^{90}Zr(^{17}O,^{17}O′),(^{17}O,^{17}O′γ) 1993Li24,2010Kr01,2015Cr02

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	S. K. Basu, E. A. Mccutchan	NDS 165,1 (2020)	1-Mar-2020

1993Li24: (^{17}O,^{17}O′), E=1435 MeV. Measured scattered ^{17}O ions at various angles. Determined B(E2)↑ and B(E3)↑. Detector: ion chamber, plastic scintillator. Other: 1995Be12, 1992VaZW.

1993Ho03, 1992Ho02: (^{6}Li,^{6}Li′), E=70 MeV. Measured scattered ^{6}Li ions at various angles from θ=4° to 45°. Detector: magnetic spectrometer, FWHM≈225 keV. Determined B(E2)↑. Target: 97.67% enriched ^{90}Zr.

2010Kr01: (^{6}Li,^{6}Li′), E=240 MeV. 90% enriched 5.0 mg/cm^2 ^{90}Zr target; measured scattered ^{6}Li ions at various angles from θ(c.m.) = 4° to 43°. Multipole-Dipole-Multipole (MDM) spectrometer at TAMU. Determined B(E2)↑, B(E3)↑. Double folding model analysis using density dependent M3Y NN effective interaction and with phenomenological Woods-Saxon potential.

2015Cr02: E(^{17}O)=340 MeV beam from the Tandem-ALPI accelerator complex of the Legnaro National Laboratories of INFN at Legnaro, Italy. Self-supporting target with thickness of 2 mg/cm^2. Measured Eγ, Iγ, γ(θ) using the AGATA demonstrator consisting of three triple clusters of HPGe detectors and E(recoil), recoil-γ coincidences using two ΔE-E silicon telescopes (FWHM ≈ 0.3% at 340 MeV). Differential cross sections compared to the results of DWBA calculations using both the standard collective form factor and a form factor obtained by folding microscopically calculated transition densities. Comparison of data to (γ,γ') and (p,p′) data in the energy region of 6 to 11 MeV.

^{90}Zr Levels

E(level)	J^π[†]	Comments
0.0	0^+	
1760.7	0^+	
2186.3	2^+[‡]	B(E2)↑=0.066 *6* (^{6}Li,^{6}Li′) (1993Ho03); B(E2)↑=0.043 *9*, (^{17}O,^{17}O′) (1993Li24), B(E2)↑=0.059 *+2−6* (^{6}Li,^{6}Li′) (2010Kr01).
2319.0	5^-	
2739.3	$(4)^-$[#]	
2747.9	3^-[‡]	B(E3)↑=0.027 *5*, (^{17}O,^{17}O′)(1993Li24) ;B(E2)↑=0.086 *+2 −9* (^{6}Li,^{6}Li′)(2010Kr01).
3076.9	4^+	
3308.8	2^+[‡]	
3448.2	6^+	
3842.2	2^+	E(level): cross section best reproduced by a calculation which considers only the Coulomb excitation contribution.
4223	(2^+)[#]	
4681	2^+	E(level): excitation cross section measurements suggest that other sizable decay branches (apart from the observed 839γ and 4681γ) might exist from this level.
6424	1^-	E(level): cross section not well reproduced by DWBA calculation using standard deformed potential model, better agreement obtained when nuclear contribution is calculated from a microscopic form factor. E(level): dominant isoscalar component, exhausts 2.17% of the isoscalar dipole energy weighted sum rule strength.

[†] From the Adopted Levels.
[‡] DWBA calculations with standard deformed potential model consistent with J^π from Adopted Levels.
[#] Listed without parentheses in level-scheme Fig. 4 of 2015Cr02.

γ(^{90}Zr)

Yield ratio is determined from Y_R=Y(125°−150°)/Y(100°−125°) where Y(θ) is the yield at angle θ. The average for the known E2 ground state transitions from the 2186-, 3309-, and 3842-keV levels is Y_R=1.05 *5* (read by evaluators from Fig. 3 of 2015Cr02). For the 6.5 to 8 MeV energy interval, Y_R=1.39 *7*, and for the 6.5 to 10 MeV energy interval, Y_R=1.36 *6* (both read by evaluators from Figure 3 of 2015Cr02), suggesting dominant E1 character for transitions in this energy range, although the presence of M1 and E2 transitions cannot be excluded.

Continued on next page (footnotes at end of table)

^{90}Zr(^{17}O,^{17}O′),(^{17}O,^{17}O′γ) 1993Li24,2010Kr01,2015Cr02 (continued)

γ(^{90}Zr) (continued)

E_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.‡	Comments
420	2739.3	$(4)^-$	2319.0	5^-		
425	2186.3	2^+	1760.7	0^+		E_γ: listed as 562 keV in Figure 4 of 2015Cr02, which evaluators consider to be a typo. Figure 1 and text of 2015Cr02 describe a 425γ depopulating the 2186.3-keV level. A 562γ depopulates 2748, 3^- level.
562	2747.9	3^-	2186.3	2^+		
839#	4681	2^+	3842.2	2^+		E_γ: observed in spectrum with condition on the energy of the scattered ^{17}O particles which corresponds to excitation energies in ^{90}Zr between 4.2 MeV and 5.2 MeV, however, absent in same spectrum gated on ^{90}Zr energies between 3.0 MeV and 4.0 MeV.
891	3076.9	4^+	2186.3	2^+		
1122	3308.8	2^+	2186.3	2^+		
1129	3448.2	6^+	2319.0	5^-		E_γ: a 562γ is shown in Figure 4 of 2015Cr02 as depopulating the 3448-keV level and populating the 2739-keV level, which evaluators considers to be a typo. Figure 1 and text of 2015Cr02 describe a 1129γ depopulating the 3448-keV level.
2186†	2186.3	2^+	0.0	0^+	E2	Mult.: Y_R=1.02 *2*, read by evaluators from Figure 3 of 2015Cr02.
2748†	2747.9	3^-	0.0	0^+		
3309†	3308.8	2^+	0.0	0^+	E2	Mult.: Y_R=1.1 *1*, read by evaluators from Figure 3 of 2015Cr02.
3842†	3842.2	2^+	0.0	0^+	E2	Mult.: Y_R=1.13 *8*, read by evaluators from Figure 3 of 2015Cr02.
4223	4223	(2^+)	0.0	0^+		
4681† *8*	4681	2^+	0.0	0^+		
6424†	6424	1^-	0.0	0^+	E1	Mult.: dipole from observation in spectra with condition on angle between emitted γ ray and recoil direction which enhances dipole transitions. Mult.: Y_R=1.43 *17*, read by evaluator from Figure 3 of 2015Cr02.

† Confirmed ground state transitions through their observation in spectra obtained by requiring the γ-ray energy to be equal to the excitation energy in ^{90}Zr, within the energy resolution of the charged-particle telescopes.

‡ From yield ratio,Y_R (2015Cr02).

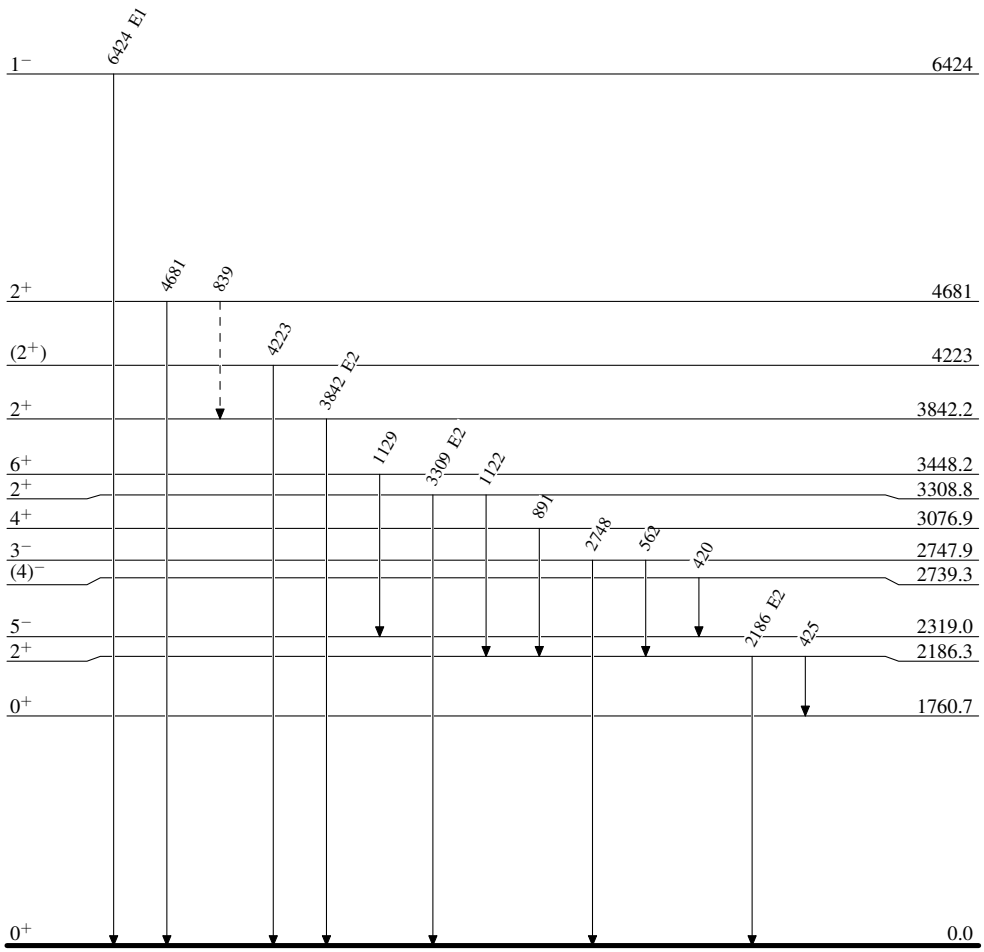
Placement of transition in the level scheme is uncertain.

Legend

^{90}Zr(^{17}O,^{17}O′),(^{17}O,^{17}O′γ) 1993Li24,2010Kr01,2015Cr02

Level Scheme

- - - - - - ► γ Decay (Uncertain)



$^{90}_{40}Zr_{50}$