

Table 19.18 from (1983AJ01): Energy levels of  $^{19}\text{F}$  from  $^{18}\text{O}(p, p)^{18}\text{O}$  and  $^{18}\text{O}(p, \alpha)^{15}\text{N}$  <sup>a</sup>

$E_p$ (MeV $\pm$ keV)	$\Gamma_{\text{lab}}$ (keV)	Particles out	$\Gamma_p^b$ (keV)	$\Gamma_\alpha^b$ (keV)	$J^\pi$	$E_x$ (MeV)
$0.095 \pm 3^c$	$\leq 3$	$\alpha_0$	$\omega\gamma = (1.6 \pm 0.5) \times 10^{-7} \text{ eV}$			8.083
$0.152 \pm 1^c$	$\leq 0.5$	$\alpha_0$	$0.17 \pm 0.02 \text{ eV}$			8.137
$0.216 \pm 1^c$	$\leq 1$	$\alpha_0$	$(2.3 \pm 0.6) \times 10^{-3} \text{ eV}$			8.198
$0.334 \pm 1^c$	$\leq 1$	$\alpha_0$	$0.057 \pm 0.010 \text{ eV}$			8.310
$0.6326 \pm 0.4^d$	$2.1 \pm 0.1$	$p_0, \alpha_0$	$0.065 \pm 0.006$	$2.0 \pm 0.2$	$\frac{3}{2}^-$	8.5925
$\approx 0.695^c$	$\approx 340$	$p_0, \alpha_0$	$5^e$	$95^e$	$\frac{1}{2}^+$	8.65
$0.846 \pm 1.5$	$47 \pm 1$	$p_0, \alpha_0$	$26 \pm 1.5$	$21 \pm 1$	$\frac{1}{2}^+; T = \frac{3}{2}$	8.795
$0.9870 \pm 0.7$	$3.8 \pm 0.2$	$p_0, \alpha_0$	$0.080 \pm 0.007$	$3.7 \pm 0.3$	$\frac{3}{2}^-$	8.928
(1.135)	140					(9.068)
$1.1685 \pm 0.5$	$0.60 \pm 0.03$	$p_0, \alpha_0$	$0.005 \pm 0.0006$	$0.595 \pm 0.08$	$\frac{7}{2}^+$	9.0999
$1.2390 \pm 1$	$6.1 \pm 0.3$	$p_0, (\alpha_0)$	$0.40 \pm 0.03$	$5.7 \pm 0.4$	$\frac{1}{2}^+$	9.167
$1.4025 \pm 1$	$5.2 \pm 0.2$	$p_0, \alpha_0$	$0.23 \pm 0.02$	$5.0 \pm 0.4$	$\frac{1}{2}^+$	9.321
$1.620 \pm 6$	30	$p_0, \alpha_0$			$(\frac{5}{2})$	9.527
$1.668 \pm 6$	27	$p_0, \alpha_0$			$\frac{3}{2}^+$	9.573
$1.766 \pm 3$	3.6	$p_0, \alpha_0$	2.1	1.5	$\frac{3}{2}^+$	9.666
$1.928 \pm 3$	0.16	$p_0, \alpha_0$	0.09	0.07	$(\frac{5}{2}, \frac{7}{2})^-$	9.819
$2.001 \pm 4$	31	$p_0, \alpha_0$	12	19	$\frac{1}{2}^+$	9.888
$2.2630 \pm 0.7$	$5.0 \pm 1.0$	$\alpha_0, \alpha_1, \alpha_2$	$\approx 5$	$0.004^c$	$\frac{3}{2}^-$	10.136
$2.289 \pm 3$	33	$p_0, \alpha_0$	2.3	(1.0)	$\frac{1}{2}^+$	10.161
$2.363 \pm 3$	4.5	$p_0, \alpha_0$	2.8	1.7	$\frac{1}{2}^+$	10.231
$2.387 \pm 3$	24	$p_0, \alpha_0$	11	13	$\frac{3}{2}^+$	10.253
$2.443 \pm 4$	9.7	$p_0, \alpha_0$	5.2	4.5	$\frac{3}{2}^+$	10.307
$2.644 \pm 3$	4.6	$p_0, p_1, \alpha_0, \alpha_{1+2}$	2.4	(1.0)	$\frac{3}{2}^+$	10.497
$2.705 \pm 3$	$8 \pm 2$	$p_1, \alpha_0$			$\frac{3}{2}^{(+)}; (T = \frac{3}{2})$	10.555
$2.732 \pm 4$	$23 \pm 3$	$p_1, \alpha_0$			$(\frac{5}{2}^+)$	10.580
$2.768 \pm 3$	4.0	$p_0, p_1, \alpha_0, \alpha_{1+2}$	0.7	(1.0)	$\frac{5}{2}^+; T = \frac{3}{2}^a$	10.614
$2.925 \pm 3$	5.7	$p_0, p_1, \alpha_0, \alpha_{1+2}$	4.5	1.2	$\frac{1}{2}^-$	10.763
$3.029 \pm 4$	19.5	$p_0, p_1, \alpha_0, \alpha_{1+2}$	13.0		$\frac{5}{2}^+$	10.862
(3.06)		$\alpha_0$				(10.89)
$3.148 \pm 4$	(14)	$p_0, p_1, \alpha_0, \alpha_{1+2}$	(4.5)	(4.5)	$(\frac{3}{2}, \frac{5}{2})^+$	10.974
$3.266 \pm 9$	35	$p_0, p_1, \alpha_0, \alpha_{1+2}$			$\frac{1}{2}^+$	11.086
$3.386 \pm 9$	20	$p_0, p_1, \alpha_0, \alpha_{1+2}$			$(\frac{1}{2}^-)$	11.200
$3.479 \pm 8$	$23 \pm 5$	$p_0, p_1, \alpha_0, \alpha_{1+2}$	$4.3 \pm 1$		$\frac{5}{2}^+$	11.288
$3.547 \pm 25$	$286 \pm 33$	$p_0$	$241 \pm 2$		$\frac{1}{2}^+$	11.35
$3.643 \pm 9$	$40 \pm 7$	$p_0, (\alpha_{1+2})$	$17 \pm 3$		$\frac{1}{2}^-$	11.443
$3.694 \pm 9$	$29 \pm 6$	$p_0, p_1, \alpha_0, (\alpha_{1+2})$	$12 \pm 2$		$\frac{3}{2}^-$	11.491
$3.744 \pm 8$	$23 \pm 5$	$p_0, p_1, \alpha_0$	$3.7 \pm 1$		$\frac{5}{2}^+$	11.539

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$E_p$ (MeV $\pm$ keV)	$\Gamma_{\text{lab}}$ (keV)	Particles out	$\Gamma_p^b$ (keV)	$\Gamma_\alpha^b$ (keV)	$J^\pi$	$E_x$ (MeV)
3.811 $\pm$ 12	66 $\pm$ 7	p <sub>0</sub>	30 $\pm$ 12		$\frac{3}{2}^-$	11.602
3.869 $\pm$ 8	28 $\pm$ 7	p <sub>0</sub> , p <sub>1</sub> , ( $\alpha_{1+2}$ )	12 $\pm$ 2		$\frac{3}{2}^+$ ; ( $T = \frac{3}{2}$ )	11.657
4.290 $\pm$ 30	75 $\pm$ 25	p <sub>0</sub> , $\alpha_0$ , $\alpha_{1+2}$	10 $\pm$ 3		$\frac{1}{2}^-$	12.06
4.390 $\pm$ 15	110 $\pm$ 15	p <sub>0</sub> , p <sub>1</sub> , ( $\alpha_0$ , $\alpha_{1+2}$ )	60 $\pm$ 10		$\frac{3}{2}^-$ ; $T = \frac{3}{2}$	12.150
4.465 $\pm$ 12	78 $\pm$ 1	p <sub>0</sub> , p <sub>1</sub> , $\alpha_0$ , $\alpha_{1+2}$	48 $\pm$ 6		$\frac{3}{2}^+$	12.221
4.782 $\pm$ 7	16 $\pm$ 4	p <sub>0</sub> , p <sub>1</sub>	2.4 $\pm$ 1		$\frac{1}{2}^-$	12.521
4.840 $\pm$ 10	50 $\pm$ 10	p <sub>0</sub> , p <sub>1</sub> , $\alpha_{1+2}$	6.4 $\pm$ 2		$\frac{5}{2}^+$	12.576
4.848 $\pm$ 25	300 $\pm$ 50	p <sub>0</sub>	80 $\pm$ 25		$\frac{1}{2}^-$ ; $T = \frac{3}{2}$	12.58
5.074 $\pm$ 30	100 $\pm$ 40	p <sub>0</sub> , p <sub>1</sub> , ( $\alpha_0$ )	13 $\pm$ 5		$\frac{5}{2}^+$ ; $T = \frac{3}{2}$	12.80
5.135 $\pm$ 30	290 $\pm$ 40	p <sub>0</sub> , p <sub>1</sub>	114 $\pm$ 17		$\frac{3}{2}^+$ ; $T = \frac{3}{2}$	12.86
5.225 $\pm$ 25	75 $\pm$ 25	p <sub>0</sub> , p <sub>1</sub> , $\alpha_{1+2}$	3 $\pm$ 1.5		$\frac{5}{2}^+$	12.94
5.27 $\pm$ 50	130 $\pm$ 40	p <sub>0</sub>	20 $\pm$ 8		$\frac{1}{2}^-$	12.98
5.38 $\pm$ 75	300 $\pm$ 75	p <sub>0</sub>	75 $\pm$ 25		$\frac{3}{2}^-$	13.09
5.622 $\pm$ 8	30 $\pm$ 6	p <sub>0</sub> , p <sub>1</sub> , $\alpha_0$ , $\alpha_{1+2}$	10 $\pm$ 3		$\frac{7}{2}^-$	13.317
5.670 $\pm$ 25	40 $\pm$ 20	p <sub>0</sub>	2 $\pm$ 2		$\frac{3}{2}^-$	13.36
6.060 $\pm$ 11	55 $\pm$ 10	p <sub>0</sub> , p <sub>1</sub> , ( $\alpha_{1+2}$ )	13 $\pm$ 3		$\frac{7}{2}^-$ ; $T = \frac{3}{2}$	13.731
6.390 $\pm$ 20 <sup>f</sup>	148 $\pm$ 30	p <sub>0</sub>	12 $\pm$ 3		$\frac{5}{2}^+$	14.04
6.428 $\pm$ 30	88 $\pm$ 30	p <sub>0</sub>	8 $\pm$ 3		$\frac{3}{2}^-$	14.08
6.687 $\pm$ 20	80 $\pm$ 30	p <sub>0</sub>	9 $\pm$ 3		$\frac{3}{2}^-$	14.32
7.080 $\pm$ 20	130 $\pm$ 40	p <sub>0</sub>	21 $\pm$ 5		$\frac{3}{2}^-$	14.70
7.10 $\pm$ 70 <sup>g</sup>	270 $\pm$ 70	$\alpha_0$			$\frac{1}{2}^-$	14.72
7.125 $\pm$ 50 <sup>f,g</sup>	380 $\pm$ 70	p <sub>0</sub> , $\alpha_0$	100 $\pm$ 25		$\frac{1}{2}^+$	14.74
7.167 $\pm$ 40	210 $\pm$ 50	p <sub>0</sub>	21 $\pm$ 6		$\frac{5}{2}^+$	14.78
7.337 $\pm$ 40	208 $\pm$ 30	p <sub>0</sub>	20 $\pm$ 4		$\frac{7}{2}^-$	14.94
7.775 $\pm$ 20	70 $\pm$ 10	p <sub>0</sub>	6 $\pm$ 2		$\frac{1}{2}^-$	15.35
7.820 $\pm$ 30	84 $\pm$ 25	p <sub>0</sub>	7 $\pm$ 2		$\frac{3}{2}^+$	15.40
8.282 $\pm$ 40	102 $\pm$ 25	p <sub>0</sub>	8 $\pm$ 3		$\frac{3}{2}^-$	15.83
8.670 $\pm$ 40	180 $\pm$ 30	p <sub>0</sub>	16 $\pm$ 4		$\frac{3}{2}^+$	16.20
8.695 $\pm$ 30	234 $\pm$ 40	p <sub>0</sub>	13 $\pm$ 4		$\frac{7}{2}^-$	16.23
8.747 $\pm$ 30	176 $\pm$ 30	p <sub>0</sub>	13 $\pm$ 4		$\frac{3}{2}^-$	16.27
9.563 $\pm$ 40	348 $\pm$ 70	p <sub>0</sub>	39 $\pm$ 8		$\frac{3}{2}^-$	17.05
9.679 $\pm$ 40	340 $\pm$ 70	p <sub>0</sub>	30 $\pm$ 8		$\frac{7}{2}^-$	17.16
9.986 $\pm$ 30	34 $\pm$ 20	p <sub>0</sub>	3 $\pm$ 2		$\frac{3}{2}^-$	17.45
10.200 $\pm$ 60	100 $\pm$ 60	p <sub>0</sub>	5 $\pm$ 3		$\frac{7}{2}^-$	17.65
10.496 $\pm$ 40	268 $\pm$ 60	p <sub>0</sub>	23 $\pm$ 5		$\frac{3}{2}^-$	17.93
10.596 $\pm$ 60	384 $\pm$ 60	p <sub>0</sub>	32 $\pm$ 7		$\frac{7}{2}^-$	18.02
11.698 $\pm$ 60	584 $\pm$ 150	p <sub>0</sub>	22 $\pm$ 7		$\frac{3}{2}^-$	19.07

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$E_{\text{p}}$ (MeV $\pm$ keV)	$\Gamma_{\text{lab}}$ (keV)	Particles out	$\Gamma_{\text{p}}$ <sup>b</sup> (keV)	$\Gamma_{\alpha}$ <sup>b</sup> (keV)	$J^{\pi}$	$E_{\text{x}}$ (MeV)
12.499 $\pm$ 150	388 $\pm$ 60	p <sub>0</sub>	13 $\pm$ 6		$\frac{5}{2}^{-}$	19.83
12.547 $\pm$ 40	498 $\pm$ 60	p <sub>0</sub>	39 $\pm$ 8		$\frac{3}{2}^{-}$	19.87
13.542 $\pm$ 50	434 $\pm$ 60	p <sub>0</sub>	32 $\pm$ 5		$\frac{1}{2}^{-}$	20.81
13.662 $\pm$ 50	334 $\pm$ 50	p <sub>0</sub>	12 $\pm$ 4		$\frac{3}{2}^{-}$	20.93
13.791 $\pm$ 40	472 $\pm$ 30	p <sub>0</sub>	25 $\pm$ 5		$\frac{7}{2}^{-}$	21.05

<sup>a</sup> See also Tables 19.17 in (1978AJ03) and 19.14 in (1972AJ02) for the earlier work and references.

<sup>b</sup> See also Table 19.16.

<sup>c</sup> (1979LO01).

<sup>d</sup>  $\omega\gamma = 420 \pm 80$  eV (1979LO01).

<sup>e</sup> Widths not in accord with  $\Gamma$  measured by (1979LO01) who calculate also  $\omega\gamma \approx 1.2 \times 10^5$  eV.

<sup>f</sup> The parameters of this resonance and all the ones below [except for the two footnoted <sup>g</sup>] are from a phase-shift analysis by (1979MU05) of the elastic scattering for  $E_{\text{p}} = 6.1$  to 16.6 MeV. Other structures have also been observed but parameters for those have not been obtained.

<sup>g</sup> (1979WI09).