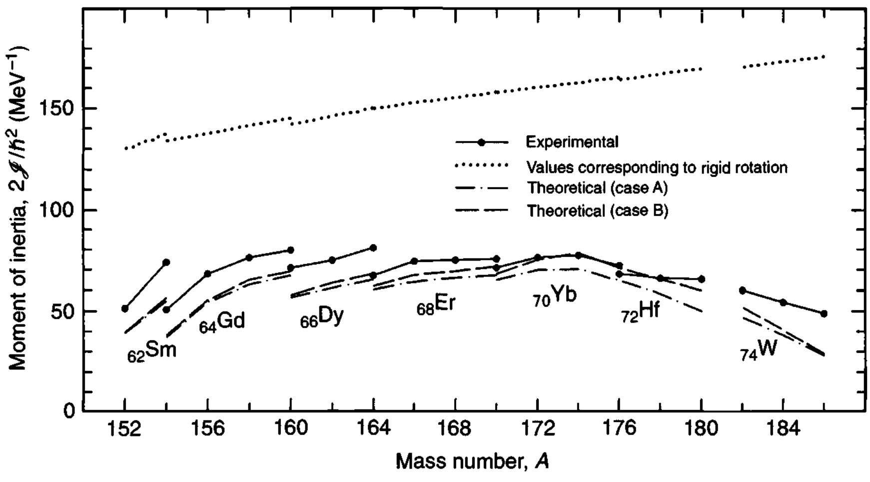

Fig. 11.2. Experimental and calculated moments of inertia of nuclei in the rare-earth region. The experimental values are extracted from the E_{2+} energies. Note that these values are far below the rigid moments of inertia. In the single-particle model with the pairing correlation correctly accounted for (dot–dashed lines), it is possible to get a fair agreement between theory and experiment. The two cases A and B correspond to somewhat different choices of the single-particle parameters (from Nilsson and Prior, 1961).

a preserved quantum number. As illustrated on the left in fig. 11.3, the total spin, **I**, is built as the sum of the spin of the odd particle, **j**, and the collective spin of the core, **R**. The core is built from all the paired nucleons. Thus, the collective energy for rotation of an axially symmetric nucleus around a perpendicular axis, the 3-axis being the symmetry axis, is calculated from

$$
\begin{aligned}
H_{\text{rot}} &= \frac{\mathbf{R}^2}{2\mathscr{J}} = \frac{1}{2\mathscr{J}}\left[(I_1 - j_1)^2 + (I_2 - j_2)^2\right] \\
&= \frac{1}{2\mathscr{J}}\left[\mathbf{I}^2 - I_3^2 + \left(j_1^2 + j_2^2\right) - (I_+ j_- + I_- j_+)\right]
\end{aligned}
$$

The term $(I_+j_- + I_-j_+)$ corresponds classically to the Coriolis and centrifugal forces. It gives a coupling between the motion of the particle in the deformed potential and the collective rotation. For small I it is justified to assume that this term is small and we need therefore consider only its diagonal contributions, i.e. the term $(I_+j_- + I_-j_+)$ is treated in first order perturbation theory. This approximation, where it is assumed that the influence of the rotational motion on the intrinsic structure of the nucleus can be neglected, is generally referred to as the adiabatic approximation or the strong coupling limit. The selection rules for j_+ and j_- are $\Delta\Omega = \pm 1$. Each