Table 20.21 from (1983AJ01): Resonances in ^{16}O(α, α) [a]

E_α (MeV $\pm$ keV)	$\Gamma_{\rm c.m.}$ (keV)	Outgoing particles	θ^2 (%)	$E_{\rm x}$ (MeV $\pm$ keV)	J^π	K^π
1.3174 ± 2.2 [b]	$(2.8 \pm 0.3) \times 10^{-2}$ [b]	α_0		5.785	1^-	0^-
2.490 ± 10	19	α_0	22	6.722	0^+	0^+_2
3.0359 ± 2.3 [b]	8.1 ± 0.3 [b]	α_0	36	7.1563 ± 0.5	3^-	0^-
3.090 ± 10	4	α_0	1.1	7.202	0^+	0^+_3
3.380 ± 10	8	α_0	4.7	7.434	2^+	0^+_2
3.885 ± 10	2	α_0	0.6	7.838	2^+	0^+_3
4.653 ± 5	0.013 ± 0.004	α_0	0.07	8.452	5^-	2^-
≈ 4.9	> 800	α_0	≈ 70	≈ 8.6	0^+	0^+_4
5.002	2.5	α_0	0.23	8.731	1^-	
5.058 ± 3	0.11 ± 0.02	α_0	8.5 ± 1.5	8.776	6^+	0^+_1
≈ 5.1	> 800	α_0	≈ 95	≈ 8.8	2^+	0^+_4
5.11	< 1	α_0		8.82	(5^-)	
5.152 ± 5	19	α_0	1.1	8.851	1^-	
5.395 ± 5	3	α_0	3.9	9.046	4^+	0^+_3
5.486 ± 5	3.2	α_0	0.49	9.118	3^-	
5.955 ± 10	24	α_0	1.4	9.493	2^+	
6.569 ± 10	97	α_0	17	9.984	4^+	0^+_2
6.912 ± 5	141	α_0	66	10.259	5^-	0^-
6.92 ± 10 [c]	≤ 0.3	α_0	$\leq 1.3 \times 10^{-3}$	10.27	(2^+)	
7.092 ± 5	81	α_0	4.8	10.403	3^-	
7.276 ± 5	16	α_0	1.8	10.550	4^+	
7.314 ± 10	24	α_0	0.85	10.580	2^+	
7.580 ± 100	349	α_0	33	10.79	4^+	0^+_4
7.635 ± 5	13	α_0	0.42	10.837	2^+	
7.636	45	α_0	2.1	10.838	3^-	
(7.75)	80	α_0		(10.93)		
7.80 ± 150	576	α_0	14	10.97	0^+	
7.860 ± 10	24	α_0	2.0	11.017	4^+	
7.93 ± 10 [c]	≤ 0.5	α_0	≤ 0.05	11.07	(4^+)	
8.132 ± 30	172	α_0	4.2	11.234	1^-	
8.16 ± 10 [c]	≤ 0.3	α_0	≤ 0.009	11.26	(1^-)	
8.24 ± 10 [c]	40 ± 10	α_0	1.4	11.32	2^+	
8.528 ± 10 [c]	1.0 ± 0.5	α_0	0.03, 0.02	11.551	$(2^+, 0^+)$	
(≈ 8.6)	≈ 500	α_0		(≈ 11.6)	(2^+)	
8.930 ± 20	46	α_0	1.1	11.872	2^+	
8.997 ± 5	0.44 ± 0.15	α_0, $\gamma_{6.13}$	0.04 ± 0.01	11.926	4^+	
9.026 ± 5	$(35 \pm 10) \times 10^{-3}$	α_0	1.0 ± 0.3	11.949	8^+	0^+_1

Table 20.21 from (1983AJ01): Resonances in ^{16}O(α, α) [a] (continued)

9.043 ± 10 [c]	30 ± 5	α_0	0.72	11.962	1^-	
9.26		$\gamma_{6.13}$	[d]	12.137 ± 5	6^+	0_3^+
9.39 ± 30 [c]	148 ± 20	α_0	7.7	12.24	4^+	
9.406 ± 4	< 1	$\gamma_{6.13}$	[d]	12.253 ± 3	3^-; 1	
9.53 ± 100 [c]	≈ 500	α_0	≈ 13	12.35	2^+	
9.58 [c,e]	37.3 ± 0.9	α_0, $\gamma_{6.13}$		12.394 ± 4	3^-	
9.64 [f]	24.4 ± 0.5	α_0, α_1	[f]	12.436 ± 4	0^+	
9.790 ± 10 [c]	88 ± 10	α_0	28	12.560	6^+	0_4^+
(9.860 ± 100)		α_0		(12.62)		
9.944 ± 15	97	α_0	7.3	12.683	5^-	
10.050 ± 100	100	α_0		12.77	4^+	
10.14 ± 70	55	α_0, $\gamma_{6.13}$		12.84		
10.32 ± 75 [g]	60	α_0, $\gamma_{6.13}$		12.98	(4^+)	
10.43 ± 90	70	α_0, $\gamma_{6.13}$		13.07	(4^+)	
10.57 ± 75	60	α_0, $\gamma_{6.13}$		13.18	(4^+)	
10.759 ± 6	$(80 \pm 30) \times 10^{-3}$	α_0	0.08 ± 0.03	13.334	7^-	2^-
10.770 ± 6	20 ± 5	α_0, $\gamma_{6.13}$	0.7 ± 0.2	13.343	4^+	
10.83 ± 50	40	$\gamma_{6.13}$		13.39		
10.87 ± 140	110	α_0, $\gamma_{6.13}$		13.42	(4^+)	
11.20 ± 400	320	α_0, $\gamma_{6.13}$		13.7	$(3, 7)^-$	
(11.51 ± 125) [g]	(400)	(α_0, $\gamma_{6.13}$)		13.93	(6^+)	
11.77		α_0, $\gamma_{6.9+7.1}$		14.14		
E_α (MeV $\pm$ keV)	$\Gamma_{\rm c.m.}$ (keV)	Outgoing particles	Γ_{α_0}/Γ	$E_{\rm x}$ (MeV $\pm$ keV)	J^π	K^π
11.97 ± 300	240	α_0, $\gamma_{6.13}$, $\gamma_{6.9+7.1}$		14.3	6^+	
(12.06)		α_0, $\gamma_{6.9+7.1}$		(14.37)		
12.31 ± 300	240	α_0, $\gamma_{6.9+7.1}$		14.6	(4^+)	
12.66 ± 150	120	α_0, $\gamma_{6.13}$, $\gamma_{6.9+7.1}$		14.85		
12.86 ± 150	120	α_0, $\gamma_{6.13}$, $\gamma_{6.9+7.1}$		15.01		
13.165 ± 150	120	α_0, $\gamma_{6.13}$		15.26		
13.22		α_0		15.30		
13.37 ± 470	380	α_0, $\gamma_{6.13}$, $\gamma_{6.9+7.1}$		15.4	7^-	0^-
13.58		α_0, $\gamma_{6.13}$, $\gamma_{6.9+7.1}$		15.59		
13.73		α_0, $\gamma_{6.13}$, $\gamma_{6.9+7.1}$		15.71	(6^+)	
14.05		α_0, $\gamma_{6.13}$, $\gamma_{6.9+7.1}$		15.97	(6^+)	
14.26		$\gamma_{6.13}$, $\gamma_{6.9+7.1}$		16.13		
14.40		$\gamma_{6.13}$		16.25		
14.501 ± 15	43	α_0, α_{1+2}		16.326	4^+	
14.636 ± 15	34	α_0, α_{1+2}		16.434	$(0, 2, 4)^+$	

Table 20.21 from (1983AJ01): Resonances in ^{16}O(α, α) [a] (continued)

14.726 ± 11 [h]	25 ± 3	α_0, α_{1+2}	0.473 ± 0.024	16.506	6^+	
14.815 ± 15 [h]	86 ± 6	α_0	0.446 ± 0.019	16.577 ± 12	7^-	
14.886 ± 17 [h]	51 ± 14	α_0	0.173 ± 0.014	16.634 ± 14	3^-	
14.932 ± 12 [h]	79 ± 11	α_0	0.259 ± 0.025	16.671	4^+	
14.988 ± 12 [h]	14 ± 7	α_0, α_{1+2}	0.062 ± 0.026	16.715	$(5, 3)^-$	
15.156 ± 11 [h]	16 ± 5	α_0, α_{1+2}	0.126 ± 0.021	16.850	5^-	
15.540 ± 11 [h]	33 ± 3	α_0, α_{1+2}	0.291 ± 0.019	17.156	5^-	
15.601 ± 15 [h]	142 ± 9	α_0	0.460 ± 0.019	17.205 ± 12	4^+	
15.691 ± 12 [h]	52 ± 10	α_0	0.155 ± 0.019	17.277	4^+	
15.721 ± 17 [h]	213 ± 12	α_0	0.237 ± 0.013	17.301 ± 14	8^+	
15.828 ± 15	< 10	α_{1+2}		17.387		
15.837 ± 17 [h]	241 ± 13	α_0	0.209 ± 0.012	17.394 ± 14	9^-	
16.023 ± 15	136	α_0, α_{1+2}		17.542	6^+	
16.285 ± 15	36	α_0, α_{1+2}		17.752	$(4, 0)^+$	
16.598 ± 15	< 10	α_0, α_{1+2}		18.002	7^-	
16.625 ± 10 [h]	35 ± 3	α_0, α_{1+2}	0.372 ± 0.018	18.024 ± 8	5^-	
16.744 ± 9 [h]	29 ± 3	α_0, α_{1+2}	0.420 ± 0.024	18.119 ± 8	7^-	
16.98 ± 300	240	α_0, $\gamma_{6.13}$, $\gamma_{6.9+7.1}$		18.31	(6^+)	
17.45	600	α_0, $\gamma_{6.13}$		18.7	(6^+)	
17.988 ± 12 [h]	149 ± 18	α_1	0.420 ± 0.012 [i]	19.113 ± 10	6^+	
18.250 ± 11 [h]	123 ± 10	α_1	0.272 ± 0.014 [i]	19.322 ± 9	6^+	
18.393 ± 12 [h]	102 ± 7	α_1	0.466 ± 0.012 [i]	19.437 ± 10	6^+	
18.658 ± 12 [h]	89 ± 8	α_1	0.332 ± 0.012 [i]	19.648 ± 10	6^+	
18.990 ± 15 [h]	203 ± 19	α_1	0.379 ± 0.017 [i]	19.914 ± 12	5^-	
19.261 ± 21 [h]	156 ± 21	α_1	0.301 ± 0.020 [i]	20.130 ± 17	7^-	
19.495 ± 15 [h]	203 ± 19	α_1	0.343 ± 0.021 [i]	20.317 ± 12	7^-	
19.640 ± 20 [h]	346 ± 32	α_1	0.444 ± 0.020 [i]	20.433 ± 16	6^+	
19.953 ± 11 [h]	75 ± 9	α_0	0.247 ± 0.018	20.683 ± 9	9^-	
20.076 ± 14	122 ± 13	α_1	0.395 ± 0.020	20.782 ± 11	7^-	
20.249 ± 15	181 ± 22	α_1	0.339 ± 0.017	20.920 ± 12	7^-	
20.45 ± 40	80	α_0		21.08	9^-	
20.70	300	α_0		21.3	7^-	
21.3 ± 200	300	α_0		21.8	7^-	
22.0 ± 200	500	α_0		22.3	7^-	
22.5 ± 250	500	α_0		22.7	9^-	
22.65 ± 125	250	α_0		22.84	9^-	
23.3 ± 250	500	α_0		23.4	8^+	
24.24 ± 150	350	α_0		24.11	8^+	
25.4 ± 300	600	α_0		25.0	8^+	

Table 20.21 from (1983AJ01): Resonances in ^{16}O(α, α) [a] (continued)

26.2 ± 200	400	α_0		25.7		
28.1 ± 350	700	α_0		27.2		
29	1600	α_0		28	8^+	
29.4 ± 350	700	α_0		28.2		

[a] See also Table 20.20, and Table 2 in (1973HA63). For a complete listing of references see Table 20.23 in (1978AJ03).

[b] (1980MA27): $\Gamma_{\rm c.m.} = \Gamma_\alpha$.

[c] (1978ST08).

[d] $(2J+1)\Gamma_{\alpha_0}\Gamma_{\alpha_2}/\Gamma = 81 \pm 12$ eV and 14 ± 2 eV, respectively, for ^{20}Ne*(12.14, 12.25) (1980FI01).

[e] (1981GA35): $\omega\gamma_{\rm c.m.} = 3.3 \pm 0.3$ keV. See also (1978ST08).

[f] $\omega\gamma_{\rm c.m.} = 2.82 \pm 0.29$, $\Gamma_{\alpha_1} = 20.8 \pm 0.4$ keV, $\Gamma_{\alpha_0} = 3.2 \pm 0.4$ keV. The spectroscopic factors are ≈ 1 and 0.001 for the α_1 and α_0 decays suggesting that the wave function of ^{20}Ne*(12.44) contains a large amount of 8p-4h configuration (1981GA35). See also (1980CA1K).

[g] (1981CA1J; abstract) suggest 8p-4h 2^+ and 4^+ states at $E_{\rm x} = 12.95$ and 13.96 MeV; $\theta^2 = 0.004$ and 0.001, respectively. (1982HIZY; abstract) find $\Gamma_{\alpha_1}/\Gamma < 0.6\%$ [^{16}O*(12.98)], $\Gamma_{\alpha_3}/\Gamma < 0.1\%$ [^{16}O*(13.34)] and $\Gamma_{\alpha_1}/\Gamma = (0.7 \pm 0.5)$, $\Gamma_{\alpha_{3+4}}/\Gamma = (1.0 \pm 0.4)$ [^{16}O*(13.93)]. The corresponding reduced widths are very small and indicate that these states are not the 8p-4h 2^+ and 4^+ states suggested by (1981CA1J).

[h] (1979BI10). The state at $E_{\rm x} = 19.577$ MeV has been withdrawn. The quoted errors in the branching ratios reported by (1979BI10) correspond to a χ^2 doubling as the parameter is varied. However because of correlations in the fitting program, the uncertainties may well be as large as ± 0.1. The uncertainties in the quoted widths may be appreciably larger than shown (H.T. Richards and S. Riedhauser, private communication).

[i] $(\Gamma_{\alpha_0}\Gamma_{\alpha_1})^{1/2}/\Gamma$.

[j] Preliminary work by G. Caskey indicates that the resonance at $E_\alpha = 11183 \pm 5$ keV corresponds to a state at $E_{\rm x} = 13672 \pm 4$ keV [$\Gamma_{\rm c.m.} = 15 \pm 6$ keV] with $J^\pi = 5^-$ (H.T. Richards, private communication).