^{90}Zr(p,d),(pol p,d) 1991Du01,1968Ta07,1968Ba31

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh	NDS 114, 1 (2013)	20-Oct-2012

Measurements:
1991Du01: (pol p,d) E=58 MeV. Measured $\sigma(\theta)$ and Ay(θ), (θ=6° to 50°), FWHM=80 keV, DWBA analysis.
1968Ta07 (also 1973Ta07): (p,d) E=55 MeV, FWHM≈100 keV, measured $\sigma(\theta)$.
1968Ba31: (p,d) E=31 MeV. Measured $\sigma(\theta)$, FWHM=18 keV. DWBA calculations.
Other measurements:
1983Ka18: (pol p,d) E=90 MeV. Measured $\sigma(\theta)$, Ay(θ), FWHM=120 keV, DWBA analysis.
1981Cr02: (pol p,d) E=90 MeV. Measured $\sigma(\theta)$, Ay(θ), FWHM=100 keV, DWBA analysis.
1980Ho18: (pol p,d) E=65 MeV. Measured $\sigma(\theta)$, Ay(θ). L, J and S values for three states at 0, 588 and 1096.
1978An19: (p,d) E=121.2 MeV. Measured $\sigma(\theta)$, DWBA and coupled- coupled-channel calculations. Data for g.s., 588, 1095, 1451 states.
1977IkZX (also 1977IkZV): (p,d) E=50 MeV. Measured $\sigma(\theta)$.
1975Ro27: (p,d) E=65 MeV. Measured $\sigma(\theta)$. Data for g.s., 590, 1090, 1470 levels.
1971Ma58: (pol p,d) E=22.9 MeV. Measured $\sigma(\theta)$, Ay(θ), FWHM=80-150 keV. DWBA calculations. Data for g.s., 588, 1094.
1966Go34, 1964Go02 (also 1960Go10): (p,d) E=36 MeV. Measured $\sigma(\theta)$, data for 600 and 1100 states.
Analyses and calculations:
1984Al05: (p,d) E=22.9-185.0 MeV. Analyzed $\sigma(\theta)$ data by DWBA. Deduced spectroscopic factors as a function of proton energy (E(p)= 22.9, 31.0, 55.0, 65.0, 90.0, 121.2, 185.0 MeV) for g.s., 588, 1095 and 1451 states using four different sets of deuteron parameters.
1983Ko23: (p,d) E=22.9, 31, 55, 65, 121 MeV. Analyzed spectroscopic factors using DWBA calculations for g.s., 588 and 1095.
1979Wa11: (p,d) E=140 MeV.
Additional information 1.

^{89}Zr Levels

E(level)[†]	J$^{\pi}$[b]	L[c]	C^{2}S[d]	Comments
0[‡]	9/2$^+$	4	7.1	C^{2}S: 9.6 (1983Ka18); 8.9 (1981Cr02); 3.81, 4.01 (1980Ho18); 5.1 (1978An19); 8.5 (quoted by 1978An19 from Kallne et al., Gustaf Werner Inst. Rept. May ^{1975,}AtE(p)=185 MeV); 4.1, 4.8, 5.5 (1975Ro27); 9.5 (1973Ta07); 5.9, 6.8 (1971Ma58); 9.6 (1968Ba31). S=3.0 to 6.2 (for E(p)=22.9 to 185, 1984Al05). See 1984Al05 and 1983Ko23 for details of S factors vs E(p) (from 22.9 to 185 MeV) calculated with four different potential parameters.
588[‡&] *5*	1/2$^-$	1	2.4	E(level): 595 (1991Du01), 590 *20* (1968Ta07). C^{2}S: 1.2 (1983Ka18); 0.75 (1981Cr02); 0.98, 1.31 (1980Ho18); 0.99 (1978An19); 2.3 (quoted by 1978An19 from Kallne et al., Gustaf Werner Inst. Rept. May ^{1975,}AtE(p)=185 MeV); 2.1 (1975Ro27); 1.7, 2.1 (1973Ta07); 1.4 (1971Ma58); 1.7 (1968Ba31). S=0.4 to 1.3 (for E(p)=22.9 to 185, 1984Al05). See 1984Al05 and 1983Ko23 for details of S factors vs E(p) (from 22.9 to 185 MeV) calculated with four different potential parameters.
1094[‡&] *5*	3/2$^-$	1	2.7	E(level): 1.1×10^3 (1991Du01), 1090 *20* (1968Ta07). C^{2}S: 2.1 (1983Ka18); 1.20 (1981Cr04); 2.73, 2.30 (1980Ho18); 2.3 (1978An19); 6.5 (quoted by 1978An19 from Kallne et al., Gustaf Werner Inst. Rept. May ^{1975,}AtE(p)=185 MeV); 3.1 (1975Ro27); 2.7, 2.2, 2.4 (1973Ta07); 1.4, 2.1 (1971Ma58), 2.4 (1968Ba31). S=0.8 to 1.8 (for E(p)=22.9 to 185, 1984Al05). See 1984Al05 and 1983Ko23 for details of S factors vs E(p) (from 22.9 to 185 MeV) calculated with four different potential parameters.
1450[‡&] *5*	5/2$^-$	3	3.0	E(level): 1460 (1991Du01), 1450 *20* (1968Ta07). Contribution from 1520, (9/2)$^+$ has been subtracted. C^{2}S: 3.5 (1983Ka18) with≈20% contribution from 1520 level; 2.9 (1981Cr02); 1.5 (1978An19); 3.1 (quoted by 1978An19 from Kallne et al., Gustaf Werner Inst. Rept. May ^{1975,}AtE(p)=185 MeV); 2.9 (1975Ro27); 3.5, 4.0 (1973Ta07); 3.0 (1968Ba31). S=1.1 to 1.9 (for E(p)=22.9 to 185, 1984Al05). See 1984Al05 for details of S factors vs E(p) (from 22.9 to 185 MeV) calculated with four different potential parameters.
1513 *5*	(9/2)$^+$	4	0.33	E(level),L,C^{2}S: from 1968Ba31.

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^{90}Zr(p,d),(pol p,d) 1991Du01,1968Ta07,1968Ba31 (continued)

^{89}Zr Levels (continued)

E(level)[†]	J$^{\pi}$[b]	L[c]	C^{2}S[d]	Comments
				Not listed by 1991Du01, but the authors corrected the intensity of 1460 peak by subtracting contribution from 1513.
1626[‡&] *5*	5/2$^+$	2	0.085	E(level): 1620 (1991Du01). C^{2}S: 0.05 (1968Ba31).
1740[‡&] *5*	1/2$^-$	1	0.38	E(level): 1750 (1991Du01), 1720 *20* (1968Ta07). C^{2}S: 0.24 (1968Ba31), 0.27 (1968Ta07).
1866[‡&] *5*	3/2$^-$	1	0.58	E(level): 1870 (1991Du01), 1860 *20* (1968Ta07). C^{2}S: 0.53 (1983Ka18), 0.40 (1968Ba31), 0.42, 0.62 (1973Ta07).
2098[&] *5*	5/2$^-$	3	1.12	E(level): 2110 *20* (1991Du01), 2100 *20* (1968Ta07). C^{2}S: 0.66 (1983Ka18,1968Ba31), 0.8, 1.1 (1973Ta07).
2280 *50*		(4+1)		J$^{\pi}$: (9/2$^+$) for one of the components.
2390 *50*		(4+1)		J$^{\pi}$: (9/2$^+$) for one of the components.
2620[a] *20*	9/2$^+$	4	0.12	E(level): 2620 *50* (1991Du01).
2760[a] *20*	7/2$^-$&9/2$^+$	3+4	0.21,0.19	E(level): 2780 *50* (1991Du01). C^{2}S: 0.29 for 2750, $g_{9/2}$ (1983Ka18), 0.41 (1973Ta07) for $g_{9/2}$. J$^{\pi}$: 7/2$^+$ suggested from Adopted Levels for L=4 component.
2920[a] *20*				E(level): 2920 *50* (1991Du01).
3020[a] *20*	7/2$^-$	3	0.30	E(level): 3020 *50* (1991Du01). C^{2}S: 0.46 assuming J=5/2$^-$; $f_{5/2}$ (1983Ka18), 0.52, 0.43 (1973Ta07).
3130[a] *20*	9/2$^+$	4	0.15	E(level): 3120 *50* (1991Du01).
3370 *50*	9/2$^+$	4	0.20	E(level): 3340 *20* (1968Ta07). C^{2}S: 0.12, 0.20 (1973Ta07) average for L=1 for 3340 *20* group.
3570 *50*	5/2$^-$	3	0.58	E(level): 3540 *20* (1968Ta07). C^{2}S: 0.42, 0.33 (1973Ta07).
3760[a] *20*	5/2$^-$	3	0.47	E(level): 3750 *50* (1991Du01). C^{2}S: 0.43, 50 (1973Ta07).
3950 *50*	7/2$^-$	3	0.14	
4100[a] *20*	7/2$^-$	3	0.28	E(level): 4100 *50* (1991Du01). C^{2}S: 0.82 (1983Ka18), 0.27 (1968Ta07).
4260[a] *20*	7/2$^-$&(5/2$^+$)	3+(2)	0.25	E(level): 4270 *50* (1991Du01, complex peak).
4590 *50*	7/2$^-$	3	0.24	
4650[a] *20*	7/2$^-$&(5/2$^+$)	3+(2)	0.44	E(level): 4650 *50* (1991Du01, complex peak).
4850 *50*	7/2$^-$	3	0.19	
5050 *50*	7/2$^-$	3	0.18	
5170 *50*	7/2$^-$&(3/2$^-$)	3+(1)	0.28	E(level): complex peak (1991Du01). E=5140 *20* (1968Ta07). C^{2}S: 0.35 (1983Ka18) for $f_{7/2}$.
5320 *50*	7/2$^-$&(3/2$^-$)	3+(1)	0.19	
5400 *50*	7/2$^-$&(3/2$^-$)	3+(1)	0.14	
5600 *50*	7/2$^-$&3/2$^-$	3+1	0.068,0.042	
5750 *50*	7/2$^-$&3/2$^-$	3+1	0.069,0.04	
5960[a] *20*	7/2$^-$&3/2$^-$	3+1	0.078,0.087	E(level): 5950 *50* (1991Du01).
6100 *50*	7/2$^-$&3/2$^-$	3+1	0.064,0.04	
6250 *50*	7/2$^-$&3/2$^-$	3+1	0.076,0.082	
6520 *50*	7/2$^-$&3/2$^-$	3+1	0.066,0.04	
6750[#] *50*	7/2$^-$&(3/2$^-$)	3+(1)	0.19	C^{2}S: 1.7 for 3400 to 7000 for $1f_{5/2}$ (1983Ka18).
8110[‡a] *20*	1/2$^-$	1	0.14	C^{2}S: 0.11 (1983Ka18) for 8100, 0.13, 0.35 (1973Ta07). Γ=19 keV in (p,d) (1977IkZX).
9040[‡a] *20*	9/2$^+$	4	0.06	E(level): 9020 (1991Du01). C^{2}S: 0.11 (1983Ka18) for 9030, 0.077, 0.11, 0.069 (1973Ta07).
9.3×10^3[@] *23*	(7/2$^-$)	3[e]	2.8[e]	
9620[‡a] *20*	3/2$^-$	1	0.22	C^{2}S: 0.24 (1983Ka18), 0.26, 0.67 (1973Ta07). Γ=25 keV in (p,d) (1977IkZX).

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^{90}Zr(p,d),(pol p,d) 1991Du01,1968Ta07,1968Ba31 (continued)

^{89}Zr Levels (continued)

E(level)[†]	Jπ[b]	L[c]	C²S[d]	Comments
9860[‡a] *20*	5/2⁻	3	0.41	C²S: 0.64 (1983Ka18), 0.62, 1.8 (1973Ta07). Γ=22 keV in (p,d) (1977IkZX).
12150[a] *20*	(7/2)⁻	3	0.12	L,C²S: from 1968Ta07.
13.8×10³ [@] *22*	(7/2)⁻	3[e]	2.1[e]	
18.5×10³ [@] *25*	(7/2)⁻&(3/2)⁺	3+2[e]	0.43,1.2[e]	

† From 1991Du01, unless otherwise stated. In the 3500-7000 range, values represent centroids of 19 energy bins (see figure 1 of 1991Du01 for size of each bin).
‡ Level energy used for calibration curve.
\# Complex peaks.
@ Centroid of an energy bin of size 4400 to 5000 (1983Ka18).
& From 1968Ba31.
a From 1968Ta07 (also 1973Ta07).
b From comparison of $\sigma(\theta)$ and Ay(θ) with DWBA calculations (1991Du01).
c From 1991Du01, unless otherwise stated. The assignments are from comparison of $\sigma(\theta)$ data with DWBA calculations with the active orbitals: $1g_{9/2}$ for L=4, $1f_{7/2}$ or $1f_{5/2}$ for L=3, $2p_{3/2}$ or $2p_{1/2}$ for L=1 and $1d_{3/2}$ for L=2.
d From 1991Du01, unless otherwise stated. The value assumes pure $f_{7/2}$, for L=3+(1 or 2) and equal yields from $p_{3/2}$ and $f_{7/2}$ for L=3+1. Difference in values from different studies for low lying states reflect variations of S factor with E(p), not necessarily, discrepancies.
e From 1983Ka18 for a wide energy bin.