90 Zr(17 O, 17 O'),(17 O, 17 O' γ) 1993Li24,2010Kr01,2015Cr02

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

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

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

2010Kr01: (⁶Li,⁶Li'), E=240 MeV. 90% enriched 5.0 mg/cm² ⁹⁰Zr target; measured scattered ⁶Li 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/cm². Measured E γ , I γ , $\gamma(\theta)$ using the AGATA demonstrator consisting of three triple clusters of HPGe detectors and E(recoil), recoil- γ coincidences using two Δ E-E silicon telescopes (FWHM $\approx 0.3\%$ 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.

⁹⁰Zr 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 3076.9	3 ^{-‡} 4 ⁺	B(E3) [↑] =0.027 5, $({}^{17}\text{O}, {}^{17}\text{O'})(1993\text{Li}24)$; B(E2) [↑] =0.086 +2 -9 (${}^{6}\text{Li}, {}^{6}\text{Li'})(2010\text{Kr}01)$.				
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 Ado	nted Levels				

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.

$\gamma(^{90}\text{Zr})$

Yield ratio is determined from $Y_R = Y(125^\circ - 150^\circ)/Y(100^\circ - 125^\circ)$ where $Y(\theta)$ is the yield at angle θ . The average for the known E2 ground state transitions from the 2186-, 3309-, and 3842-keV levels is $Y_R = 1.055$ (read by evaluators from Fig. 3 of 2015Cr02). For the 6.5 to 8 MeV energy interval, $Y_R = 1.397$, and for the 6.5 to 10 MeV energy interval, $Y_R = 1.366$ (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.

⁹⁰**Zr**(¹⁷**O**,¹⁷**O**'),(¹⁷**O**,¹⁷**O**' γ) 1993Li24,2010Kr01,2015Cr02 (continued)

γ (⁹⁰Zr) (continued)

Eγ	E _i (level)	\mathbf{J}_i^{π}	E_f	\mathbf{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 425 γ depopulating the 2186 3-keV level A 562 γ 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^{+}		C C C C C C C C C C C C C C C C C C C
1122	3308.8	2^{+}	2186.3	2^{+}		
1129	3448.2	6+	2319.0	5-		E_{γ} : a 562 γ 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 1129 γ 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.: $Y_R=1.1 I$, read by evaluators from Figure 3 of 2015Cr02.
3842 [†] 4223	3842.2 4223	2^+ (2 ⁺)	$\begin{array}{c} 0.0\\ 0.0\end{array}$	$0^+ \\ 0^+$	E2	Mult.: $Y_R=1.13$ 8, read by evaluators from Figure 3 of 2015Cr02.
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 <i>17</i> , 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.



 $^{90}_{40}{
m Zr}_{50}$