$^{12}C(^{20}Ne,p\gamma),^{16}O(^{16}O,p\gamma)$ 2005Je07,2008Pa27

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Jun Chen and Balraj Singh	NDS 184, 29 (2022)	24-Jun-2022

2005Je07 (also 2006Je03, 2006Je06): E(^{20}Ne)=32 MeV beam was produced from the ATLAS accelerator at Argonne. Target was 90 μg/cm^2 ^{12}C. Measured Eγ, Iγ, $\gamma\gamma$-coin, $\gamma\gamma(\theta)$(DCO) using Gammasphere array with 100 high-purity Compton-suppressed Ge detectors. Deduced levels, J, π, multipolarities.

2008Pa27: $^{16}O(^{16}O,p\gamma)$ E=29 MeV beam was produced from the ATLAS accelerator at Argonne. Nickel monoxide target on a backing of nickel foil. Measured Eγ, lifetime of 4431 level by Doppler-shift attenuation method (DSAM) using Gammasphere array of 100 Compton-suppressed HPGe detectors. Deduced $T_{1/2}$ of 4431 level.

2021To09: E=33 MeV ^{20}Ne beam was produced from the Piave-Alpi accelerator of the Laboratori Nazionali di Legnaro. Target was 0.75 mg/cm^2 ^{12}C on a 10 mg/cm^2 gold layer. γ rays were detected with the GASP array in configuration II and charged particles were detected with the EUCLIDES silicon ball. Measured Eγ, Iγ, $\gamma\gamma(\theta)$, Doppler-shift attenuation. Deduced levels, $T_{1/2}$, mixing ratios, transition strengths. Comparisons with available data and theoretical calculations.

All data are from 2005Je07, unless otherwise indicated.

^{31}P Levels

E(level)†	J^π‡	$T_{1/2}$	Comments
0.0	1/2$^+$		J^π: from Adopted Levels.
1266.14 *9*	3/2$^+$	0.510 ps *24*	$T_{1/2}$: from DSAM in 2021To09.
2233.67 *9*	5/2$^+$		
3295.08 *14*	5/2$^+$		
3414.62 *11*	7/2$^+$		
4430.84 *13*	7/2$^-$	0.433 ps *31*	$T_{1/2}$: weighted average of 0.413 ps *31* from 2021To09, 0.50 ps *6* (gating on 2029 γ 1266 γ below level and corrected for side feeding) and 0.46 ps *10* (gating on 2394γ above level) from 2008Pa27.
4634.06 *14*	7/2$^+$		
5342.94 *14*	9/2$^+$		
6078.58 *13*	9/2$^+$		
6453.57 *24*	11/2$^+$		
6502.42 *24*	9/2$^-$		Additional information 1.
6824.39 *18*	11/2$^-$		Additional information 2.
7442.6 *3*	11/2$^+$		
8707.8 *4*	13/2$^-$		
9176.2 *5*	13/2$^+$		
9453.5 *4*	13/2$^-$		
10218.6 *5*	13/2$^-$		
10523.8 *5*	15/2$^{(-)}$		
11300.3 *5*	17/2$^-$		
12171.0 *25*	(15/2$^+$)		

† From a least-squares fit to γ-ray energies.
‡ As proposed for excited states by 2005Je07 based on measured $\gamma\gamma(\theta)$(DCO) data.

$\gamma(^{31}P)$

DCO correspond to intensity of a γ ray at forward (32° and 37°) or backward (143° and 148°) angles relative to those at 90°; under this geometry DCO=1.6 *1* for ΔJ=2, stretched transition and DCO=0.90 *5* for ΔJ=1, stretched dipole transition.

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$^{12}C(^{20}Ne,p\gamma),^{16}O(^{16}O,p\gamma)$ 2005Je07,2008Pa27 (continued)

$\gamma(^{31}P)$ (continued)

E_γ‡	I_γ‡	E_i(level)	J^π_i	E_f	J^π_f	Mult.#	Comments
745.8 *2*	3.1 *6*	9453.5	13/2⁻	8707.8	13/2⁻	D+Q	DCO=1.61 *12* Mult.: ΔJ=0 transition.
776.7 *3*	3.0 *5*	11300.3	17/2⁻	10523.8	15/2$^{(-)}$	D+Q	DCO=0.99 *15*
988.9 *3*	4.0 *4*	7442.6	11/2⁺	6453.57	11/2⁺	D+Q	DCO=1.68 *16*
1016.4 *1*	3.1 *5*	4430.84	7/2⁻	3414.62	7/2⁺	D	DCO=2.00 *15* B(E1)↓=5×10^{-7} *1* (2021To09) I_γ: 2021To09 report a branching of 4.9 *1*. Mult.: ΔJ=0 transition.
1042.4 *2*	3.4 *3*	10218.6	13/2⁻	9176.2	13/2⁺	D	DCO=0.96 *7* Mult.: ΔJ=0 transition.
1061.6 *2*	11.1 *9*	3295.08	5/2⁺	2233.67	5/2⁺	D+Q	DCO=1.41 *4* Mult.: ΔJ=0 transition.
1070.7 *4*	2.4 *2*	10523.8	15/2$^{(-)}$	9453.5	13/2⁻		
1080.9 *6*	2.2 *3*	11300.3	17/2⁻	10218.6	13/2⁻		
1110.1 *3*	5.5 *5*	6453.57	11/2⁺	5342.94	9/2⁺	D+Q	DCO=1.32 *9*
1135.6 *2*	23.4 *15*	4430.84	7/2⁻	3295.08	5/2⁺	D	DCO=0.89 *1* B(E1)↓=2.7×10^{-6} *2*; B(M2)↓=0.22 *11* (2021To09) I_γ: 2021To09 report a branching of 37.0 *1*, but the uncertainty is unrealistically small. 2021To09 report δ(Q/D)=−0.03 *7*.
1180.9 *2*	2.6 *4*	3414.62	7/2⁺	2233.67	5/2⁺		
1219.4 *1*	8.7 *6*	4634.06	7/2⁺	3414.62	7/2⁺	D+Q	DCO=1.18 *4* Mult.: ΔJ=0 transition.
1266.1 *1*	162 *2*	1266.14	3/2⁺	0.0	1/2⁺	D+Q	DCO=0.86 *1*
1339.6 *3*	8.8 *7*	4634.06	7/2⁺	3295.08	5/2⁺	D+Q	DCO=1.23 *7*
1445.0 *3*	2.9 *3*	6078.58	9/2⁺	4634.06	7/2⁺		
1480.8 *2*	25.7 *8*	6824.39	11/2⁻	5342.94	9/2⁺	D	DCO=0.85 *1* E_γ: poor fit, level-energy difference=1481.4.
1733.4 *7*	2.9 *6*	9176.2	13/2⁺	7442.6	11/2⁺	D+Q	DCO=1.04 *16*
1815.9 *4*	4.2 *4*	10523.8	15/2$^{(-)}$	8707.8	13/2⁻	D+Q	DCO=0.99 *9*
1883.7 *4*	12.7 *12*	8707.8	13/2⁻	6824.39	11/2⁻	D+Q	DCO=1.15 *9*
1928.0 *1*	27.3 *16*	5342.94	9/2⁺	3414.62	7/2⁺	D+Q	DCO=0.82 *1*
ˣ1970†							
2028.8 *2*	38.8 *21*	3295.08	5/2⁺	1266.14	3/2⁺	D+Q	DCO=1.21 *2*
2071.5 *2*	9.5 *8*	6502.42	9/2⁻	4430.84	7/2⁻	D+Q	DCO=2.01 *9*
2148.4 *1*	100	3414.62	7/2⁺	1266.14	3/2⁺	Q	DCO=1.57 *2*
2197.0 *2*	36.8 *12*	4430.84	7/2⁻	2233.67	5/2⁺	D	DCO=0.96 *8* B(E1)↓=5.8×10^{-7} *4*; B(M2)↓=0.013 *24* (2021To09) I_γ: 2021To09 report a branching of 58.1 *1*, but the uncertainty is unrealistically small. 2021To09 report δ(Q/D)=−0.03 *3*.
2205.3 *15*	0.6 *1*	8707.8	13/2⁻	6502.42	9/2⁻		
2233.6 *1*	48 *3*	2233.67	5/2⁺	0.0	1/2⁺		
2394.0 *2*	22.6 *15*	6824.39	11/2⁻	4430.84	7/2⁻	Q	DCO=1.53 *18*
2628.8 *9*	<1	9453.5	13/2⁻	6824.39	11/2⁻	D+Q	DCO=1.04 *9*
2723.5 *8*	23.2 *12*	9176.2	13/2⁺	6453.57	11/2⁺	D+Q	DCO=0.83 *2*
2994.6 *24*	1.7 *2*	12171.0	(15/2⁺)	9176.2	13/2⁺		
3039.7 *4*	55.7 *25*	6453.57	11/2⁺	3414.62	7/2⁺	Q	DCO=1.60 *4*
3110.9 *6*	2.8 *3*	5342.94	9/2⁺	2233.67	5/2⁺		
ˣ3380†							
3392.3 *7*	6.5 *5*	10218.6	13/2⁻	6824.39	11/2⁻	D+Q	DCO=1.12 *12*
ˣ3703†							
3844.6 *1*	6.9 *6*	6078.58	9/2⁺	2233.67	5/2⁺		
4027.8 *3*	11.0 *9*	7442.6	11/2⁺	3414.62	7/2⁺	Q	DCO=1.57 *8*

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$^{12}C(^{20}Ne,p\gamma),^{16}O(^{16}O,p\gamma)$ 2005Je07,2008Pa27 (continued)

$\gamma(^{31}P)$ (continued)

† Shown in $\gamma\gamma$ spectrum double-gated by 1266γ and 2148γ in figure 2 of 2006Je03 but not seem to be placed in the level scheme. They are possibly connected with negative-parity structure according to transitions with similar energies in Adopted Gammas.

‡ From (^{20}Ne,pγ) (2005Je07).

Assigned by the evaluators based on $\gamma\gamma(\theta)$(DCO) data of 2005Je07. The quadrupole (Q) transitions are most likely to be E2 and D+Q to be M1+E2 transitions.

^{x} γ ray not placed in level scheme.

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