

## HW2- 400A (Written Part)

$$1. 100\% H \rightarrow X=1 \Rightarrow K_{es} = 0.2(1+1) = 0.4 \Rightarrow b\gamma = \frac{1}{0.4} = \frac{1}{0.4} \cdot \left[ \frac{1.989 \cdot 10^{33}}{4/3 \pi (6.96 \cdot 10^{10})^3} \right]^{1/3}$$

$$\Rightarrow b\gamma \approx 1.77 \text{ cm} \Rightarrow \text{Displacement from center} = \text{radius}_{\text{sun}} = R$$

$$\textcircled{1} \Rightarrow R = \sqrt{N \cdot b\gamma} \Rightarrow R^2 = N \cdot b\gamma^2 \Rightarrow N = \frac{R^2}{b\gamma^2} = \frac{(6.96 \cdot 10^{10})^2}{1.77^2} \approx 1.55 \cdot 10^{22} \text{ scatterings}$$

$$\textcircled{2} t_{\text{diff}} = \frac{N \cdot b\gamma}{c} = \frac{1.55 \cdot 10^{22} \cdot 1.77}{3 \cdot 10^{10}} \approx 9.14 \cdot 10^8 \text{ s} \approx 28979 \text{ years}$$

$$t_{\text{dynamic}} = \frac{R}{\sqrt{GM/R}} = \frac{6.96 \cdot 10^{10}}{(6.674 \cdot 10^{-8} \cdot 1.989 \cdot 10^{33} / 6.96 \cdot 10^{10})^{1/2}} \approx 1585.87 \text{ s} \approx 44 \text{ hr}$$