^{54}Fe(^{58}Ni,2pnγ) 1995Do13,1995Pa01,1998De44

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	S. Kumar(a), J. Chen(b) and F. G. Kondev	NDS 137, 1 (2016)	31-May-2016

1995Do13: E(^{58}Ni)=270 MeV, accelerator facilities at the Neils Bohr institute. Target:10 mg/cm^2 of ^{54}Fe (99.8% enriched). Detectors: NORDball array (15 BGO-shielded Ge detectors and 30 BaF2 calorimeter in backward hemisphere), 11 liquid scintillators, 4π charged-particle array (21 ΔE-type Si detectors). Measured: Eγ, Iγ, $\gamma\gamma$, p-$\gamma\gamma$, n-$\gamma\gamma$, angular correlation intensity ratio, R, corresponding to 143° and 79°+101°.

1995Pa01: E(^{58}Ni)=240 MeV, Tandem Van de Graff accelerator at Daresbury. Target= 400 μg/cm^2 self-supporting foil of ^{54}Fe. Detectors: EUROGAM array (45 escape-suppressed HPGe detectors), Recoil separator, Recoil-decay tagging method using double sided Si strip detector (DSSD). Measured: Eγ, Iγ, particle-$\gamma\gamma$, recoil-$\gamma\gamma$, DCO ratios that correspond to average 90° and 134° geometry.

1998De44: E(^{58}Ni)=220 MeV, Tandem XTU, Legnaro National Laboratory. Target= 400 μg/cm^2 self-supporting ^{54}Fe foil. Detectors: 4π GASP spectrometer (40 Compton-suppressed Ge detectors with BGO), charged-particle array Si-ball ISIS (40 ΔE-E Si telescopes covering about 70% of the total solid angle). Measured: Eγ, Iγ, $\gamma(\theta)$, $\gamma\gamma$, 2p-$\gamma\gamma$, $\gamma\gamma\gamma$, DCO using triple coincidence. The reported γ-ray energies in 1998De44 are 1 keV higher than those reported by others. DCO ratios are shown only in Figure 3 in 1998De44.

Level scheme is that reported by 1998De44, unless otherwise noted.

^{109}Te Levels

E(level)[†]	J$^\pi$[‡]	Comments
0.0	5/2$^+$	
98.11 *10*	7/2$^+$	
265.4 *4*	(5/2$^+$)	E(level),J$^\pi$: from 1995Do13.
537.9 *4*	7/2	
690.01 *13*	9/2$^+$	
762.75 *19*	9/2$^+$	
772.40 *18*	(11/2)	
1088.73[#] *15*	11/2$^-$	
1351.5 *6*	13/2$^+$	
1532.5 *4*	(15/2$^+$)	E(level),J$^\pi$: from 1995Do13.
1583.04[#] *18*	15/2$^-$	
2192.05[#] *21*	19/2$^-$	
2385.8 *6*	(19/2$^+$)	E(level): from 1995Do13 only. J$^\pi$: From Adopted Levels.
2887.25[#] *23*	23/2$^-$	
3776.75[#] *25*	27/2$^-$	
4672.7[@] *3*	29/2$^{(+)}$	
4710.6[#] *3*	31/2$^-$	
5549.9[@] *4*	33/2$^{(+)}$	
5726.5[#] *4*	35/2$^-$	
6398.6[@] *4*	37/2$^{(+)}$	
6755.8[#] *6*	39/2$^-$	
7387.7[@] *5*	41/2$^{(+)}$	
7989.8[#] *12*	43/2$^-$	
8361.9[@] *6*	45/2$^{(+)}$	
9279.8[#] *16*	47/2$^-$	
10656.8[#] *19*	(51/2$^-$)	
12079.8[#] *21*	(55/2$^-$)	

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^{54}Fe(^{58}Ni,2pnγ) 1995Do13,1995Pa01,1998De44 (continued)

^{109}Te Levels (continued)

† From a least-squares fit to Eγ.
‡ From 1998De44 based on measured DCO ratios and γ(θ), and band structure, unless otherwise stated.
# Band(A): Band based on the J^π=11/2$^-$ state at 1088 keV (1998De44).
@ Band(B): Band based on the J^π=29/2$^{(+)}$ state at 4673 keV (1998De44).

γ(^{109}Te)

E_γ†	I_γ†	E_i(level)	J_i^π	E_f	J_f^π	Mult.&	Comments
98.1 *1*	46 *15*	98.11	7/2$^+$	0.0	5/2$^+$	(M1+E2)	Eγ: Other: 97.8 *5* (1995Pa01). Iγ: Other:<10 (1995Pa01). Mult.: R=0.99 *13* (1995Do13), DCO=0.7 *1* (1995Pa01). DCO≈1.0 from 1998De44 indicates E2.
224.6 *5*	5 *2*	762.75	9/2$^+$	537.9	7/2	(M1+E2)	Eγ: Other: 225.1 *5* (1995Pa01). Iγ: Other:<10 (1995Pa01). Mult.: DCO=0.6 *1* (1995Pa01), DCO≈0.6 (1998De44).
233‡ *1*		1583.04	15/2$^-$	1351.5	13/2$^+$	D	Mult.: DCO≈0.5 (1998De44).
265.2@ *5*	5 *2*	265.4	(5/2$^+$)	0.0	5/2$^+$		
316.2 *2*	11 *2*	1088.73	11/2$^-$	772.40	(11/2)	D	Mult.: DCO≈0.5 (1998De44). R=1.7 *7* from 1995Do13 could indicate E2.
326.1 *2*	51 *5*	1088.73	11/2$^-$	762.75	9/2$^+$	(E1)	Eγ: Other: 327.3 *5* (1995Pa01). Iγ: Other: 29 (1995Pa01). Mult.: R=0.75 *10* (1995Do13), DCO=0.6 *1* (1995Pa01), DCO≈0.6 (1998De44), A_2/A_0=−0.33 *6* and δ(Q/D)=0 (1998De44).
398.7 *1*	41 *4*	1088.73	11/2$^-$	690.01	9/2$^+$	(E1)	Eγ: Other: 399.6 15 (1995Pa01). Mult.: R=0.80 *12* (1995Do13), DCO≈0.5 (1998De44).
424.5@ *5*	6 *3*	690.01	9/2$^+$	265.4	(5/2$^+$)		
440‡a *1*		537.9	7/2	98.11	7/2$^+$		
494.3 *1*	100	1583.04	15/2$^-$	1088.73	11/2$^-$	E2	Eγ: Other: 494.6 *5* (1995Pa01). Mult.: R=1.47 *22* (1995Do13), DCO=1.1 *1* (1995Pa01), DCO≈1.0 (1998De44).
537.6 *5*	5 *2*	537.9	7/2	0.0	5/2$^+$	(M1+E2)	Eγ: Other: 538.0 *5* (1995Pa01). Iγ: Other:<10 (1995Pa01). Mult.: DCO≈0.5 (1998De44).
580‡ *1*		1351.5	13/2$^+$	772.40	(11/2)		Mult.: DCO AP 1.0 from 1998De44 indicates E2 character.
591.9 *1*	40 *4*	690.01	9/2$^+$	98.11	7/2$^+$	(M1+E2)	Eγ: Other: 593.0 *5* (1995Pa01). Iγ: Other: 14 (1995Pa01). Mult.: R=0.94 *17* (1995Do13), DCO=1.0 *1* (1995Pa01), DCO≈0.8 (1998De44).
602‡a *1*		7989.8	43/2$^-$	7387.7	41/2$^{(+)}$		
609.0 *1*	99 *9*	2192.05	19/2$^-$	1583.04	15/2$^-$	E2	Eγ: Other: 609.4 *5* (1995Pa01). Iγ: Other: 95 (1995Pa01). Mult.: R=1.57 *19* (1995Do13), DCO=1.1 *1* (1995Pa01), DCO≈1 (1998De44).
633‡ *1*		7387.7	41/2$^{(+)}$	6755.8	39/2$^-$	(E1)	Mult.: A_2/A_0=−0.27 *5*, DCO≈0.6 (1998De44).
662‡ *1*		1351.5	13/2$^+$	690.01	9/2$^+$		
666‡ *1*		762.75	9/2$^+$	98.11	7/2$^+$	(M1+E2)	Mult.: DCO≈0.7 (1998De44).
672.0 *4*	13 *2*	6398.6	37/2$^{(+)}$	5726.5	35/2$^-$	(E1)	Mult.: R=1.2 *5* (1995Do13), DCO≈0.5 (1998De44), A_2/A_0=−0.27 *8* (1998De44).
674.2 *2*	28 *5*	772.40	(11/2)	98.11	7/2$^+$	E2	Mult.: R=1.6 *3* (1995Do13), DCO≈1.1 (1998De44).
695.2 *1*	96 *9*	2887.25	23/2$^-$	2192.05	19/2$^-$	E2	Eγ: Other: 695.5 *5* (1995Pa01). Iγ: Other: 94 (1995Pa01).

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^{54}Fe(^{58}Ni,2pnγ) 1995Do13,1995Pa01,1998De44 (continued)

$\gamma(^{109}Te)$ (continued)

E_γ[†]	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[&]	Comments
							Mult.: R=1.57 *20* (1995Do13), DCO=1.2 *1* (1995Pa01), DCO≈1.0 (1998De44).
[x]726.4[#] *5*	12[#] *2*						
[x]757.2[#] *5*	10[#] *1*						
760.1 *3*	15 *4*	1532.5	$(15/2^+)$	772.40	(11/2)	E2	E_γ: not seen in 1998De44. Mult.: R=1.4 *4* (1995Do13).
763.0 *3*	44 *6*	762.75	$9/2^+$	0.0	$5/2^+$	E2	E_γ: Other: 763.3 *5* (1995Pa01). I_γ: Other: 32 (1995Pa01). Mult.: R=1.51 *25* (1995Do13), DCO=1.2 *1* (1995Pa01), DCO≈1.1 (1998De44).
839.3 *3*	15 *5*	5549.9	$33/2^{(+)}$	4710.6	$31/2^-$	(E1)	Mult.: R=0.84 *23* (1995Do13), DCO≈0.5 (1998De44), A_2/A_0=−0.26 *9* (1998De44).
848.7 *2*	17 *5*	6398.6	$37/2^{(+)}$	5549.9	$33/2^{(+)}$	E2	Mult.: R=1.5 *4* (1995Do13), DCO≈1.1 (1998De44), A_2/A_0=+0.38 *8*, A_4/A_0=−0.14 *3*.
853.3 *5*	9 *2*	2385.8	$(19/2^+)$	1532.5	$(15/2^+)$	E2	E_γ: not seen in 1998De44. Mult.: R=1.5 *5* (1995Do13).
877.0 *4*	14 *4*	5549.9	$33/2^{(+)}$	4672.7	$29/2^{(+)}$	E2	Mult.: R=1.6 *5* (1995Do13), DCO≈0.9 (1998De44), A_2/A_0=+0.39 *8*, A_4=−0.14 *3* (1998De44).
889.5 *1*	88 *8*	3776.75	$27/2^-$	2887.25	$23/2^-$	E2	E_γ: Other: 889.9 *5* (1995Pa01). I_γ: Other: 90 (1995Pa01). Mult.: R=1.47 *19* (1995Do13), DCO=1.0 *1* (1995Pa01), DCO≈0.9 (1998De44).
895.9 *1*	20 *4*	4672.7	$29/2^{(+)}$	3776.75	$27/2^-$	(E1)	Mult.: R=1.0 *4* (1995Do13), DCO≈0.5 (1998De44), A_2/A_0=−0.25 *4* (1998De44).
933.9 *1*	61 *6*	4710.6	$31/2^-$	3776.75	$27/2^-$	E2	E_γ: Other: 933.9 *5* (1995Pa01). I_γ: Other: 90 (1995Pa01). Mult.: R=1.60 *24* (1995Do13), DCO=1.1 *1* (1995Pa01), DCO≈1.0 (1998De44).
974.2 *3*	7 *3*	8361.9	$45/2^{(+)}$	7387.7	$41/2^{(+)}$	E2	Mult.: R=1.0 *4* (1995Do13), DCO≈1.0 (1998De44).
989.0 *3*	16 *3*	7387.7	$41/2^{(+)}$	6398.6	$37/2^{(+)}$	E2	E_γ: Other: 990.9 *5* (1995Pa01). Mult.: R=1.2 *4* (1995Do13), DCO≈1.0 (1998De44).
1015.9 *2*	28 *2*	5726.5	$35/2^-$	4710.6	$31/2^-$	E2	E_γ: Other: 1016.1 *3* (1995Pa01). I_γ: Other: 70 (1995Pa01). Mult.: R=1.9 *4* (1995Do13), DCO≈1.0 (1998De44).
1029.5 *5*	6 *3*	6755.8	$39/2^-$	5726.5	$35/2^-$	E2	E_γ: Other: 1032.0 *5* (1995Pa01). Mult.: R=1.0 *4* (1995Do13), DCO≈1.0 (1998De44).
1234[‡] *1*		7989.8	$43/2^-$	6755.8	$39/2^-$		
1290[‡] *1*		9279.8	$47/2^-$	7989.8	$43/2^-$		
1377[‡] *1*		10656.8	$(51/2^-)$	9279.8	$47/2^-$		
1423[‡] *1*		12079.8	$(55/2^-)$	10656.8	$(51/2^-)$		

[†] From 1995Do13, unless otherwise states. Iγ are normalized to Iγ(494.3)=100.
[‡] From 1998De44 only. ΔE=1 keV assumed by evaluators.
[#] Seen only in 1995Pa01 and placed as a 757.2γ-726.4γ cascade to E=690 level.
[@] From 1995Do13 only.
[&] From 1995Pa01, 1998De44 and 1995Do13, based on angular correlation intensity ratio, R, from 1995Do13, DCO ratios from 1995Pa01 and 1998De44 (see Fig. 3 in 1998De44) and $\gamma(\theta)$ from 1998De44. R is expected to be 1.5 for stretched E2 transitions and 0.8 for stretched dipole transitions (1995Do13). DCO values≥1.0 indicate stretched quadrupole transitions, while values of≈0.65 are expected for pure stretched dipole transitions (1995Pa01).
[a] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

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Level Scheme

Intensities: Relative I_γ

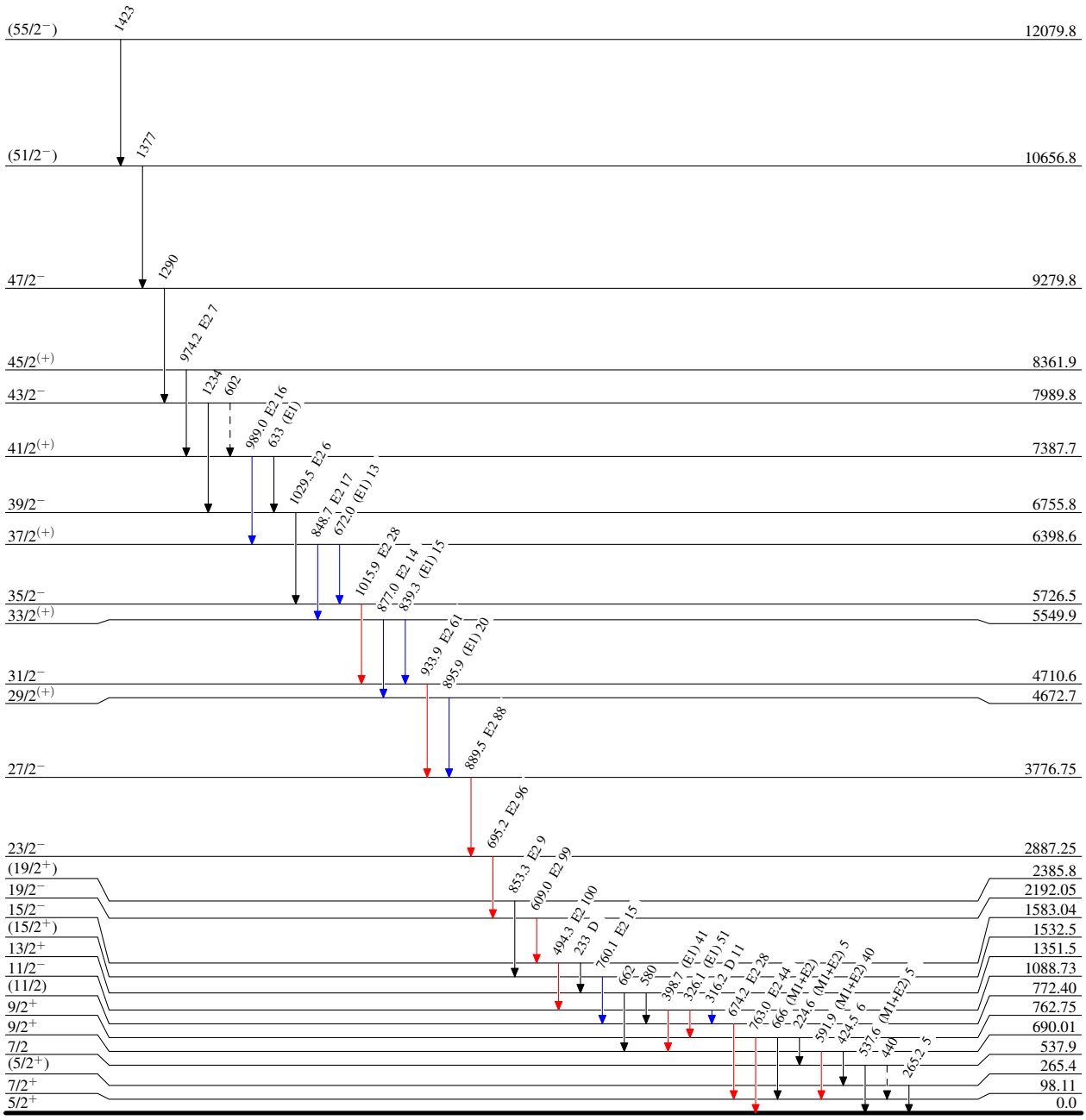
Legend

$I_\gamma < 2\% \times I_\gamma^{max}$

$I_\gamma < 10\% \times I_\gamma^{max}$

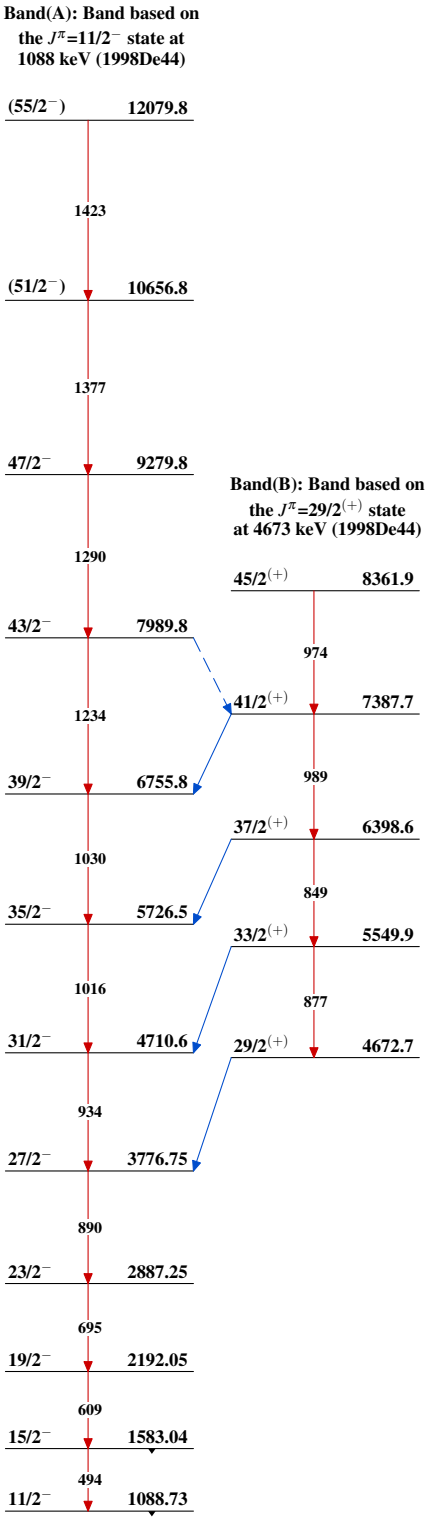
$I_\gamma > 10\% \times I_\gamma^{max}$

γ Decay (Uncertain)



$^{109}_{52}Te_{57}$

$^{54}Fe(^{58}Ni,2pn\gamma)$ 1995Do13,1995Pa01,1998De44



$^{109}_{52}Te_{57}$