^{18}O(^{16}O,pnγ) 2014Bh14,2011Ch54

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Jun Chen	NDS 201,1 (2025)	31-Oct-2024

2014Bh14,2011Ch54 (also 2010Gh02): E=34 MeV ^{16}O beam was produced from the BARC-TIFR 14 UD Pelletron Accelerator at Mumbai. Target was tantalum oxide Ta_2O^5 with a thickness of about 50 mg/cm^2 of Ta and approximately 1.6 mg/cm^2 of ^{18}O on both sides of the Ta foil. De-exciting γ-rays were detected with the Indian National Gamma Array consisting of 18 clover Ge detectors. Measured Eγ, Iγ, $\gamma\gamma$-coin, $\gamma\gamma$(lin pol), $\gamma\gamma$(anisotropy), Doppler-shift attenuation. Deduced levels, J,π, lifetimes (in 2014Bh14), γ-ray multipolarities and branching ratios (in 2011Ch54). Comparisons with available data and theoretical calculations. 2010Gh02 report a preliminary level scheme.

1978Ba76: E=35 MeV. Ge detector. Measured Eγ, $\gamma\gamma$-coin. Report 3443, 5861, 7415 levels.

^{32}P Levels

E(level)[†]	J$^\pi$[‡]	T$_{1/2}$[#]	Comments
0.0	1$^+$		
78.2 *6*	2$^+$		
1323.3 *7*	2$^+$	330 fs *+26−16*	T$_{1/2}$: from τ=476 fs *+38−23* weighted average of 485 fs *+57−32* for 1323γ and 472 fs *+38−23* for 1245γ.
1755.3 *6*	3$^+$	427 fs *+45−32*	T$_{1/2}$: see figure 7 in 2014Bh14 where lifetime is measured as a function of the areal density of the target; the mean lifetime (τ) varies from 620 fs for target density of 5.76 mg/cm^2 to 440 fs for target density of 8.2 mg/cm^2.
2177.2 *7*	3$^+$		
3149.5 *7*	4$^+$	<574 fs	T$_{1/2}$: from τ<745 fs *+83−76* in 2014Bh14.
3321.0 *10*	3$^-$		
3444.3 *8*	4$^-$	<683 fs	T$_{1/2}$: from τ<883 fs *+103−82* in 2014Bh14.
4024.2 *13*			
4036.4 *10*	4$^+$	<71 fs	T$_{1/2}$: from τ<80 fs *+22−10* in 2014Bh14.
4067.4 *13*			
4276.2 *8*	5$^-$	<684 fs	T$_{1/2}$: from τ<696 fs *+99−42* for 1127γ and τ<902 fs *+85−101* for 832γ in 2014Bh14.
4698.5 *10*		<449 fs	T$_{1/2}$: from τ<579 fs *+69−62* in 2014Bh14.
4990.1 *13*			
5481.4 *11*	5$^{(-)}$	<155 fs	T$_{1/2}$: from τ<188 fs *+36−29* in 2014Bh14.
5550.2 *13*			
5583.4 *13*			
5862.4 *9*	6$^{(-)}$	<493 fs	T$_{1/2}$: from τ<629 fs *+82−61* in 2014Bh14.
6415.3 *13*		<150 fs	T$_{1/2}$: from τ<186 fs *30* in 2014Bh14.
6814.3 *11*	(6$^-$)		
6835.1 *13*		<131 fs	T$_{1/2}$: from τ<159 fs *+30−23* in 2014Bh14.
7417.2 *12*	7$^{(+)}$	<796 fs	T$_{1/2}$: from τ<1018 fs *+130−82* in 2014Bh14.
9637.7 *15*	(8$^-$)	<173 fs	T$_{1/2}$: from τ<220 fs *+30−27* in 2014Bh14.

[†] From a least-squares fit to γ-ray energies.
[‡] From 2011Ch54 based on measured $\gamma\gamma$(anisotropy), $\gamma\gamma$(pol) or theoretical predictions where no $\gamma\gamma(\theta)$ data are available.
[#] From DSAM in 2014Bh14.

γ(^{32}P)

γ anisotropy is defined as R_{ang}=[Iγ_1(32°) gated by γ_2(90°)]/[Iγ_1(57°) gated by γ_2(90°)], with gating transition of ΔJ=1, dipole. Expected values are ≈0.83 for ΔJ=1, dipole and ≈1.11 for ΔJ=2, Q transitions (2011Ch54). Numerical values obtained as e-mail reply of Nov 3, 2011 from R. Chakrabarti to B. Singh.

For γ linear polarization (POL), positive value is for dominant electric transitions and negative for dominant M1 transitions; value is nearly zero for mixed transitions (2011Ch54).

Continued on next page (footnotes at end of table)

$^{18}O(^{16}O,pn\gamma)$ 2014Bh14,2011Ch54 (continued)

$\gamma(^{32}P)$ (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[‡]	E_f	J_f^π	Mult.[#]	Comments
78.2	2^+	78.2 *10*	100	0.0	1^+		
1323.3	2^+	1245.1 *10*	47 *1*	78.2	2^+		
		1323.1 *10*	53 *1*	0.0	1^+	D	R_{ang}=0.84 *11*.
1755.3	3^+	432.4 *10*	2.0 *1*	1323.3	2^+		I_γ: other: 1.4 *1* (2011Ch54). POL=−0.06 *9*.
		1677.1 *10*	98 *2*	78.2	2^+	D	I_γ: 97.6 *1* (2011Ch54). Rang=0.54 *2*, consistent with ΔJ=1.
		1755.1 *10*	1.0 *1*	0.0	1^+		I_γ: 1.1 *1* (2011Ch54).
2177.2	3^+	2098.8 *10*	96.7[@] *18*	78.2	2^+		
		2177.4 *10*	3.3[@] *3*	0.0	1^+		
3149.5	4^+	972.1 *10*	25 *1*	2177.2	3^+	D+Q	I_γ: other: 25.4 *9* (2011Ch54). POL=−0.05 *7*.
		1394.4 *10*	14 *1*	1755.3	3^+		I_γ: other: 13.9 *6* (2011Ch54).
		1825.7 *10*	56 *2*	1323.3	2^+		I_γ: 55.6 *14* (2011Ch54). POL=+0.03 *3*.
		3071.3 *10*	5.0 *4*	78.2	2^+		I_γ: 5.1 *4* (2011Ch54).
3321.0	3^-	3242.5 *10*	100	78.2	2^+		
3444.3	4^-	1267.3 *10*	1.8[@] *3*	2177.2	3^+		
		1689 *1*	98.3[@] *25*	1755.3	3^+	D	R_{ang}=0.79 *2*, consistent with ΔJ=1.
4024.2		579.9 *10*		3444.3	4^-		
4036.4	4^+	2281.0 *10*	100	1755.3	3^+		
4067.4		623.1 *10*		3444.3	4^-		
4276.2	5^-	832.2 *10*	77[@] *12*	3444.3	4^-	M1	POL=−0.07 *4*. R_{ang}=0.83 *8*, consistent with ΔJ=1.
		955.1 *10*		3321.0	3^-	Q	R_{ang}=1.3 *4*, consistent with ΔJ=2.
		1126.5 *10*	23[@] *12*	3149.5	4^+		
4698.5		662.1 *10*	15[@] *2*	4036.4	4^+		
		1254.2 *10*	85[@] *8*	3444.3	4^-		
4990.1		713.9 *10*		4276.2	5^-		
5481.4	$5^{(-)}$	2036.7 *10*	100	3444.3	4^-		
5550.2		1274.0 *10*		4276.2	5^-		
5583.4		2139.0[&] *10*		3444.3	4^-		
5862.4	$6^{(-)}$	380.6 *10*	8.2[@] *4*	5481.4	$5^{(-)}$	M1	POL=−0.08 *10*. R_{ang}=0.58 *17*.
		1586.2 *10*	2.6[@] *2*	4276.2	5^-		I_γ: other: 3.0 *2* (2014Bh14).
		2418.4 *10*	89.2[@] *18*	3444.3	4^-	E2+M3	I_γ: other: 89 *2* (2014Bh14). POL=+0.04 *6*. R_{ang}=1.12 *3*.
6415.3		2139.0[&] *10*		4276.2	5^-		
6814.3	(6^-)	951.7 *10*		5862.4	$6^{(-)}$		
		2115.8 *10*		4698.5			
6835.1		2558.8 *10*		4276.2	5^-		
7417.2	$7^{(+)}$	602.7 *10*		6814.3	(6^-)		
		1554.9 *10*		5862.4	$6^{(-)}$	D+Q	POL=−0.01 *7*. R_{ang}=0.80 *5*, consistent with ΔJ=1.
9637.7	(8^-)	2220.4 *10*		7417.2	$7^{(+)}$		

[†] From 2011Ch54.
[‡] From 2014Bh14, unless otherwise noted. Most of the values are the same as those in 2011Ch54 where quoted uncertainty includes only statistical uncertainty from fitting, as given under comments if different.

Continued on next page (footnotes at end of table)

^{18}O(^{16}O,pnγ) 2014Bh14,2011Ch54 (continued)

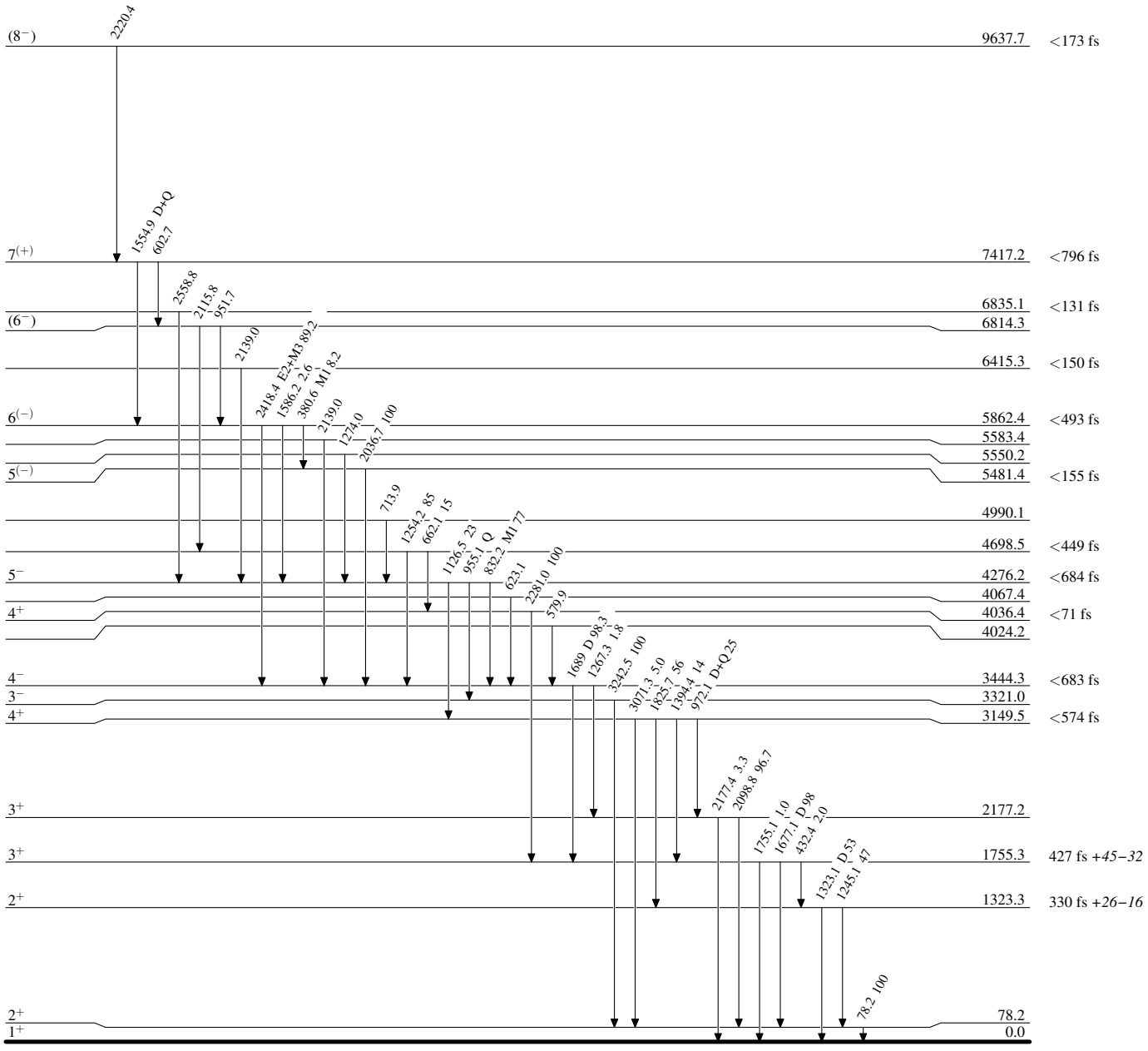
γ(^{32}P) (continued)

From $\gamma\gamma$(lin pol) and $\gamma\gamma$(DCO) in 2011Ch54, unless otherwise noted.
@ From 2011Ch54.
& Multiply placed.

$^{18}O(^{16}O,pn\gamma)$ 2014Bh14,2011Ch54

Level Scheme

Intensities: % photon branching from each level



$^{32}_{15}P_{17}$