ASTR 792
T/R 9:30 - 10:45 AM
Due September 26

Week #6

Draine 1.3

The "very local" interstellar medium has $n_H \approx 0.22$ cm^{-3} (Lallement et al. 2004: A&A 426, 875; Slavin & Frisch 2007: Sp. Sci. Revs. 130, 409). The Sun is moving at $v_W = 26 \pm 1$ km s^{-1} relative to this local gas (Möbius et al. 2004: A&A 426, 897).

Suppose that this gas has He/H=0.1, and contains dust particles with total mass equal to 0.5% of the mass of the gas. Suppose these particles are of radius $a = 0.1\mu$m and density $\rho = 2$ g cm^{-3}, and we wish to design a spacecraft to collect them for study.

How large a collecting area A should this spacecraft have in order to have an expected collection rate of 1 interstellar grain per hour? Neglect the motion of the spacecraft relative to the Sun, and assume that the interstellargrains are unaffected by solar gravity, radiation pressure, and the solar wind (and interplanetary magnetic field).