^{76}Ge(^{3}He,d) 1976Sc13,2009Ka06

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh	ENSDF	30-Sep-2020

1976Sc13: E=23 MeV. Enriched target, measured $\sigma(\theta)$, Q3D spectrograph with FWHM=6 keV used below 1100 keV and multigap magnetic spectrograph with FWHM≈30 keV used above 1100 keV. DWBA analysis. Cross section uncertainty ≈15%.

1974Be54, E=17 MeV, enriched target, measured $\sigma(\theta)$, multiangle spectrograph, FWHM=18-24 keV. DWBA analysis. Cross section uncertainty ≈10%. Levels reported up to 3560-keV excitation.

2009Ka06, 2008KaZT: E=73 MeV beam provided by the AVF cyclotron at RCNP, Osaka. Enriched target. The outgoing deuterons were detected and analyzed with Grand Raiden magnetic spectrograph, with an angular aperture of ±1.1°. FWHM=18 keV. Levels up to 2655 keV. Measured precise absolute cross sections and relative cross sections where these are maximum for the relevant L transfer, angular distributions. Spectroscopic factors were deduced from analysis of cross section data by DWBA calculations using PTOLEMY code and six different sets of optical-model potential parameters and two bound-state potential parameters. The experiments were designed to map out the occupancies of valence proton orbitals in the ground states of ^{74}Ge, ^{76}Ge, ^{76}Se and ^{78}Se by precise measurements of absolute cross sections and relative cross sections at the angles where these are maximum in angular distributions in single-particle transfer reactions. Uncertainty in cross sections: statistical uncertainty of 1% for strong peaks; systematic uncertainties of 5% in absolute values and 3% in relative values. Multiplets have larger uncertainties.

Measured cross sections (2008KaZT)

Level keV	dσ/dΩ(4.5°) mb/sr	dσ/dΩ(8°) mb/sr	dσ/dΩ(12°) mb/sr
0	4.47 a	1.43	0.85
195	4.28 ab	1.45 b	0.91 b
215	b	b	b
264	2.49	2.27 a	1.24
475	3.13	3.45	3.12 a
504	4.32 a	1.37	0.76
785	0.17	0.20	0.17
875	0.40	0.20	0.11
1054	0.84 a	0.41	0.19
1654	0.28 *4* a	0.073	0.049
1654	0.19	0.18	0.15 *3* a
1971	≤0.4		
1971	1.35	1.033	0.86 a
2335	0.26 a	0.21	0.15
2372	0.42	0.34	0.17
2516	0.39	0.43	0.30 a
2623	0.18 *3* a	0.048	0.032
2623	0.12	0.11	0.09 *2* a
2655	0.45 a	0.12	0.090

a: cross section used to deduce the spectroscopic factors. Systematic uncertainties are 5% in absolute values and 3% in relative values. Statistical uncertainties are 1% for strong peaks, larger for multiplets.

b: total cross section of 195+215 group is given with the 195 level.

^{77}As Levels

E(level)†	L‡	(2J+1)C^{2}S#	Comments
0	1&	0.97@	(2J+1)C^{2}S: 1.06 (1976Sc13), 0.73 (1974Be54). Additional information 1.
192.6 *25*	1&	0.07	(2J+1)C^{2}S: 0.93 (2008KaZT) combined for 192.6+214.9 unresolved group with L=1 for the doublet; 0.74 for the doublet (1974Be54).

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^{76}Ge(^{3}He,d) 1976Sc13,2009Ka06 (continued)

^{77}As Levels (continued)

E(level)†	L‡	(2J+1)C^{2}S#	Comments
214.9 *8*	1&	0.81	Additional information 2.
265.1 *15*	3&	1.90@	(2J+1)C^{2}S: 2.15 (1976Sc13), 2.05 (1974Be54). Additional information 3.
475.0 *13*	4&	3.66@	(2J+1)C^{2}S: 3.73 (1976Sc13), 2.61 (1974Be54). Additional information 4.
503.0 *9*	1&	0.94@	(2J+1)C^{2}S: for 1/2$^-$. Others: 0.82 (1976Sc13), 0.76 (1974Be54). Additional information 5.
628.6 *17*	2&	0.46	(2J+1)C^{2}S: 0.34 (1974Be54). dσ/dΩ(max)=0.34 mb/sr (1974Be54).
781 *5*	3		L: from 2008KaZT. Additional information 6.
875[a] *5*			
1052 *5*	1&	0.18@	(2J+1)C^{2}S: 0.20 (1976Sc13), 0.16 (1974Be54). Additional information 7.
1158[a] *5*	0	0.03	
1194 *5*	3	0.47	E(level): 1974Be54 report 1201 *7* with L=0, (2J+1)C^{2}S=0.04; dσ/dΩ(max)=0.18 mb/sr. A level at 1204 with L=0 is also reported in (d,^{3}He). It is possible that the 1194 level is a doublet with two components, one with L=3 and the other with L=0.
1520[a] *5*	2	0.12	
1618[a] *5*	1+3	0.08+0.22	
1652 *5*	1+4&	0.062+0.15@	E(level): 1974Be54 report 1674 *7* with L=1 and (2J+1)C^{2}S=0.08; dσ/dΩ(max)=0.17 mb/sr. (2J+1)C^{2}S: angle-to-angle ratios of cross sections were used in 2008KaZT to assign separate cross sections to the two components of the doublet. Other: 0.09 for L=1, 0.16 for L=4 (1976Sc13).
1760[a] *10*			
1825[a] *10*			
1960 *10*	4(+0)	1.09+0.01	E(level): partly contributed by ^{75}As. 1974Be54 report 1998 *7* with L=4, (2J+1)C^{2}S=1.17; dσ/dΩ(max)=0.16 mb/sr. (2J+1)C^{2}S: 0.87 (2008KaZT) for a 1971 group analyzed as L=4 transition.
2098 *10*	0+2	0.03+0.04	E(level): 1974Be54 report 2118 *10* with L=0, (2J+1)C^{2}S=0.06; dσ/dΩ(max)=0.23 mb/sr.
2195 *10*	1	0.07	E(level): partly contributed by ^{75}As, 1974Be54 report 2212 *10*; dσ/dΩ(max)=0.11 mb/sr.
2335 *10*	1	0.058@	L: from 2008KaZT and 1974Be54. (2J+1)C^{2}S: 0.05 (1974Be54), level not in 1976Sc13. Additional information 8.
2372	(2)		E(level): from 2008KaZT only. L: not 1,3 or 4 from σ(θ) (2008KaZT), possible L=2.
2410[b] *10*			dσ/dΩ(max)=0.11 mb/sr (1974Be54).
2516 *10*	4&	0.29@	E(level): 1974Be54 report 2541 *10*; dσ/dΩ(max)=0.10 mb/sr. (2J+1)C^{2}S: 0.55 (1976Sc13).
2623 *10*	1+4&	0.041,0.084@	(2J+1)C^{2}S: 0.05 for L=1, 0.14 for L=4 (1976Sc13). E(level),(2J+1)C^{2}S,L: 1974Be54 report a level at 2637 with L=1+3, (2J+1)C^{2}S=0.03 for L=1 and 0.30 for L=3; dσ/dΩ(max)=0.09 mb/sr for L=1 and 0.05 for L=3.
2655 *5*	1&	0.10@	(2J+1)C^{2}S: 0.15 (1976Sc13), 0.12 (1974Be54). Additional information 9.
2750[b] *10*	2	0.07	dσ/dΩ(max)=0.11 mb/sr (1974Be54).
2846[b] *10*			dσ/dΩ(max)=0.12 mb/sr (1974Be54).
2934[a] *10*	2+4	0.04+0.19	
3009[a] *5*	3,4	0.13,0.19	E(level),L,(2J+1)C^{2}S: 1974Be54 report 2964 *10* with L=(1), (2J+1)C^{2}S=0.07 and dσ/dΩ(max)=0.19 mb/sr.
3086 *10*	1+4	0.06+0.22	E(level),L,(2J+1)C^{2}S: 1974Be54 report 3113 *10* with L=(1), (2J+1)C^{2}S=0.08 which probably corresponds to 3086 level and not 3118; dσ/dΩ(max)=0.25 mb/sr.

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^{76}Ge(^{3}He,d) 1976Sc13,2009Ka06 (continued)

^{77}As Levels (continued)

E(level)†	L‡	(2J+1)C^{2}S#	Comments
3118[a] *5*	(2)	0.04	
3190[c] *10*	0+3,4	0.01+0.05,0.1	E(level),L,(2J+1)C^{2}S: 1974Be54 report 3215 *10* level with L=0, (2J+1)C^{2}S=0.02 and dσ/dΩ(max)=0.23 mb/sr.
3258[a] *10*	(1+4)	0.01+0.08	
3312[a] *10*	2	0.04	
3376[ad] *10*	1+4	0.03+0.20	
3483 *10*	0	0.02	dσ/dΩ(max)=0.17 mb/sr for 3516 *10* (1974Be54).
3559[b] *10*	1	0.13	dσ/dΩ(max)=0.43 mb/sr (1974Be54).
3593 *10*	0+2	0.01+0.04	
3633 *15*	0	0.02	
3676 *15*	0+4	0.01+0.13	
3742 *15*	0	0.01	
3770 *15*	2+(4)	0.04+0.14	
3835 *15*	0+4	0.01+0.13	
3885[c] *15*	0+1	0.02+0.02	
3960 *15*	0+2	0.01+0.04	
4022 *20*	0	0.01	
4102 *20*	2	0.05	
4192[cd] *20*	1+3+4	0.02+0.21+0.1	
4325 *20*	0+2	0.02+0.03	

† From 1976Sc13, unless otherwise stated. Values from 1974Be54 are generally higher, deviating by as much as 30 keV in some cases.
‡ From 1976Sc13, unless otherwise specified.
# From 1976Sc13, unless otherwise noted. 1976Sc13 assume J=3/2 (for L=1), 5/2 (for L=2), 5/2 (for L=3) and 9/2 (for L=4).
@ From 2008KaZT.
& Same L value in 2008KaZT and/or 1974Be54.
[a] Level reported only by 1976Sc13.
[b] Level reported only by 1974Be54.
[c] Partly contributed by ^{73}As.
[d] Partly contributed by ^{71}As.