^{238}U(^{64}Ni,^{64}Ni′γ) 2012Br15

History

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

Deep-inelastic measurements. Also includes ^{64}Ni(^{238}U,^{64}Ni′γ) from 2017Kl01.

2012Br15: E=430 MeV beam from ATLAS facility at ANL incident upon a ^{238}U target of 55 mg/cm^2 thickness. Measured Eγ, Iγ, γγ coin, γγ(θ) using Gammasphere array consisting of 100 Compton-suppressed HPGe detectors. Deduced levels, J, π. Comparison with shell-model calculations. Includes brief results from ^{64}Co β$^-$ decay observed from delayed coincidence spectra in this experiment. 2012Br15 state (reference 27 in their paper) that detailed study of ^{64}Co β$^-$ decay carried out at ISOLDE-CERN facility is to be published.

2017Kl01: E(^{238}U)=6.5 MeV/nucleon, target=1.25 mg/cm^2 thick ^{64}Ni. Measured ΔE-E energy spectrum for target-like reaction products, mass-over-charge ratio of the ions from tof, Eγ, Iγ, (recoil ions)γ-coin, level lifetimes using recoil distance Doppler shift (RDDS) method using Orsay universal plunger system (OUPS). Particles were detected using large-acceptance variable mode spectrometer VAMOS++. The Gamma rays were detected using AGATA array of 19 HPGe crystals at GANIL facility.

^{64}Ni Levels

E(level)[†]	Jπ[#]	$T_{1/2}$	Comments
0.0	0$^+$		
1345.83 *10*	2$^+$	1.065 ps *116*	$T_{1/2}$: from measured mean lifetime τ=1.537 ps *76*(stat) *150*(syst) (2017Kl01).
2276.59[‡] *14*	2$^+$		
2610.10 *14*	4$^+$		
2867.34[‡] *23*	0$^+$		
2972.2 *3*	(2$^+$)		
2982.95 *18*	(3$^+$)		
3025.95[‡] *23*	0$^+$		
3165.78 *18*	4$^+$		
3395.90 *16*	4$^+$		
3463.1 *4*	(2,3$^-$)		
3559.74 *18*	3$^-$		
3749.25 *19*	4$^-$		
3849.12 *16*	5$^-$		
4085.05 *21*	5$^-$		
4172.52 *19*	6$^-$		
4417.6 *4*	(3,4$^+$)		
4477.1 *5*	(6$^+$)		
4531.89 *21*	7$^-$		
4711.97 *23*	(6$^-$)		
5735.8 *3*	(7$^-$)		
5811.9 *3*	8$^+$		
6188.7 *4*	9$^-$		
6795.9 *5*	(10$^+$)		

[†] From a least-squares fit to Eγ data.

[‡] Level also populated from ^{64}Co β$^-$ decay in this experiment.

[#] As proposed by 2012Br15 based on their γγ(θ) measurements and previous assignments for low-energy levels.

$^{238}U(^{64}Ni,^{64}Ni'\gamma)$ 2012Br15 (continued)

$\gamma(^{64}Ni)$

The $\gamma\gamma(\theta)$ measurements are for gates on stretched E2 transitions, unless otherwise stated. Expected values of coefficients are: A_2=+0.10, A_4=+0.01 for stretched quadrupole−stretched quadrupole cascade; A_2=−0.07, A_4=0.0 for stretched quadrupole-stretched dipole cascade; A_2=+0.05, A_4=0.0 for stretched dipole-stretched dipole cascade (2012Br15).

E_γ †	I_γ †	E_i(level)	J_i^π	E_f	J_f^π	Mult.‡	δ	Comments
100.0 *3*	1.1 *3*	3849.12	5^-	3749.25	4^-			
189.3 *3*	3.3 *3*	3749.25	4^-	3559.74	3^-	D		(189γ)(1346γ)(θ): A_2=−0.05 *4*.
230.0 *3*	0.18 *8*	3395.90	4^+	3165.78	4^+			
236.1 *3*	0.7 *3*	4085.05	5^-	3849.12	5^-			
289 *1*	0.12 *7*	3849.12	5^-	3559.74	3^-			
323.4 *1*	20.1 *2*	4172.52	6^-	3849.12	5^-	D		(323γ)(1264γ)(θ): A_2=−0.05 *1*, A_4=+0.04 *3*. (323γ)(1346γ)(θ): A_2=−0.06 *3*, A_4=+0.04 *5*.
359.4 *1*	12.0 *2*	4531.89	7^-	4172.52	6^-			(359γ)(1346γ)(θ): A_2=−0.06 *2*, A_4=+0.03 *3*. (359γ)(323γ)(θ): A_2=+0.04 *1*, A_4=+0.01 *2*; 323γ gating transition is ΔJ=1, dipole or D+Q. (359γ)(1264γ)(θ): A_2=−0.08 *2*, A_4=0.00 *3*.
413.0 *3*	0.20 *5*	3395.90	4^+	2982.95	(3^+)			
453.3 *3*	1.4 *3*	3849.12	5^-	3395.90	4^+	D		(453γ)(2050γ)(θ): A_2=−0.17 *10*, A_4=+0.02 *10*.
583.4 *3*	1.2 *2*	3749.25	4^-	3165.78	4^+	D		(583γ)(1820γ)(θ): A_2=+0.24 *8*.
626.8 *3*	0.3 *2*	4711.97	(6^-)	4085.05	5^-			
683.6 *4*	0.2 *1*	3849.12	5^-	3165.78	4^+			
688.9 *3*	0.20 *5*	4085.05	5^-	3395.90	4^+			
695.5 *3*	0.4 *2*	2972.2	(2^+)	2276.59	2^+			
706.5 *2*	2.5 *3*	2982.95	(3^+)	2276.59	2^+			(706γ)(1346γ)(θ): A_2=+0.07 *6*.
766.6 *4*	0.25 *5*	3749.25	4^-	2982.95	(3^+)			
785.9 *2*	1.6 *3*	3395.90	4^+	2610.10	4^+			(786γ)(1264γ)(θ): A_2=+0.19 *6*, A_4=−0.03 *6*.
862.9 *2*	1.1 *2*	4711.97	(6^-)	3849.12	5^-			
930.8 *1*	21.5 *5*	2276.59	2^+	1345.83	2^+	D+Q	≈−0.9	Mult.,δ: from (931γ)(1346γ)(θ): A_2=−0.25 *3*, A_4=+0.15 *4*.
984.0 *4*	0.3 *1*	6795.9	(10^+)	5811.9	8^+			
1139.4 *3*	0.6 *2*	3749.25	4^-	2610.10	4^+			
1186.5 *3*	0.3 *1*	3463.1	$(2,3^-)$	2276.59	2^+			
1204.1 *3*	0.5 *2*	5735.8	(7^-)	4531.89	7^-			
1239.0 *1*	23.0 *2*	3849.12	5^-	2610.10	4^+	D		(1239γ)(1346γ)(θ): A_2=−0.08 *1*, A_4=+0.03 *1*. (1239γ)(1264γ)(θ): A_2=−0.08 *2*, A_4=+0.02 *3*.
1264.3 *1*	65.0 *5*	2610.10	4^+	1345.83	2^+	Q		(1264γ)(1346γ)(θ): A_2=+0.08 *1*, A_4=+0.03 *2*.
1280.0 *2*	1.9 *3*	5811.9	8^+	4531.89	7^-			(1280γ)(1264γ)(θ): A_2=−0.10 *8*, A_4=−0.04 *10*. (1280γ)(359γ)(θ): A_2=+0.04 *1*, A_4=+0.07 *6*; 359γ gating transition is ΔJ=1, dipole or D+Q.
1283.3 *3*	0.9 *2*	3559.74	3^-	2276.59	2^+			
1311.3 *4*	0.25 *5*	4477.1	(6^+)	3165.78	4^+			
1345.8 *1*	100	1345.83	2^+	0.0	0^+	Q		
1474.9 *3*	2.1 *3*	4085.05	5^-	2610.10	4^+	D		(1475γ)(1346γ)(θ): A_2=−0.08 *5*, A_4=+0.01 *10*. (1475γ)(1264γ)(θ): A_2=−0.07 *3*, A_4=+0.03 *4*.
1521.5 *2*	1.3 *2*	2867.34	0^+	1345.83	2^+	Q		(1522γ)(1346γ)(θ): A_2=+0.43 *15*, A_4=+0.75 *20*.
1562.8 *4*	0.4 *2*	5735.8	(7^-)	4172.52	6^-			
1626.4 *4*	0.5 *3*	2972.2	(2^+)	1345.83	2^+			
1637.0 *3*	1.6 *3*	2982.95	(3^+)	1345.83	2^+			(1637γ)(1346γ)(θ): A_2=+0.06 *6*, A_4=−0.02 *11*.
1656.8 *3*	0.5 *2*	6188.7	9^-	4531.89	7^-	Q		(1657γ)(1264γ)(θ): A_2=+0.11 *3*, A_4=+0.01 *4*.
1680.1 *2*	0.6 *2*	3025.95	0^+	1345.83	2^+	Q		(1680γ)(1346γ)(θ): A_2=+0.60 *20*, A_4=+0.80 *20*.
1819.9 *2*	3.2 *4*	3165.78	4^+	1345.83	2^+	Q		(1820γ)(1346γ)(θ): A_2=+0.10 *6*.
2049.9 *2*	2.7 *4*	3395.90	4^+	1345.83	2^+	Q		(2050γ)(1346γ)(θ): A_2=+0.13 *6*, A_4=+0.04 *10*.
2141.0 *3*	0.4 *1*	4417.6	$(3,4^+)$	2276.59	2^+			
2213.7 *2*	3.2 *4*	3559.74	3^-	1345.83	2^+	D		(2214γ)(1346γ)(θ): A_2=−0.07 *4*, A_4=−0.02 *4*.

Continued on next page (footnotes at end of table)

^{238}U(^{64}Ni,^{64}Ni′γ) 2012Br15 (continued)

γ(^{64}Ni) (continued)

E_γ †	I_γ †	E_i(level)	J_i^π	E_f	J_f^π
2277 *2*	0.18 *5*	2276.59	2^+	0.0	0^+
2973 *1*	0.4 *2*	2972.2	(2^+)	0.0	0^+

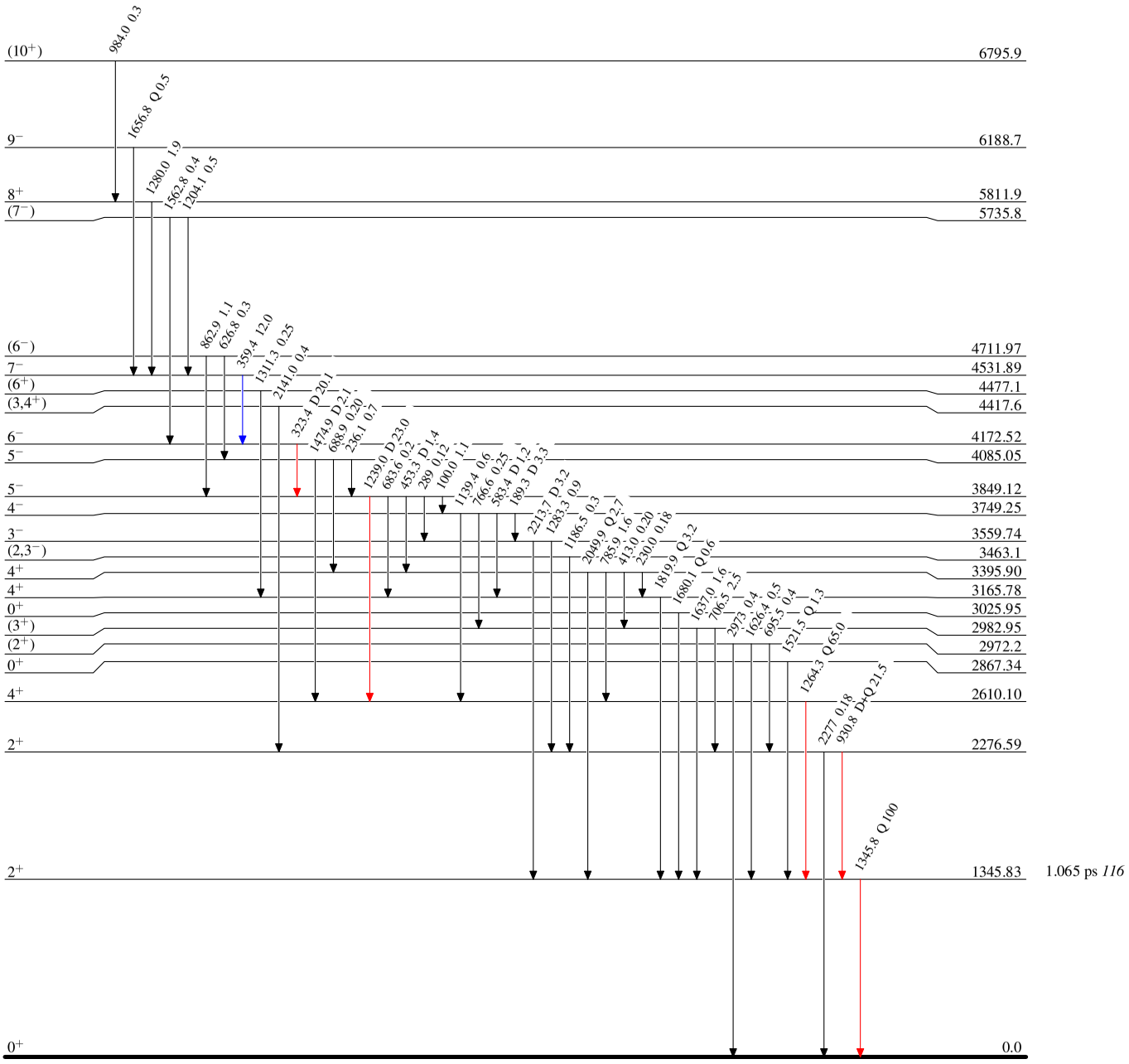
† From 2012Br15.
‡ Assigned by the evaluators based on $\gamma\gamma(\theta)$ in 2012Br15, not given by the authors except for 930.8γ.

$^{238}U(^{64}Ni,^{64}Ni'\gamma)$ **2012Br15**

Level Scheme

Intensities: Relative I_γ

Legend
- $I_\gamma < 2\% \times I_\gamma^{max}$
- $I_\gamma < 10\% \times I_\gamma^{max}$
- $I_\gamma > 10\% \times I_\gamma^{max}$



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