^{58}Ni(^{40}Ca,3αpγ) 1999Jo01,1993Mi11,1991Gr16

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen	NDS 116, 1 (2014)	31-Dec-2013

Includes reactions: ^{58}Ni(^{32}S,αpγ) and ^{40}Ca(^{50}Cr,αpγ).

1999Jo01: E=185 MeV. Measured Eγ, Iγ, γγ, particle-γ coin, γγ(θ)(DCO) using GAMMASPHERE array with 94 escape-suppressed n-type Ge detectors for γ rays and Microball charged-particle detector system for particles. Comparisons with Cranked Strutinsky calculations.

1993Mi11: ^{58}Ni(^{32}S,αpγ) E=125 MeV. Measured Eγ, Iγ, γγ, (particle)γ coin using NORDBALL Ge detector array for γ rays and Silicon ball for charged particles. The (9/2$^+$) band seen up to (37/2$^+$) with 634, 841, 996, 1024, 1058, 1224 and 1424 γ rays. In coin with 134γ, following γ rays seen: 75, 140, 232, 369, 420, 453, 668, 678, 728, 746, 769, 804, 854, 872 and 966. Out of these 75, 140, 232 and 966 γ rays are not reported by 1999Jo01. No intensities or other details were given.

1991Gr16: ^{40}Ca(^{50}Cr,αpγ) E=170 MeV. Measured Eγ, Iγ, γγ, (recoil)γ coin, γγ(θ)(DCO) using recoil separator and POLYTESSA Ge detector array at Daresbury facility. The (9/2$^+$) band up to (37/2$^+$) established with γ cascade: 634-841-996-1023-1058-1225-1419. No intensities or other details were given.

All data given here are from 1999Jo01.

^{85}Nb Levels

E(level)[†]	J^π[‡]	Comments
0+x	(3/2$^-$)	
15.44+x[#] *17*	9/2$^+$	E(level): this 9/2$^+$ level seems a different one from the spherical 9/2$^+$ g.s.
134.15+x[&] *5*	5/2$^-$	
503.69+x[@] *9*	7/2$^-$	
649.79+x[#] *17*	13/2$^+$	
812.18+x[&] *11*	9/2$^-$	
1171.81+x[@] *12*	11/2$^-$	
1491.05+x[#] *18*	17/2$^+$	
1557.90+x[&] *13*	13/2$^-$	
1899.74+x[@] *13*	15/2$^-$	
2326.43+x[&] *18*	17/2$^-$	
2361.84+x *23*	17/2	
2487.05+x[#] *18*	21/2$^+$	
2649.87+x[@] *15*	19/2$^-$	
2780.1+x? *4*		
3180.45+x[&] *22*	21/2$^-$	
3510.94+x[#] *19*	25/2$^+$	
3522.32+x[@] *16*	23/2$^-$	
4178.6+x[&] *3*	(25/2$^-$)	
4543.16+x[@] *19*	(27/2$^-$)	
4568.90+x[#] *20*	29/2$^+$	
5289.9+x[&] *3*	(29/2$^-$)	
5637.14+x[@] *21*	(31/2$^-$)	
5794.06+x[#] *21*	33/2$^+$	
6386.1+x[&] *4*	(33/2$^-$)	
6739.38+x[@] *24*	(35/2$^-$)	
7216.01+x[#] *25*	37/2$^+$	
7508.2+x[&] *4*	(37/2$^-$)	
7950.0+x[@] *3*	(39/2$^-$)	

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^{58}Ni(^{40}Ca,3αpγ) 1999Jo01,1993Mi11,1991Gr16 (continued)

^{85}Nb Levels (continued)

E(level)[†]	Jπ[‡]	Comments
8739.6+x *4*	41/2+	E(level): member of the 9/2+ band as a fork-type structure, two 41/2+ states are produced, this 41/2+ member seems to be part of the non-collective terminating structure, while the other 41/2+ state at 8960+X keV seems to be continuation of the rotational band.
8795.4+x[&] *5*	(41/2−)	
8960.0+x[#] *11*	(41/2+)	E(level): see comment for 8739.6+x level.
9366.6+x[@] *4*	(43/2−)	
10264.7+x[&] *6*	(45/2−)	
10317.8+x *6*	(45/2+)	E(level): continuation of 9/2+ band as a fork-type structure. This level is interpreted (1999Jo01) as a terminating 45/2+ state with configuration=$\pi[g^3_{9/2}p^{-2}_{1/2}]_{21/2+}\otimes\nu g^4_{9/2}\ {}_{12+}$. E(level): 10481.6 in table 1 of 1999Jo01 seems a misprint.
11010.3+x[@] *5*	(47/2−)	
11962.5+x[&] *7*	(49/2−)	
12916.5+x[@] *9*	(51/2−)	
13906.0+x[&] *14*	(53/2−)	
15144.6+x?[@] *17*	(55/2−)	

[†] From least-squares fit to Eγ data.

[‡] As proposed by 1999Jo01 based on band assignments, γγ-cascades, from comparisons with TRS calculations and systematics. The measured DCO ratios are consistent with these assignments. The same assignments are listed in Adopted Levels, except that all the assignments are given in parentheses there due to lack of strong supporting arguments.

[#] Band(A): $\pi g_{9/2}$ band. This band shows an upbend at $\hbar\omega \approx 0.5$ MeV due to the alignment of a pair of $\gamma_{9/2}$ neutrons. Above 37/2+, this band splits into into two structures (fork-type): one continuing as a rotational band and the other forming a non-collective structure terminating in a 45/2+ state. The model calculations also predict crossing by configuration=$\pi[g^3_{9/2}p^{-2}_{1/2}]_{21/2+}\otimes\nu g^4_{9/2}\ {}_{12+}$ with spin of 45/2+.

[@] Band(B): Strongly-coupled band, α=−1/2. Possible mixed configuration=3/2[312]+5/2[303]. Both signatures show two upbends, first at $\hbar\omega\approx0.35$ MeV and the second at ≈0.55 MeV. The first upbend is interpreted as due to the alignment of a pair of $g_{9/2}$ protons while the second due to the alignment of a pair of $g_{9/2}$ neutrons.

[&] Band(b): Strongly-coupled band, α=+1/2. For configuration and alignments, see comments for the α=−1/2 signature partner.

γ(^{85}Nb)

DCO ratios correspond to gates on ΔJ=2 transitions. Expected values are: 1.3 for ΔJ=2, Q and 0.7 for ΔJ=1, dipole transitions.

Eγ	Iγ	Ei(level)	J^π_i	Ef	J^π_f	Mult.[†]	Comments
134.15 *5*	20 *2*	134.15+x	5/2−	0+x	(3/2−)	D+Q	DCO=0.8 *1*
308.1 *6*	2 *1*	812.18+x	9/2−	503.69+x	7/2−	D	DCO=0.6 *1*
322.9 *10*	1 *1*	2649.87+x	19/2−	2326.43+x	17/2−		
341.9[#] *10*	<3[#]	1899.74+x	15/2−	1557.90+x	13/2−		Eγ: uncertainty of 0.12 in 1999Jo01 seems too small, the evaluators assign the same energy as for the other placement from 3522 level. Iγ: 1 *2* (1999Jo01).
341.9[#] *10*	5[#] *2*	3522.32+x	23/2−	3180.45+x	21/2−		
359.5 *2*	2 *1*	1171.81+x	11/2−	812.18+x	9/2−		
369.53 *8*	15.0 *10*	503.69+x	7/2−	134.15+x	5/2−	D	DCO=0.6 *1*
386.1 *10*	7 *2*	1557.90+x	13/2−	1171.81+x	11/2−		
419[@] *4*	1 *1*	2780.1+x?		2361.84+x	17/2		

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^{58}Ni(^{40}Ca,3αpγ) 1999Jo01,1993Mi11,1991Gr16 (continued)

γ(^{85}Nb) (continued)

E_γ	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	Comments
426.7 4	10 2	2326.43+x	17/2$^-$	1899.74+x	15/2$^-$		
453.7[@] 3	4 2	2780.1+x?		2326.43+x	17/2$^-$		
488.5 2	5 2	503.69+x	7/2$^-$	15.44+x	9/2$^+$		
530.7 3	10 2	3180.45+x	21/2$^-$	2649.87+x	19/2$^-$		
634.34 4	100 5	649.79+x	13/2$^+$	15.44+x	9/2$^+$	Q	DCO=1.1 1 I_γ: part of a doublet structure.
668.19 10	31 4	1171.81+x	11/2$^-$	503.69+x	7/2$^-$		
678.03 11	23 4	812.18+x	9/2$^-$	134.15+x	5/2$^-$	Q	DCO=1.1 1
727.95 9	31 2	1899.74+x	15/2$^-$	1171.81+x	11/2$^-$		
745.75 11	44 7	1557.90+x	13/2$^-$	812.18+x	9/2$^-$		
750.16 8	50 4	2649.87+x	19/2$^-$	1899.74+x	15/2$^-$	Q	DCO=1.2 1
768.50 15	27 4	2326.43+x	17/2$^-$	1557.90+x	13/2$^-$	Q	DCO=1.4 2
803.9 2	17 3	2361.84+x	17/2	1557.90+x	13/2$^-$	Q	DCO=1.2 2
818.4 5	7 2	3180.45+x	21/2$^-$	2361.84+x	17/2		
841.25 4	82 5	1491.05+x	17/2$^+$	649.79+x	13/2$^+$	Q	DCO=1.2 1
854.0 2	38 8	3180.45+x	21/2$^-$	2326.43+x	17/2$^-$	(Q)	DCO=1.5 4
872.44 7	51 3	3522.32+x	23/2$^-$	2649.87+x	19/2$^-$	Q	DCO=1.3 1
995.99 5	81 5	2487.05+x	21/2$^+$	1491.05+x	17/2$^+$	Q	DCO=1.2 1
998.11 14	55 12	4178.6+x	(25/2$^-$)	3180.45+x	21/2$^-$		
1020.83 9	55 6	4543.16+x	(27/2$^-$)	3522.32+x	23/2$^-$		
1023.89 5	74 5	3510.94+x	25/2$^+$	2487.05+x	21/2$^+$	Q	DCO=1.1 1
1057.95 6	48 4	4568.90+x	29/2$^+$	3510.94+x	25/2$^+$	Q	DCO=1.1 1
1093.98 10	50 4	5637.14+x	(31/2$^-$)	4543.16+x	(27/2$^-$)	Q	DCO=1.4 1 DCO= 1.4 1.
1096.2 2	24 9	6386.1+x	(33/2$^-$)	5289.9+x	(29/2$^-$)		
1102.23 12	37 3	6739.38+x	(35/2$^-$)	5637.14+x	(31/2$^-$)		
1111.35 14	26 3	5289.9+x	(29/2$^-$)	4178.6+x	(25/2$^-$)	Q	DCO=1.6 2
1122.1 2	25 3	7508.2+x	(37/2$^-$)	6386.1+x	(33/2$^-$)		
1156.2[‡] 4	19 4	1171.81+x	11/2$^-$	15.44+x	9/2$^+$		E_γ: 1156.3 3 in table 3 of 1999Jo01.
1158.5[‡] 3	5 3	2649.87+x	19/2$^-$	1491.05+x	17/2$^+$		E_γ: 1158.7 3 in table 3 of 1999Jo01.
1210.60 14	27 2	7950.0+x	(39/2$^-$)	6739.38+x	(35/2$^-$)		
1225.15 8	40 5	5794.06+x	33/2$^+$	4568.90+x	29/2$^+$	Q	DCO=1.4 1
1249.8[‡] 3	15.0 11	1899.74+x	15/2$^-$	649.79+x	13/2$^+$	(D)	DCO=0.7 4 E_γ: 1250.0 2 in table 3 of 1999Jo01.
1287.1 2	23 3	8795.4+x	(41/2$^-$)	7508.2+x	(37/2$^-$)		
1416.6 2	20 2	9366.6+x	(43/2$^-$)	7950.0+x	(39/2$^-$)		
1421.94 12	37 5	7216.01+x	37/2$^+$	5794.06+x	33/2$^+$	Q	DCO=1.1 1
1469.3 3	20 5	10264.7+x	(45/2$^-$)	8795.4+x	(41/2$^-$)		
1523.6 3	26 4	8739.6+x	41/2$^+$	7216.01+x	37/2$^+$	Q	DCO=1.3 2
1578.2 4	16 3	10317.8+x	(45/2$^+$)	8739.6+x	41/2$^+$		
1643.7 3	14.6 13	11010.3+x	(47/2$^-$)	9366.6+x	(43/2$^-$)		
1697.8 4	11 4	11962.5+x	(49/2$^-$)	10264.7+x	(45/2$^-$)		
1744 1	7 1	8960.0+x	(41/2$^+$)	7216.01+x	37/2$^+$		
1906.2 7	5.5 9	12916.5+x	(51/2$^-$)	11010.3+x	(47/2$^-$)		
1943.5 12	8 3	13906.0+x	(53/2$^-$)	11962.5+x	(49/2$^-$)		
2228.0 14	3.9 6	15144.6+x?	(55/2$^-$)	12916.5+x	(51/2$^-$)		

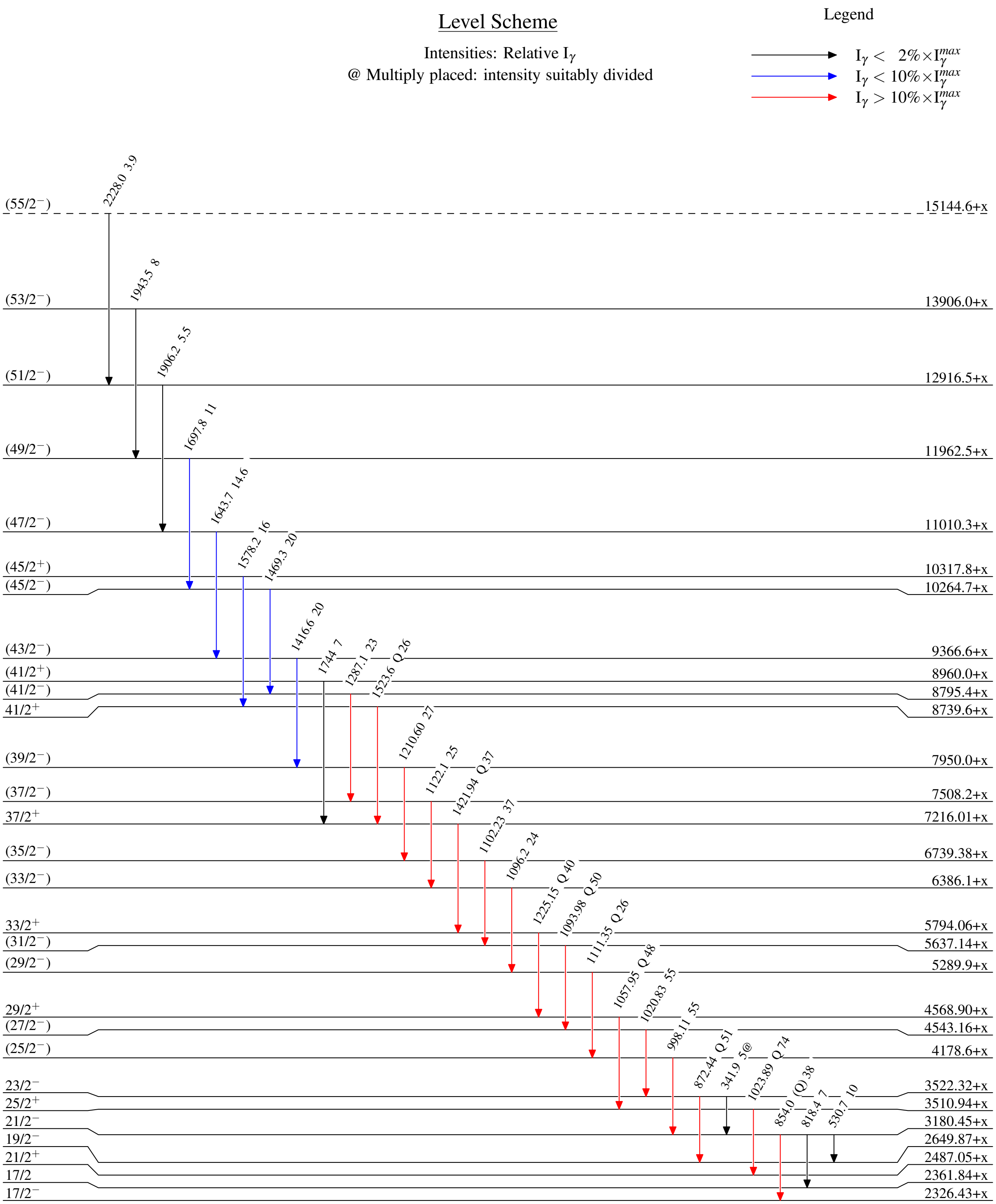
[†] 1999Jo01 assign E2 to ΔJ=2, Q transitions and M1 or M1+E2 to ΔJ=1 transitions based on DCO ratios. For other transitions where no DCO ratios are available, 1999Jo01 assign multipolarities from band assignments. The evaluators assign mult=Q to ΔJ=2 transitions and D or D+Q for ΔJ=1 transitions only when DCO data are available.

[‡] Dipole moment D_0=0.035 fm 6 for 1156.2γ, 0.034 fm 2 for 1249.8γ and 0.018 fm 7 for 1158.5γ suggest octupole correlations.

[#] Multiply placed with intensity suitably divided.

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

$^{58}Ni(^{40}Ca,3\alpha p\gamma)$ 1999Jo01,1993Mi11,1991Gr16



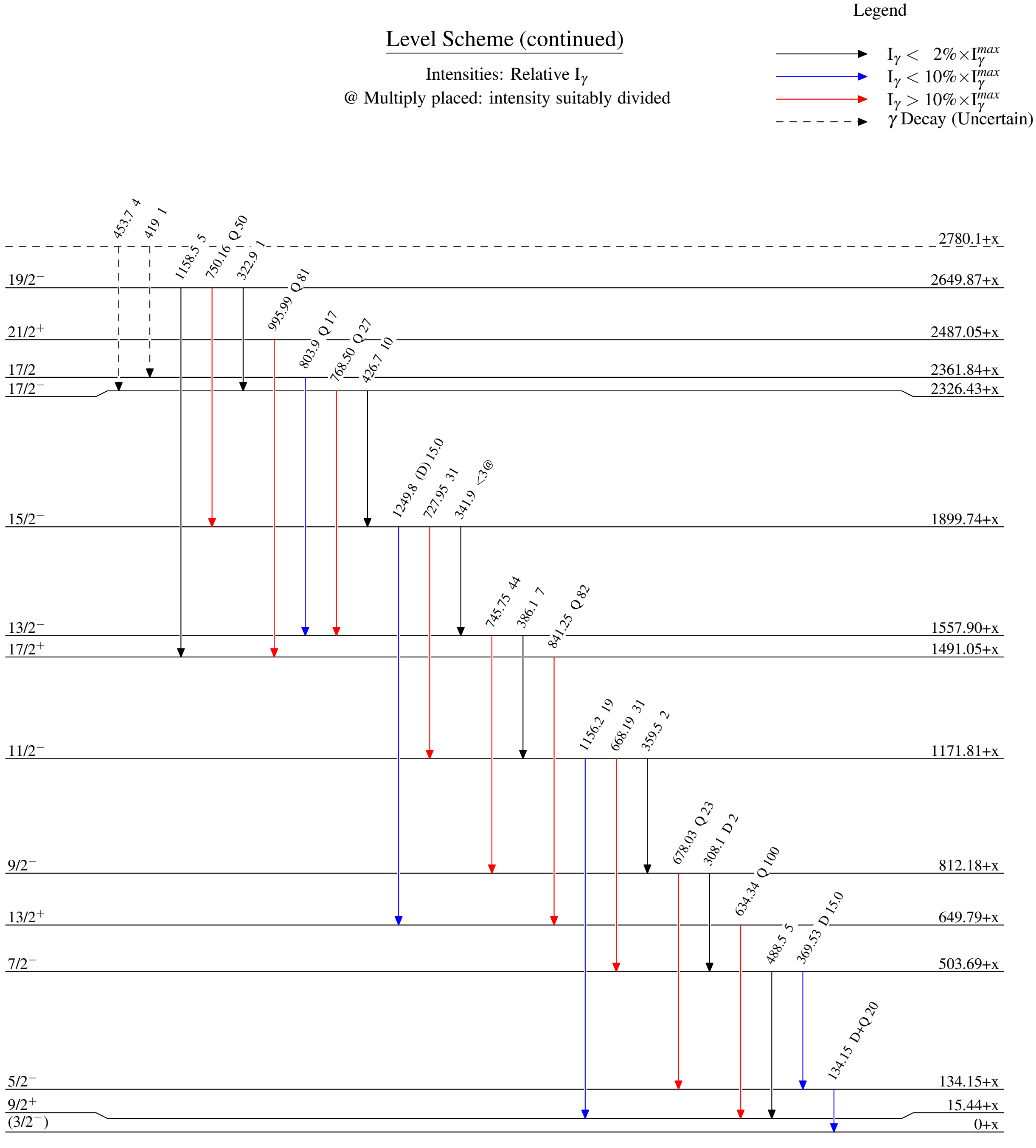
$^{85}_{41}Nb_{44}$

$^{58}Ni(^{40}Ca,3\alpha p\gamma)$ 1999Jo01,1993Mi11,1991Gr16

Level Scheme (continued)

Intensities: Relative I_γ

@ Multiply placed: intensity suitably divided



$^{85}_{41}Nb_{44}$

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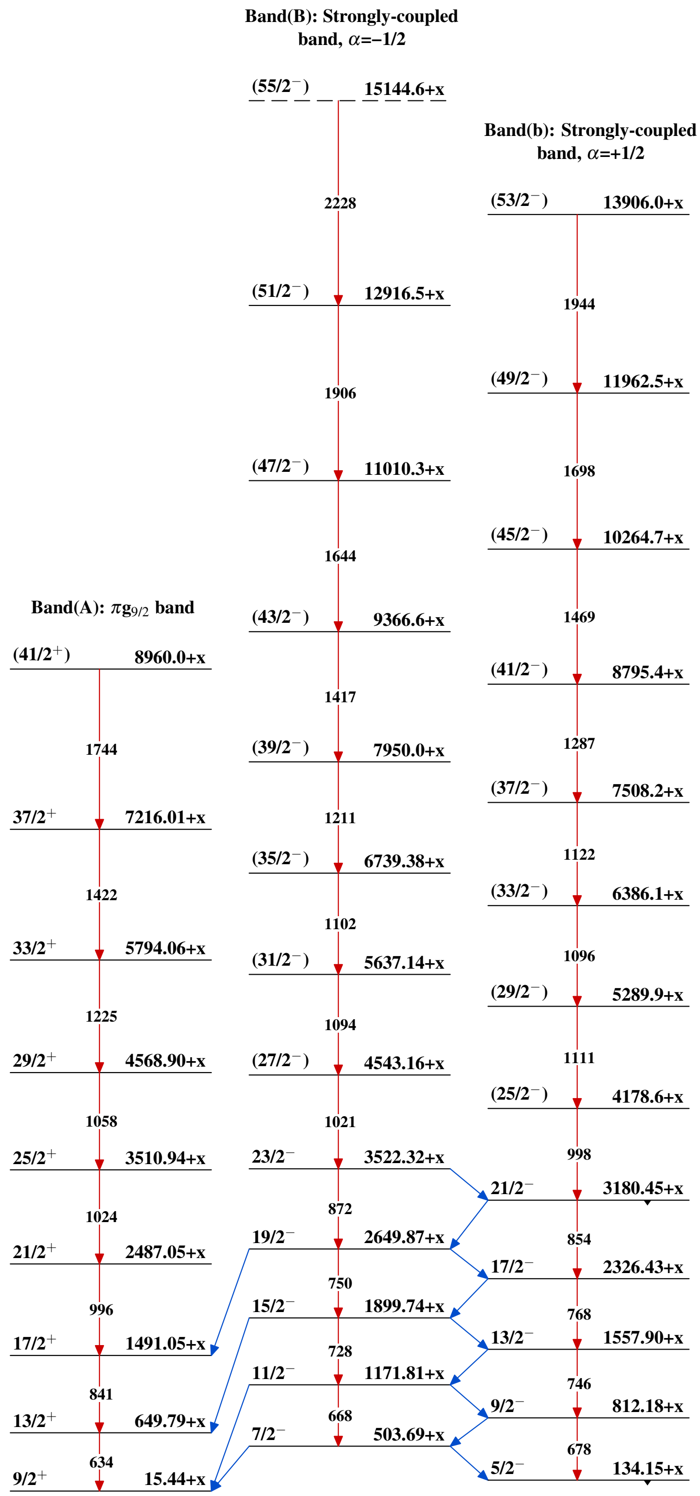

$^{85}_{41}Nb_{44}$