^{62}Ni(^{18}O,^{16}Oγ) 2020Ma37

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen	NDS 178,41 (2021).	12-Nov-2021

Includes the following reactions: ^{65}Cu(^{11}B,^{12}C); ^{63}Ni(n,γ),E=thermal; ^{208}Pb(^{64}Ni,^{64}Ni$'\gamma$); ^{64}Ni(γ,γ'), nuclear resonance fluorescence.

2020Ma37: four experiments were carried out at three facilities to investigate low-spin states, especially 0^+, in ^{64}Ni:

1. ^{62}Ni(^{18}O,^{16}Oγ),E(^{18}O)=39 MeV at the tandem accelerator of IFIN-HH, Bucharest. Measured Eγ, Iγ, $\gamma\gamma$-coin, level half-lives by recoil-distance Doppler-shift technique using ROSPHERE array of 25 Compton-suppressed HPGe detectors. Target was 5 mg/cm^2 thick for γ-ray measurements and 0.92 mg/cm^2 thick for half-life measurement. ^{65}Cu(^{11}B,^{12}C),E(^{11}B)=26 MeV reaction was also used. See also 2019Le24 and 2019LeZW for the same experiment.
2. ^{63}Ni(n,γ),E=thermal at ILL, Grenoble. Measured primary and secondary γ rays in singles and coincidence, $\gamma\gamma(\theta)$, using 2GBq ^{63}Ni radioactive target from CERN n_TOF using FIPPS array of 16 clover HPGe detectors. Detailed results of this experiment are to be published elsewhere.
3. ^{208}Pb(^{64}Ni,^{64}Ni$'\gamma$),E(^{64}Ni)=272 MeV, Coulomb excitation experiment. Measured Eγ, Iγ, (particle)γ-coin, Coulomb excitation yields using GRETINA array for γ detection and CHICO2 array at ATLAS-ANL facility for scattered particles. Deduced E2 matrix elements and B(E2) using GOSIA least-squares fitting code for measured Coulomb excitation yields.
4. Nuclear resonance fluorescence experiment using HIγS facility at TUNL facility. Results of this experiment are to be published elsewhere. Comparison with Monte-Carlo shell model calculations with A3DA-m effective interaction, and model space of protons and neutrons in the full *fp* shell with, in addition to $g_{9/2}$ and $d_{5/2}$ orbitals. Deduced complex nature of deformation for J=0 states. Results from this measurements are not reported in 2020Ma37 and will be published elsewhere.

For data reported in 2020Ma37, $\gamma\gamma$-coin and lifetimes from ^{62}Ni(^{18}O,^{16}Oγ), $\gamma\gamma(\theta)$ from (n,γ) E=th, B(E2) values from Coulomb excitation via ^{208}Pb(^{64}Ni,^{64}Ni$'\gamma$).

^{64}Ni Levels

E(level)[†]	J$^\pi$[‡]	T$_{1/2}$[@]	Comments
0.0	0^+		
1346.4 *5*	2^+		
2276.8 *6*	2^+		
2610.4 *12*	4^+		
2867.3 *9*	0^+	1.4 ps *6*	T$_{1/2}$: other: 1.45 ps *10* from B(E2) measured in Coulomb excitation in (2020Ma37).
2972.0 *6*	$(1,2^+)$		J$^\pi$: 2^+ proposed in 2020Ma37 but no arguments given.
2983.1 *9*	(3^+)		
3026.1 *8*	0^+	3.6 ps *12*	J$^\pi$: spin=0 from 1680γ-1346$\gamma(\theta)$ in (n,γ) E=th (2020Ma37); 1680γ E2, ΔJ=2 to 2^+. T$_{1/2}$: other: 4.1 ps *+5–4* from B(E2) measured in Coulomb excitation in (2020Ma37).
3153.5 *6*	2^+		J$^\pi$: 1^+ reported by 2020Ma37, but no arguments given.
3165.4 *12*	4^+		
3276.0	2^+		E(level): from 2020Ma37.
3395.4 *12*	4^+		
3463.8 *7*	0^+[#]		J$^\pi$: spin=0 from 2117γ-1346$\gamma(\theta)$ in (n,γ) E=th (2020Ma37); primary γ from 1^- expected to be E1; 310γ, 492γ and 1187γ to 2^+.
3560.5 *12*	3^-		
3648.3 *7*	2^+		J$^\pi$: spin=2 from 2302γ-1346γ in (n,γ) E=th (2020Ma37).
3749.4 *6*	2^+	>0.5 ps	J$^\pi$: spin=2 from 2403γ-1346γ in (n,γ) E=th (2020Ma37); 2403γ M1+E2 to 2^+. T$_{1/2}$: from line-shape analysis for 2403γ observed in ^{65}Cu(^{11}B,^{12}C).
3798.7	2^+		E(level),J$^\pi$: from 2020Ma37. The authors state that $J^\pi=2^+$ is firmly established in their (n,γ) E=th experiment, but no further details are given.
3849.4 *15*	5^-		
3857.2 *12*	0^+		J$^\pi$: 2020Ma37 note that 0^+ is established based on a 702γ-3154γ correlation cascade from a (n,γ) E=th experiment at ILL, which has not been published.
4085.4 *15*	$5^{(-)}$		
4269.3 *12*	0^+[#]		
4704.3 *12*	0^+[#]		

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^{62}Ni(^{18}O,^{16}Oγ) 2020Ma37 (continued)

^{64}Ni Levels (continued)

E(level)[†]	J$^{\pi}$[‡]	Comments
5769.4 *12*	0^{+}[#]	
(9658.5 *7*)	1^{-}	E(level): S(n)=9657.46 *20* (2021Wa16).

[†] From a least-squares fit to γ-ray energies, assuming $\Delta E\gamma$=1 keV, unless otherwise noted.
[‡] From Adopted Levels, unless otherwise noted. Supporting arguments from this dataset are given in footnotes or comments where available.
[#] From 2020Ma37. The authors state that the decay pattern is only consistent with 0^{+} based on an unpublished (n,γ) E=th experiment at ILL and that $\gamma\gamma(\theta)$ of a cascade toward 1346 level also yields firm 0^{+} assignment.
[@] From recoil-distance Doppler-shift technique in ^{62}Ni(^{18}O,^{16}Oγ) experiment in 2020Ma37.

γ(^{64}Ni)

B(E2) values are from GOSIA analysis of Coulomb excitation data from ^{208}Pb(^{64}Ni,^{64}Ni$'\gamma$) experiment in 2020Ma37.

E$_i$(level)	J$_i^{\pi}$	E$_{\gamma}$[†]	I$_{\gamma}$[‡]	E$_f$	J$_f^{\pi}$	Mult.[@]	δ	Comments
1346.4	2^{+}	1346	100	0.0	0^{+}			B(E2)↓=0.0140 *20*
2276.8	2^{+}	930		1346.4	2^{+}			B(E2)↓=0.0073 *8*
		2277		0.0	0^{+}			
2610.4	4^{+}	1264		1346.4	2^{+}			
2867.3	0^{+}	1521	100	1346.4	2^{+}			B(E2)↓=0.0048 *3*
2972.0	(1,2^{+})	695		2276.8	2^{+}			
		1626		1346.4	2^{+}			
		2972		0.0	0^{+}			
2983.1	(3^{+})	706		2276.8	2^{+}			
		1637		1346.4	2^{+}			
3026.1	0^{+}	749	3.6 *2*	2276.8	2^{+}			
		1680	100	1346.4	2^{+}	E2		B(E2)↓=0.0010 *1* Mult.: Q (ΔJ=2) from 1680γ-1346$\gamma(\theta)$; M2 ruled out by RUL.
3153.5	2^{+}	877		2276.8	2^{+}			
		1806		1346.4	2^{+}			
		3154		0.0	0^{+}			
3165.4	4^{+}	1819		1346.4	2^{+}			
3276.0	2^{+}	1930[#a]		1346.4	2^{+}	(M1+E2)[&]		
3395.4	4^{+}	2049		1346.4	2^{+}			
3463.8	0^{+}	310	4.6	3153.5	2^{+}			
		492	1.0	2972.0	(1,2^{+})			
		1187	100	2276.8	2^{+}			
		2117	23	1346.4	2^{+}	Q		B(E2)↓<0.00013
3560.5	3^{-}	2214		1346.4	2^{+}			
3648.3	2^{+}	2302		1346.4	2^{+}	(M1+E2)[&]		
		3648		0.0	0^{+}			
3749.4	2^{+}	1473	20	2276.8	2^{+}			B(E2)↓<0.00032
		2403	100	1346.4	2^{+}	E2+M1	+1.23 *10*	Mult.,δ: D+Q and δ from $\gamma\gamma(\theta)$ in ^{63}Ni(n,γ) E=th; E1+M2 disfavored by the large δ and RUL.
		3749	31	0.0	0^{+}			
3798.7	2^{+}	2453[#a]		1346.4	2^{+}	(M1+E2)[&]		
3849.4	5^{-}	1239		2610.4	4^{+}			
3857.2	0^{+}	702[a]		3153.5	2^{+}			E$_{\gamma}$: 2020Ma37 mention a 702γ-3154γ

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^{62}Ni(^{18}O,^{16}Oγ) 2020Ma37 (continued)

γ(^{64}Ni) (continued)

E_i(level)	J_i^π	E_γ †	E_f	J_f^π	Comments
					correlation cascade from a (n,γ) E=th experiment at ILL, which has not been published.
4085.4	$5^{(-)}$	1475	2610.4	4^+	
4269.3	0^+	2922#a	1346.4	2^+	
4704.3	0^+	3358#a	1346.4	2^+	
5769.4	0^+	4423#a	1346.4	2^+	
(9658.5)	1^-	3889	5769.4	0^+	
		4954	4704.3	0^+	
		5389	4269.3	0^+	
		5801	3857.2	0^+	
		5909	3749.4	2^+	
		6010	3648.3	2^+	
		6194	3463.8	0^+	
		6632	3026.1	0^+	
		6791	2867.3	0^+	

† From 2020Ma37, mainly from ^{62}Ni(^{18}O,^{16}Oγ) and (n,γ) E=th.
‡ From (n,γ) E=th experiment in 2020Ma37.
# From level-energy difference. A transition to 1346 level is mentioned but its energy is not given by 2020Ma37.
@ From $\gamma\gamma(\theta)$ in (n,γ) E=th experiment in 2020Ma37.
& 2020Ma37 states that $\gamma\gamma(\theta)$ of the cascade toward 1346 level indicates a dominant M1 character, with only a small E2 admixture.
a Placement of transition in the level scheme is uncertain.

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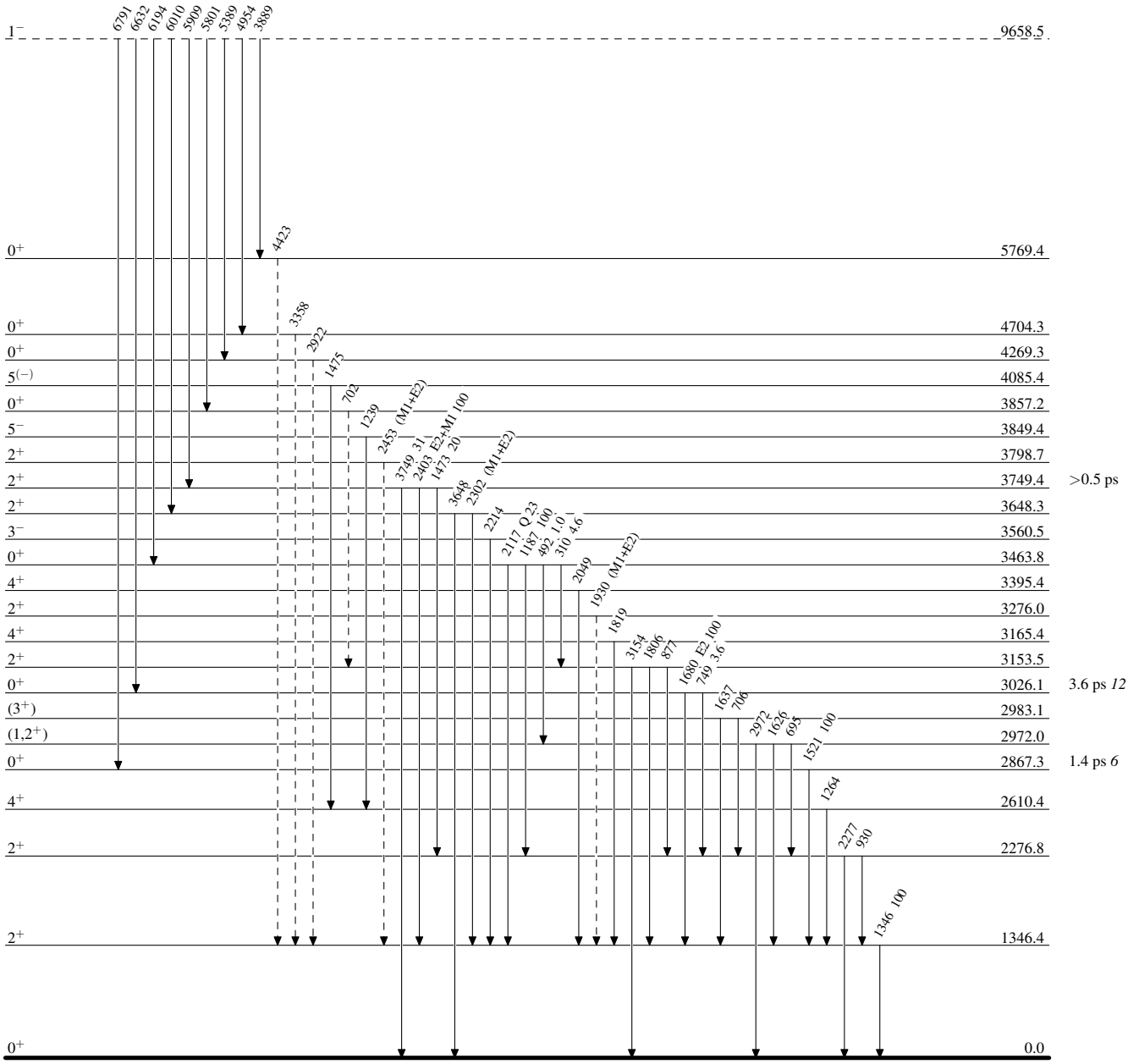
Legend

Level Scheme

Intensities: Relative photon branching from each level

γ Decay (Uncertain)



$^{64}_{28}Ni_{36}$