^{71}Ga(^{3}He,t),(^{3}He,tγ) 2015Fr02,1998Ej03,1988Ch25

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen	NDS 188,1 (2023)	17-Jan-2023

Target $J^{\pi}=3/2^{-}$.

The ^{71}Ga(^{3}He,t) studies are relevant to determination of neutrino capture rates in ^{71}Ga, a detector of solar neutrino flux.

2015Fr02 (also 2011Fr15): (^{3}He,t),E=420 MeV (450 MeV in 2011Fr15). Measured triton spectra, and angular distributions using Grand Raiden spectrometer with FWHM=45 keV at RCNP, Osaka cyclotron facility. DWBA analysis of $\sigma(\theta)$ data. Deduced B(GT) and solar-neutrino capture rates.

1998Ej03 (also 1996Fu06,1994Fu11): (^{3}He,t),(^{3}He,tγ),E=450 MeV from RCNP ring cyclotron. Measured triton energies at 0-2° in the forward direction in singles and coin with γ rays. Tritons were analyzed by GRAND RAIDEN magnetic spectrometer with FWHM=300-400 keV. The γ rays were detected using six NaI(Tl) detectors with FWHM=100-300 keV. The target was enriched and 2 mg/cm^2 thick. The CASCADE and GEANT codes were used to evaluate and simulate γ-spectrum. Deduced Gamow-Teller strengths and solar neutrino capture rates.

1988Ch25: (^{3}He,tγ),(^{3}He,t): E=29.9 MeV. Measured E(t) in singles (at 0°) and coin with γ rays using Q3D magnetic spectrometer for tritons and NaI(Tl) detector for γ rays. 99.8% enriched target. Detailed study of the isobaric analog state at 8.9 MeV.

1984Ko10 (from the same group as 1988Ch25): (^{3}He,t) E=20.42 MeV. Measured triton spectra using Q3D spectrometer, deduced Q value and excited states in ^{71}Ge.

Not all the peaks shown in triton spectra of 1998Ej03 and 1984Ko10 are identified.

^{71}Ge Levels

B(GT)=2.88 *9* (1998Ej03) for 1580-7420 energy region.

E(level)[†]	J$^{\pi}$[‡]	B(GT)[#]	Comments
0	1/2^{-}	0.0852 *11*	dσ/dΩ(q=0)=0.786 mb/sr *9* (2015Fr02). Solar neutrino capture rate=109.8 SNU *13* (2015Fr02). B(GT)=0.0891 *13* (1998Ej03).
175 *1*	5/2^{-}	0.0034 *26*	dσ/dΩ(q=0)=0.071 mb/sr *4* (2015Fr02). Solar neutrino capture rate=1.2 SNU *7* (2015Fr02). B(GT)=0.0049 *18* (1998Ej03).
500 *1*	3/2^{-}	0.0176 *14*	dσ/dΩ(q=0)=0.171 mb/sr *4* (2015Fr02). Solar neutrino capture rate=2.7 SNU *2* (2015Fr02). B(GT)=0.0208 *21* (1998Ej03).
708 *1*	3/2^{-}	0.0011 *5*	dσ/dΩ(q=0)=0.018 mb/sr *1* (2015Fr02). Solar neutrino capture rate=0.03 SNU *1* (2015Fr02).
808 *1*	1/2^{-}	0.0229 *10*	E(level): 830 in 1998Ej03. dσ/dΩ(q=0)=0.210 mb/sr *4* (2015Fr02). Solar neutrino capture rate=0.61 SNU *7* (2015Fr02). B(GT)=0.0237 *23* (1998Ej03).
1096 *1*	3/2^{-}	0.0183 *17*	dσ/dΩ(q=0)=0.184 mb/sr *4* (2015Fr02). Solar neutrino capture rate=0.33 SNU *3* (2015Fr02). B(GT)=0.0233 *24* (1998Ej03). E(level): 1096 (1984Ko10), 1160 (1998Ej03).
1299 *1*	3/2^{-}	0.0133 *8*	dσ/dΩ(q=0)=0.126 mb/sr *2* (2015Fr02). Solar neutrino capture rate=0.17 SNU *1* (2015Fr02). B(GT)=0.0201 *23* (1998Ej03). E(level): 1299 (1984Ko10), 1360 in 1998Ej03 could be a composite of 1299 and 1378 keV peaks.
1378 *1*	5/2^{-}	0.0033 *4*	dσ/dΩ(q=0)=0.035 mb/sr *3* (2015Fr02). Solar neutrino capture rate=0.041 SNU *5* (2015Fr02).
1598 *1*	3/2^{-}	0.0011 *5*	dσ/dΩ(q=0)=0.018 mb/sr *2* (2015Fr02). Solar neutrino capture rate=0.013 SNU *6* (2015Fr02).
1744 *1*	3/2^{-}	0.0068 *2*	dσ/dΩ(q=0)=0.061 mb/sr *1* (2015Fr02). Solar neutrino capture rate=0.077 SNU *3* (2015Fr02).
1964 *1*	3/2^{-}	0.0012 *6*	dσ/dΩ(q=0)=0.020 mb/sr *2* (2015Fr02).

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^{71}Ga(^{3}He,t),(^{3}He,tγ) 2015Fr02,1998Ej03,1988Ch25 (continued)

^{71}Ge Levels (continued)

E(level)[†]	J$^{\pi}$[‡]	$T_{1/2}$	B(GT)[#]	Comments
				Solar neutrino capture rate=0.013 SNU *6* (2015Fr02).
2041 *1*	(3/2$^-$,5/2$^-$)		0.0181 *2*	dσ/dΩ(q=0)=0.187 mb/sr *3* (2015Fr02).
				Solar neutrino capture rate=0.187 SNU *6* (2015Fr02).
2145 *1*	(3/2$^-$,5/2$^-$)		0.0031 *6*	dσ/dΩ(q=0)=0.036 mb/sr *1* (2015Fr02).
				Solar neutrino capture rate=0.031 SNU *6* (2015Fr02).
2276 *1*	(3/2$^-$,5/2$^-$)		0.0036 *9*	dσ/dΩ(q=0)=0.046 mb/sr *1* (2015Fr02).
				Solar neutrino capture rate=0.035 SNU *9* (2015Fr02).
2352 *1*	(3/2$^-$,5/2$^-$)		0.0130 *28*	dσ/dΩ(q=0)=0.157 mb/sr *2* (2015Fr02).
				Solar neutrino capture rate=0.12 SNU *3* (2015Fr02).
2435 *1*	(3/2$^-$,5/2$^-$)		0.0123 *17*	dσ/dΩ(q=0)=0.133 mb/sr *2* (2015Fr02).
				Solar neutrino capture rate=0.11 SNU *2* (2015Fr02).
2642 *1*	(5/2$^-$)		0.0054 *10*	dσ/dΩ(q=0)=0.062 mb/sr *1* (2015Fr02).
				Solar neutrino capture rate=0.046 SNU *9* (2015Fr02).
2778 *1*	(5/2$^-$)		0.0058 *12*	dσ/dΩ(q=0)=0.070 mb/sr *1* (2015Fr02).
				Solar neutrino capture rate=0.048 SNU *10* (2015Fr02).
2806 *1*	(5/2$^-$)		0.0172 *12*	dσ/dΩ(q=0)=0.165 mb/sr *3* (2015Fr02).
				Solar neutrino capture rate=0.140 SNU *11* (2015Fr02).
2888 *1*	(5/2$^-$)		0.0019 *7*	dσ/dΩ(q=0)=0.028 mb/sr *4* (2015Fr02).
				Solar neutrino capture rate=0.015 SNU *6* (2015Fr02).
2924 *1*	(5/2$^-$)		0.0033 *14*	dσ/dΩ(q=0)=0.052 mb/sr *1* (2015Fr02).
				Solar neutrino capture rate=0.026 SNU *11* (2015Fr02).
325×10^1 *25*			0.110 *10*	E(level): 3.0-3.5 MeV energy range.
				Solar neutrino capture rate=0.77 SNU *7* (2015Fr02).
375×10^1 *25*			0.165 *16*	E(level): 3.5-4.0 MeV energy range.
				Solar neutrino capture rate=0.96 SNU *10* (2015Fr02).
425×10^1 *25*			0.191 *17*	E(level): 4.0-4.5 MeV energy range.
				Solar neutrino capture rate=0.92 SNU *9* (2015Fr02).
475×10^1 *25*			0.209 *16*	E(level): 4.5-5.0 MeV energy range.
				Solar neutrino capture rate=0.82 SNU *7* (2015Fr02).
525×10^1 *25*			0.191 *18*	E(level): 5.0-5.5 MeV energy range.
				Solar neutrino capture rate=0.61 SNU *6* (2015Fr02).
575×10^1 *25*			0.265 *19*	E(level): 5.5-6.0 MeV energy range.
				Solar neutrino capture rate=0.67 SNU *5* (2015Fr02).
625×10^1 *25*			0.338 *18*	E(level): 6.0-6.5 MeV energy range.
				Solar neutrino capture rate=0.66 SNU *4* (2015Fr02).
675×10^1 *25*			0.315 *17*	E(level): 6.5-7.0 MeV energy range.
				Solar neutrino capture rate=0.47 SNU *3* (2015Fr02).
721×10^1 *21*			0.289 *16*	E(level): 7.0-7.42 MeV energy range.
				Solar neutrino capture rate=0.33 SNU *2* (2015Fr02).
794×10^1 *52*			0.645 *39*	E(level): 7.42-8.46 MeV energy range.
				B(GT)=0.74 *10* (1998Ej03).
8913 *5*	3/2$^-$	≈50 keV		%n≈100 (1988Ch25)
				B(Fermi)=0.0900 *22* (2011Fr15).
				53% *9* decay proceeds through neutron decay to 1.22 MeV state in ^{70}Ge with subsequent observation of 1040γ in ^{70}Ge.
				The γ decay of IAS to ^{71}Ga through single high-energy γ ray or a cascade of two γ rays is determined to be less than 11% (1988Ch25).
				E(level): from 2011Fr15 and 2015Fr02, with uncertainty estimated as 5 keV by evaluators based on FWHM=45 keV. Other: 8932 *13* (1988Ch25).
				J$^{\pi}$: IAS of 3/2$^-$ g.s. in ^{71}Ga.
				Γ from 2011Fr15.
				dσ/dΩ(q=0)=9.04 mb/sr *12* (2011Fr15).
11.75×10^3				Gamow-Teller giant resonance (GTGR), wide structure from 10-16

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^{71}Ga(^{3}He,t),(^{3}He,tγ) 2015Fr02,1998Ej03,1988Ch25 (continued)

^{71}Ge Levels (continued)

E(level)[†]	Comments
	MeV, peaking at ≈11.75 MeV (2015Fr02,2011Fr15).
18.0×10^{3}	Interpreted as $T_{>}$ component of the GTGR (2015Fr02,2011Fr15).

† From 2015Fr02, unless otherwise noted.
‡ States populated by Gamow-Teller excitations are expected to be $1/2^{-}$,$3/2^{-}$ or $5/2^{-}$. J^{π} assignments are as given in Table I of 2015Fr02, which are based on literature assignments for low-lying levels, and from $\sigma(\theta)$ data with comparison to DWBA calculations in the higher energy region.
# From 2015Fr02.