^{56}Fe(α,nγ) 1973Hu03,1974Mo02,1976Pi05

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	M. Shamsuzzoha Basunia	NDS 151, 1 (2018)	1-Apr-2018

Others: 1968Bi03, 1974Pi03.

1976Pi05: Eα=10, 15, 22.5 MeV. Measured Eγ, Iγ, $\gamma\gamma$ coin, $\gamma(\theta)$, semi, natural target.

1974Mo02: Eα=10-14 MeV. Measured Eγ, Iγ, $\gamma\gamma$ coin, $\gamma(\theta)$, excit, linear polarization, semi, enriched target.

1974Pi03: Eα=7.5-10.5 MeV, measured Eγ, DSA, semi, 99% ^{56}Fe target.

1973Hu03: Eα=6.1, 8.5, 10.5 MeV. Measured Eγ, Iγ, n-$\gamma(\theta)$ at θ=90°−142°, DSA in coin with n, recoil distance, semi and scin, 99.93% ^{56}Fe target.

1968Bi03: Eα=6.57 MeV, measured 339$\gamma(\theta)$.

In keeping with the results of the ^{58}Ni(^{3}He,2pγ) reaction, the evaluator has reversed the proposed order (1976Pi05) of the 581γ-1792γ cascade, replacing a proposed level at 2349 keV with one at 3560 keV whose weaker deexcitation branches (854γ, 435γ) are reported but not placed by 1974Mo02.

^{59}Ni Levels

E(level)	J$^{\pi}$†	T$_{1/2}$‡	E(level)	J$^{\pi}$†	T$_{1/2}$‡	E(level)	J$^{\pi}$†	T$_{1/2}$‡
0.0	3/2$^-$		1735.3 *4*		0.122 ps *25*	3376.76 *16*		
339.40 *9*	5/2$^-$	83[#] ps *14*	1739.22 *22*			3546.0 *3*		0.21[@&] ps *5*
465.18 *9*		20[#] ps *4*	1767.46 *11*	9/2$^-$	0.56[@] ps *14*	3559.19 *23*	11/2	
877.98 *16*	3/2$^-$	0.46 ps *10*	1948.0 *3*		0.135 ps *27*	4140.97 *22*		
1189.26 *19*	5/2$^-$	0.28 ps *6*	2415.1 *5*		34[@] ps *10*	4455.1 *4*		
1301.96 *22*		0.15 ps *5*	2535.49 *24*			4947.19 *24*		
1337.91 *11*	7/2$^-$	1.01 ps *24*	2704.95 *13*	11/2$^-$	0.35[@] ps *8*			
1679.8 *3*	5/2$^-$	0.20[@] ps *4*	3125?					

† Assumed for mult and δ. For results from $\gamma(\theta)$ and linear polarization, see Adopted Levels.

‡ From DSA method; unweighted average of data from 1973Hu03 and 1974Pi03, except as noted. 20% uncertainty in stopping power included by 1973Hu03.

[#] From 1973Hu03, recoil-distance method.

[@] From 1974Pi03, DSA method.

[&] Ascribed to different level by 1974Pi03 because 1779γ was placed without benefit of $\gamma\gamma$ coin data of 1974Mo02.

γ(^{59}Ni)

1974Mo02 alone report the following unplaced γ rays assigned to ^{59}Ni and having [Eγ, Iγ/I(339γ)] as follows: 579.4, 0.014; 758.8 *3*, 0.031; 768.5 *5*, 0.026; 993.0 *3*, 0.058; 1106.7 *2*, 0.070; 1173.0 *3*, 0.074; 1224.1 *2*, 0.060; 1238.1 *2*, 0.120; 1332.5 *4*, 0.100.

E$_i$(level)	J$_i^{\pi}$	E$_{\gamma}$[@]	I$_{\gamma}$†	E$_f$	J$_f^{\pi}$	Mult.‡	δ[#]	Comments
339.40	5/2$^-$	339.40 *9*	100	0.0	3/2$^-$	D(+Q)	+0.01 *1*	Mult.: A$_2$=−0.153 *4*, A$_4$=−0.004 *5* (1974Mo02). A$_2$=−0.07 *2*, A$_4$=0.00 *3* (1976Pi05). δ: weighted average of 0.00 *1* (1974Mo02), +0.11 *3* (1973Hu03), −0.05 *5* (1968Bi03). −3.7 *7* also possible (1973Hu03).
465.18		465.18 *9*	100	0.0	3/2$^-$			$\gamma(\theta)$ isotropic (1974Mo02); A$_2$=+0.03 *9*, A$_4$=0.00 *17* (1976Pi05).
877.98	3/2$^-$	539.0[a] *10*	2 *1*	339.40	5/2$^-$			
		877.94 *17*	98 *1*	0.0	3/2$^-$	M1(+E2)	+0.08 *3*	A$_2$=+0.177 *17*, A$_4$=−0.022 *17* (1974Mo02); A$_2$=+0.03 *4*, A$_4$=0.00 *6* (1976Pi05). pol=+0.1+0.7 (1974Mo02).

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^{56}Fe(α,nγ) 1973Hu03,1974Mo02,1976Pi05 (continued)

$\gamma(^{59}Ni)$ (continued)

E_i(level)	J_i^π	E_γ[@]	I_γ[†]	E_f	J_f^π	Mult.[‡]	δ[#]	Comments
								δ: weighted average of +0.09 *4* (1973Hu03), +0.06 *6* (1976Pi05), 0.00 *12* (1974Mo02). +4.0 *+15−10* also possible (1974Mo02).
1189.26	5/2$^-$	311.0[a] *10*	2 *2*	877.98	3/2$^-$			
		850.0[a] *20*	<7	339.40	5/2$^-$			I_γ: measurement hampered by presence of 847γ from ^{56}Fe(α,α').
		1189.26[&] *20*	98 *2*	0.0	3/2$^-$	D+Q	−0.43 *9*	Mult.: A_2=−0.34 *6*, A_4=−0.01 *8* (1976Pi05). δ: from 1973Hu03; −1.7 *5* also possible. Other: −0.76 *12* (1976Pi05).
1301.96		423.9[a] *5*	15 *2*	877.98	3/2$^-$			
		837.0[a] *10*	14 *3*	465.18				
		1301.95[d] *25*	71 *2*	0.0	3/2$^-$			
1337.91	7/2$^-$	998.52 *9*		339.40	5/2$^-$	M1+E2	+4.8 *+9−8*	A_2=+0.321 *24*, A_4=+0.175 *25* (1974Mo02). A_2=+0.24 *2*, A_4=+0.03 *3* (1976Pi05). pol=−0.15, +0.8 (1974Mo02). Other δ: +8 *+7−3* (1973Hu03), +2.8 *+19−9* (1976Pi05).
		1337.8		0.0	3/2$^-$	Q		E_γ: 1337.8 *1* for doublet in 1976Pi05 where this transition contributes approximately 85% of Iγ(doublet) (based on adopted 1338 level branching). A_2=+0.38 *5*, A_4=−0.04 *5* (1974Mo02). A_2=+0.18 *4*, A_4=−0.02 *6* (1976Pi05). Mult.,δ: from 1974Mo02. δ(Q,O)=+0.10 *+9−10*.
1679.8	5/2$^-$	1215[a] *3*	<2	465.18				E_γ: Uncertain γ.
		1339.5	83[e] *2*	339.40	5/2$^-$			E_γ,I_γ: E=1339.5 *10* for doublet in 1973Hu03; I(1680γ)/I(1338γ+1340γ) is much greater in spectrum of 1973Hu03 than in spectra of 1974Mo02, 1976Pi05.
		1679.9[d] *3*	17[e] *3*	0.0	3/2$^-$	D+Q	−1.6 *+7−22*	Mult.,δ: from 1973Hu03.
1735.3		546.0[a] *10*	16 *3*	1189.26	5/2$^-$			
		1269[a] *2*	15 *8*	465.18				
		1396.0[a] *10*	19 *3*	339.40	5/2$^-$			
		1735.3 *5*	50 *2*	0.0	3/2$^-$			E_γ: weighted average from 1973Hu03, 1974Pi03.
1739.22		1399.8[b] *2*	100[b]	339.40	5/2$^-$			
1767.46	9/2$^-$	429.58 *9*	7	1337.91	7/2$^-$	D(+Q)	−0.07 *4*	I_γ: from 1974Mo02. A_2=−0.42 *3*, A_4=+0.05 *5* (1974Mo02). A_2=−0.22 *5*, A_4=−0.02 *7* (1976Pi05). δ: weighted average of −0.03 *7* (1976Pi05), −0.09 *5* (1973Hu03).
		1428.02 *9*	93	339.40	5/2$^-$	E2(+M3)	+0.01 *4*	I_γ: from 1974Mo02. A_2=+0.32 *3*, A_4=−0.07 *3* (1974Mo02). A_2=+0.22 *2*, A_4=−0.08 *3* (1976Pi05). pol=+0.4, +0.8 (1974Mo02).
1948.0		1609 *2*	28 *5*	339.40	5/2$^-$			E_γ,I_γ: from 1973Hu03; doublet in 1974Mo02, 1974Pi03, 1976Pi05.
		1948.0 *3*	72 *3*	0.0	3/2$^-$	Q		A_2=+0.23 *12*, A_4=−0.04 *16* (1976Pi05).
2415.1		1226 *1*	[c]	1189.26	5/2$^-$			E_γ: from 1974Pi03 only.
		1537.1 *5*		877.98	3/2$^-$			E_γ: from 1974Pi03 only.
2535.49		796.26 *9*	100[b]	1739.22				Doublet.

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^{56}Fe(α,nγ) 1973Hu03,1974Mo02,1976Pi05 (continued)

$\gamma(^{59}Ni)$ (continued)

E_i(level)	J_i^π	E_γ [@]	I_γ [†]	E_f	J_f^π	Mult.[‡]	δ[#]	Comments
2704.95	11/2$^-$	937.45 *14*	10[b]	1767.46	9/2$^-$	D+Q	−0.95 *+17−60*	Mult.: from A_2=0.89 *5*, A_4=+0.11 *11* (1974Mo02).
		1367.02 *9*	90[b]	1337.91	7/2$^-$	E2(+M3)	0.00 *4*	A_2=+0.33 *3*, A_4=−0.08 *3* (1974Mo02); A_2=+0.28 *3*, A_4=−0.06 *5* (1976Pi05). pol=+0.6, +1.4 (1974Mo02).
3125?		(2786.0)		339.40	5/2$^-$			
3376.76		671.80 *9*	30	2704.95	11/2$^-$			A_2=+0.32 *4*, A_4=+0.08 *6* (1976Pi05).
		1609.3	70	1767.46	9/2$^-$			E_γ: multiply placed γ transition, unless Eα<10 MeV. I_γ: estimated by evaluator from branching ratio for 1948 level and Iγ. A_2=−0.13 *3*, A_4=+0.08 *3* (1976Pi05) for doublet dominated by this transition.
3546.0		1778.5 *3*	100	1767.46	9/2$^-$			E_γ: weighted average from 1974Mo02 and 1974Pi03.
3559.19	11/2	434.7 *5*	19	3125?				From 1974Mo02; no nuclidic assignment made by authors.
		854.5 *5*	66	2704.95	11/2$^-$			From 1974Mo02.
		1791.9 *4*	100	1767.46	9/2$^-$			From 1974Mo02.
4140.97		581.8 *1*		3559.19	11/2	D+Q		E_γ: from 1976Pi05. A_2=−0.10 *4*, A_4=+0.08 *4* (1976Pi05). δ: −11 *+3−6* from 1976Pi05, assuming J=11/2 to J=9/2 transition (cf. adopted 13/2 to 11/2 sequence). A_2=−0.10 *4*, A_4=+0.08 *4*.
		764.10 *20*		3376.76				A_2=+0.21 *4*, A_4=−0.03 *6* (1976Pi05).
4455.1		1750.15 *35*	100[b]	2704.95	11/2$^-$			
4947.19		806.22 *9*	100[b]	4140.97				

[†] % branching from 1973Hu03, except as noted. See 1974Mo02 and 1976Pi05 for relative Iγ (uncertainty unstated).
[‡] Based on $\gamma(\theta)$ and γ linear polarization from 1974Mo02 if π given; from $\gamma(\theta)$ of 1976Pi05 otherwise (except as noted).
[#] Based on $\gamma(\theta)$; from 1974Mo02, except as noted.
[@] Weighted average of 1974Mo02 and 1976Pi05 data, except as noted.
[&] Weighted average of data from 1973Hu03, 1974Mo02, 1974Pi03, 1976Pi05.
[a] Reported only in Eα=8.5 MeV data of 1973Hu03.
[b] From 1976Pi05.
[c] Differs from 1224.1γ of 1974Mo02 because 1974Mo02 do not observe the more intense 1537γ which de-excites the 2415 level.
[d] Weighted average from 1974Mo02, 1973Hu03, 1974Pi03.
[e] The 1338γ is a doublet in (α,nγ), deexciting the 1338 and 1680 levels. 1973Hu03 determine branching for 1680 level by assuming I(999γ):I(1338γ)=100 *5*:40.3 *20* for 1338 level (1970Te02) from a (p,nγ) study below the threshold for excitation of the 1680 level.

Legend

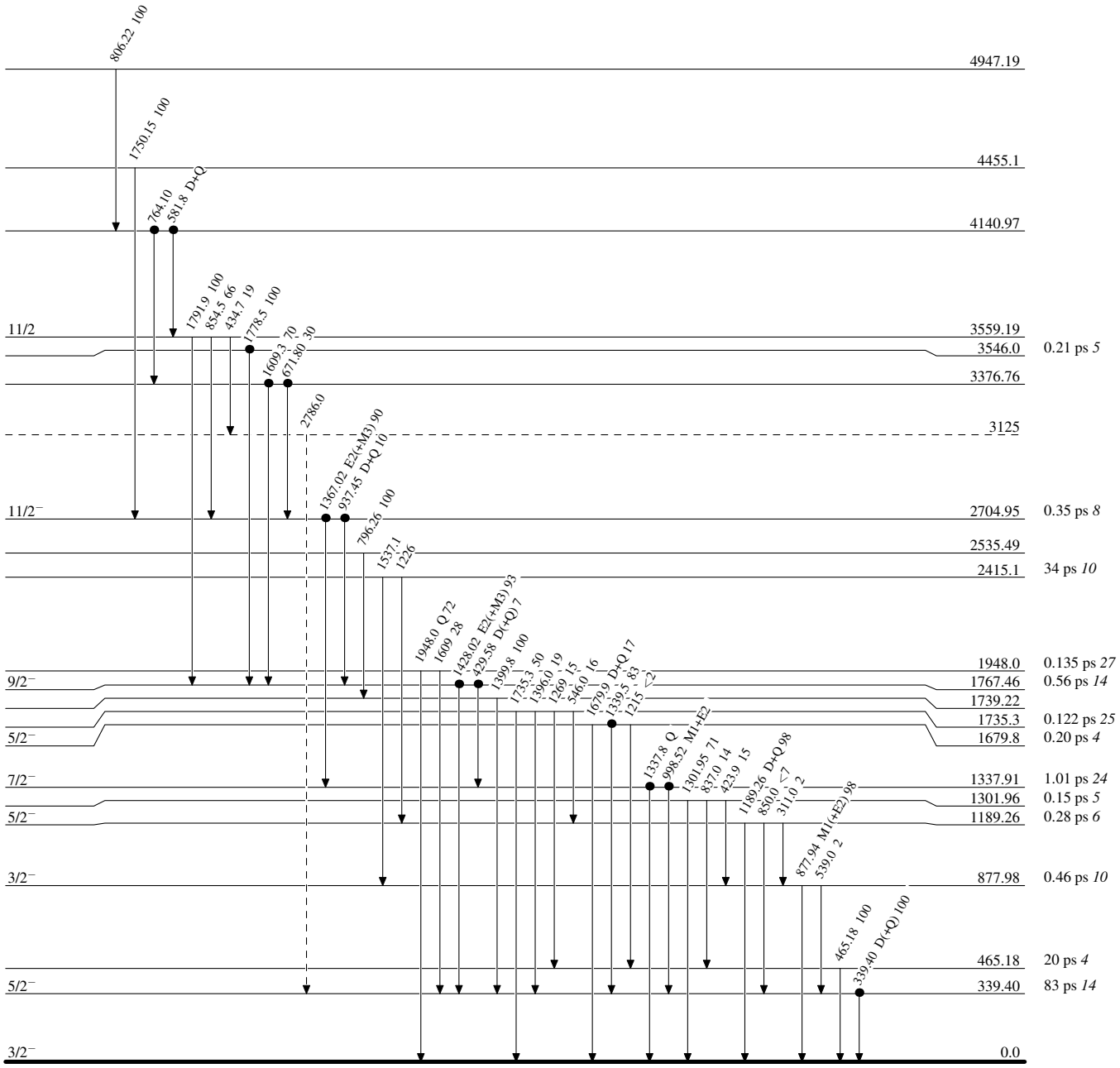
^{56}Fe(α,nγ) 1973Hu03,1974Mo02,1976Pi05

Level Scheme

Intensities: % photon branching from each level

γ Decay (Uncertain)

Coincidence



$^{59}_{28}Ni_{31}$