Astrophysics & Cosmology
HW 8

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11.1 Since the mean free path between collision is l, the volume swept out by a dust particle with cross sectional area πR^2 is

$$V = l\pi R^2.$$

Since only one collision is expected to occur within such a volume, we have

$$n/N = n = l\pi R^2$$

or

$$l = \frac{1}{n\pi R^2}.$$

Given $l = 3000$ ly and $R = 10^{-5}$ cm, we have a density

$$n = \frac{1}{l\pi R^2} = 33.6 \text{ stars cm}^{-3}.$$

Given a football stadium volume of 10^{12} cm^3 this given the number of stars as

$$N = 33.65(10^{12}) = 3.36 \times 10^{12}$$