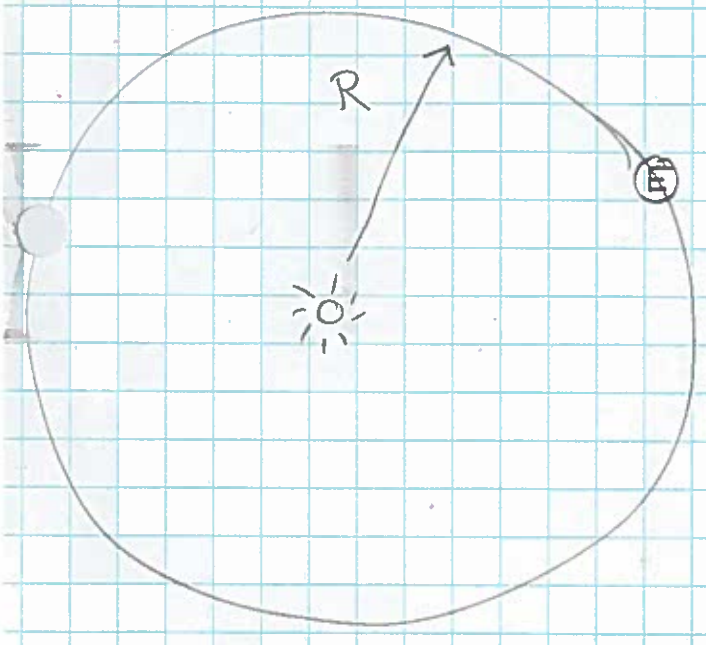
The Sun spontaneously turns into a (big, fluffy) neutron star!

Every proton merges with a nearby electron.

How many interactions with neutrinos are recorded in the SAGE detector?

The number of proton (and electrons) in the Sun is roughly

$$N_p = \frac{M_\odot}{m_p} = \frac{2\times10^{30}\ \text{kg}}{1.67\times10^{-27}\ \text{kg}} \cong 1.2\times10^{57}$$



At the distance of the Earth, the (time-integrated) flux of neutrinos must be

$$F_\nu = \frac{N_p}{4\pi R^2} \quad \frac{\text{neutrinos}}{\text{m}^2}$$

$$= \frac{1.2\times10^{57}\ \nu}{4\pi\left(1.5\times10^{11}\ \text{m}\right)^2}$$

$$= 4.2\times10^{33}\ \nu/\text{m}^2$$

[We assume each $p^+, e^- \rightarrow n, \nu$]

Now, we need to compute the total cross-section area of the SAGE detector. Using values from the lecture notes,