^{64}Ni(pol d,^{3}He),(d,^{3}He) 1991Se09,1979Ha03

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Jun Chen	NDS 196,17 (2024)	30-Sep-2023

Target J^{π}(^{64}Ni g.s.)=0^{+}.

1991Se09: two measurements were performed. (pol d,^{3}He) E=52 MeV polarized deuteron beam was from the Karlsruhe isochronous cyclotron. Target was a 1 mg/cm^{2} self-supporting Ni foil (99.7% enriched). Reaction products were detected with a ΔE-E telescope of a silicon strip detector and a surface barrier detector (FWHM=130 keV). Measured $\sigma(\theta)$, $\theta_{c.m.}$=12° to 38°. Deduced J, π, analyzing powers, L-transfers, spectroscopic factors from DWBA analysis. (d,^{3}He) E=52 MeV deuteron beam was produced from the Julich isochronous cyclotron. Target was a 200 μg/cm^{2} self-supporting Ni foil (96.5% enriched). Reaction products were momentum-analyzed with the variable-dispersion QQDDQ spectrometer BIG KARL (FWHM=20 keV) and detected with a mult-wire drift chamber. Measured E(^{3}He,θ). Deduced levels, J, π.

1992Se03: E=31 MeV deuteron beam was produced from the Heidelberg MP tandem-post accelerator facility. Target was a 1.0 mg/cm^{2} self-supporting Ni foil (99.7% enriched). Charged particles were detected with four silicon ΔE-E detector telescopes (FWHM=170 keV). γ rays were detected with two Ge(Li) and two intrinsic Ge detectors. Measured ^{3}He-γ-coin; $\sigma(\theta)$, $\theta_{c.m.}$=15° to 25°. Deduced levels, J, π, L-transfers from DWBA analysis. See also (d,^{3}Heγ) for γ data from this measurement.

1979Ha03: (d,^{3}He) E=55 MeV deuteron beam was produced from the KVI cyclotron at Groningen, Netherlands. Target was 130 μg/cm^{2} 98% enriched ^{64}Ni. Reaction products were detected with a ΔE-E solid state detector telescope (FWHM≈100 keV). Measured σ(E(^{3}He),θ), $\theta_{c.m.}$=10° to 35°. Deduced levels, J, π, L-transfers, spectroscopic factors from DWBA analysis. Comparisons with available data.

^{63}Co Levels

Spectroscopic factors $C^{2}S$ is defined by dσ/dΩ(exp)=2.95×$C^{2}S$×dσ/dΩ(DWBA)/(2j+1), where j is the transferred total angular momentum (1979Ha03).

E(level)[†]	J^{π}[‡]	L[#]	$C^{2}S$[#]	Comments
0	7/2^{-}	3[@]	4.53	$C^{2}S$: other: 6.3 for J=7/2 (1979Ha03).
992 *5*	3/2^{-}	1[@]	0.34	$C^{2}S$: other: 0.45 for J=3/2 (1979Ha03).
1382 *5*		(3)	0.06,0.03	
1423 *5*		(3)	0.1	E(level): other: 1430 *30* (1979Ha03). L: from 1979Ha03. Other: L=(1) from 1991Se09. As claimed in 1991Se09 L=3, 1 and 3 are assigned to the weak levels of 1382, 1423, and 1491, respectively, but no $\sigma(\theta)$ data are shown in 1991Se09, while L=(3) for a 1430 level in 1979Ha03 seems to be a good fit to their measured $\sigma(\theta)$ data and L=(1) is assigned to the 1492 level by 1966Bl15 in (t,α). The evaluator has adopted L(1423)=(3) and L(1491)=(1). $C^{2}S$: from 1979Ha03 for J=7/2. Other: 0.01 for J^{π}=1/2^{-} and 3/2^{-} in 1991Se09.
1491 *5*		(1)		L: see comments for 1423 level. Other: L=(3) with $C^{2}S$=0.08 or 0.04 from 1991Se09, but not adopted by the evaluator.
1668 *5*		(5)[@]	0.17,0.54	Additional information 1. E(level): other: 1660 *20* (1979Ha03). $C^{2}S$: other: 0.2 for J=11/2 (1979Ha03).
1888 *5*	1/2^{-}	1[@]	0.04	E(level): other: 1880 *10* (1979Ha03). $C^{2}S$: other: 0.05 for J=3/2 (1979Ha03).
2082 *5*		(3)		
2129 *5*	7/2^{-}	3[@]	0.73	E(level): other: 2160 *10*, doublet of 2129+2191 (1979Ha03). $C^{2}S$: other: 1.4 for J=7/2 from 1966Bl15 in (t,α) assumed in analysis (1979Ha03).
2191 *5*	1/2^{+}	0[@]	0.83	$C^{2}S$: other: 1.2 (1979Ha03). See comments for 2129 level.
2330 *5*	7/2^{-}	3[@]	0.68	E(level): other: 2320 *10* (1979Ha03). $C^{2}S$: other: 1.1 for J=7/2 (1979Ha03).
2375				E(level): rounded value from (d,^{3}Heγ) data in 1992Se03; not reported in 1992Se03 but a

Continued on next page (footnotes at end of table)

^{64}Ni(pol d,^{3}He),(d,^{3}He) 1991Se09,1979Ha03 (continued)

^{63}Co Levels (continued)

E(level)[†]	Jπ[‡]	L[#]	C^{2}S[#]	Comments
				weak peak can been seen at around this energy in the ^{3}He spectrum in 1992Se03. See also comments for 2473 level.
2473 *5*		(3)	0.06,0.03	E(level): a peak at this energy is clearly seen in the ^{3}He spectrum (FWHM=20 keV) in Fig.5 of 1991Se09, but not seen in the ^{3}He spectrum in 1992Se03 (FWHM=170 keV) and 1979Ha03 (FWHM≈100 keV) probably because it is not resolved from the 2330 level due to poor resolution. However, a level at 2374.8 is reported by 1992Se03 based on γ data of (d,^{3}Heγ) but it is not reported in 1991Se09. A weak peak in Fig.5 of 1991Se09 between 2330 and 2473 peaks and on the tail of 2330 peak may correspond to this level in 1992Se03.
2689 *5*		2[@]	0.99,0.61	Jπ: 3/2$^+$ is favored from analyzing powers, but 5/2$^+$ can not be ruled out compeltely (1991Se09). E(level): other: 2680 *20* (1979Ha03). C^{2}S: other: 1.8 for J=3/2 (1979Ha03).
2791 *5*		(3)	0.14,0.07	
2882 *5*		(1)	0.02,0.01	
2929 *5*		(3)[@]	0.17,0.09	C^{2}S: other: 0.2 for J=7/2 for a doublet of 2929+3031 at 2940 *70* (1979Ha03).
3031 *5*		(3)	0.19,0.10	
3135 *5*		(3)[@]	0.14,0.07	C^{2}S: other: 0.5 for J=7/2 for a doublet of 3135+3172 at 3150 *20* (1979Ha03).
3172 *5*	(7/2$^-$)	(3)	0.51,0.26	
3412 *5*		3	0.67,0.34	E(level): other: 3400 *20* (1979Ha03). L: from 1979Ha03. Other: (3,2) from 1991Se09; L=(2) from 1992Se03. Note that 1992Se03 assigned L=2 based on their measured $\gamma(\theta)$, which however looks structureless. This makes their L=2 assignment questionable. The L=3 assignment from 1979Ha03 looks to be a good fit to their $\gamma(\theta)$. C^{2}S: other: 0.6 for J=7/2 (1979Ha03); 0.11 for J^π=3/2$^+$ and 0.07 for 5/2$^+$ with L=(2) (1991Se09).
3604 *5*		(3)	0.09,0.18	E(level),L: other: 3580 *40* with L=(2) (1979Ha03). C^{2}S: other: 0.4 for J^π=3/2$^+$ (1979Ha03).
3676 *5*		(3)	0.10,0.05	
3766 *5*		(3)	0.15,0.07	
3893 *5*	(7/2$^-$)	(3)	0.47,0.24	E(level): other: 3880 *40* (1979Ha03).
3985 *5*	(3/2$^+$)	(2)	0.22,0.14	
4039 *5*		2	0.02,0.01	E(level): other: 4050 *30* (1979Ha03). L: from 1979Ha03. C^{2}S: other: 0.6 for J=3/2 (1979Ha03).
4094 *5*		(2)[&]	0.09,0.04	
4127 *5*		(2)[&]	0.15,0.10	
4234 *5*		(2)[&]	0.22,0.14	
4376 *5*		(2)[&]	0.20,0.13	
4453 *5*		(2)[&]	0.11,0.07	
4524 *5*		(2)[&]	0.07,0.03	
4538 *5*		(2)[&]	0.05,0.03	
4588 *5*		(2)[&]	0.08,0.05	
4700 *5*		(2)[&]	0.04,0.03	
4722 *5*		(2)[&]	0.05,0.03	
4820 *5*		(2)[&]	0.07,0.04	
4886 *5*		(2)[&]	0.13,0.08	
4968 *5*		(2)[&]	0.03,0.02	
5010 *5*		(2)[&]	0.05,0.03	
5080 *5*		(2)[&]	0.14,0.09	

Continued on next page (footnotes at end of table)

^{64}Ni(pol d,^{3}He),(d,^{3}He) 1991Se09,1979Ha03 (continued)

^{63}Co Levels (continued)

E(level)[†]	L[#]	C^{2}S[#]
5132 *5*	(2)[&]	0.07,0.05
5215 *5*	(2)[&]	0.12,0.07
5294 *5*	(2)[&]	0.10,0.06
5342 *5*	(2)[&]	0.11,0.07
5457 *5*	(2)[&]	0.11,0.07
5659 *5*	(2)[&]	0.12,0.07

[†] From 1991Se09.
[‡] From analysis of measured analyzing powers in Fig.6 of 1991Se09.
[#] From DWBA analysis of measured $\sigma(\theta)$ in 1991Se09, unless otherwise noted. Where two values are listed, they are for L-1/2 and L+1/2, respectively.
[@] Also from 1979Ha03.
[&] L=2 from a fit to $\sigma(\theta)$ for an energy range of 4-7 MeV in 1991Se09 and of 3.75-7.75 MeV in 1979Ha03.