$$\beta = 2\,\frac{R(1+2\delta_1) - R(1-\delta_1)}{2R} \approx 3\delta_1,$$

or

$$a \approx R(1 + \tfrac{2}{3}\beta),$$

$$b \approx R(1 - \tfrac{1}{3}\beta).$$

Then the perturbation H' assumes the following form:

$$H' = -\frac{1}{2M}\left[\left(\frac{R^2}{R^2(1+\frac{2}{3}\beta)^2} - 1\right)\frac{\partial^2}{\partial z^2} + \right.$$

$$\left. + \left(\frac{R^2}{R^2(1-\frac{1}{3}\beta)^2} - 1\right)\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right)\right] \approx -\frac{\beta}{3M}\left(\nabla^2 - 3\frac{\partial^2}{\partial z^2}\right).$$

Suppose that ϵ^0_{nlj} is the energy of a particle leaving out of account the deformation of the nucleus (it does not depend upon the magnetic quantum number by virtue of the spherical symmetry of the field). When we take the deformation into account, in the first order of the perturbation theory we get

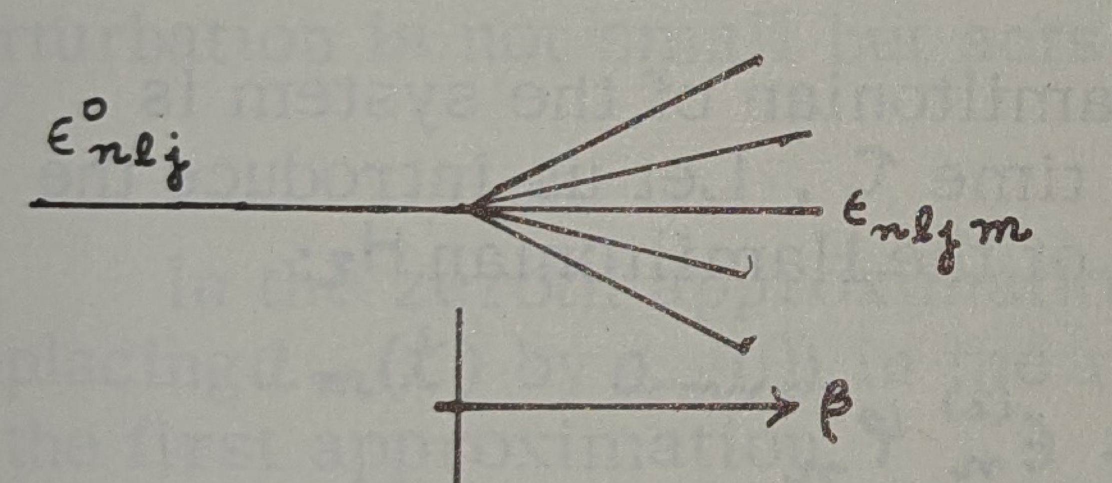

Figure 20

$$\epsilon_{nljm} = \epsilon^0_{nlj} +$$

$$+ (\varphi^{(0)}_{nljm}|H'|\varphi^{(0)}_{nljm}).$$

After some calculation we find

$$\epsilon_{nljm} = \epsilon^0_{nlj}\left[1 + \beta\left(\frac{m^2}{j(j+1)} - \frac{1}{3}\right)\right].$$

The dependence of ϵ_{nljm} upon β is indicated schematically in Figure 20. We note that $\frac{1}{2j+1}\sum_m \epsilon_{nljm} = \epsilon^0_{nlj}$, that is, the center of gravity of the multiplet does not shift when the nucleus is deformed.

Problem. Calculate ϵ_{nljm} using the quasi-classical approximation.

Section 3 SUDDEN PERTURBATIONS. IONIZATION IN β-DECAY AND IN A COLLISION WITH A NUCLEUS

In the examples which we have considered heretofore, the small parameter in the problem was the relative change in the