

Hamiltonian

$$\mathcal{H} = -\frac{J_x^2}{2mr_0^2(\cos(q(t)) - 1)} + \frac{J_y^2}{4mr_0^2} + \frac{J_z^2}{2mr_0^2(\cos(q(t)) + 1)} + \frac{p^2(t)}{mr_0^2} \quad (1)$$