$$
\begin{aligned}
\mathcal{H} = {} & \frac{I}{2}(A_1 + A_2) + A_3 I^2 + I(I - \frac{1}{2}) \sin^2\theta \,(A_1 \cos^2\varphi + A_2 \sin^2\varphi - A_3) \\
& + \frac{j}{2}(A_2 + A_3) + A_1 j^2 - 2A_1 I j \sin\theta - V\frac{2j-1}{j+1}\sin\left(\gamma + \frac{\pi}{6}\right).
\end{aligned}
$$

$$H(\theta, \varphi) = \underset{\text{const.}}{h_0} + \underset{f(\theta)}{h_\theta} + \underset{g(\theta,\varphi)}{h_1}$$

$$
\begin{cases}
x_1 = I\cos\theta \\
x_2 = I\sin\theta\cos\varphi \\
x_3 = I\sin\theta\sin\varphi
\end{cases}
$$

x_1 – rotation MOI

$$h_0 = \frac{I}{2}(A_1 + A_2) + A_3 I^2 + \frac{j}{2}(A_2 + A_3) + A_1 j^2 - V\frac{2j-1}{j+1}\sin\left[\gamma + \frac{\pi}{6}\right]$$

$\hookrightarrow$ constant (can be ignored)

$$
\begin{aligned}
h_\theta &= -2Ij A_1 \sin\theta = -2jA_1\sqrt{I^2 - I^2\cos^2\theta} \\
&= -2jA_1\sqrt{I^2 - x_1^2}
\end{aligned}
$$

$\hookrightarrow x_1^2 \le I^2$

$|x_1| \le I$

$$\boxed{a_k = \frac{A_k}{2I}}$$

$$
\begin{aligned}
h_1 &= I\left(I - \frac{1}{2I}\right)\sin^2\theta\left(A_1\cos^2\varphi + A_2\sin^2\varphi - A_3\right) \\
&= A_1 I^2 \sin^2\theta\cos^2\varphi + A_2 I^2 \sin^2\theta\sin^2\varphi - I^2\sin^2\theta A_3 - \\
&\quad - \frac{A_1}{2} I\sin^2\theta\cos^2\varphi - \frac{A_2}{2} I\sin^2\theta\sin^2\varphi + \frac{A_3 I}{2}\sin^2\theta \\
&= A_1 x_2^2 + A_2 x_3^2 - A_3 I^2(1 - \cos^2\theta) - a_1 x_2^2 - a_2 x_3^2 + a_3 I^2(1 - \cos^2\theta) \\
&= (A_1 - a_1)x_2^2 + (A_2 - a_2)x_3^2 + A_3 x_1^2 - A_3 I^2 + a_3 I^2 - a_3 x_1^2 \\
&= (A_3 - a_3)x_1^2 + (A_1 - a_1)x_2^2 + (A_2 - a_2)x_3^2 - (A_3 - a_3)I^2
\end{aligned}
$$

cartesian form of H

$$H = h_0 - \Big(2 j A_1 \overbrace{\sqrt{I^2 - x_1^2}}^{C_1(x_1)}\Big) + \overbrace{(A_3 - a_3)\, x_1^2 + (A_1 - a_1)\, x_2^2 + (A_2 - a_2)\, x_3^2}^{C_2(x_1, x_2, x_3)} - (A_3 - a_3)\, I^2$$

cartesian expression of H

$$H = C_0 + C_1(x_1) + C_2(x_1, x_2, x_3)$$