^{208}Pb(d,p),(pol d,p) 1974Ko20,1973Vi06,1978Ba13

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	J. Chen # and F. G. Kondev	NDS 126, 373 (2015)	30-Sep-2013

Target ^{208}Pb J^π(g.s.)=0^+.

1974Ko20: E=20 MeV deuteron beam was produced from the Yale tandem accelerator. Targets were 100 μg/cm^2 99.9% enriched ^{208}Pb evaporated on carbon foils. Reaction products were momentum analyzed with the Yale multigap spectrograph (FWHM=10-15 keV). Measured $\sigma(\theta)$. Deduced levels, J^π, L, spectroscopic factors from DWBA analysis.

1973Vi06: E(pol d)=12.3 MeV beam was produced from the University of Wisconsin tandem. A 15 mg/cm^2 lead target was used. Reaction products were momentum analyzed with a magnetic spectrograph, FWHM=70 keV. Measured $\sigma(\theta)$, analyzing powers. Deduced levels, J^π, spectroscopic factors from DWBA analysis.

1978Ba13: E(pol d)=12.3 MeV deuteron beam was produced from the University of Birmingham Radial Ridge Cyclotron. A 8 mg/cm^2 99.1% enriched ^{208}Pb target was used. Protons were detected in six telescopes of a surface barrier silicon detector (ΔE) and a Li-drifted detector (E). Measured $\sigma(\theta)$, analyzing powers. Deduced levels, J^π, L from DWBA analysis.

1967Do02: E=8 MeV beam was from the Heidelberg tandem. Measure $\sigma(\theta)$.

Deduced levels, spectroscopic factors from DWBA analysis.

1967Mu16: E=14.8, 20.1, 24.8 MeV beams were produced from the Michigan 83-inch cyclotron. Reaction products were momentum analyzed with a magnetic spectrograph. Measured $\sigma(\theta)$. Deduced levels, spectroscopic factors from DWBA analysis. 20.1-MeV data presented here.

1968Cr04: E=8 MeV beam was produced from the ANU tandem. Reaction products were momentum analyzed with a Buechner broad-range spectrograph. Measured $\sigma(\theta)$. Deduced levels, L, spectroscopic factors from DWBA analysis.

1969El02: E=12 MeV beam was produced from the Niels Bohr Institute tandem. Protons were detected with a Si(Li) counter, FWHM<50 keV. Measured $\sigma(\theta)$. Deduced levels, spectroscopic factors from DWBA analysis.

1969Je01: E=8-18.7 MeV beams were produced from the Oxford tandem. Reaction products were momentum analyzed with the Oxford multichannel spectrograph. Measured $\sigma(\theta)$. Deduced levels, J^π, L, spectroscopic factors from DWBA analysis. 18.7-MeV data presented here.

1969Va02: E=8.7-15.8 MeV beams were produced from the 110 cm cyclotron of the CSIR. Protons were detected with a ΔE-E telescope of a silicon surface barrier detector and a Li-drifted detector. Measured $\sigma(\theta)$. Deduced levels, spectroscopic factors from DWBA analysis. Average of spectroscopic data presented here.

1973Ca04: E(pol d)=12.3, 15 MeV beams were produced from the Los Alamos tandem. Protons were detected with a ΔE-E telescope of a surface barrier silicon detector and a Li-drifted detector, FWHM$\approx$26 keV. Measured $\sigma(\theta)$, analyzing powers. Deduced levels, J^π, spectroscopic factors from DWBA analysis.

1977St33: E=7-11 MeV beams were produced from the FN tandem at Universitat zu Koln. Protons were detected with four silicon surface barrier detectors, FWHM=15 keV. Measured $\sigma(\theta)$. Deduced levels, spectroscopic factors from DWBA analysis.

1980St18: E(pol d)=7, 8, 9 MeV. Measured $\sigma(\theta)$, analyzing powers. Deduced levels, J^π. ^{2}H deduced asymptotic d- to s-state amplitude ratio.

1984Go10: E(pol d)= 9 MeV. Measured $\sigma(\theta)$, analyzing powers.

1985MuZX: E(pol d)=12.3, 15 MeV. Measured $\sigma(\theta)$, analyzing powers.

1977Kn05: E(pol d)=5.5 MeV. Measured $\sigma(\theta)$, analyzing powers.

1970De21: E(pol d)=12.3 MeV. Measured $\sigma(\theta)$, analyzing powers.

1970Ki09: E(pol d)=11-30 MeV. Measured $\sigma(\theta)$, analyzing powers.

1990Ro02: E(pol d)=6, 7 MeV. Measured $\sigma(\theta)$, analyzing powers.

1998Hi05: E(pol d)=22.0 MeV. Measured $\sigma(\theta)$, analyzing powers.

2001Li41: E=8 MeV. Measured $\sigma(\theta)$.

Others: 1962Er01, 1962Mu05, 1967Mu16, 1968Be07, 1970HeZI, 1973LuZN, 1977JaZP, 1977Ma04, 2005Ya02, 2010Pa39.

1978Ba13 measured tensor analyzing powers for the g.s., 1565, and 2033 levels. They confirm the J dependence of these analyzing powers. See also 1985MuZX.

Summary of strengths: 1969Je01 and 1969Va02 give more than one set of C^2S values corresponding to different choices of optical-model parameters. For each of these authors, the compilers have chosen the set such that the C^2S values are from a zero-range, local DWBA calculation with neutron parameters radius=1.20-1.25 fm, diffuseness=0.60-0.65, spin-orbit coupling=25-32, and deuteron well depth and radius$\approx$100 MeV and$\approx$1.15 fm, respectively. This choice of parameters is consistent with that used by the other authors and puts all the C^2S values on roughly the same footing. 1977St33 extract asymptotic normalization factors for

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the levels given in the table below. The authors point out that these factors are less sensitive than are the C^2S to the choice of optical model parameters for the bound neutron

	C^2S						
	g.s. 2g9/2	779 1i11/2	1424 1j15/2	1565 3d5/2	2033 4s1/2	2492 2g7/2	2537 3d3/2
1967Do02	0.88	1.52	1.38	1.06	0.97	1.04	0.99
1967Mu16&	0.77	0.78	0.79	1.05	0.90	1.08	1.07
1968Cr04	0.99			1.10	1.05	0.96	1.00
1969El02	0.78	0.96	0.53	0.88	0.88	0.78	0.88
1969Je01#	0.66	0.75	0.71	0.62	0.70	0.81	0.88
1969Va02	1.08			1.13	1.00	1.22†	
1973Ca04	0.91	1.2	0.66	0.89	0.91	1.1	0.97
1974Ko20	0.83	0.86	0.58	0.98	0.98	1.05	1.07
1987Ro20@	0.8	0.9	0.53	0.85	0.8	0.9	0.74

& for E_t=20.3 MeV.See 1977Ma04 for a reanalysis of the data of theseauthors
# See 1977Ma04 for a reanalysis of the 24.8-MeV data of these authors
@ Reanalysis of data of 1974Ko20 using a formalism that includes breakup of the deuteron
† Value for unresolved 2492+2537 levels

^{209}Pb Levels

E(level)[†]	J^π[‡]	L[#]	C^2S[@]	Comments
0.0	9/2+	4	0.83	C^2S: for configuration=$\nu(2g_{9/2})^{+1}$.
779 *5*	11/2+	6	0.86	C^2S: for configuration=$\nu(1i_{11/2})^{+1}$.
1424 *5*	15/2−	7	0.58	C^2S: for configuration=$\nu(1j_{15/2})^{+1}$.
1565 *5*	5/2+	2	0.98	C^2S: for configuration=$\nu(3d_{5/2})^{+1}$.
2033 *5*	1/2+	0	0.98	C^2S: for configuration=$\nu(4s_{1/2})^{+1}$.
2152 *5*		1		C^2S: 0.0067 if configuration=$\nu(3p_{1/2})^{-1}$, 0.0036 if $\nu(4p_{1/2})^{+1}$.
2319 *5*		1		E(level): 2310 keV *5* (1969Je01). C^2S: 0.0074 if configuration=$\nu(3p_{3/2})^{-1}$, 0.0045 if $\nu(4p_{3/2})^{+1}$.
2424? *5*				
2461 *5*		(2,3)		C^2S: 0.0012 if configuration=$\nu(2f_{5/2})^{-1}$, 0.0013 if $\nu(3f_{5/2})^{+1}$.
2492 *5*		4	1.05	C^2S: for configuration=$\nu(2g_{7/2})^{+1}$.
2537 *5*		2	1.09	C^2S: for configuration=$\nu(3d_{3/2})^{+1}$.
2592 *5*		4,5	0.0185[&]	J^π: magnitude of $\sigma(\theta)$ is reproduced by a distorted wave calculation for configuration $h_{11/2}$, but the shape is not well reproduced (1969Ha13 as reported by 1969El02).
2738 *5*		2,3		C^2S: 0.0027 if configuration=$\nu(2f_{5/2})^{-1}$, 0.0005 if $\nu(3f_{5/2})^{+1}$.
2866 *5*		(2,3)		C^2S: 0.0010 if configuration=$\nu(2f_{5/2})^{-1}$, 0.0002 if $\nu(3f_{5/2})^{+1}$.
3026 *5*		4,5	0.0090[a]	
3052 *5*		7	0.070[b]	
3075 *5*		1		C^2S: 0.0021 if configuration=$\nu(3p_{3/2})^{-1}$, 0.0012 if $\nu(4p_{3/2})^{+1}$.
3203 *5*		2,3		C^2S: 0.0012 if configuration=$\nu(2f_{7/2})^{-1}$, 0.0007 if $\nu(3f_{7/2})^{+1}$.
3309 *5*		4,5	0.0050[&]	
3365 *5*		4,5	0.0087[&]	
3389 *5*				
3414 *5*				
3430 *5*				
3490 *5*		2,3		C^2S: 0.0017 if configuration=$\nu(2f_{7/2})^{-1}$, 0.0010 if $\nu(3f_{7/2})^{+1}$.
3556 *5*		7	0.032[b]	E(level): 1969Je01 report a level at 3567 keV *10*.
3615 *5*				
3656 *5*		2,3		C^2S: 0.0070 if configuration=$\nu(2f_{5/2})^{-1}$, 0.0044 if $\nu(3f_{5/2})^{+1}$.
3681 *5*		(1)		C^2S: 0.0048 if configuration=$\nu(3p_{1/2})^{-1}$, 0.0029 if $\nu(4p_{1/2})^{+1}$.

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^{209}Pb Levels (continued)

E(level)[†]	L[#]	C^2S[@]	Comments
3716 *5*	7	0.032[b]	
3904 *5*	(2,3)	0.0113[c]	E(level): 3917 keV 20 from 1969Je01.
3947 *5*			E(level): 3955 keV *20* (1969Je01). L,C^2S: fit by authors to L=3 with S=0.0161 for configuration=$\nu(3f_{7/2})^{+1}$; however, this peak is a doublet in (d,pγ).
3985 *5*	(2,3)	0.0178[c]	
4008 *5*	(2,3)	0.0070[c]	E(level): 4000 keV *20* (1969Je01).
4022 *5*	(2,3)	0.0038[c]	
4075 *5*	(2,3)	0.0030[c]	
4096 *5*	(2,3)	0.012	C^2S: if configuration=$\nu(3d_{5/2})^{+1}$.
4112 *5*	(2,3)	0.0125[c]	E(level): 4123 keV *20* (1969Je01).
4137 *5*	(2,3)	0.0078[c]	E(level): 4145 keV *20* (1969Je01).
4166 *5*	(5)	0.0023[&]	E(level): 4175 keV *20* (1969Je01).
4211 *7*			E(level): 4216 keV *5* (1969El02).
4239? *10*			
4295 *5*	(0,1)	0.093	E(level): 4298 keV *5* (1969El02), 4304 keV *20* (1969Je01). C^2S: configuration=$\nu(4p_{3/2})^{+1}$.
4348 *5*			
4380 *5*			
4430 *9*			E(level): 4415 keV *20* (1969Je01).
4464 *7*	(0,1)	0.109	C^2S: configuration=$\nu(4s_{1/2})^{+1}$.
4502 *10*			
4530 *10*			
4552 *10*			
4575 *10*			
4612 *10*			
4629 *10*			
4661 *10*			
4676 *10*			
4706 *10*			
4726 *10*			
4747 *10*			
4764 *10*			
4799 *10*			
4864 *10*			
4885 *10*			
4920 *10*			
4940 *10*			
4962 *10*			
4986 *10*			
5028 *10*			
5061 *10*			
5085 *10*			
5102 *10*			
5153 *10*			
5170 *10*			

† From 1974Ko20, unless otherwise noted.
‡ From L+1/2 or L-1/2 transfers from analyzing power fits to measured cross sections (1973Vi06, 1978Ba13).
# From 1974Ko20, based on DWBA analysis. Except for the single-particle states, L(n)=2 cannot be distinguished from L(n)=3, nor can L(n)=4 be distinguished from L(n)=5. For some levels the L(n) ambiguities can be removed by comparison with L(t,p) or L(n) in (p,d). 1974Ko20 point out that, for the two-particle one-hole states below≈4 MeV, only negative-parity states are

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^{209}Pb Levels (continued)

expected (except for the configuration=$\nu(1i_{13/2})^{-1}$ state) so that L(n)=odd.

[@] From 1974Ko20, S=(1/(2J+1))($\sigma(\theta)^{exp}/\sigma(\theta)^{DWBA}$)/N, calculated using local zero-range DWBA with normalization factor 1.5 and neutron parameters radius=1.23 fm, diffuseness=0.65 fm, and spin-orbit coupling strength=25. The neutron well depth was chosen based on the separation-energy approximation. The authors also quote strengths based on a deuteron breakup potential.

[&] If configuration=$\nu(2h_{11/2})^{+1}$.

[a] If configuration=$\nu(1h_{9/2})^{-1}$.

[b] If configuration=$\nu(1j_{15/2})^{+1}$.

[c] If configuration=$\nu(3f_{7/2})^{+1}$.