^{16}O(n,n),(n,n′) 1973Jo01,1981Hi01

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	C. G. Sheu, J. H. Kelley, J. Purcell	ENSDF	5-Aug-2021

^{16}O(n,n),(n,n′):
1953Ad02: ^{16}O(n,n), E=1 MeV; measured products; deduced resonance parameters.
1954Th42: ^{16}O(n,n′), E=14.1 MeV; measured products, ^{12}C, ^{16}O.
1955Ok01: ^{16}O(n,n),(n,x), E=214-686 keV; measured products, O; deduced σ, σ(E), $\sigma(\theta)$, resonance parameters.
1957Wa46: ^{16}O(n,n), E=3.4-5.2 MeV; measured products, ^{4}He; deduced σ, σ(E), resonance parameters.
1966Mc01: ^{16}O(n,n′γ), E=14.1 MeV; measured σ(En′,θ), σ(Eγ,θ), $\gamma\gamma$-coin. ^{16}O deduced levels.
1969Bu08: ^{16}O(n,n′γ), E=14.6 MeV; measured σ.
1969Me15: ^{16}O(n,n),(n,n′), E=14 MeV; measured $\sigma(\theta)$; deduced optical model parameters.
1970Bo30: ^{16}O(n,n), E=14-19 MeV; measured σ(E). ^{17}O deduced resonances, J, π, T.
1970Fo03: ^{16}O(n,n), E=1.116-3.67 MeV; measured σ(E; θ). ^{17}O deduced resonances, L, J, π, level-width.
1970Lu16: ^{16}O(n,n′γ), E<8.2 MeV; measured σ(E; Eγ,$\theta(\gamma)$). ^{17}O deduced resonances, J, π.
1972Bo52: ^{16}O(n,n),(n,n′), E=14.1 MeV; measured $\sigma(\theta)$.
1973FoZU: ^{16}O(n,n′); measured $\sigma(E_{n'})$. ^{17}O deduced resonances, level-width, J, π.
1973Hi09: ^{16}O(n,n), E=1-4 MeV; measured σ(E), n-polarization.
1974Co10: ^{16}O(n,n), E=0.5-1.3 MeV; measured nothing, analyzed σ(E) data. ^{17}O level deduced S.
1974Ge03: ^{16}O(n,n), measured nothing, calculated σ(E) with up to 4p-4h states included.
1975Po08: ^{16}O(n,n′γ), E=14.9 MeV; measured σ(Eγ), n′γ-coin.
1976Dr08: ^{16}O(pol. n,n), E=2.25-3.90 MeV; measured A(E,θ).
1978No04: ^{16}O(n,n′γ),(n,$\alpha\gamma$), E=7-10.5 MeV; measured σ(E,Eγ).
1979GrZP: ^{16}O(n,n),(n,n′), E=24 MeV; measured $\sigma(\theta)$. Coupled-channels analysis.
1979GrZU: ^{16}O(n,n),(n,n′), E=24 MeV; measured $\sigma(\theta)$. Optical model, DWBA analysis.
1979Ko26: ^{16}O(n,n), E=0.51,0.68 MeV; measured small angle scattering; deduced coherent scattering lengths for bound atoms. Crystalline powder targets, Christiansen filter.
1980GlZZ: ^{16}O(n,n),(n,n′), E not given; measured $\sigma(\theta)$; deduced optical potential energy dependence. Optical model, coupled-channel analyses, isospin effects.
1980Gr15: ^{16}O(n,n),(n,n′), E=24 MeV; measured σ(E,θ); deduced optical model parameters. ^{16,18}O deduced deformation lengths, transition matrix elements. Enriched targets. Coupled-channels, DWBA analyses.
1981Hi01: ^{16}O(n,n), E=3-30 MeV; measured transmission vs E. ^{17}O resonances deduced t, Γ, Γ_n. Natural target.
1982FiZW: ^{16}O(pol. n,n′), E=10 MeV; measured $\sigma(\theta)$, asymmetry. Optical model analysis.
1982Gl09: ^{16}O(n,n), E=9.21-14.93 MeV; measured $\sigma(\theta)$, $\sigma(E_n)$, σ(total) vs E. ^{17}O deduced resonances, Γ, Γ_n, J, π. Optical model plus resonance effect, Legendre polynomial analyses.
1983Da22: ^{16}O(n,n), E=7-15 MeV; measured $\sigma(\theta)$; deduced spherical optical model parameters.
1983IsZW: ^{16}O(n,n),(n,n′), E=22 MeV; measured $\sigma(\theta)$. DWBA, coupled-channels analyses.
1984IsZZ: ^{16}O(n,n),(n,n′), E=18-26 MeV; measured $\sigma(\theta)$; deduced two-step process role. Optical model, coupled-channels analyses.
1985AnZX: ^{16}O(pol. n,n), E=5-17 MeV; measured analyzing power vs θ, $\sigma(\theta)$.
1985Ko16: ^{16}O(n,n′γ), E=25-2000 keV; measured neutron detection efficiency. ^{16}O deduced resonance effect. Thick Ne-912 lithium glass scintillator.
1985La13: ^{16}O(pol. n,n), E=23 MeV; measured $\sigma(\theta)$, A(θ). Optical model potential analysis.
1985Pe10: ^{16}O(n,n), E=18-26 MeV; measured $\sigma(\theta)$ vs E; Micropscopic optical model.
1986De10: ^{16}O(n,n), E=18-46 MeV; measured σ(E,θ); deduced giant resonance coupling, *l*-dependent potential effects. Natural target, coupled channel analysis.
1986FiZY: ^{16}O(n,n),(n,n′), E=18-26 MeV; measured σ(E,θ); deduced heavy-ion recoil contribution to kerma factors, optical model parameters.
1986HaZI: ^{16}O(pol. n,n), E=7.18,7.5,7.71,7.81,8.05 MeV; measured $\sigma(\theta)$, analyzing powers. Optical model analyses.
1986IsZW: ^{16}O(n,n),(n,n′), E=18-26 MeV; measured $\sigma(\theta)$. ^{16}O levels deduced excitation mechanism. Tof. Coupled-channels approach.
1986IsZZ: ^{16}O(n,n),(n,n′), E=18-46 MeV; measured $\sigma(\theta)$. ^{16}O deduced giant resonances.
1987Is04: ^{16}O(n,n),(n,n′), E=18-26 MeV; measured $\sigma(\theta)$. DWBA, coupled-channels analyses.

^{16}O(n,n),(n,n′) 1973Jo01,1981Hi01 (continued)

1987Is03: ^{16}O(n,n),(n,n′), E=18-60 MeV; measured $\sigma(\theta)$; deduced optical model parameters, partial kerma factors. Previously acquired data included in analysis.
1988MeZX: ^{16}O(n,n′), E=20-26 MeV; measured not given. ^{16}O levels deduced transition matrix elements.
1989Li26: ^{16}O(pol. n, n), E=5-17 MeV; measured $\sigma(\theta)$, analyzing power vs θ; deduced model parameters. Other data analysis, optical model.
1990Ol01: ^{16}O(n,n),(n,n′), E=21.6 MeV; measured $\sigma(E,\theta)$; deduced optical-model potential parameters. DWBA, coupled-channels analyses.
1992Qi02: ^{16}O(n,n), E=14.8 MeV; measured $\sigma(\theta)$; deduced model parameters. Spherical optical model, coupled-channels analysis.
1994Lo25: ^{16}O(n,n′γ), E=7.2-8.4 MeV; measured γ production $\sigma(E)$; compiled, reviewed, analyzed $\sigma(E)$ evaluations; deduced BGO detector utilization features as active oxygen target.
1995Be69: ^{16}O(n,n′γ), E=6.2-8.51 MeV; measured $\sigma(\theta)$. Inconsistencies, errors in neutron σ libraries.
2002NeZY: ^{16}O(n,n′),(n,2n),(n,p),(n,d),(n,α),(n,nα), E=4-200 MeV; measured Eγ, Iγ, $\sigma(\theta)$, excitation functions. Comparison with previous results.
2006Me26: ^{16}O(n,n),(n,n′), E=95 MeV; measured $\sigma(E,\theta)$; deduced three-nucleon force effects, recoil kerma coefficients.
2008MeZW: ^{16}O(n,n),(n,n′), E≈95 MeV; measured E_n, $I_n(\theta)$; deduced dσ(E), d$\sigma(\theta)$; calculated dσ using different forces with and without 3N component. Compared to other data and calculations.
2008Ta15: ^{16}O(n,n′),(n,γ), E=14 MeV; measured Eγ, Iγ using a NaI(Tl) detector with multiple time-gated system for use with complex samples.
2010La05: ^{16}O(n,n), E=ultracold; measured σ, γ-spectra, Bragg reflection spectra, low-temperature dependence on yield of ultracold neutrons. Liquid orthodeuterium and solid oxygen targets. Pulse-neutron incident beam.
2018Sc04: ^{16}O(n,n),(n,n′),(n,α), E=1-10 MeV; measured reaction products, E_n, I_n; deduced light and heavy water leakage neutron flux density, neutron fluences for the light and heavy water spheres. Comparison with calculations using ENDF/B-VII.0, ENDF/B-VIII.b4 and JENDL-4 nuclear data libraries.
See also (1971Do15,1992Ba50,2017Sv01: theory).

Theory:
^{16}O(n,n),(n,n′),(n,α).
1971We08: ^{16}O(n,n), E=0.5-4 MeV; calculated σ(E). ^{17}O resonances deduced S.
1972JoZV: ^{16}O(n,n),(n,α), E=600-930, 1390-1640 keV; measured σ(nT). ^{17}O deduced resonances, level-width.
1973Jo01: ^{16}O(n,X),(n,α), E<5.8 MeV; analyzed σ(E). ^{17}O deduced resonances, J, π, level-width, S.
1975Ge08: ^{16}O(n,n), E<4 MeV; calculated total σ(E), polarization. ^{17}O deduced resonances, Γ.
1977No07: ^{16}O(n,n), E=th; calculated scattering parameters.
1986Sh33: ^{16}O(n,n),(n,n′),(n,α), E=threshold−20 MeV; compiled, evaluated neutron induced reaction data. R-matrix theory, direct, preequilibrium processes.
1990Ha38: ^{16}O(n,n), E≤20 MeV; calculated phase shifts vs E. Cluster-orbital shell model, resonating group method.
1995Ch84: ^{16}O(n,n),(n,α), E=6.2-10.5 MeV; analyzed σ, $\sigma(\theta)$; deduced R-matrix parameters.
2000SaZK: ^{16}O(n,n), E=0-6.3 MeV; ORNL lab report R-matrix Evaluation of ^{16}O neutron cross sections; deduced E_{res}, E_x, Γ_n, Γ_α and Γ.
2012Pr13: ^{16}O(n,n), E<20 MeV; calculated neutron thermal σ, Westcott factors, resonance integrals and their uncertainties using evaluated neutron libraries; deduced ENDF/B-VII.1, JEFF-3.1.2, JENDL-4.0, ROSFOND 2010, CENDL-3.1, EAF 2010 neutron-induced reaction σ deficiencies.
2017HaZY: ^{16}O(n,n),(n,x),(n,α), E=0-7 MeV; calculated total σ, $\sigma(\theta)$; compared with data and ENDF VIII.0-CIELO.

^{17}O Levels

Notes:
1) Values from (1964St25) are recommended values.
2) (1973Jo01) is an analysis of prior works of (1955Ok01, 1958St28, 1961Fo07, 1969Da13, 1973Fo11).
3) The levels at E_x=5216, 7576 keV were searched for by (1973Fo11) but not observed. The lack of observation suggests narrow widths for these states of Γ<0.1 keV. (1957Wa46) observed a level at E_x=7559 keV with $\Gamma\leq$4 keV and $J^\pi\geq$7/2 which might be the 7576-keV state.
4) See ^{13}C(α,n) for additional neutron resonance levels that are not reported in ^{16}O(n,n) reactions. See also (1981MuZQ).

Continued on next page (footnotes at end of table)

^{16}O(n,n),(n,n′) 1973Jo01,1981Hi01 (continued)

^{17}O Levels (continued)

E(level)	J^π	$\Gamma^\dagger$	L	E_n(res) (keV)	Comments
4551[@] *4*	$3/2^-$[#]	39[‡] keV *3*	1	433 *4*	E(level): from E_n=433 keV *4* (1958Hu18). See also E_n(keV)=440 (1950Bo95,1951Bo45), 442 (1955Ok01,1964St25). Γ: From Γ_{lab}=41 keV *3*. See also Γ_{lab}(keV)=45 (1950Bo95), 40 (1951Bo45), 48 (1955Ok01), 46 (1964St25) and Γ_n=45 keV (1973Jo01). L: See (1953Ad02,1955Ok01,1958Hu18,1964St25).
5082[@] *8*	$3/2^+$[#]	90[‡] keV *5*	2	998 *8*	E(level): from E_n=998 keV *8* (1958Hu18). See also E_n=1000 keV (1950Bo95, 1951Bo45, 1958La09, 1958St28, 1964St25). Γ: From Γ_{lab}=96 keV *5*. See also Γ_{lab}=100 keV (1950Bo95, 1951Bo45, 1958St28, 1964St25) and Γ_n=96 keV (1973Jo01). L: See (1953Ad02,1958Fo67,1958Hu18,1964St25).
5377.9[@] *35*	$3/2^-$[#]	31[‡] keV *4*	1	1312.0 *35*	E(level): from E_n=1312.0 keV *35* (Davis, et al., PLB 27, 636 (1968)). See also E_n(keV)=1310 *8* (1958Hu18), 1300 (1950Bo95), 1320 (1951Bo45), 1312 (1958St28,1964St25). Γ: From Γ_{lab}=33 keV *4*. See also Γ_{lab}=40 keV (1950Bo95), 35 keV (1951Bo45), 42 keV (1964St25), 44 keV (1958St28) and Γ_n=41.5 keV (1973Jo01). L: See (1953Ad02,1958Hu18,1964St25).
5697[@] *2*	$7/2^-$[#]	3.4[&] keV *3*		1651 *2*	E(level): from E_n=1651 keV *2* (1973Fo11). See also E_n(keV)=1651 *6* (1958Hu18), 1660 (1951Bo45,1958La09), 1651 (Jo68: Johnson, et al., Neutron Cross Sections and Technology, Proc. Conf.; NBS Special Publication 299 Vol. II, 851 (1968)). Γ: See also $\Gamma_{lab}\leq$7 keV (1951Bo45,1958Hu18), Γ_{lab}=4 keV (Jo68) and Γ_n=3.4 keV (1973Jo01). L: See (1951Bo45: >0) and (1958Hu18: ≥1).
5733[@] *2*		<1[&] keV		1689 *2*	E(level): from E_n=1689 keV *2* (1973Fo11). See also E_n=1689 keV (Jo68). Γ: See also Γ_{lab}<1 keV (Jo68). J^π: $\neq 1/2^+$ (1973Fo11).
5868[@] *2*	$3/2^+$[#]	6.6[&] keV *7*	2[*f*]	1833 *2*	E(level): from E_n=1833 keV *2* (1973Fo11). See also E_n(keV)=1830 *6* (1958Hu18), 1840 (1951Bo45), 1833 (Jo68). Γ: See also Γ_{lab}(keV)≤10 (1951Bo45), ≤8 (1958Hu18), Γ=7 keV (Jo68) and Γ_n=6.6 keV (1973Jo01). L: See also (1951Bo45: >0), (1958Hu18: ≥1).
5939[@] *4*	$1/2^-$[#]	32[&] keV *3*	1	1908 *4*	E(level): from E_n=1908 keV *4* (1973Fo11). See also E_n(keV)=1903 *11* (1958Hu18), 1910 (1951Bo45,1964St25), 1906 (Jo68), 1900 (Ba52: Baldinger, et al., Helv. Phys. Acta 25, 142 (1952)). Γ: See also Γ_{lab}=30 keV (1951Bo45,1964St25), 28 keV *5* (1958Hu18) and Γ_n=31.5 keV (1973Jo01). L: See (1951Bo45,1958Hu18,1964St25).
6356[@] *8*	$1/2^+$[#]	124[&] keV *12*	0	2351 *8*	E(level): from E_n=2351 keV *8* (1973Fo11). See also E_n(keV)=2370 *20* (1958Hu18), 2370 (1951Bo45,1964St25), 2350 (Ba52,Jo68). Γ: See also Γ_{lab}(keV)=120 (1951Bo45,1964St25), 140 *50* (1958Hu18), 180 (Ba52) and Γ_n=124 keV (1973Jo01). L: See (1951Bo45,1958Hu18,1964St25).
6862[@] *2*		<1[&] keV		2889 *2*	E(level): from E_n=2889 keV *2* (1973Fo11). See also E_n=2889 keV (Jo68). Γ: See also Γ_{lab}<1 keV (Jo68). J^π: $\neq 1/2^+$ (1973Fo11).
6972[@] *2*		<1[&] keV		3006 *2*	E(level): from E_n=3006 keV *2* (1973Fo11).

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^{16}O(n,n),(n,n′) 1973Jo01,1981Hi01 (continued)

^{17}O Levels (continued)

E(level)	Jπ	Γ†	L	E_n(res) (keV)	Comments
					J^π: ≠1/2$^+$ (1973Fo11).
7165.86@ *17*	5/2$^-$#	1.38[a] keV *5*	3[f]	3211.70 *17*	E(level): from E_n=3211.70 keV *17* (1980Ci03). See also E_n(keV)=3211 *3* (1973Fo11), 3213 (Jo68). Γ: See also Γ_{lab}=2 keV (Jo68), Γ=5 keV (1957Wa46), 1.3 keV *4* (1973Fo11), Γ_n=1.4 keV and Γ_α=0.0027 keV (1973Jo01), Γ_n/Γ_α=(1300) (1957Wa46) and Γ_{n0}=1.38 keV *5* (1980Ci03).
7202@ *10*	3/2$^+$#	280&[e] keV *28*	2	3250 *10*	E(level): from E_n=3250 keV *10* (1973Fo11). See also E_n(keV)=3330 *30* (1958Hu18), 3290 *20* (1966Li03), 3350 (1967Jo12), 3330 (Ba52). Γ: See also Γ_{lab}=200 keV *40* (1958Hu18), 220 keV (Ba52), Γ=500 keV (1967Jo12), 400 keV *30* (1966Li03), Γ_n=280 keV and Γ_α=0.12 keV (1973Jo01) and Γ_n/Γ>0.99 (1966Li03). J^π: See also (1966Li03,1967Jo12). L: from (1958Hu18,1967Jo12).
7379.20@ *19*	5/2$^+$#	0.64[a] keV *23*	2[f]	3438.38 *19*	E(level): from E_n=3438.38 keV *19* (1980Ci03). See also E_n(keV)=3438 *3* (1973Fo11), 3442 (Jo68). Γ: See also Γ(keV)=0.5 *2* (1973Fo11), 0.5 (1970Fo03), ≤4 (1957Wa46), Γ_n=0.5 keV and Γ_α=0.01 keV (1973Jo01), Γ_n/Γ_α=(450) (1957Wa46) and Γ_{n0}=0.64 keV *23* (1980Ci03).
7382.36@ *14*	5/2$^-$#	0.96[a] keV *20*	3	3441.73 *14*	E(level): from E_n=3441.73 keV *14* (1980Ci03). See also E_n(keV)=3441 *3* (1973Fo11), 3440 (1961Fo07), 3444 (Jo68). Γ: See also Γ(keV)=1.1 *3* (1973Fo11), 1.1 (1970Fo03), ≤8 (1961Fo07), Γ_n=1.2 keV and Γ_α=0.0032 keV (1973Jo01) and Γ_{n0}=0.96 keV *20* (1980Ci03). L: see (1970Fo03).
7560 *20*	3/2$^-$#	500&[e] keV *50*	1	3630 *20*	E(level): from E_n=3630 keV *20* (1973Fo11). See also E_n(keV)=3770 *20* (1966Li03), 3600 (1964St25), (3600) (1961Fo01), 3643 (Jo68), 3750 (1967Jo12). Γ: See also Γ(keV)=360 *30* (1966Li03), 600 (1961Fo07,1964St25), 405 (1967Jo12), Γ_n=500 keV and Γ_α=0.08 keV (1973Jo01) and Γ_n/Γ>0.99 (1966Li03). J^π: See also (1966Li03,1967Jo12). L: from (1964St25,1967Jo12).
7668? *10*	(3/2,5/2)$^+$	≈20 keV	2	3745 *10*	(1973Fo11) indicates this level does not exist. E(level): from E_n=3745 keV *10* (1960Ts02). See also E_n=3770 keV (1961Fo07,1964St25), 3772 keV (1967Jo12). Γ: from (1960Ts02). See also Γ=25 keV (1961Fo07,1964St25), 22 keV (1957Wa46), 3 keV (1967Jo12). J^π: See (1957Wa46,1960Ts02,1961Fo07,1964St25, 1967Jo12). L: See (1964St25,1967Jo12).
7689.21 *22*	7/2$^-$#	14.4[a] keV *3*	3[g]	3767.76 *22*	E(level): from E_n=3767.76 keV *22* (1980Ci03). See also E_n(keV)=3780 *10* (1966Li03), 3765 *3* (1969Da13), 3766 *4* (1973Fo11), 3769 (1967Jo12). Γ: See also Γ(keV)=14 keV (1967Jo12), <23 (1966Li03), 18 keV *2* (1973Fo11), Γ_n=18 keV and Γ_α=0.01 keV (1973Jo01), Γ_n/Γ>0.99 (1966Li03) and

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^{16}O(n,n),(n,n′) 1973Jo01,1981Hi01 (continued)

^{17}O Levels (continued)

E(level)	Jπ	Γ†	L	E_n(res) (keV)	Comments
					Γ_{n0}=13.0 keV *6* (1980Ci03).
					Jπ: See also (1966Li03,1967Jo12).
7720? *80*	3/2−	753 keV *188*	1	3800 *80*	E(level): from E_n=3800 keV *80* (1958Hu18). See also E_n=3800 keV (Ba52).
					Γ: from Γ_{lab}=800 keV *200* (1958Hu18). See also Γ_{lab}=800 keV (Ba52).
					Jπ: See (Ba52,1958Hu18).
					L: from (1958Hu18).
7958 *8*	1/2+#	90& keV *9*		4053 *8*	E(level): from E_n=4053 keV *8* (1973Fo11).
					Jπ: See also (1973Fo11).
					Γ: See also Γ_n=84 keV and Γ_α=6.7 keV (1973Jo01).
7992 *50*	1/2−#	270&e keV *27*	1g	4090 *50*	E(level): from E_n=4090 keV *50* (1973Fo11). See also E_n(keV)=3920 *20* (1966Li03), 4000 (1967Jo12), (3980) (1961Fo07).
					Γ: See also Γ(keV)=245 *30* (1966Li03), 110 (1957Wa46: triplet), Γ_n=250 keV and Γ_α=14 keV (1973Jo01), Γ_n/Γ_α=10 (1957Wa46) and Γ_n/Γ>0.95 (1966Li03).
					Jπ: See also (1966Li03,1967Jo12,1973Fo11).
8060 *8*	3/2+#	85&e keV *9*	2g	4162 *8*	E(level): from E_n=4162 keV *8* (1973Fo11). See also E_n(keV)=4200 *10* (1960Ts02), 4175 *10* (1966Li03), 4180 (1967Jo12), 4200 (1961Fo07).
					Γ: See also Γ(keV)=75 *20* (1966Li03), 80 (1961Fo07) and 70 (1957Wa46), Γ_n=71 keV and Γ_α=15 keV (1973Jo01), Γ_n/Γ_α=10 (1957Wa46) and Γ_n/Γ>0.90 (1966Li03).
					Jπ: See also (1966Li03,1967Jo12).
8181 *20*	1/2−#	69& keV *7*		4290 *20*	E(level): from E_n=4290 keV *20* (1973Fo11).
					Γ: See also Γ_n=68 keV and Γ_α=0.8 keV (1973Jo01).
8209 *10*	3/2−#	52 keV	1g	4320 *14*	E(level): from E_n=4320 keV *10*, which is the average of (1960Ts02: 4330 keV *10*) and (1973Fo11: 4310 keV *10*). See also E_n=4320 keV (1961Fo07).
					Γ: Deduced, in part, from (1961Fo07). See also Γ≈90 keV (1960Ts02), 60 keV (1957Wa46,1961Fo07), Γ_n=48 keV and Γ_α=4 keV (1973Jo01) and Γ_n/Γ_α=13 (1957Wa46).
8343.94 *26*	1/2	11.4a keV *5*	1	4463.41 *26*	E(level): from E_n=4463.41 keV *26* (1980Ci03). See also E_n(keV)=4400 *40* (1958Hu18), 4400 (Ba52,1958Hu18), 4470 (1960Ts02: group), 4450 (1964St25), 4440 (1956Be98).
					Γ: See also Γ=18 keV (1957Wa46), Γ_{lab}=280 keV *80* (1958Hu18), 280 keV (Ba52), Γ_n=10 keV and Γ_α=2.2 keV (1973Jo01), Γ_n/Γ_α=6.7 (1957Wa46) and Γ_{n0}=8.1 keV *3* (1980Ci03).
					Jπ: See (Ba52,1958Hu18,1964St25,1973Jo01).
					L: from (1958Hu18,1964St25).
8403.90 *7*	5/2+#	6.17a keV *13*		4527.12 *7*	E(level): from E_n=4527.12 keV *7* (1980Ci03). See also E_n=4530 keV (1956Be98,1961Fo07).
					Γ: See also Γ≤10 keV (1961Fo07), 11 keV (1957Wa46), Γ_n=4.8 keV and Γ_α=0.54 keV (1973Jo01), Γ_n/Γ_α=19 (1957Wa46) and Γ_{n0}=4.75 keV *11* (1980Ci03).
8467.63 *9*	7/2+#	2.13a keV *11*		4594.83 *9*	E(level): from E_n=4594.83 keV *9* (1980Ci03). See also E_n(keV)=4625 *10* (1960Ts02), 4600 (1961Fo07), 4590 (1956Be98).
					Γ: See also Γ≤11 keV (1961Fo07), 9 keV (1957Wa46:

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^{16}O(n,n),(n,n′) 1973Jo01,1981Hi01 (continued)

^{17}O Levels (continued)

E(level)	J$^{\pi}$	Γ[†]	E$_n$(res) (keV)	Comments
				doublet), Γ_α=7.6 keV (1973Jo01), Γ_n/Γ_α=31 (1957Wa46) and Γ_{n0}=1.18 keV *4* (1980Ci03).
8502.40 *12*	5/2^{-}[#]	6.89[a] keV *22*	4631.78 *12*	E(level): from E$_n$=4631.78 keV *12* (1980Ci03). See also E$_n$(keV)=4705 *10* (1960Ts02), 4630 (1956Be98), 4640 (1961Fo07). Γ: See also Γ≤13 keV (1961Fo07), 11 keV (1957Wa46), Γ_n=3.4 keV and Γ_α=1.9 keV (1973Jo01), Γ_n/Γ_α=2.8 (1957Wa46) and Γ_{n0}=2.86 keV *8* (1980Ci03).
8688.9 *4*	3/2^{-}[#]	55.3[a] keV *6*	4829.9 *4*	E(level): from E$_n$=4829.9 keV *4* (1980Ci03). See also E$_n$=4845 keV *10* (1960Ts02), 4840 (1961Fo07), 4850 (1956Be98). Γ: See also Γ(keV)≈90 (1960Ts02), 55 (1961Fo07), 85 (1957Wa46: triplet), Γ_n=42 keV and Γ_α=1.8 keV (1973Jo01), Γ_n/Γ_α=17 (1957Wa46) and Γ_{n0}=48.9 keV *11* (1980Ci03).
8858 *10*		<20 keV	5010 *10*	E(level),Γ: from (1960Ts02: 5010 keV *10*). See also 5080 (1956Be98). E(level): In past evaluations, information from ^{16}O(n,α) and ^{13}C(α,n) is peppered into the ^{16}O(n,n) dataset. It is usually harmless; however, in the present case we associate the 8858 keV level with the narrow (7/2$^-$,9/2$^-$) member of the E$_x$=8.9 MeV doublet. The broad 3/2$^+$ member of this doublet is not reported in (n,n′). The Γ_n=68 keV and Γ_α=9.7 keV (1973Jo01), and Γ≈110 keV and Γ_n/Γ_α=3.5 (1957Wa46), etc. parameters accociated with E$_x$=8.9 MeV; J$^{\pi}$=3/2$^+$ are from ^{16}O(n,α) and ^{13}C(α,n) (1957Wa46,1973Ba10).
8968.5 *16*	7/2^{-}[#]	26.3[a] keV *19*	5127.0 *16*	E(level): from E$_n$=5127.0 keV *16* (1980Ci03). See also E$_n$(keV)=5122 *4* (1969Da13), 5110 (1961Fo07), 5130 (1956Be98). Γ: See also Γ(keV)=28 (1961Fo07), 35 (1957Wa46), Γ_n=23 keV and Γ_α=2.3 keV (1973Jo01), Γ_n/Γ_α=35 (1957Wa46) and Γ_{n0}=23.5 keV *19* (1980Ci03).
9178	≥3/2[b]	≤17[b] keV	5350	E(level): from E$_n$=5350 keV (1961Fo07). See also E$_n$=5380 keV (1956Be98).
9196.16 *9*		3.53[a] keV *13*	5368.90 *9*	E(level): from E$_n$=5368.90 keV *9* (1980Ci03). Γ: see also Γ_{n0}=2.37 keV *8* (1980Ci03).
9423	3/2^{-}[#]	120 keV	5610	E(level): from E$_n$=5610 keV (1973Jo01). See also E$_n$=5630 keV (1961Fo07). Γ=Γ_n=120 keV (1973Jo01). See also 140 keV (1961Fo07).
9714.53 *14*	≥5/2[b]	23.1[a] keV *3*	5919.67 *14*	E(level): from E$_n$=5919.67 keV *14* (1980Ci03). See also E$_n$(keV)=5914 *5* (1969Da13), 5900 (1961Fo07). Γ: See also Γ=28 keV (1961Fo07) and Γ_{no}=18.0 keV *6* (1980Ci03).
9786.07 *15*	≥3/2[b]	11.7[a] keV *3*	5995.68 *15*	E(level): from E$_n$=5995.68 keV *15* (1980Ci03). See also E$_n$=5990 keV (1961Fo07). Γ: See also Γ=28 keV (1961Fo07) and Γ_{n0}=10.3 keV *3* (1980Ci03).
9861.74 *15*	(5/2^{-})[a]	4.01[a] keV *23*	6076.08 *15*	E(level): from E$_n$=6076.08 keV *15* (1980Ci03). Γ: See also Γ_{n0}=3.37 keV *20* (1980Ci03).
9879.4 *10*	(1/2^{-})[a]	16.7[a] keV *17*	6094.8 *10*	E(level): from E$_n$=6094.8 keV *10* (1980Ci03). See also E$_n$=6080 keV (1961Fo07). Γ: See also Γ=25 keV (1961Fo07) and Γ_{n0}=10.9 keV *12* (1980Ci03).
10170.9 *5*	(7/2^{-})[a]	49.1[a] keV *8*	6404.6 *5*	E(level): from E$_n$=6404.6 keV *5* (1980Ci03). See also E$_n$(keV)=6395 *7* (1969Da13), 6390 (1961Fo07). Γ: See also Γ=38 keV (1961Fo07) and Γ_{n0}=22.3 keV *6* (1980Ci03).

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^{16}O(n,n),(n,n′) 1973Jo01,1981Hi01 (continued)

^{17}O Levels (continued)

E(level)	Jπ	Γ†	E_n(res) (keV)	Comments
				See also E_n(keV)=6395 *7* (1969Da13), 6390 (1961Fo07). Γ: See also Γ=38 keV (1961Fo07) and Γ_{n0}=22.3 keV *6* (1980Ci03).
10562.6 *6*	7/2−	42.5[a] keV *11*	6820.7 *6*	E(level): from E_n=6820.7 keV *6* (1980Ci03). See also E_n(keV)=6807 *7* (1969Da13), 6830 (1959Ha13), 6790 (1961Fo07), 6860 (1970Lu16). Γ: See also Γ=40 keV (1961Fo07) and Γ_{n0}=17.2 keV *7* (1980Ci03). Jπ: from (1970Lu16). See also (1980Ci03).
10797			7070	E(level): from E_n=7070 keV (1959Ha13). See also E_n=(7080) keV (1970Lu16).
10918.9 *13*	(5/2+)[a]	41.7[a] keV *14*	7199.3 *13*	E(level): from E_n=7199.3 keV *13* (1980Ci03). See also E_n(keV)=7200 *8* (1969Da13), 7200 (1970Lu16), 7180 (1961Fo07). Γ: See also Γ=70 keV (1961Fo07) and Γ_{n0}=26.4 keV *9* (1980Ci03).
10957			7240	E(level): from E_n=7240 keV (1959Ha13).
11082.67 *18*	1/2−[d]	2.4 keV *3*	7373.31 *18*	T=3/2 (1976Mc11,1981Hi01) E(level): from E_n=7373.31 keV *18* (1980Ci03,1981Hi01); see also E_n=7400 keV (1959Ha13), 7440 keV (1970Lu16). See also E_x=11076 keV *5* (1976Mc11: ^{13}C(α,n)). Γ: from (1980Ci03,1981Hi01). See also Γ=5.0 keV *11* (1976Mc11) and Γ_{n0}=1.88 keV *12* (1980Ci03,1981Hi01).
11519	≥3/2[b]	190[b] keV	7837	E(level): from E_n=7837 keV, which is the average of (1961Fo07: 7810 keV), (1959Ha13: 7870 keV) and (1970Lu16: 7830 keV). Jπ: See also (3/2,5/2) (1970Lu16).
11978	≥3/2[b]	270[b] keV	8325	E(level): from E_n=8325 keV, which is the average of (1959Ha13: 8350 keV) and (1961Fo07: 8300 keV).
12143			8500	E(level): from E_n=8500 keV (1959Ha13).
12350		130[b] keV	8720	E(level): from E_n=8720 keV (1961Fo07).
12471.4 *6*	3/2−[d]	6.9 keV *11*	8848.8 *6*	T=3/2 (1976Mc11,1981Hi01) E(level): from E_n=8848.8 keV *6* (1980Ci03,1981Hi01). See also E_n=8840 keV (1959Ha13); E_x=12458 keV *5* (1976Mc11: ^{13}C(α,n)). Γ: from (1980Ci03,1981Hi01). See also Γ=8 keV *2* (1976Mc11) and Γ_{n0}=1.27 keV *14* (1980Ci03,1981Hi01).
12675		95[b] keV	9065	E(level): from E_n=9065 keV, which is the aveage of (1959Ha13: 9100 keV) and (1961Fo07: 9030 keV).
12946 *6*	1/2+[d]	6[d] keV *2*	9353 *6*	T=3/2 (1976Mc11,1980Hi01) E(level): from E_n=9353 keV *6* (1981Hi01). See also E_n=9340 keV (1959Ha13); E_x=12944 keV *6* (1976Mc11: ^{13}C(α,n)). Γ: See also Γ_{n0}=0.21 keV *14* (1981Hi01).
13004.2 *6*	5/2−[d]	2.5 keV *10*	9414.9 *6*	T=3/2 (1976Mc11,1981Hi01) E(level): from E_n=9414.9 keV *6* (1980Ci03,1981Hi01). See also E_x=12993 keV *6* (1976Mc11: ^{13}C(α,n)). Γ: from (1980Ci03,1981Hi01). See also Γ≤3 keV (1976Mc11) and Γ_{n0}=0.40 keV *6* (1980Ci03,1981Hi01).
13641.9 *24*		9[c] keV *5*	10092.5 *24*	T=3/2 (1981Hi01) E(level): from E_n=10092.5 keV *24* (1981Hi01). Γ: See also Γ_{n0}=0.24 keV *9* (1981Hi01).
13649		400[b] keV	10100	E(level): from E_n=10100 keV (1961Fo07).
14237.7 *15*	(7/2−)[c]	20.5 keV *16*	10725.5 *15*	T=3/2 (1981Hi01)

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^{16}O(n,n),(n,n′) 1973Jo01,1981Hi01 (continued)

^{17}O Levels (continued)

E(level)	J$^{\pi}$	Γ[†]	E$_n$(res) (keV)	Comments
				E(level): from E$_n$=10725.5 keV *15* (1980Ci03,1981Hi01). Γ: from (1980Ci03,1981Hi01). See also Γ$_{n0}$=2.07 keV *16* (1980Ci03,1981Hi01).
14294 *3*		7.5[c] keV *4*	10785 *3*	T=3/2 (1981Hi01) E(level): from E$_n$=10785 keV *3* (1981Hi01). Γ: See also (J±1/2)Γ$_{n0}$=0.80 keV *16* (1981Hi01).
14458 *3*		40[c] keV *6*	10960 *3*	E(level): from E$_n$=10960 keV *3* (1981Hi01). Γ: See also (J±1/2)Γ$_{n0}$=13 keV *6* (1981Hi01).
14590	(≥3/2)[b]	340[b] keV	11100	E(level): from E$_n$=11100 keV (1961Fo07).
14799 *3*	1/2$^-$[c]	36[c] keV *13*	11322 *3*	T=3/2 (1981Hi01) E(level): from E$_n$=11322 keV *3* (1981Hi01). Γ: See also (J±1/2)Γ$_{n0}$=3.2 keV *10* (1981Hi01).
14967		180[b] keV	11500	E(level): from E$_n$=11500 keV (1961Fo07).
15208 *3*	(3/2)[c]	52[c] keV *14*	11756 *3*	T=3/2 (1981Hi01) E(level): from E$_n$=11756 keV *3* (1981Hi01). Γ: See also (J±1/2)Γ$_{n0}$=11 keV *3* (1981Hi01).
15377 *3*	≤5/2[c]	40[c] keV *6*	11936 *3*	T=3/2 (1981Hi01) E(level): from E$_n$=11936 keV *3* (1981Hi01). Γ: See also (J±1/2)Γ$_{n0}$=7 keV *1* (1981Hi01).
16253 *4*	(7/2$^+$,9/2$^+$)[c]	21[c] keV *10*	12867 *4*	T=3/2 (1981Hi01) E(level): from E$_n$=12867 keV *4* (1981Hi01). Γ: See also (J±1/2)Γ$_{n0}$=2.0 keV *5* (1981Hi01).
17448 *11*		66[c] keV *20*	14136 *11*	T=3/2 (1981Hi01) E(level): from E$_n$=14136 keV *11* (1981Hi01). Γ: See also (J±1/2)Γ$_{n0}$=8.0 keV *24* (1981Hi01).
18122 *4*		46 keV *12*	14853 *4*	T=3/2 (1981Hi01) E(level): from E$_n$=14853 keV *4* (1981Hi01). Γ: from (1981Hi01: Table 1). See also Γ=43 keV *12* (1981Hi01: Table 2), Γ$_{n0}$=1.9 keV *6* (1981Hi01: Table 1) and (J±1/2)Γ$_{n0}$=1.0 keV *3* (1981Hi01: Table 2).
20425	(1/2$^+$)		17300	T=(1/2) (1970Bo30) E(level): from E$_n$=17300 keV (1970Bo30). Γ: Γ$_n$≈700 keV (1970Bo30). J$^{\pi}$: from (1970Bo30).

[†] Γ, Γ$_n$ and Γ$_{\alpha}$ are in c.m. system except where noted. Γ$_{\alpha}$ from (1973Jo01) are to fit (n,α) cross sections of (1973Ba10) normalized (×0.8).

[‡] Γ$_{lab}$ from (Ar60: Armstrong, et al., Bull. Amer. Phys. Soc. II, 5, 247 (1960)). The values are presented in (FAS61: Ajzenberg-Selove and Lauritsen, Energy Levels of Nuclei: A=5 to A=257, Vol. 1, p. 1-59 (1961)) and later in (1958Hu18). Values in (FAS61) are given in the cm system, while the Γ$_n$ values of (1958Hu18) represent the lab width of the state.

[#] From (1973Jo01).

[@] Also observed in (1970Fo03).

[&] From (1973Fo11).

[a] from (1980Ci03).

[b] from (1961Fo07).

[c] from (1981Hi01).

[d] from (1976Mc11).

[e] We adopt the careful R-matrix analysis of (1973Fo11,1973Jo01), which considers the interference of the E$_{res}$(keV)=3250 *10* and 4162 *8* J$^{\pi}$=3/2$^+$ levels. A different set of level parameters is given in (1966Li03).

[f] From (1970Fo03).

[g] From (1967Jo12).