^{18}O(^{18}O,pnγ) E=20-44 MeV 2012Be11,2009Be26

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Ninel Nica, Balraj Singh	NDS 113, 1563 (2012)	28-May-2012

2012Be11: 25 MeV ^{18}O beam produced using the Argonne Tandem-Linac Accelerator System(ATLAS) at Argonne National Laboratory impinged on a 260 μg/cm^2 thick ^{18}O target enriched to 97% with Ta backing surrounded by a nearly 4π array of 95 CsI(Tl) scintillators to detect charged particles. γ-rays detected by Gammasphere array consisting of about 100 HPGe detectors. Measured angular distribution, energy and intensity of γ rays, lifetimes by DSAM. Comparison with shell-model calculations. Additional information 1.

2009Be26 (superseded by 2012Be11): E=20, 24, 25, 30, 44 MeV. Two experiments were done: 1. at FSU: E=24 and 44 MeV; detector system was an array of 6 single crystal HPGe detectors and 3 four-crystal clover detectors. 2. at LBNL: E=20, 25, 30 MeV; detector system was E-ΔE Si telescope for particles and 5 HPGe clover detectors. Measured Eγ, Iγ, $\gamma\gamma$, (particle)γ coin, angular distributions, lifetimes by DSAM. Comparison with shell-model calculations.

2011MaZP: E=36 MeV; beam produced using the Tandem accelerator at the National Institute of Physics and Nuclear Engineering Bucharest; measured $T_{1/2}$ by γ-ray coincidence fast-timing technique using 8 HPGe detectors and 7 $LaBr_3$:Ce detectors; prompt $LaBr_3$:Ce time resolution FWHM=470 ps *10*; calculated reduced transition probabilities for different M2/E3 mixing ratios and compared with shell model estimates.

This nuclide is of some relevance to "island of inversion".

Unless noted otherwise, the data and level scheme are from 2012Be11.

Relative intensities at several beam energies from 2009Be26 are given in the table placed at the beginning of the γ (^{34}P) section.

^{34}P Levels

E(level)[†]	J$^\pi$[‡]	$T_{1/2}$	Comments
0.0	1$^+$		
429.11 *20*	2$^+$	1.3 ps *+6−3*	
1608.2 *4*	1$^+$	0.52 ps *+45−14*	
2228.8 *4*	2$^{(-)}$	>2 ps	
2305.1 *4*	4$^-$	2.0 ns *1*	$T_{1/2}$: From $\gamma\gamma$(t) (2011MaZP).
2320.6 *5*	3$^-$	>7 ps	
3352.6 *5*	5$^-$	0.36 ps *+12−8*	
3752.5 *7*	(4,3)$^-$	0.26 ps *6*	
3911.6 *11*	(3,4)$^-$	0.14 ps *7*	
3951.4 *5*	5$^-$	0.111 ps *35*	
4446.7 *21*	(4)$^-$	<0.10 ps	
4630.1 *6*	6$^-$	0.30 ps *5*	
5012.7 *21*	(2)$^-$	<0.07 ps	
5280.7 *21*	(3)$^-$	<0.07 ps	
5394.2 *6*	(6$^-$)	0.11 ps *+8−5*	
5726.5 *13*			
6180.7 *21*	(6)$^-$	<0.07 ps	
6193.9 *11*			J$^\pi$: (7$^+$) is suggested (but not adopted) by 2012Be11 based on shell-model arguments, See also 2009Be26.
6237.4 *6*	(7$^+$)	>6.9 ps	
6357.3 *9*	(7)$^-$	<0.035 ps	
7426.4 *21*		<0.07 ps	
7920.2 *10*		>0.35 ps	

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

[‡] As proposed in 2012Be11 and 2009Be26.

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$\gamma(^{34}P)$

Transition strengths in W.u. have been deduced by evaluators. In cases values are slightly different in 2012Be11.

Relative intensities data					
Eγ(keV)	20 MeV	24 MeV	25 MeV	30 MeV	44 MeV
429	100	100	100	100	
679	1.0 5	7 1	4 1	7 1	9 2
1047	17 2	37 4	28 2	44 4	36 4
1179	9 2	5 1	6 1	3 1	8 2
1607 a	6 2	11 2	13 2	11 2	
1645	11 2	19 2	31 2	46 4	20 3
1876	37 4	76 4	54 4	64 4	76 6 b
1891	17 2	10 2	15 2	9 1	6 1
2325	2 1	10 2	4 1	10 2	11 2
2839	<1	6 1	2 1	7 1	10 2
2883	<1	5 1	3 1	5 1	11 2

a) doublet b) data at 44 MeV normalized to Iγ=76 at 24 MeV

E_i(level)	J_i^π	E_γ	I_γ	E_f	J_f^π	Mult.[†]	δ[‡]	Comments
429.11	2^+	429.1 *2*	100	0.0	1^+	(M1(+E2))	+0.11 *+13−12*	A_2=−0.09 *3*; A_4=+0.02 *4* B(M1)(W.u.)=0.21 *+5−10* Additional information 2.
1608.2	1^+	1179.1 *4*	66 *3*	429.11	2^+	(M1)		A_2=−0.03 *3*; A_4=+0.01 *4* B(M1)(W.u.)=0.017 *+5−15* Additional information 3.
		1608 *1*	34 *3*	0.0	1^+	[M1]		B(M1)(W.u.)=0.004 *+1−3* Additional information 4.
2228.8	$2^{(-)}$	620.6 *4*	30 *6*	1608.2	1^+	(E1(+M2))	+0.07 *16*	A_2=−0.12 *8*; A_4=+0.06 *10* B(E1)(W.u.)<4×10^{-4}
		1799.7 *6*	44 *7*	429.11	2^+	[E1]		B(E1)(W.u.)<2.4×10^{-5} Additional information 5.
		2229 *1*	26 *6*	0.0	1^+	[E1]		B(E1)(W.u.)<8×10^{-6}
2305.1	4^-	1875.9 *4*	100	429.11	2^+	(M2)		A_2=+0.32 *6*; A_4=+0.02 *8* B(M2)(W.u.)=0.064 *4* δ(E3/M2)=0.00 *12*. Additional information 6.
2320.6	3^-	1891.4 *5*	100	429.11	2^+	(E1(+M2))	+0.07 *14*	A_2=−0.15 *7*; A_4=+0.03 *8* B(E1)(W.u.)<1.4×10^{-5} Additional information 7.
3352.6	5^-	1031.7 *7*	2 *1*	2320.6	3^-	[E2]		B(E2)(W.u.)=4 *2* Additional information 8.
		1047.5 *4*	98 *1*	2305.1	4^-	(M1(+E2))	+0.02 *9*	A_2=−0.23 *7*; A_4=+0.04 *8* B(M1)(W.u.)=0.052 *+12−18* Additional information 9.
3752.5	$(4,3)^-$	1431.8 *6*	93 *2*	2320.6	3^-	(M1(+E2))		B(M1)(W.u.)=0.027 *6* δ(E2/M1)=+0.18 *+15−14* for $(4)^-$; ≈ −0.36 for $(3)^-$ (e-mail reply from P.C. Bender, Feb. 29, 2012).
		1446[#]		2305.1	4^-			
		1523.9 *9*	7 *2*	2228.8	$2^{(-)}$	[M1,E2]		B(E2)(W.u.)=2.5 *6* if E2, and B(M1)(W.u.)=0.0015 *4* if M1 from an earlier communication from authors of

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^{18}O(^{18}O,pnγ) E=20-44 MeV 2012Be11,2009Be26 (continued)

γ(^{34}P) (continued)

E_i(level)	J_i^π	E_γ	I_γ	E_f	J_f^π	Mult.[†]	δ[‡]	Comments
								2012Be11, who list same B(M1)(W.u.) value (for 3^- to 3^- transition), and give no value for B(E2)(W.u.).
3911.6	$(3,4)^-$	1591 *1*	100	2320.6	3^-	[M1,E2]		B(M1)(W.u.)=0.040 *+26−16* if M1; B(E2)(W.u.)=61 *+41−20* if E2 from an earlier communication from authors of 2012Be11, who list same B(M1)(W.u.) value (for 4^- to 3^- transition), and give no value for B(E2)(W.u.).
		1606[#]		2305.1	4^-			
3951.4	5^-	1631.5 *11*	4 *2*	2320.6	3^-	[E2]		B(E2)(W.u.)=2.7 *16* Additional information 10.
		1646.1 *4*	96 *2*	2305.1	4^-	(M1(+E2))	−0.03 *18*	A_2=−0.31 *7*; A_4=+0.01 *8* B(M1)(W.u.)=0.043 *14* Additional information 11.
4446.7	$(4)^-$	2126 *2*	100	2320.6	3^-	[M1]		B(M1)(W.u.)>0.024
4630.1	6^-	678.7 *4*	35 *3*	3951.4	5^-	(M1(+E2))	+0.12 *11*	A_2=−0.05 *8*; A_4=+0.03 *8* B(M1)(W.u.)=0.081 *16* Additional information 12.
		2325.1 *6*	65 *3*	2305.1	4^-	E2(+M3)	+0.02 *+11−10*	A_2=+0.42 *8*; A_4=−0.05 *8* B(E2)(W.u.)=2.8 *5* Additional information 13.
5012.7	$(2)^-$	2692 *2*	100	2320.6	3^-	[M1]		B(M1)(W.u.)>0.016
5280.7	$(3)^-$	2960 *2*	100	2320.6	3^-	[M1]		B(M1)(W.u.)>0.012 Additional information 14.
5394.2	(6^-)	762.9 *8*	8 *3*	4630.1	6^-	[M1]		B(M1)(W.u.)=0.036 *+22−30* Additional information 15.
		1442.6 *7*	54 *6*	3951.4	5^-	(M1(+E2))	+0.02 *5*	A_2=−0.24 *9*; A_4=+0.12 *10* B(M1)(W.u.)=0.036 *+17−27* Additional information 16.
		2042 *1*	24 *5*	3352.6	5^-	(M1(+E2))	+0.05 *14*	A_2=−0.21 *12*; A_4=+0.26 *15* B(M1)(W.u.)=0.006 *+3−5* Additional information 17.
		3090 *2*	15 *5*	2305.1	4^-	[E2]		B(E2)(W.u.)=0.4 *+2−3* Additional information 18.
5726.5		2373.9 *15*	78 *6*	3352.6	5^-			
		3421 *2*	22 *6*	2305.1	4^-			
6180.7	$(6)^-$	2828 *2*	100	3352.6	5^-	[M1]		B(M1)(W.u.)>0.014
6193.9		1563.4 *14*	33 *7*	4630.1	6^-			
		2841 *2*	67 *7*	3352.6	5^-			
6237.4	(7^+)	842.5 *6*	19 *4*	5394.2	(6^-)	(E1(+M2))	+0.05 *14*	A_2=−0.19 *12*; A_4=−0.02 *12* B(E1)(W.u.)<3×10^{-5} Additional information 19.
		1607.9 *5*	40 *5*	4630.1	6^-	(E1(+M2))	+0.05 *9*	A_2=−0.17 *10*; A_4=+0.11 *11* B(E1)(W.u.)<0.9×10^{-5}

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$^{18}O(^{18}O,pn\gamma)$ E=20-44 MeV 2012Be11,2009Be26 (continued)

$\gamma(^{34}P)$ (continued)

E_i(level)	J_i^π	E_γ	I_γ	E_f	J_f^π	Mult.[†]	δ[‡]	Comments
								Additional information 20.
6237.4	(7^+)	2884.3 *7*	36 *5*	3352.6	5^-	(M2(+E3))	+0.11 *18*	A_2=+0.52 *10*; A_4=−0.05 *11* B(M2)(W.u.)<0.8
		3932 *3*	5 *3*	2305.1	4^-	[E3]		B(E3)(W.u.)<9
								Additional information 21.
6357.3	$(7)^-$	2405.9 *7*	43 *8*	3951.4	5^-	(E2)		A_2=−0.53 *12*; A_4=−0.57 *13* B(E2)(W.u.)>13 Evaluators note that negative A_2 in 2012Be11 is inconsistent with ΔJ=2, quadrupole transition, which requires positive A_2.
								Additional information 22.
		3004 *2*	57 *8*	3352.6	5^-	[E2]		B(E2)(W.u.)>5.7
								Additional information 23.
7426.4		1189 *2*	100	6237.4	(7^+)			
7920.2		1683 *1*	67 *4*	6237.4	(7^+)			
		1726 *1*	33 *4*	6193.9				

[†] Assignments are mainly from 2012Be11, but parentheses or square brackets are added by evaluators since these are determined primarily from parity-insensitive $\gamma(\theta)$ data.

[‡] Sign convention is that of Rose and Brink in 2012Be11 (their arctan(δ)-listed values are converted to δ values by evaluators). Krane-Steffen convention used in ENSDF required each sign in 2012Be11 to be reversed.

[#] Placement of transition in the level scheme is uncertain.

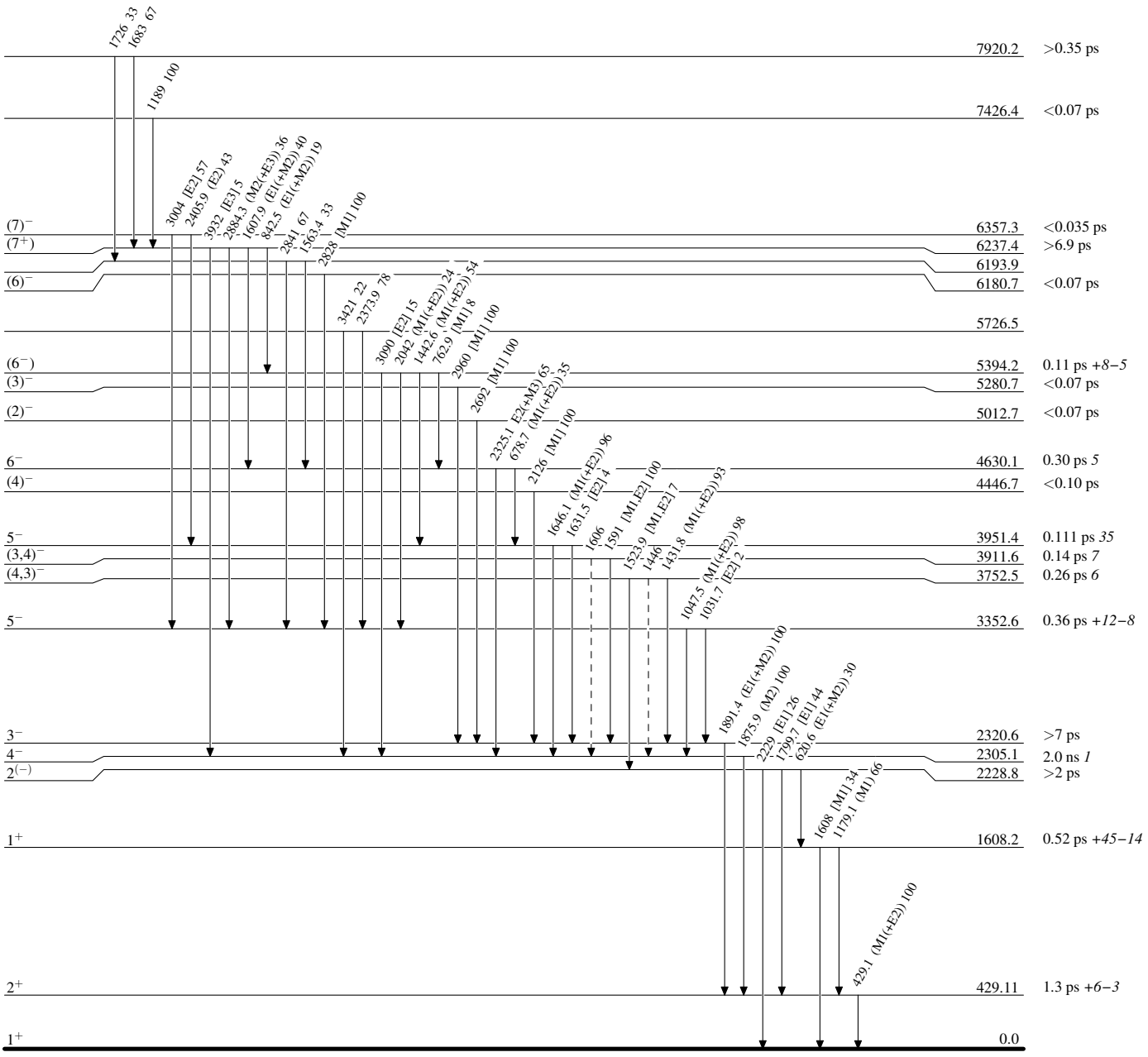
$^{18}O(^{18}O,pn\gamma)$ E=20-44 MeV 2012Be11,2009Be26

Legend

Level Scheme

Intensities: % photon branching from each level

γ Decay (Uncertain)



$^{34}_{15}P_{19}$