Table 11.19 from (2012KE01): Electromagnetic transitions in ^{11}B [a]

Initial state	J^π	Γ_γ (total) (eV)	Branching ratios (%) to final state [h]						
			g.s.	2.12	4.44	5.02	6.74	6.79	7.29
2.12 [b]	$\frac{1}{2}^-$	0.117 ± 0.004	100						
4.44 [b]	$\frac{5}{2}^-$	0.55 ± 0.05	100 [i]						
5.02 [c]	$\frac{3}{2}^-$	1.97 ± 0.07	85.6 ± 0.6 [j]	14.4 ± 0.6 [k]					
6.74 [d]	$\frac{7}{2}^-$	0.030 ± 0.007	70 ± 2 [l]	< 3	30 ± 2	< 1			
6.79 [c]	$\frac{1}{2}^+$	0.39 ± 0.05	67.5 ± 1.1	28.5 ± 1.1	< 0.04	4.0 ± 0.3			
7.29 [d]	$\frac{5}{2}^+$	1.14 ± 0.08	87.0 ± 2.0 [m]	< 1	5.5 ± 1 [n]	7.5 ± 1 [o]			
7.98 [e]	$\frac{3}{2}^+$	1.15 ± 0.15	46.2 ± 1.1	53.2 ± 1.2	< 0.06	< 0.09		< 0.10	0.85 ± 0.04
8.56 [d]	$(\frac{3}{2}^-)$ [p]	1.00 ± 0.09	56 ± 2	30 ± 2	5 ± 1	9 ± 1			
8.92 [f]	$\frac{5}{2}^-$	4.368 ± 0.021	95 ± 1 [q]	< 1	4.5 ± 0.5 [r]	< 1	< 1	< 1	
9.19 [g]	$\frac{7}{2}^+$	$0.17^{+0.06}_{-0.03}$	0.9 ± 0.3		86.6 ± 2.3		12.5 ± 1.1	< 1.3	
9.27 [g]	$\frac{5}{2}^+$	1.15 ± 0.16	18.4 ± 0.9		69.7 ± 1.4		11.9 ± 0.6	< 0.6	

[a] See Table 11.4 in (1980AJ01), Tables 11.21 and 11.30 here and (1965OL03).

[b] Γ_γ from ^{11}B(γ, γ'). The mean of values given in Table 11.14 in (1985AJ01)

[c] Γ_γ from ^{11}B(γ, γ') (1980MO23). Branching Ratios (BR) from discussion in (1982MI08).

[d] Γ_γ from ^{11}B(γ, γ') (1980MO23). BR from ^{9}Be(^{3}He, pγ), ^{10}B(d, pγ) and analysis of prior results (1965OL03). See also ^{11}B(n, nγ) (1972NI05).

[e] Γ_γ from ^{11}B(γ, γ') (1980MO23). BR from discussion in (1982MI08). See also ^{9}Be(^{3}He, pγ) and ^{10}B(d, pγ) (1965OL03) and ^{11}B(n, n$'\gamma$) (1972NI05).

[f] Γ_γ from discussion in (1984HA13). BR from (1965OL03).

[g] Γ_γ from ^{7}Li(α, γ) (1984HA13). BR from (1985AJ01) analysis of (1962GR07, 1984HA13) and earlier results.

[h] Mixing ratios are given in the Krane-Steffen convention. Values from (1968BE03) have been converted here from the Rose and Brink convention.

[i] $\delta = +0.158^{+0.025}_{-0.021}$ (2009RU04). See also $\delta = +0.19 \pm 0.03$ (1968BE03).

[j] $\delta = -0.036 \pm 0.013$ (2009RU04). See also $\delta = -0.03 \pm 0.05$ (1968BE03).

[k] $\delta = -0.19^{+0.10}_{-0.17}$ (2009RU04). See also $\delta = -0.05 \pm 0.20$ (1968BE03).

[l] $\delta = -0.45 \pm 0.18$. This value leads to too large a value of Γ_γ for an M3 transition (P.M. Endt, private communication with FAS).

[m] $\delta = +0.001^{+0.022}_{-0.021}$ (2009RU04).
[n] $\delta = -0.081^{+0.164}_{-0.126}$ (2009RU04).
[o] $\delta = +0.028^{+0.073}_{-0.075}$ (2009RU04).
[p] This is probably the ^{11}B analog of ^{11}C*(8.10). If so $J^\pi = \frac{3}{2}^-$.
[q] $\delta = 0.000 \pm 0.014$ (2009RU04). See also $\delta = -0.11 \pm 0.04$ (1968CO09).
[r] $\delta = -0.061^{+0.025}_{-0.022}$ (2009RU04).

Comments [mainly from (1962GR07, 1965OL03)]
(1) *4.44 MeV*. $9.28 \rightarrow 4.44 \rightarrow 0$ angular distribution fixes $J = \frac{5}{2}$. Odd parity determined from direct interaction assignments.
(2) *5.02 MeV*. Internal pair correlation permit M1, E2 for the g.s. transition: $J^\pi \leq \frac{7}{2}^-$ (parity from l-assignments). τ_m excludes $\frac{7}{2}$, branch to 2.12, $\frac{5}{2}$. Angular correlation fixes $\frac{3}{2}^-$.
(3) *6.74 MeV*. Internal pairs indicate practically pure E2 g.s. radiation. Angular distributions and branching ratios (and l-assignments) all lead to $\frac{7}{2}^-$.
(4) *6.79 MeV*. The allowed β-decay from ^{11}Be [$J^\pi = \frac{1}{2}^+$] requires $J^\pi \leq \frac{3}{2}^+$. The relatively strong γ-branch to ^{11}B*(2.12) favors $\frac{1}{2}^+$, $\frac{3}{2}^+$. All γ-rays from this level are isotropic, suggesting $J^\pi = \frac{1}{2}^+$, but not excluding $\frac{3}{2}^+$.
(5) *7.29 MeV*. The g.s. transition is mainly E1, so $J^\pi \leq \frac{5}{2}^+$. The assignment $\frac{1}{2}^+$ is excluded by the strength of (7.29→4.44). $J^\pi = \frac{5}{2}^+$ is consistent with $\log ft > 8.04$ in the ^{11}Be β-decay.
(6) *7.98 MeV*. Transitions to ^{11}B(0, 2.12) are predominantly E1; thus ^{11}B*(7.98) has even parity, and the odd parity of ^{11}B*(2.12) is confirmed. The transition to ^{11}B*(2.12) is not isotropic, so $J^\pi = \frac{3}{2}^+$.
(7) *8.56 MeV*. Correlation of internal pairs indicate that the g.s. transition is M1 + E2 or E1 + M2, $J^\pi = \leq \frac{5}{2}^+$ or $\leq \frac{7}{2}^+$; the lifetime to ^{11}B*(2.12) excludes $\frac{7}{2}^-$. If the level has even parity, the required M2 admixture is excessive. $J^\pi \leq \frac{5}{2}^-$ is favored. See also footnote [p].
(8) *8.92 MeV*. From ^{7}Li(α, γ)^{11}B, $J^\pi = \frac{3}{2}^+, \frac{5}{2}^+, \frac{5}{2}^-$. The internal pair correlation confirms $\frac{5}{2}^-$. For higher states see comments under individual reactions and (1968AJ02).