

$$\tau \sim k \left(\frac{P}{M^2} \right)$$

$$|GPE| > KE$$

$$\mathfrak{r}_{\text{strong}} = \frac{2GM}{(\Delta v)^2}$$

$$f = n \, \sigma \, \Delta v$$

$$\sigma = \pi(\mathfrak{r}_{\text{strong}}^2) = \pi\left(\frac{2GM}{(\Delta v)^2}\right)^2 \propto M^2$$

$$\Delta v \sim \frac{1}{2} \left(\frac{\Delta a}{a} \right) v \propto \left(\frac{v}{a} \right) \propto \frac{1}{P}$$

$$f \propto n \, (M^2) \, \left(\frac{1}{P} \right) \propto \frac{M^2}{P}$$