PHYS 239 HW 2

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1. Since the cloud has depth $D = 100\text{pc} = 3.0856775814914 \times 10^{18}\text{cm}$, then the column density reads $N = nD = 3.0856775814914 \times 10^{18}\text{cm}^{-2}$. Since the optical depth can be written in

$$\tau_\nu = N\sigma_\nu$$

With τ_ν specified, we can rewrite the equation: $\sigma_\nu = \frac{\tau_\nu}{N}$ so

   (a) $\tau_\nu = 10^{-3} \implies \sigma_\nu = \frac{\tau_\nu}{N} = 3.24 \times 10^{-22}\text{cm}^2$

   (b) $\tau_\nu = 1 \implies \sigma_\nu = \frac{\tau_\nu}{N} = 3.24 \times 10^{-19}\text{cm}^2$

   (c) $\tau_\nu = 10^{3} \implies \sigma_\nu = \frac{\tau_\nu}{N} = 3.24 \times 10^{-16}\text{cm}^2$

2. Everything else: in program

   For convenience, I set $S = 1$ and write everything in terms of optical depth (or set $N = 1$)