^{64}Ni(p,p), (p,p′), (p,n), IAR

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	E. Browne, J. K. Tuli	NDS 111, 2425 (2010)	1-Aug-2009

1970Br33: (p,p), (p,n): E(p)≈2.5-3.3 MeV, FWHM=0.3-0.45 MeV; measured σ(E,θ), θ=90°, 120°, 135° and 160°; deduced widths, L.
1971Mo16: E(p)=3.1-3.3 MeV, FWHM≈0.3-0.4 MeV; measured σ(E,θ), θ=90°, 120°, 135°, 160°; deduced widths, L.
1966Bo26: E(p)≤8 MeV, FWHM≈10 keV (protons), ≈100 keV (neutrons); measured σ(E(p)).
1969Gu07: (p,p), (p,p′), (p,n): E(p)=2.5-8.7 MeV; measured σ(E,θ); deduced widths, L.
1972Ra23: (p,p), (p,p′): E(p)=3.1-5.3 MeV, FWHM=2 keV; measured σ(E,θ), θ=90°, 140°, 150° and 160°; deduced widths.
1966Ga14: E(p)≈3.2-3.6 MeV; measured σ(E(p)); deduced widths.
1973TyZZ: (pol p,p): E(p)=3-7 MeV; measured σ(E,θ) and analyzing powers, θ=120° and 150°; deduced widths, J^π.
1978Be40: (p,p), (p,p′γ): E(p)=5.0-6.2 MeV; measured σ(E,θ), θ=90°, 110°, 125°, 141°, and 160°; pγ(θ); deduced widths, L, J.
1979Gu17: (p,nγ): E(p)=3.86-3.94 MeV; measured σ(E(p)); deduced partial widths.
1976Le09: (p,n): E(p)≈2.67 MeV, n time-of-flight.
Other: 1995Ro30.

^{65}Cu Levels

1970Br33 measure a number of resonances and report that ≈15 fragments near E(p)=3220 are observed which show an enhancement of the proton widths and are associated with the analog of the ^{65}Ni(E=63,J^π=1/2$^-$) level. The authors also state that the analog of the J^π=5/2$^-$ g.s. was not observed. 1971Mo16 is from the same laboratory and is a further study of the ^{65}Ni(E=63,J^π=1/2$^-$) analog fragments.
1976Le09 measure the properties of a resonance which is 2.7 eV above the (p,n) threshold.
1979Gu17 measure the neutron cross-sections and partial widths to levels in ^{64}Cu for the E(p)=3896 resonance.
All other references are concerned with the identification of analogs of ^{65}Ni levels and the measurement of their properties. Note: 1969Gu07 and 1966Bo26 are from the same laboratory.
Widths: (2J+1)Γ(p) and (2J+1)Γ(n) given with uncertainties are from 1971Mo16 and without uncertainties from 1970Br33, except as noted. 1970Br33: Γ(n)=Γ−Γ(p). The uncertainty on Γ(p)≈10% for Γ≥100 eV and ≈50% for Γ(p)=10-20 keV. 1971Mo16: Γ(p) and Γ(n) values are both obtained independently from fits to the (p,p) and (p,n) data.

E(level)[†]	J^π[‡]	L[#]	Comments
S(p)+3172[@] *10*			Γ=10 keV (1969Gu07). IAS of ^{65}Ni(g.s.).
S(p)+3502[@] *10*	3/2$^-$	1	Γ=8 keV; (2J+1)Γ(p)=3 keV (1969Gu07). Γ=7.5 keV; (2J+1)Γ(p)=2.6 keV *8* (1966Ga14). Γ=10 keV; (2J+1)Γ(p)=2.8 keV *15* (1973TyZZ). (2J+1)Γ(p)=2.12 keV (1972Ra23). IAS of ^{65}Ni(310). Other E(p): 3525 *10* (1964Le06), 3520 *10* (1966Ga14), 3495 *10* (1973TyZZ). J^π: from analyzing power (1973TyZZ) and assigned L-value.
S(p)+3896[@] *10*	3/2$^-$	1	Γ=19 keV; (2J+1)Γ(p)=11 keV (1969Gu07). Γ=16 keV; (2J+1)Γ(p)=12 *5* (1973TyZZ). (2J+1)Γ(p)=5.8 keV; (2J+1)Γ(p′)=1.88 keV (1972Ra23). IAS of ^{65}Ni(692). Other E(p): 3901 *10* (1964Le06), 3898 (1979Gu17), 3885 *10* (1973TyZZ). J^π: from analyzing power (1973TyZZ) and assigned L-value. For direct Γ(n) values to levels in ^{64}Cu see 1979Gu17.
S(p)+4200[a] *10*			Γ=40 keV; (2J+1)Γ(p)=2.5 keV *15* (1973TyZZ). IAS of ^{65}Ni(1013?).
S(p)+4546[@] *10*	1/2$^+$	0	Γ=13 keV; (2J+1)Γ(p)=4 keV (1969Gu07). IAS of ^{65}Ni(1273?).

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^{64}Ni(p,p), (p,p′), (p,n), IAR (continued)

^{65}Cu Levels (continued)

E(level)[†]	Jπ[‡]	L[#]	Comments
S(p)+4635[@] *10*	1/2⁻	1	Γ=52 keV; (2J+1)Γ(p)=35 keV (1969Gu07). Γ=20 keV; (2J+1)Γ(p)=8 keV *4* (1973TyZZ). (2J+1)Γ(p)=1.0 keV (1972Ra23). IAS of ^{65}Ni(1418). Other E(p): 4533 (1964Le06), 4620 *10* (1973TyZZ). Jπ: from analyzing power (1973TyZZ) and assigned L-value.
≈S(p)+4962?		1	(2J+1)Γ(p)=4.8 keV; (2J+1)Γ(p′)=2.74 keV (1972Ra23). E(p): not given explicitly (1972Ra23), deduced assuming resonance is IAS of ^{65}Ni(1779). All data on this level are from 1972Ra23.
S(p)+5104[@] *10*	5/2⁺	2	Γ=26 keV; (2J+1)Γ(p)=46 keV (1969Gu07). Γ=19.0 keV *23*; (2J+1)Γ(p)=54 keV *14* (1978Be40). Γ=24 keV; (2J+1)Γ(p)=45 keV *11* (1973TyZZ). (2J+1)Γ(p)=73.8 keV; (2J+1)Γ(p′)=3.3 keV (1972Ra23). IAS of ^{65}Ni(1920). Jπ: from analyzing power (1973TyZZ) and assigned L-value. Other E(p): 5099 (1964Le06), 5105 *10* (1978Be40), 5095 *10* (1973TyZZ).
S(p)+5325[a] *10*	3/2⁻	1	Γ=22 keV; (2J+1)Γ(p)=7 keV *3* (1973TyZZ). Γ=34 keV *4* (1978Be40). IAS of ^{65}Ni(2147?). Other E(p): ≈5350 (1978Be40). Jπ: from L-value and pγ(θ) (1978Be40). For possible values of δ for g.s. transition from pγ(θ) and corresponding Γ(p′) values see 1978Be40.
S(p)+5525[a] *10*			Γ=30 keV; (2J+1)Γ(p)=4.2 keV *16* (1973TyZZ). Γ=27 keV *4* (1978Be40). IAS of ^{65}Ni(2336?). Other E(p): ≈5520 (1978Be40).
S(p)+5984[@] *10*	5/2⁺	2	Γ=21 keV; (2J+1)Γ(p)=24 keV (1969Gu07). Γ=30 keV *4*; (2J+1)Γ(p)=45 keV *12* (1978Be40). Γ=25 keV; (2J+1)Γ(p)=39 keV *10* (1973TyZZ). IAS of ^{65}Ni(2793). Other E(p): 5992 *10* (1964Le06), 5965 (1966Bo26), 5975 *10* (1973TyZZ), 5985 *10* (1978Be40). Jπ: from L-value and pγ(θ) (1978Be40) and analyzing power in 1973TyZZ.
S(p)+6033[@] *10*	1/2⁺	0	Γ=35 keV; (2J+1)Γ(p)=27 keV (1969Gu07). Γ=51 keV *6*; (2J+1)Γ(p)=44 keV *11* (1978Be40). Γ=80 keV; (2J+1)Γ(p)=58 keV *17* (1973TyZZ). IAS of ^{65}Ni(2829). Other E(p): 6042 *10* (1978Be40), 6040 *10* (1973TyZZ). Jπ: confirmed by pγ(θ) (1978Be40).
S(p)+6090?[a] *10*			Γ=25 keV; (2J+1)Γ(p)=2 keV *+5−2* (1973TyZZ). IAS of ^{65}Ni(2902?).
S(p)+6150[&] *10*	5/2⁺	2	Γ=39 keV *5*; (2J+1)Γ(p)=18 keV *5* (1978Be40). Γ=12 keV; (2J+1)Γ(p)=10 keV *4* (1973TyZZ). IAS of ^{65}Ni(3044?). Other E(p): 6155 *10* (1973TyZZ). Jπ: from analyzing power (1973TyZZ) and assigned L-value.
S(p)+6235?[a] *10*	(3/2⁺)	(2)	Γ=25 keV; (2J+1)Γ(p)=4 keV *3* (1973TyZZ). IAS of ^{65}Ni(3010?). Jπ: 3/2⁺ if L=2 (1973TyZZ).
S(p)+6339[@] *10*			Γ=15 keV (1969Gu07).
S(p)+6482[@] *10*			Γ=20 keV (1969Gu07).
S(p)+6520[a] *10*	(5/2⁺)	(2)	Γ=50 keV; (2J+1)Γ(p)=24 keV *14* (1973TyZZ). IAS of ^{65}Ni(3354).

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^{64}Ni(p,p), (p,p′), (p,n), IAR (continued)

^{65}Cu Levels (continued)

E(level)†	Jπ‡	L#	Comments
			Jπ: 5/2+ if L=2 (1973TyZZ). A resonance at E(p)=6541 *10* with Γ=38 keV is reported in 1969Gu07.
S(p)+6565[a] *10*			Γ=50 keV; (2J+1)Γ(p)=32 keV *14* (1973TyZZ). IAS of ^{65}Ni(3411). A resonance at E(p)=6541 *10* with Γ=38 keV is reported in 1969Gu07.
S(p)+6605@ *10*			Γ=35 keV; (2J+1)Γ(p)=7 keV *6* (1973TyZZ). IAS of ^{65}Ni(3451?). Other E(p): 6625 *10* (1973TyZZ).
S(p)+6708@ *10*			Γ=12 keV (1969Gu07).
S(p)+6764@ *10*	5/2+	2	Γ=30 keV; (2J+1)Γ(p)=48 keV *+8−16* (1973TyZZ). Γ=36 keV (1969Gu07). IAS of ^{65}Ni(3563). Other E(p): 6760 *10* (1973TyZZ). Jπ: from measured L-value and analyzing power (1973TyZZ).
S(p)+6958@ *10*	5/2+	2	Γ=25 keV; (2J+1)Γ(p)=18 keV *7* (1973TyZZ). Γ=33 keV (1969Gu07). IAS of ^{65}Ni(3743). Other E(p): 6940 *10* (1973TyZZ). Jπ: from measured L-value and analyzing power (1973TyZZ).
S(p)+7099@ *10*			Γ=37 keV (1969Gu07).
S(p)+7197@ *10*			Γ=23 keV (1969Gu07).

† S(p)+E(p)(lab) is given where S(p)=7452.1 *11* (1985Wa02) and ΔE corresponds to the uncertainty on E(p). Data are from 1970Br33, except as noted. Only those resonances are given which have been identified as IAR.

‡ From assigned L-value, except as noted.

From inspection of σ(E,θ), (1970Br33,1969Gu07,1978Be40).

@ From 1969Gu07 (These authors give E(p)=3228 *10* as the analog resonance of the ^{65}Ni(63) level, in agreement with the fine-structure data of 1970Br33 and 1971Mo16, E(p)≈3220).

& From 1978Be40.

a From 1973TyZZ. Uncertainty on E(p) estimated by evaluators to be ≤10 keV (analog of ^{65}Ni(63): E(p)=3220, Γ=20 keV; (2J+1)Γ(p)=7.6 keV *22*).