^{70}Ge(^{32}S,3pnγ) 1998Ch04

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Jun Chen, Balraj Singh	NDS 164, 1 (2020)	15-Feb-2020

1998Ch04: E=128 MeV ^{32}S beam was produced from the 14-UD pelletron accelerator at TIFR, Bombay. Target was about 800 μg/cm^2 (about 95% enriched) ^{70}Ge on 10 mg/cm^2 gold. γ rays were detected with five Compton-suppressed HPGe detectors and radioactivity background was suppressed using a 14-element NaI(Tl) filter. Measured Eγ, Iγ, $\gamma\gamma$-coin, $\gamma(\theta)$, $\gamma\gamma(\theta)$(DCO). Deduced levels, J, π. Comparisons with particle-rotor model (PRM) calculations.

The level scheme including level energies and spins and placements of γ transitions differs significantly from the largely-extended decay scheme proposed by 2014Ku04 in ^{75}As(^{28}Si,2p3nγ), with the latter adopted in Adopted Levels and given in comments. It also differs significantly from that proposed by 1998Gh07 in ^{65}Cu(^{36}S,3nγ).

Note that the level scheme proposed in 1998Ch04 is based on the 841 level which was proposed by 1983Be63 via (α,npγ) and (d,3nγ) based on the assumption of the 841γ proceeding to the (2)$^+$ ground state, while level energies and spins in Adopted Levels are based on the placement of 841γ to a level at E=56 with J^π=(5$^+$) proposed by 2014Ku04 in ^{75}As(^{28}Si,2p3nγ) based on their extended level scheme.

^{98}Rh Levels

E(level)[†]	J$^\pi$[@]	Comments
0?	(2)$^+$	The ground state would not be seen if 841γ proceeds to the isomer. J$^\pi$: from Adopted Levels.
841[‡] *1*	(4$^+$)[‡]	
1566[‡] *2*	(6$^+$)[‡]	
2560[‡] *2*	(8$^+$)[‡]	
2973[‡] *2*	(7$^-$)	J$^\pi$: (11$^+$) in Adopted Levels. 1998Ch04 assigned (7$^-$) based on the argument that the estimated partial lifetime (about 2 ps) for 1407 transition was found to be two orders of magnitude higher than the Weisskopf estimate for M1 transition and therefore was too large to be for M1 but possible for E1 transition. However, the assignment of Mult=E1 but not M1 cannot be justified by this argument in evaluators′ point of view.
3022?[#] *2*	(9$^+$)	
3517?[#] *2*	(8$^-$)	
3540[‡] *2*	(10$^+$)[‡]	
3804[‡] *2*	(9$^-$)	J$^\pi$: (13$^+$) in Adopted Levels.
3814?[#] *2*	(11$^+$)	
4353[‡] *2*	(10$^-$)	J$^\pi$: (14$^+$) in Adopted Levels; 4359, (11$^+$) level in 1998Gh07.
5034[‡] *2*	(11$^-$)	J$^\pi$: (15$^+$) in Adopted Levels.
5194?[#] *2*	(13$^+$)	
5489[‡] *2*	(12$^-$)	J$^\pi$: (16$^+$) in Adopted Levels; 5496, (13$^+$) in 1998Gh07.
6127?[#] *3*	(15$^+$)	
6345[‡] *2*	(13$^-$)	J$^\pi$: (17$^-$) in Adopted Levels.
6346?[#] *3*	(15$^+$)	
6851[‡] *2*	(14$^-$)	J$^\pi$: (17$^+$) in Adopted Levels; 6859, (15$^+$) level in 1998Gh07.
7474?[#] *3*	(17$^+$)	
7810?[#] *2*	(15$^-$)	
8283[‡] *2*	(16$^-$)	8293, (17$^+$) level in 1998Gh07.
8960?[#] *3*	(19$^+$)	J$^\pi$: (15$^-$) in 1998Gh07.
9811?[#] *3*	(18$^-$)	

[†] From least-squares fit to γ-ray energies, assuming Δ(Eγ)=1 keV.
[‡] Level energies and spins in Adopted Levels are higher by 56 keV and 3 units, respectively.

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^{70}Ge(^{32}S,3pnγ) 1998Ch04 (continued)

^{98}Rh Levels (continued)

Level is considered as questionable (by evaluators) since the deexciting transition was either placed differently or not seen in other studies in 2014Ku04 and 1998Gh07.
@ Proposed by 1998Ch04 based on $\gamma\gamma(\theta)$(DCO), unless otherwise noted.

γ(^{98}Rh)

E_γ	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.‡	Comments
264	22 *1*	3804	(9^-)	3540	(10^+)	(D)	DCO=0.88 *12*
287	5 *1*	3804	(9^-)	3517?	(8^-)	D	DCO=0.40 *12*
413	5 *1*	2973	(7^-)	2560	(8^+)	D	DCO=0.37 *15* Mult.: ΔJ=1 here is inconsistent with ΔJ=0 transition from $\gamma\gamma$(DCO) in 1998Gh07 and 2014Ku04.
455	12 *1*	5489	(12^-)	5034	(11^-)	D	DCO=0.39 *10* γ placed from a 4001 level in 1998Gh07. Mult.: inconsistent with Q from $\gamma\gamma$(DCO) in 1998Gh07 but consistent with M1 from $\gamma\gamma$(DCO) and $\gamma\gamma$(pol) in 2014Ku04.
462	25 *2*	3022?	(9^+)	2560	(8^+)	D	DCO=0.45 *13* γ placed from 4232, (13^-) level in Adopted Levels; from 3243, (10^-) level in 1998Gh07.
506	5 *1*	6851	(14^-)	6345	(13^-)	D	DCO=0.42 *18*
544	10 *1*	3517?	(8^-)	2973	(7^-)	D	DCO=0.41 *16* γ placed from 3563, (11^+) level in Adopted Levels.
549	25 *2*	4353	(10^-)	3804	(9^-)	D	DCO=0.38 *8*
681	7 *1*	5034	(11^-)	4353	(10^-)	D	DCO=0.40 *15*
725	92 *3*	1566	(6^+)	841	(4^+)	Q#	DCO=1.05 *11*
792	22 *2*	3814?	(11^+)	3022?	(9^+)	Q	DCO=1.03 *14* γ placed from 5024, (15^-) level in Adopted Levels; from a 4036, (11^-) level in 1998Gh07. Mult.: inconsistent with D (ΔJ=1) from $\gamma\gamma$(DCO) in 1998Gh07 but consistent with E2 from $\gamma\gamma$(DCO) and $\gamma\gamma$(pol) in 2014Ku04.
813	10 *1*	4353	(10^-)	3540	(10^+)	(D)	DCO=0.98 *16* Mult.: inconsistent with Q (ΔJ=2) from $\gamma\gamma$(DCO) in 1998Gh07 but consistent M1 from $\gamma\gamma$(DCO) and $\gamma\gamma$(pol) in 2014Ku04.
831	13 *1*	3804	(9^-)	2973	(7^-)	Q	DCO=1.08 *18*
836	5 *1*	4353	(10^-)	3517?	(8^-)		E_γ: placed from the 4411, (14^+) level in Adopted Levels; not seen in 1998Gh07.
841	100	841	(4^+)	0?	$(2)^+$	Q#	
856	17 *2*	6345	(13^-)	5489	(12^-)	D	DCO=0.44 *11* γ placed from 7717, (16^+) level in 1998Gh07.
933	11 *1*	6127?	(15^+)	5194?	(13^+)	Q	DCO=1.10 *14* γ placed from 7337, (19^-) level in Adopted Level; from a 6350, (13^-) level in 1998Gh07. Mult.: inconsistent with D (ΔJ=1) from $\gamma\gamma$(DCO) in 1998Gh07 but consistent with E2 from $\gamma\gamma$(DCO) and $\gamma\gamma$(pol) in 2014Ku04.
980	45 *2*	3540	(10^+)	2560	(8^+)	Q#	DCO=1.16 *14* Mult.: inconsistent with D (ΔJ=1) from $\gamma\gamma$(DCO) in 1998Gh07 but consistent with E2 from $\gamma\gamma$(DCO) and $\gamma\gamma$(pol) in 2014Ku04.
994	74 *2*	2560	(8^+)	1566	(6^+)	Q#	DCO=1.14 *12*
1136	31 *2*	5489	(12^-)	4353	(10^-)	Q	DCO=0.98 *16*
1152	11 *1*	6346?	(15^+)	5194?	(13^+)	Q	DCO=1.08 *15* γ placed from 3769, (12^+) level in Adopted Level; from a 8848 level in 1998Gh07. Mult.: inconsistent with D from $\gamma\gamma$(DCO) in 2014Ku04.

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^{70}Ge(^{32}S,3pnγ) 1998Ch04 (continued)

γ(^{98}Rh) (continued)

E_γ	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.‡	Comments
1230†@	2 *1*	5034	(11$^-$)	3804	(9$^-$)		
1311†@	8 *2*	6345	(13$^-$)	5034	(11$^-$)		
1347	8 *2*	7474?	(17$^+$)	6127?	(15$^+$)	(Q)	DCO=1.10 *30* γ placed from 8685, (21$^-$) level in Adopted Level; from a 7697, (14$^-$) level in 1998Gh07.
1362	24 *3*	6851	(14$^-$)	5489	(12$^-$)	(Q)	DCO=0.94 *20* Mult.: consistent with Q from $\gamma\gamma$(DCO) in 1998Gh07 but inconsistent with D in 2014Ku04.
1380	21 *3*	5194?	(13$^+$)	3814?	(11$^+$)	Q	DCO=1.14 *20* γ placed from 6404, (17$^-$) level in Adopted Levels; from 5417, (12$^-$) level in 1998Gh07, Mult.: inconsistent with D (ΔJ=1) from $\gamma\gamma$(DCO) in 1998Gh07 but consistent with E2 from $\gamma\gamma$(DCO) and $\gamma\gamma$(pol) in 2014Ku04.
1407	17 *2*	2973	(7$^-$)	1566	(6$^+$)	D	DCO=0.47 *25* Mult.: inconsistent with Q (ΔJ=2) from $\gamma\gamma$(DCO) in 1998Gh07 and E2 (ΔJ=2) from $\gamma\gamma$(DCO) and $\gamma\gamma$(pol) in 2014Ku04.
1432	10 *2*	8283	(16$^-$)	6851	(14$^-$)	(Q)	DCO=0.89 *30*
1465†@	5 *1*	7810?	(15$^-$)	6345	(13$^-$)		
1486	5 *1*	8960?	(19$^+$)	7474?	(17$^+$)		γ placed from 10171, (23$^-$) level in Adopted Level; from a 9185, (15$^-$) level in 1998Gh07.
1494	11 *2*	5034	(11$^-$)	3540	(10$^+$)	D	DCO=0.44 *30* γ placed from a 5496 level in 1998Gh07. Mult.: inconsistent with Q (ΔJ=2) from $\gamma\gamma$(DCO) in 1998Gh07 and 2014Ku04.
1528		9811?	(18$^-$)	8283	(16$^-$)		E_γ: from figure 2 of 1998Ch04. Placed from 6909, (17$^+$) level in Adopted level.

† Transition is considered as questionable (by evaluators) since it was not seen in other γ-spectroscopy studies in 2014Ku04 and 1998Gh07.
‡ From R(DCO)≈1 for ΔJ=2, Q (or for rare cases of ΔJ=0, dipole) and ≈0.5 for ΔJ=1, dipole (1998Ch04).
# Identified as stretched Q transition based on $\gamma(\theta)$: A_2≈+0.30, A_4≈=−0.10 (1998Ch04).
@ Placement of transition in the level scheme is uncertain.

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Level Scheme

Intensities: Relative I_γ

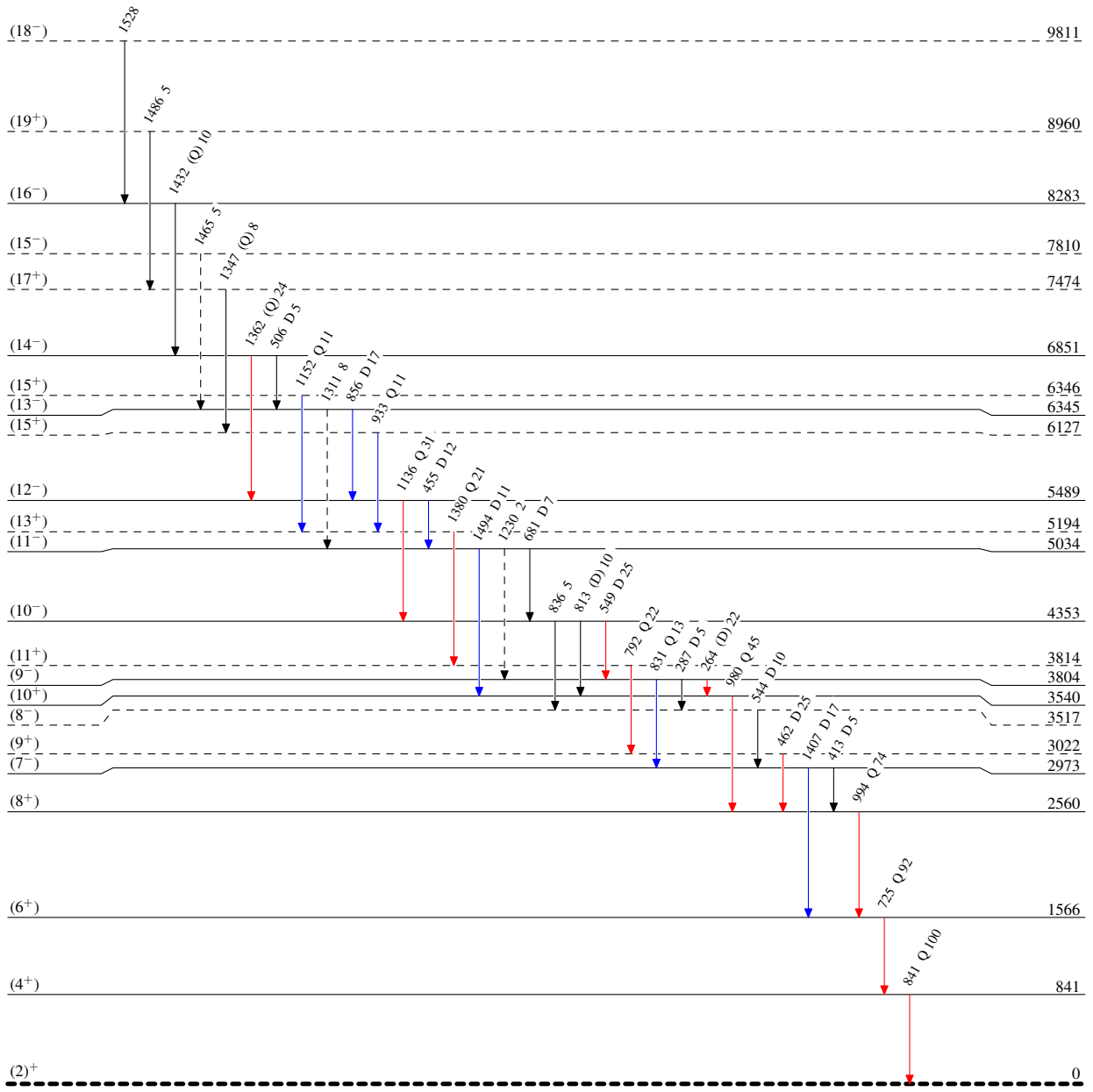
Legend

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

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

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

γ Decay (Uncertain)



$^{98}_{45}Rh_{53}$