m09 c 2

$$\frac{d}{dt}\left(\frac{1}{2} I \omega^2 + U_{em} \right) = 0$$

$$I \omega \dot{\omega} = - P_{rad} = - \frac{\mu_0 m_0^2 \omega^4}{12\pi c^3}$$

$$\dot{\omega} = \frac{-\mu_0 m_0^2}{12\pi c^3 I} \omega^3 = -\alpha \omega^3$$

where $m_0 = M \frac{4\pi a^3}{3}$

solve: $\frac{d\omega}{dt} = -\alpha\omega^3 \qquad \frac{d\omega}{\omega^3} = -\alpha\, dt \qquad -\frac{1}{2\omega^2} = -\alpha t + C$

$\omega = \frac{1}{\sqrt{2(\alpha t + C)}}$ such that $\omega(0) = \omega_0$

$$\omega_0 = \frac{1}{\sqrt{2C}} \rightarrow C = \frac{1}{2\omega_0^2}$$

$$\omega(t) = \frac{1}{\sqrt{2\alpha t + \frac{1}{\omega_0^2}}} \qquad \alpha = \frac{\mu_0 M^2}{12\pi c^3 I}\left(\frac{4\pi a^3}{3}\right)^2 = \frac{4\mu_0 M^2 a^6 \pi}{27 c^3 I}$$