$^{78}Se(^3He,d)$ 1983Zu01,1978Kl10,2009Ka06

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh	NDS 135, 193 (2016)	31-May-2016

1983Zu01: E=24 MeV. Angular distribution data from 5° to 50° (C.M.). DWBA analysis used to deduce L-transfers and C^2S' factors. FWHM=18-25 keV. See also thesis by 1981ZuZX for more details of this work.

1978Kl10: E=41 MeV. Angular distribution data from 6° to 38° (C.M.). DWBA analysis. FWHM=40 keV. See also thesis by 1978KlZT for more details of this work.

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. Measured precise absolute cross sections and relative cross sections where these are maximum for the relevant L transfers, 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.

Below 1 MeV results from 1983Zu01 and 1978Kl10 agree well, although the C^2S' factors differ in several cases. Many differences are noted above this energy.

Level energies, L-transfers and C^2S' factors are from 1983Zu01, unless indicated otherwise.

Measured cross sections (2008KaZT,2009Ka06)

Level keV	$d\sigma/d\Omega(4.5°)$ mb/sr	$d\sigma/d\Omega(8°)$ mb/sr	$d\sigma/d\Omega(12°)$ mb/sr
0	4.92 a	1.58	0.90
208	5.21	4.19	2.71 *46* a
217	1.54	2.22 *26* a	1.35
307	3.51 a	1.03	0.68
523	0.21	0.18 a	0.087
606	0.60 a	0.19	0.12
797	0.081	0.045	0.055
832	0.52 a	0.20	0.10
1112	0.29 a	0.11	0.041
1181	0.010	0.013	0.006
1189	0.27	0.27	0.14 a
1256	0.17	0.13	0.070
1376	0.042	0.037 a	0.025
1390	0.28	0.29	0.20 a
1492	0.033	0.024 a	0.008
1908	0.79	0.67	0.46 a
1974	0.10 a	0.057	0.035
2040	0.13	0.13	0.10
2159	0.21 a	0.20	0.15
2315	0.10	0.078	0.052
2345	0.18	0.14	0.15
2463	0.11	0.073	0.045
2529	0.48 a	0.26	0.10

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

a: cross section used to deduce the spectroscopic factors.

$^{78}Se(^{3}He,d)$ 1983Zu01,1978Kl10,2009Ka06 (continued)

^{79}Br Levels

E(level)	L	$(2J+1)C^2S$[†]	Comments
0	1	1.16[@]	$(2J+1)C^2S$: for $J^\pi=3/2^-$. Others: S=0.48 (1978Kl10), (2J+1)S=0.783 (1983Zu01).
210.4 *19*	4+3	3.12,1.71[@]	$(2J+1)C^2S$: doublet. First value for $J^\pi=9/2^+$ and second for $J^\pi=5/2^-$. Other: (2J+1)S=2.85 for L=4, $9/2^+$ and 1.43 for L=3, $5/2^-$.
308.2 *17*	1	0.685,0.594	$(2J+1)C^2S$: others: 1978Kl10 give S=0.21 for $J^\pi=1/2^-$, 2008KaZT, 2009Ka06 give (2J+1)S=0.83.
383.6 *18*	2	0.453,0.346	
402.9 *25*	1	0.100,0.085	L: 1978Kl10 give L=1+3 for the 384, 403 doublet.
525.1 *18*	3	0.055,0.095	$(2J+1)C^2S$: from 1978Kl10. Others: for $J^\pi=5/2^-$, S=0.102 (1983Zu01), (2J+1)S=0.13 (2009Ka06,2008KaZT).
608.6 *18*	1	0.108,0.094	$(2J+1)C^2S$: 1978Kl10 give 0.035, 0.061; 0.14 (2008KaZT,2009Ka06).
764.5 *27*	(3)	0.058	L: from 1978Kl10. Authors also give L=3+4 as a possible choice. $(2J+1)C^2S$: for $J^\pi=7/2^-$ (1978Kl10). 1983Zu01 do not give C^2S'.
795.9 *27*			
835.3 *18*	1	0.120,0.104	E(level): 821 (1978Kl10). $(2J+1)C^2S$: 1978Kl10 give 0.044, 0.076; 0.13 (2008KaZT,2009Ka06).
910.7 *19*	3	0.022,0.038	E(level): 897 (1978Kl10). $(2J+1)C^2S$: from 1978Kl10. 1983Zu01 give 0.047 for $J^\pi=5/2^-$.
954.7 *18*	2	0.027,0.017	L: 1978Kl10 give L=(3) with C^2S'=0.059 for $J^\pi=5/2^-$ and 0.103 for $J^\pi=7/2^-$.
1038.8[‡] *18*	0	0.013	
1053?[#]	3	0.105,0.182	E(level): this group reported only by 1978Kl10 may correspond to 1039+1080 groups seen by 1983Zu01, thus the 1053 level is not listed in the Adopted Levels.
1079.7[‡] *22*	3	0.192	$(2J+1)C^2S$: for $J^\pi=5/2^-$.
1116.2 *21*	1	0.037,0.032	$(2J+1)C^2S$: 1978Kl10 give 0.026, 0.044; 0.070 (2008KaZT,2009Ka06).
1131.7[‡] *24*			
1182.6 *25*	2	0.023,0.017	
1191.9 *25*	4	0.147,0.077	L: 1978Kl10 give L=1+3 for 1183, 1192 doublet. $(2J+1)C^2S$: 0.14 (2008KaZT,2009Ka06).
1221.6 *30*	3	0.089,0.154	$(2J+1)C^2S$: from 1978Kl10. 1983Zu01 give C^2S'=0.105 for $J^\pi=5/2^-$.
1256.1 *22*			
1328.9[‡] *25*			
1376	3	0.075,0.131	L: (3) in 2008KaZT,2009Ka06.
1395.1 *18*	4	0.266,0.146	$(2J+1)C^2S$: 0.20 (2008KaZT,2009Ka06).
1495	3	0.054,0.093	L: (3) in 2008KaZT,2009Ka06.
1517.3[‡] *18*	0	0.015	
1561?[#]	1+3	0.015,0.025	E(level): this group may correspond to 1578 seen by 1983Zu01. $(2J+1)C^2S$: for L=1. For L=3 C^2S'=0.14,0.24.
1578.2[‡] *19*	2	0.083,0.064	
1617.1[‡] *26*			
1692.9 *19*	1	0.012,0.010	$(2J+1)C^2S$: 1978Kl10 give 0.0048, 0.0082.
1775?[#]			E(level): this group may correspond to 1795 seen by 1983Zu01.
1794.7[‡] *20*	2	0.014,0.011	
1908.2 *19*	4	0.740,0.392	L: 1978Kl10 give L=1+3 for a possible doublet at 1898. $(2J+1)C^2S$: 0.45 (2008KaZT,2009Ka06).
1946.4[‡] *24*	2	0.033,0.026	
1973.8 *24*	1	0.036,0.022	$(2J+1)C^2S$: 0.025 (2008KaZT,2009Ka06).
2016.1 *19*	2	0.038,0.029	
2039.8 *25*	(3)		L: from 2008KaZT,2009Ka06.
2075.1[‡] *19*	0	0.025	
2159.4 *18*	1	0.053	L,$(2J+1)C^2S$: from 2008KaZT, 2009Ka06. Other: L=(1), S=0.018, 0.030 (1978Kl10).

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^{78}Se(^{3}He,d) 1983Zu01,1978Kl10,2009Ka06 (continued)

^{79}Br Levels (continued)

E(level)	L	(2J+1)C^2S[†]	Comments
			E(level): 2147 (1978Kl10).
2182.8[‡] *24*			
2202.7[‡] *24*			
2235.2 *29*			E(level): 2247 (1978Kl10). This corresponds to 2235.2 or 2260.2.
2260.2 *20*			
2314.6 *19*	3	0.017,0.030	L: from 2009Ka06,2008KaZT. Other: (3) (1978Kl10). (2J+1)C^2S: from 1978Kl10.
2344.7 *23*			
2363.3[‡] *25*			
2414.4 *32*	3	0.15, 0.26	L,(2J+1)C^2S: from 1978Kl10. E(level): 2407 (1978Kl10).
2424.8?[‡] *25*			
2434.9?[‡] *28*			
2463.4 *24*			
2511.5 *24*	(1+3)	0.051,0.087	L,(2J+1)C^2S: from 1978Kl10. E(level): doublet at 2516 (1978Kl10) corresponds to 2512, 2529 levels. (2J+1)C^2S: for L=1. For L=3, C^2S'=0.16, 0.27.
2528.9 *24*	(1)		L: from 2008KaZT,2009Ka06.
2548.0[‡] *22*			
2568.5[‡] *25*			

[†] ($2J_f$+1)C^2S values. For J_f=L−1/2 or L+1/2. Unless noted otherwise, first value for lower J_f and the second for higher J_f. Values are from 1983Zu01 unless otherwise stated.

[‡] Level reported by 1983Zu01 only.

[#] Level reported by 1978Kl10 only. Uncertainty not given by authors but expected to be≈10 keV.

[@] From 2009Ka06, 2008KaZT.