^{π}_f	Mult.[‡]	δ[‡]	Comments
3013.96	6^-	467.4 *2*	24.2 *16*	2546.51	6^+	E1		B(E1)(W.u.)=1.8×10^{-7} *4* Mult.: from (α,2nγ).
3039.81	(1^+ to 4^+)	1043.6[&] *4*	14[&] *5*	1995.897	2^+			
		1186.02 *12*	52 *7*	1853.927	3^+			
		1731.11 *7*	100 *7*	1308.644	2^+			
3048.6	(3^-)	1545.8 *10*	100	1502.825	4^+			
3089.73	(0^+)	2475.96 *15*	100	613.727	2^+			
3133.3	3^-	2519.5 *5*	100	613.727	2^+			
3139.7	4^+	1831.0 *15*	100	1308.644	2^+			
3140.2	(6^+)	593.7 *5*	61 *6*	2546.51	6^+	M1(+E2)	−0.2 *2*	B(M1)(W.u.)=0.14 *+4−8*; B(E2)(W.u.)=(20 *+40−20*)
		949.6 *4*	100 *12*	2190.65	4^+	[E2]		B(E2)(W.u.)=82 *+24−43*
3144.46	3^-	462.2 *2*	41 *4*	2682.110	4^+			
		637.1 *2*	14 *2*	2507.32	3^-			
		1290.6 *6*	7 *2*	1853.927	3^+			
		1642.0 *3*	11 *3*	1502.825	4^+			
		1835.8 *2*	100 *7*	1308.644	2^+			E_{γ}: weighted average from β^- decay and (n,n′γ). E=1834.58 *23* is reported in (n,γ) but is probably not the same transition.
3181.9	$(2)^+$	3181.8 *5*	100 *17*	0.0	0^+			
3186.37	2^+	2572.60 *14*	100	613.727	2^+			
3229.71	(1^-,2,3)	722.4 *2*	11 *1*	2507.32	3^-			
		1732[b] *1*		1498.599	0^+			E_{γ}: from (n,n′γ).
		1921.3 *3*	100 *24*	1308.644	2^+			
		2615.8 *2*	52 *8*	613.727	2^+			
3242.68	2^+	595.89 *10*	28 *3*	2647.472	$(1,2)^+$			
		976.31 *23*	15 *3*	2267.07				
		1387.56 *20*	36 *4*	1853.927	3^+			
		1484.12 *17*	94 *6*	1758.689	0^+			
		1744.24 *23*	28 *4*	1498.599	0^+			
		2627.87[&] *14*	82[&] *10*	613.727	2^+			
		3241.8 *4*	100 *14*	0.0	0^+			
3254.83	$(0,1,2)^+$	2641.05 *20*	100	613.727	2^+			
3288.27	1^-	1292.49 *10*	22 *3*	1995.897	2^+			
		1979.57 *8*	6.9 *23*	1308.644	2^+			
		2674.36 *13*	100 *15*	613.727	2^+			
3294.35	4^+	756.9 *3*	5 *1*	2536.94	2^+			
		968.2 *7*	9 *3*	2327.329	2^+			
		1440.9 *7*	19 *6*	1853.927	3^+			
		1791.9 *7*	56 *6*	1502.825	4^+			
		2681.3 *7*	100 *6*	613.727	2^+			

$^{78}_{34}$Se$_{44}$-11

Adopted Levels, Gammas (continued)

$\gamma(^{78}Se)$ (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	δ[‡]	α[@]	Comments
3306.79	6^-	357.3 *3*	21.4 *18*	2949.19	4^-	E2		0.00816	B(E2)(W.u.)=50 *19* Mult.: from (α,2nγ).
		416.9 *2*	100 *6*	2889.90	5^-	M1+E2	−0.4 *1*		B(M1)(W.u.)=0.012 *5*; B(E2)(W.u.)=15 *9*
		564.4 *4*	27 *4*	2742.52	4^-	E2			B(E2)(W.u.)=6 *3* Mult.: Q from $\gamma(\theta)$ in (n,γ) and RUL.
		760.4 *3*	42.9 *18*	2546.51	6^+	(E1)			B(E1)(W.u.)=1.7×10^{-5} *7* Mult.: from (α,2nγ).
3372.6	3^-	2064.1 *5*	100 *33*	1308.644	2^+				
		2758.8 *3*	100 *19*	613.727	2^+				
3383.69	0^+ to 4^+	2769.91 *13*	100	613.727	2^+				
3386.0	(2^+)	2772.0 *5*	100 *25*	613.727	2^+				
		3387 *1*	50 *13*	0.0	0^+				
3411.29	3^-	903.6 *4*	39 *13*	2507.32	3^-				
		2797.6 *2*	100 *13*	613.727	2^+				
3439.6	(1)	3439.5 *4*	100	0.0	0^+				
3450.94	0^+	2837.16 *14*	100	613.727	2^+				
3488.2?		941.7 *5*	100	2546.51	6^+				
3494.40	$1,2^{(+)}$	655.90 *7*	100 *8*	2838.49	(2^+)				
		1159.09 *10*	82 *22*	2335.24	0^+				
		1499.1 *3*	65 *16*	1995.897	2^+				
3496.26		657.9 *2*	58 *6*	2838.49	(2^+)				
		959.0 *2*	100 *10*	2536.94	2^+				
		988.2 *4*	20 *5*	2507.32	3^-				
		1169.5 *4*	26 *7*	2327.329	2^+				
		2187.8 *2*	78 *8*	1308.644	2^+				
3522.91	7^-	216.1 *2*	12.9 *16*	3306.79	6^-	M1		0.01327	
		509 *1*	64	3013.96	6^-				
		633.0 *5*	100	2889.90	5^-	E2			
		976.7 *4*	53 *5*	2546.51	6^+	(E1)			
3523.5	$1,2^{(+)}$	3523.4 *5*	100	0.0	0^+				
3550.15	(7^-)	536.2 *2*	100	3013.96	6^-				
3585.0	8^+	1038.6 *3*	100	2546.51	6^+	E2			B(E2)(W.u.)=56 *19* Mult.: from ce data in (α,2nγ).
3591.64	(1^-)	2977.85 *15*	100	613.727	2^+				
3603.8	2^+	2990 *1*	100	613.727	2^+				
3624.2	$1,2^{(+)}$	3624.1[&] *4*	100[&]	0.0	0^+				
3628.1		2319.4 *5*	100	1308.644	2^+				
3632.2	$(1^+,2^+)$	1778.3 *5*		1853.927	3^+				
		1873.5 *5*		1758.689	0^+				
		3632 *1*		0.0	0^+				
3686.50	3^-	3072.71 *16*	100	613.727	2^+				

From ENSDF

$^{78}_{34}Se_{44}$-12

γ(^{78}Se) (continued)

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.[‡]	δ[‡]	α[@]	Comments
3704.0	(7$^+$)	969.0 5	100 8	2735.0	(5$^+$)	E2			B(E2)(W.u.)=36 10 Mult.: from (α,2nγ).
		1158.7[ab] 5	12[a]	2546.51	6$^+$				
3711.3	(1,2,3)	3097.5 5	100	613.727	2$^+$				
3735.03	0$^+$ to 4$^+$	3121.24 17	100	613.727	2$^+$				
3830.7	8$^+$	245.6 2	33 2	3585.0	8$^+$	M1		0.00960	B(M1)(W.u.)=0.67 18 Mult.: from (α,2nγ).
		1284.1 3	100 6	2546.51	6$^+$	E2			B(E2)(W.u.)=11 3 Mult.: from (α,2nγ).
3894.55	2$^+$	2391.93[&] 17	100[&] 17	1502.825	4$^+$				
		3893.7 3	5.8 17	0.0	0$^+$				
3959.93	1,2$^{(+)}$	3345.8 4	86 15	613.727	2$^+$				
		3960.0 3	100 15	0.0	0$^+$				
3999.33	1$^-$	1672.8 4	74 29	2327.329	2$^+$				
		2003.1 6	74 29	1995.897	2$^+$				
		2240.1 8	58 29	1758.689	0$^+$				
		3385.88 21	100 6	613.727	2$^+$				
		3998.2 3	19 3	0.0	0$^+$				
4037.01	(1$^-$,3$^-$)	3423.20 21	100	613.727	2$^+$				
4048.0	8$^-$	741.2 5	100	3306.79	6$^-$	E2			B(E2)(W.u.)=140 50 Mult.: from (α,2nγ).
4079.7	1,2$^{(+)}$	4079.6 3	100	0.0	0$^+$				
4121.2	8$^+$	290.5 2	100 11	3830.7	8$^+$	M1		0.00633	B(M1)(W.u.)<0.55 Mult.: from (α,2nγ).
		536.2 2	56	3585.0	8$^+$	M1+E2	−0.4 3		B(M1)(W.u.)<0.051; B(E2)(W.u.)<70 Mult.,δ: from (α,2nγ).
		1574 1	78 22	2546.51	6$^+$	(E2)			B(E2)(W.u.)<1.4 Mult.: ΔJ=2, (Q) from (α,2nγ). RUL and $\Delta\pi$=no from level scheme.
4181.85	0$^+$	2186.0 10	59 24	1995.897	2$^+$				
		2873.15 14	100 11	1308.644	2$^+$				
4214.1	(8$^-$)	664.0 3	80 10	3550.15	(7$^-$)				
		1200 1	≈100	3013.96	6$^-$	[E2]			B(E2)(W.u.)<5
4253.11	(2$^+$)	2257.53 20	100 20	1995.897	2$^+$				
		2944.20 14	54 6	1308.644	2$^+$				
		3639.7 5	22 4	613.727	2$^+$				
4297.38	2$^+$	2988.67 15	100	1308.644	2$^+$				
4341.61	1,2$^{(+)}$	2843.02[&] 14	114[&] 15	1498.599	0$^+$				
		4341.2 3	100 8	0.0	0$^+$				
4366.61	(1)$^-$	3057.90 16	100 17	1308.644	2$^+$				
		4366.5 3	33 11	0.0	0$^+$				

$\gamma(^{78}$Se) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	Comments
4386.68	(1,2$^+$)	2627.87[&] *14*	222[&] *29*	1758.689	0$^+$		
		3773.2 *3*	100 *11*	613.727	2$^+$		
4412.02	(9$^-$)	363.1 *4*	26 *3*	4048.0	8$^-$		
		862.0 *5*	77 *9*	3550.15	(7$^-$)		
		889.1[b] *1*	100	3522.91	7$^-$		
4448.24	1,2$^{(+)}$	2452.27 *16*	67 *11*	1995.897	2$^+$		
		4448.2 *3*	100 *21*	0.0	0$^+$		
4468.6	1,2$^{(+)}$	3855.0[&] *4*	500[&] *50*	613.727	2$^+$		
		4468.0 *5*	100 *25*	0.0	0$^+$		
4528.8		3220.1[&] *4*	100[&]	1308.644	2$^+$		
4625.1	(10$^+$)	794.6[b] *4*	<21	3830.7	8$^+$		
		1040.3 *6*	100 *24*	3585.0	8$^+$		
4672.8		4059.0 *3*	100	613.727	2$^+$		
4684.30		3375.73 *20*	48 *5*	1308.644	2$^+$		
		4070.1 *3*	100 *7*	613.727	2$^+$		
4689.8	(2$^+$)	4689.6 *3*	100	0.0	0$^+$		
4697.07	(2$^+$)	2843.02[&] *14*	526[&] *68*	1853.927	3$^+$		
		4697.2 *3*	100 *37*	0.0	0$^+$		
4723.21	2$^+$	3220.1[&] *4*	112[&] *29*	1502.825	4$^+$		
		3224.4 *5*	60 *30*	1498.599	0$^+$		
		3414.57 *21*	100 *12*	1308.644	2$^+$		
4786.9	(10$^+$)	161.9 *2*	≈87	4625.1	(10$^+$)		
		955.9 *5*	100 *9*	3830.7	8$^+$	(E2)	B(E2)(W.u.)<13
		1202.2 *6*	<13	3585.0	8$^+$	[E2]	B(E2)(W.u.)<0.3
4787.93	(1)$^-$	3479.36 *22*	72 *11*	1308.644	2$^+$		
		4173.3 *5*	100 *17*	613.727	2$^+$		
4791.5	0$^+$	4177.7 *5*	100	613.727	2$^+$		
4811.5	2$^+$	3503.6 *5*	52 *18*	1308.644	2$^+$		
		4811.1 *3*	100 *13*	0.0	0$^+$		
4819.2	(9$^-$)	1269.0 *5*	100	3550.15	(7$^-$)	[E2]	B(E2)(W.u.)=10 *4*
4857.0	(9$^+$)	1152.9 *4*	100 *6*	3704.0	(7$^+$)	[E2]	B(E2)(W.u.)=9 *4*
		1273.2[b] *5*	50 *13*	3585.0	8$^+$		
4957.3	1,2$^{(+)}$	4957.1 *3*	100	0.0	0$^+$		
4972.3	1$^-$	4972.1 *3*	100	0.0	0$^+$		
4998.3		3499.6 *5*	100	1498.599	0$^+$		
5004.65	1,2$^{(+)}$	3245.6[&] *4*	81[&] *24*	1758.689	0$^+$		
		4391.2 *3*	100 *10*	613.727	2$^+$		
		5003.5 *6*	19 *5*	0.0	0$^+$		
5022.14		3168.14[&] *17*	100[&]	1853.927	3$^+$		

γ(^{78}Se) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	Comments
5029.63	2^+	3720.8 *4*	100 *27*	1308.644	2^+		
		5029.5 *3*	100 *18*	0.0	0^+		
5090.8		4476.9 *3*	100	613.727	2^+		
5094.8		1046.8 *6*	100 *17*	4048.0	8^-		
5101.9		4488.0 *5*	100	613.727	2^+		
5126.52	(2,3,4)	3131.8 *4*	50 *9*	1995.897	2^+		
		3272.13 *19*	100 *14*	1853.927	3^+		
		3624.1[&] *4*	91[&] *14*	1502.825	4^+		
5164.05		3168.14[&] *17*	46[&] *8*	1995.897	2^+		
		3855.0[&] *4*	100[&] *10*	1308.644	2^+		
5180.75	$1^{(+)},2^{(+)}$	3326.4 *3*	100 *10*	1853.927	3^+		
		3682.4 *3*	76 *10*	1498.599	0^+		
5290.22	$1,2^{(+)}$	3791.7 *3*	79 *14*	1498.599	0^+		
		4676.2 *3*	100 *14*	613.727	2^+		
		5290.0 *3*	86 *14*	0.0	0^+		
5295.2	3^-	4681.3 *3*	100	613.727	2^+		
5339.7	$1,2^{(+)}$	3840.9 *3*	100 *16*	1498.599	0^+		
		4031.3 *6*	47 *6*	1308.644	2^+		
5356.51	(2^+)	3360.50 *20*	100 *14*	1995.897	2^+		
		4742.7 *3*	67 *14*	613.727	2^+		
5391.0		4777.1 *3*	100	613.727	2^+		
5440.3		4826.4 *3*	100	613.727	2^+		
5451.2	$1,2^{(+)}$	3952.5 *4*	100	1498.599	0^+		
5513.26	$1,2^{(+)}$	3245.6[&] *4*	122[&] *37*	2267.07			
		4015.0 *3*	100 *15*	1498.599	0^+		
		5512.9 *3*	35 *7*	0.0	0^+		
5689.1		902.2 *6*	100	4786.9	(10^+)		
5783.8	(12^+)	1158.7[a] *5*	100[a]	4625.1	(10^+)	[E2]	B(E2)(W.u.)<23

† Weighted averages of all available data. For low-spin (up to about spin 4), the values are available from ^{78}As β^- decay; ^{78}Br ε decay; (α,2nγ); (n,γ) E=thermal and (n,n$'\gamma$).

‡ From $\gamma(\theta)$, γ(lin pol) and ce data (for a few transitions only) in (α,2nγ) for transitions from high-spin (J>4) states. The multipolarity and mixing ratios for transitions from low-spin states (J up to about 4) are from $\gamma(\theta)$, γ(circ pol) and ce measurements in (n,γ) E=thermal; and some from $\gamma(\theta)$ in (n,n$'\gamma$).

γ only from (n,γ) E=thermal.

@ Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

& Multiply placed with undivided intensity.

a Multiply placed with intensity suitably divided.

b Placement of transition in the level scheme is uncertain.

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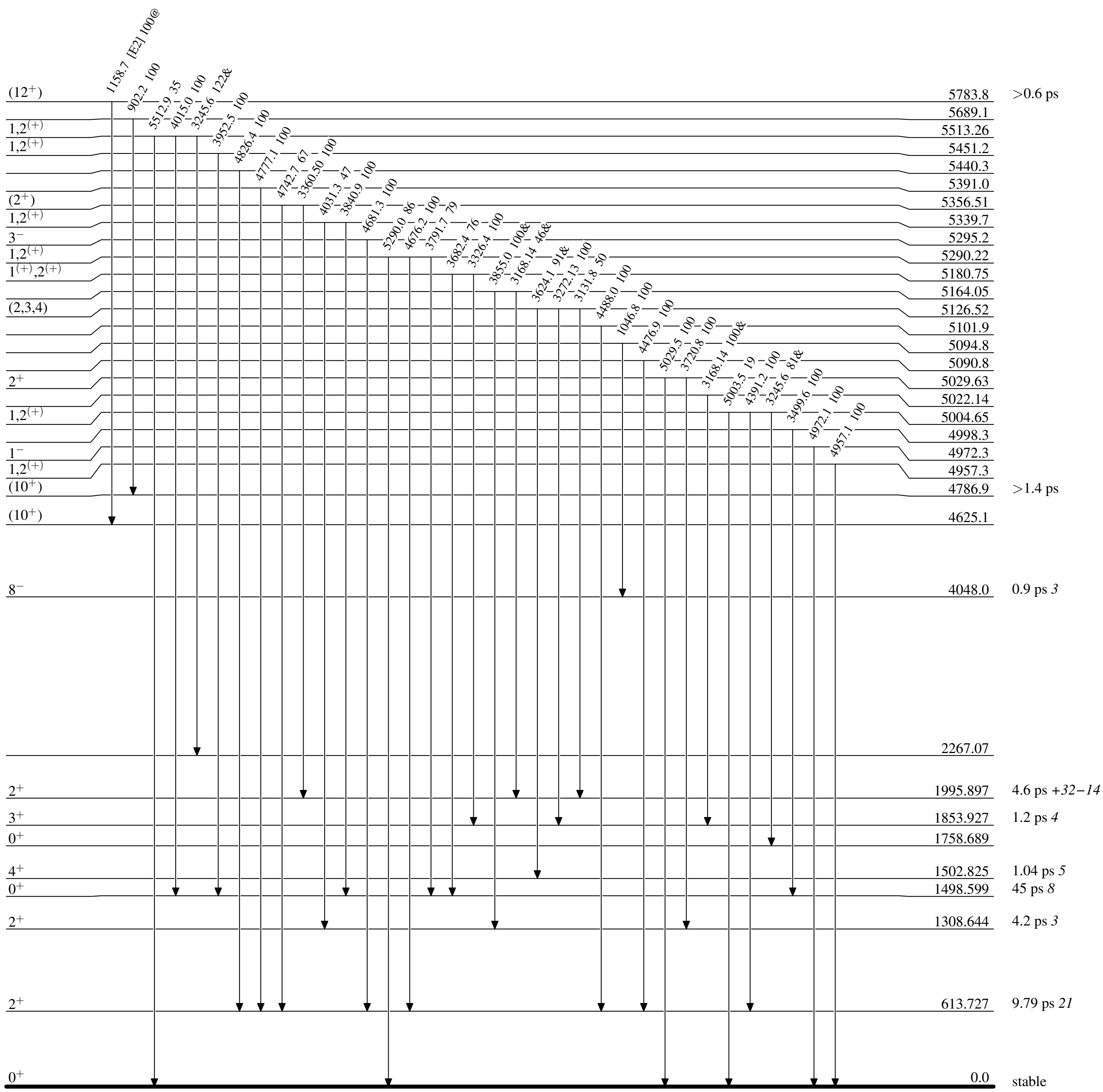
Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided

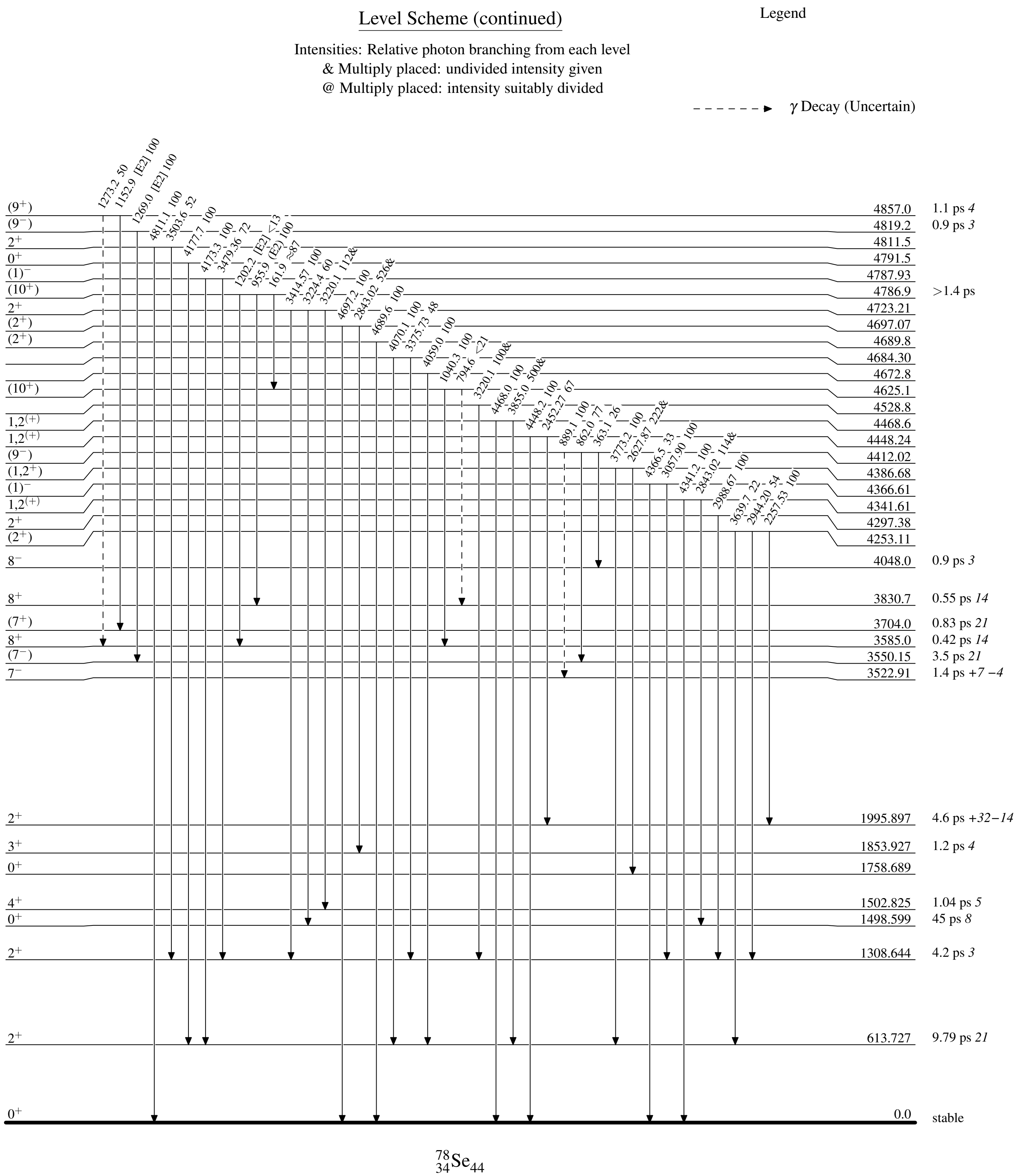


$^{78}_{34}Se_{44}$

Adopted Levels, Gammas

Level Scheme (continued)

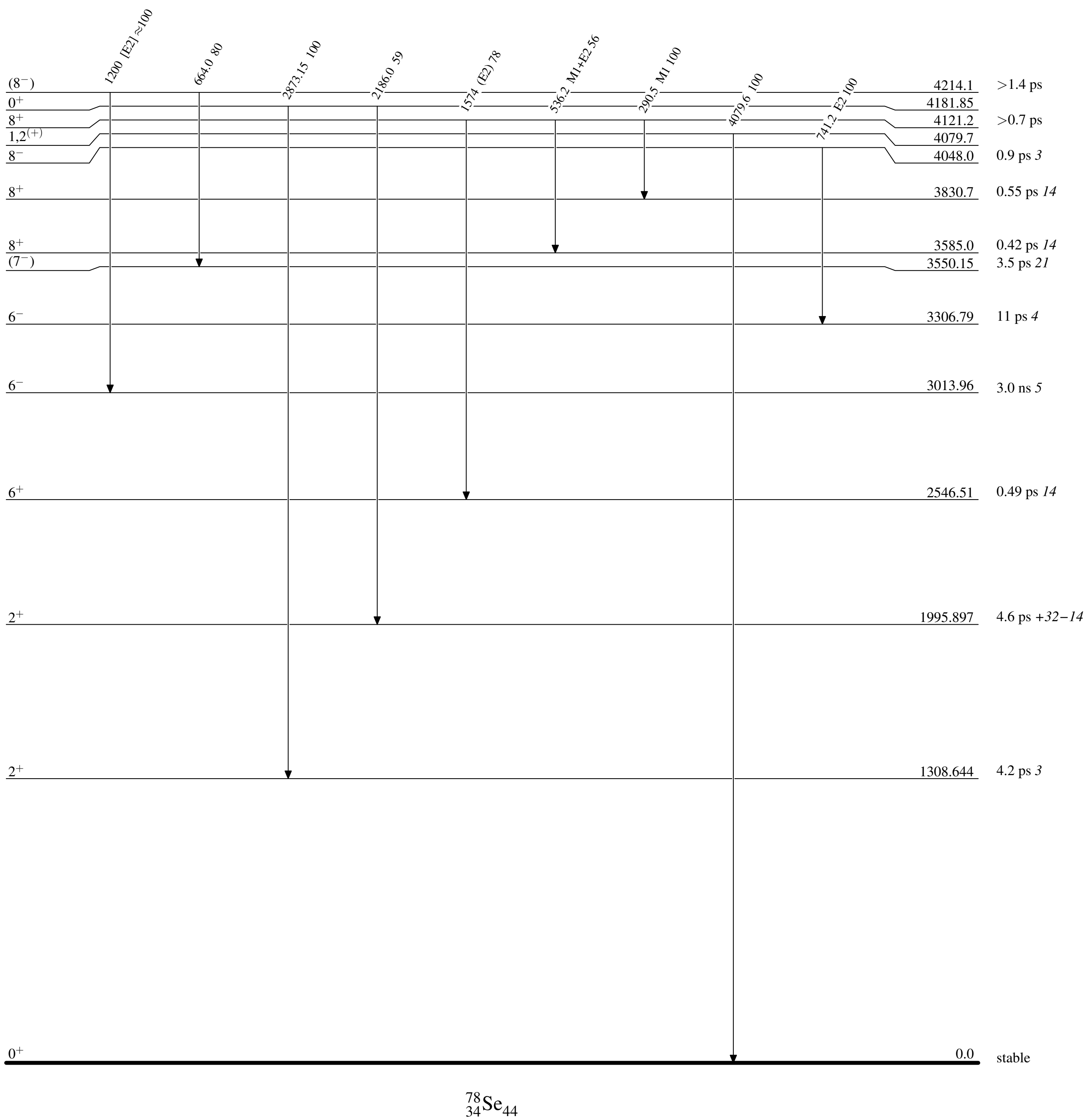
Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided



Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided

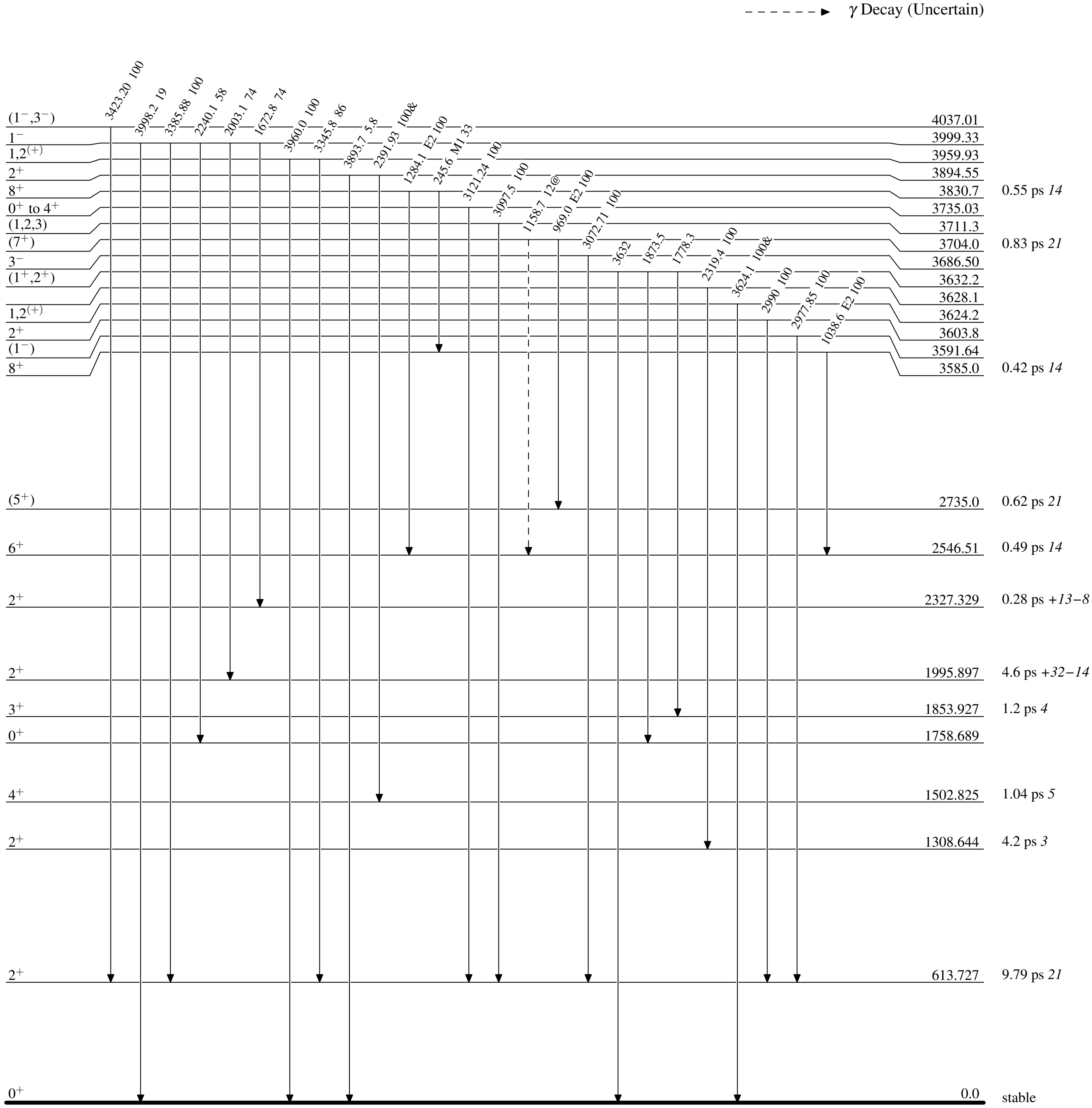


Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided

Legend

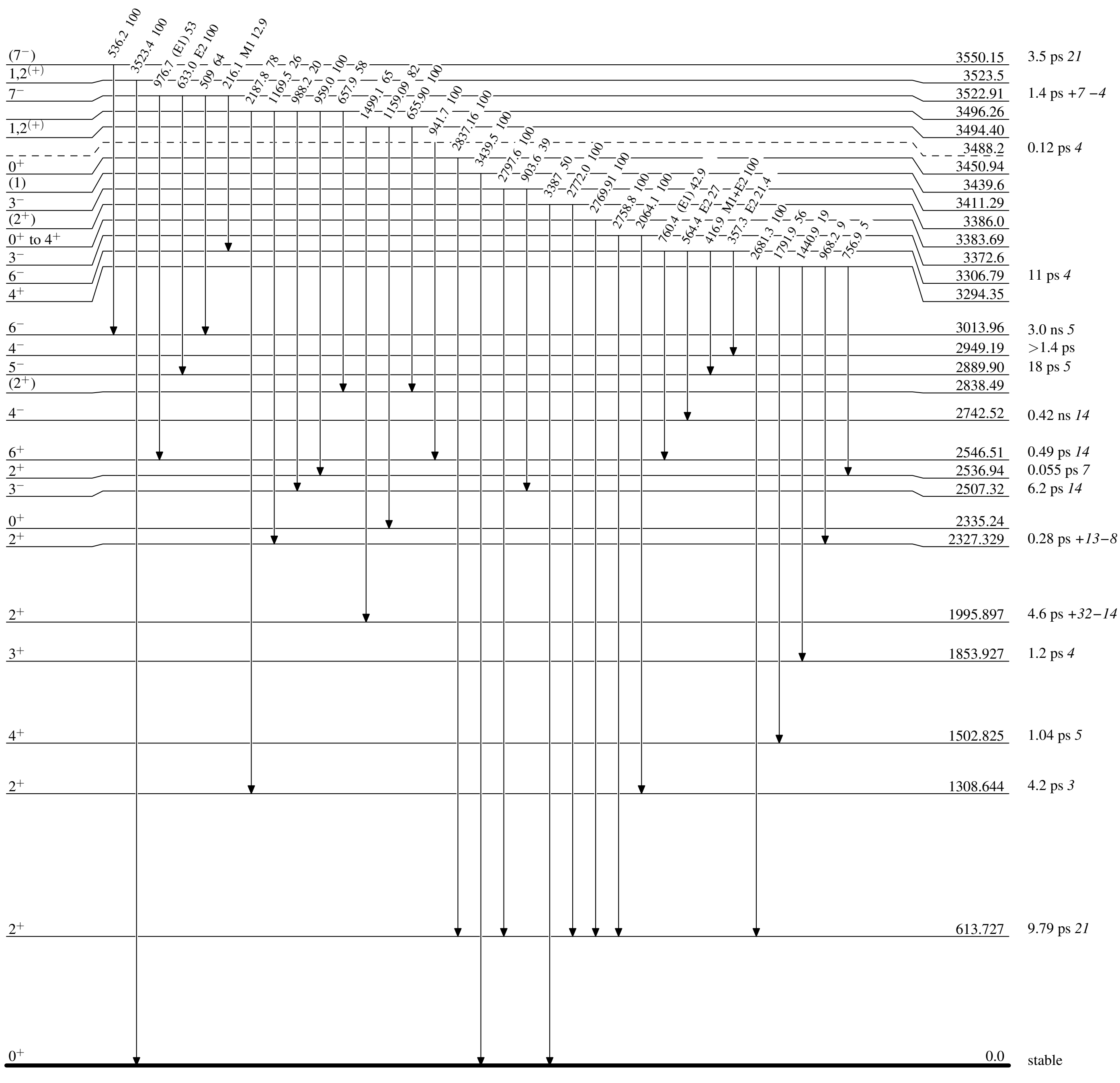


$^{78}_{34}Se_{44}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided



$^{78}_{34}Se_{44}$

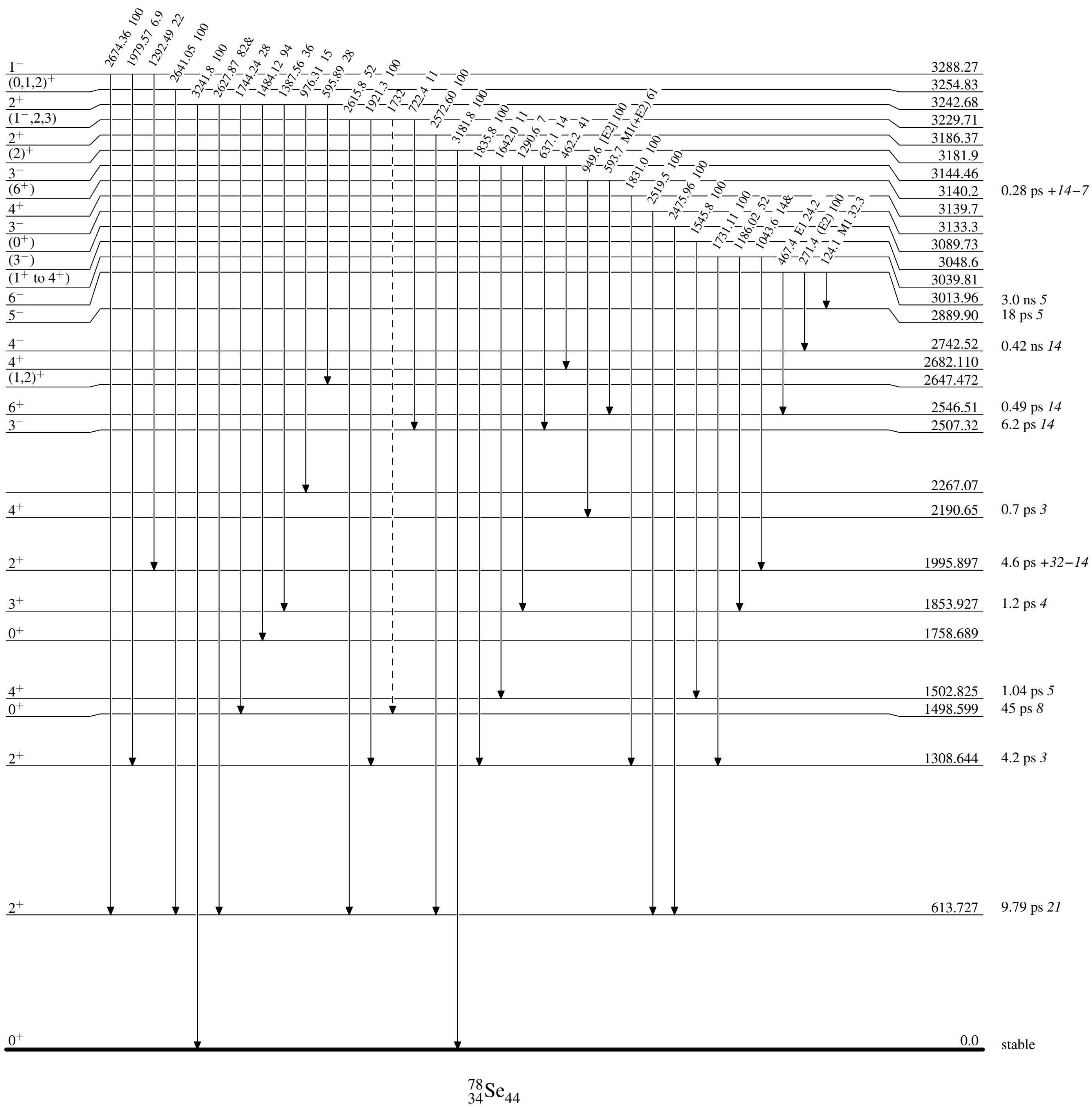
Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided

Legend

γ Decay (Uncertain)



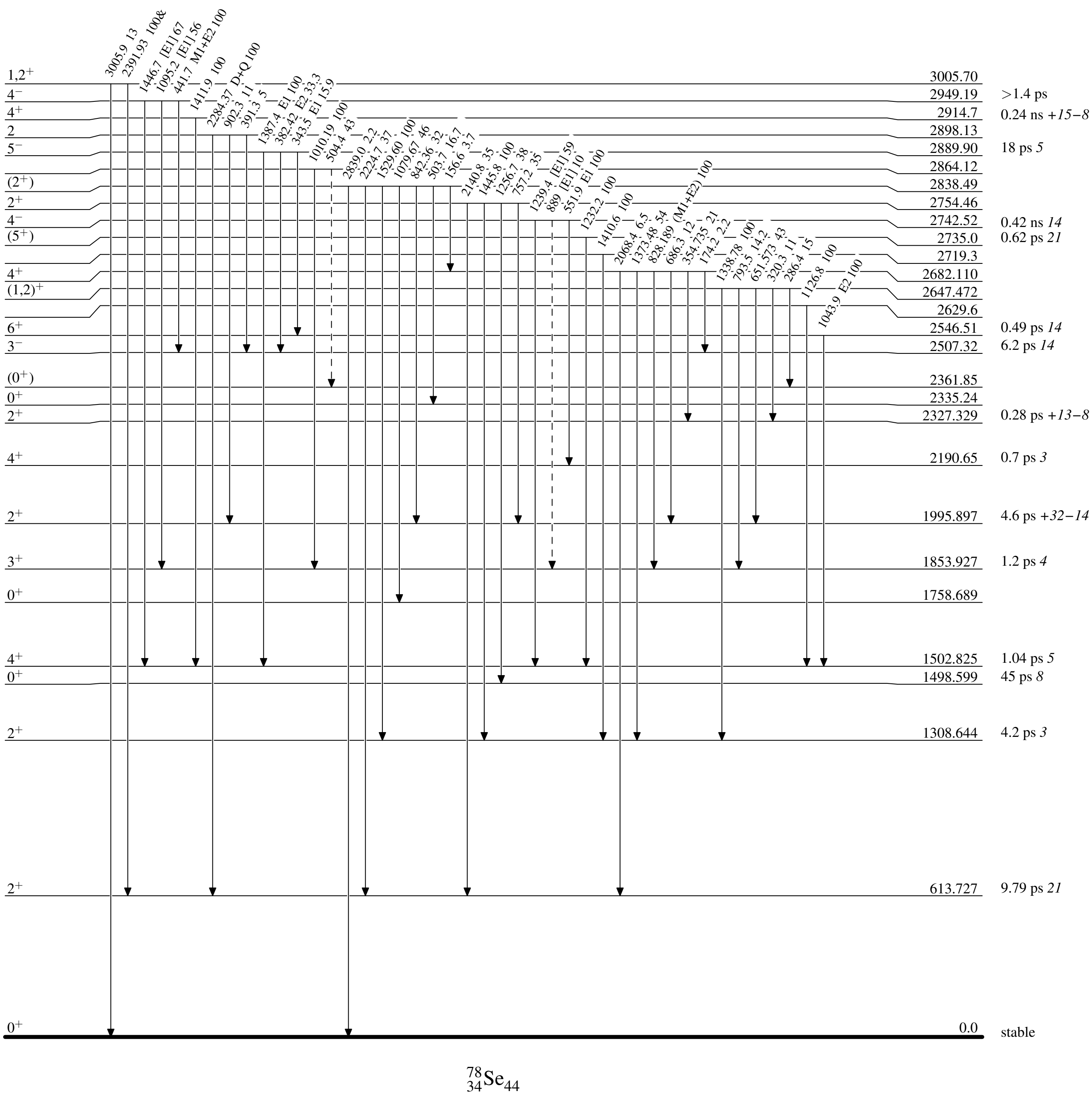
Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided

Legend

γ Decay (Uncertain)



$^{78}_{34}Se_{44}$

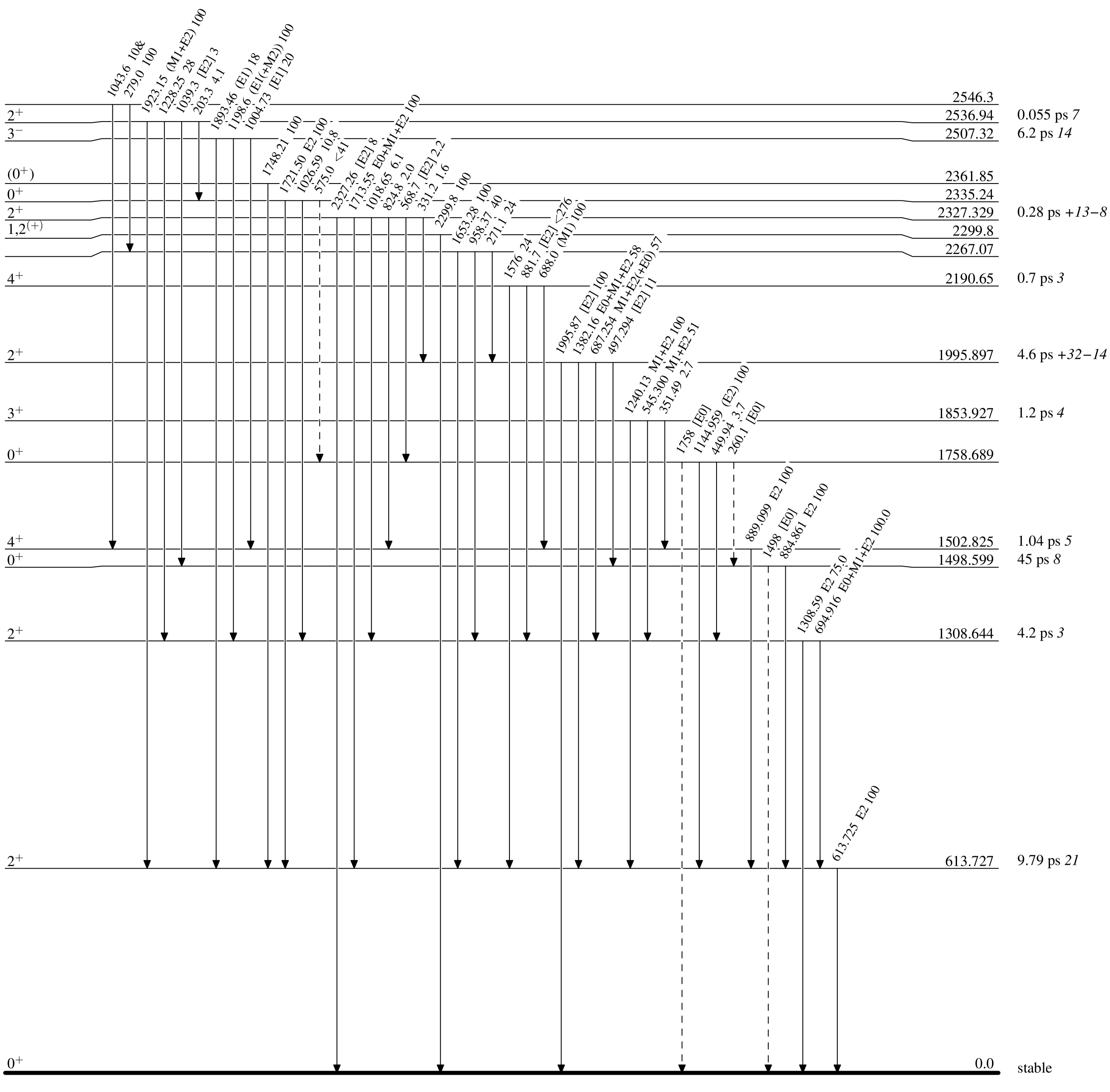
Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided

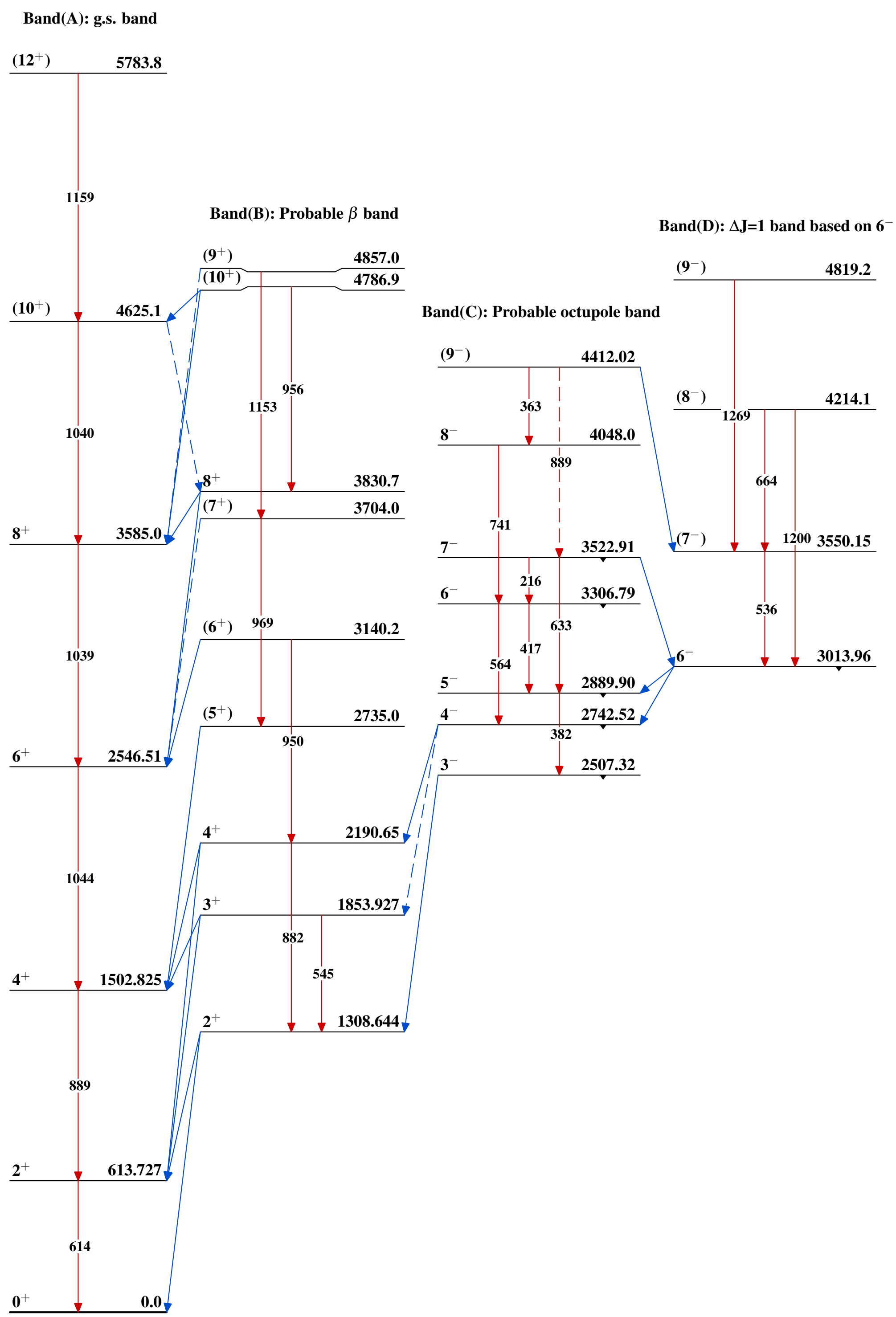
Legend

γ Decay (Uncertain)



$^{78}_{34}Se_{44}$

Adopted Levels, Gammas



$^{78}_{34}Se_{44}$