Draft of Calculator Equations Document

Reuben

1 equations

Quadrupole moment (eb?) from Matrix Element (eb$^{\lambda/2}$) :

$$Q_s = M.E. \left(\frac{16\pi}{5} \frac{J(2J-1)}{(2J+1)(2J+3)(J+1)} \right)^{\frac{1}{2}} \tag{1}$$

Jacobs thesis? (not sure of the text book or paper)

NOTE J_i is the higher energy state, J_f is the lower energy state.
B(Eλ)$\downarrow$ in W.u. to B(Eλ)$\downarrow$ in e^{2}fm$^{2\lambda}$:

$$B(E\lambda)\downarrow e^2 fm^{2\lambda} = B(E\lambda)\downarrow W.u. \frac{(1.2)^{2\lambda}}{4\pi} \frac{3}{(\lambda+3)^2} A^{2\lambda/3} \tag{2}$$

Bohr and Mottelsson

Matrix Element (eb$^{\lambda/2}$) to B(Eλ)$\downarrow$ (e^{2}b$^\lambda$) :

$$B(E\lambda)\downarrow = \frac{(M.E.)^2}{2J_i+1} \tag{3}$$

Lisa thesis (not sure of the text book of paper)

B(${}^{E}_{M}\lambda$)$\downarrow$ to B(${}^{E}_{M}\lambda$)$\uparrow$ (unit to same unit, need to convert units before or after if wanting) works for both E and M transitions :

$$B({}^{E}_{M}\lambda)\uparrow = B({}^{E}_{M}\lambda)\downarrow \frac{2J_i+1}{2J_f+1} \tag{4}$$

CHECK THE BELOW (they match what I found in text books, but doesn't make an exact conversion to what I expect?)

B(Mλ)$\downarrow$ (W.u.) to B(Mλ)$\downarrow$ (μ_N^2fm$^{(2\lambda-2)}$) :

$$B(M\lambda)\downarrow \mu_N^2 fm^{(2\lambda-2)} = B(M\lambda)\downarrow W.u. 1.2^{2\lambda-2} \frac{10}{3} \frac{3}{\lambda+3}^{2} A^{(2\lambda-2)/3} \tag{5}$$

B(Mλ)$\downarrow$ (μ_N^2fm$^{(2\lambda-2)}$) from Matrix Element ($\mu_N$fm$^{(2\lambda-2)/2}$) :

$$B(M\lambda)\downarrow = \frac{(M.E.)^2}{2J_i+1} \tag{6}$$

1.1 Unit Converters:

Matrix Element (eb$^{\lambda/2}$) to Matrix Element (efm$^{\lambda}$) : (check)

$$M.E.efm^{2\lambda/2} = M.E.eb^{\lambda/2}100^{\lambda/2} \tag{7}$$

B(Eλ)$\downarrow$ (e^{2}b$^\lambda$) to B(Eλ)$\downarrow$ (e^{2}fm$^{2\lambda}$) : (check)

$$B(E\lambda)\downarrow e^2fm^{2\lambda} = B(E\lambda)\downarrow e^2b^\lambda 100^\lambda \tag{8}$$