$$T = \left(\frac{L_*}{16\pi a^2 \sigma} \right)^{1/4}$$

$$t_{ff} = \left(\frac{3\pi}{32} \frac{1}{G\rho_0} \right)^{1/2}$$

$$L_{ff} \sim \frac{\Delta GPE}{t_{ff}} = \frac{\frac{3}{5}\frac{GM^2}{R}}{t_{ff}}$$