AST 300B – Spring 2019

In-class Problem Due: Fri. Feb. 8

14. Typical dense cores within molecular clouds have $A_V \sim 10 - 100$ mag. Assume you have a cold ($T_d = 10$ K) spherical gas and dust cloud that is thermally emitting at far-infrared through millimeter wavelengths.

(a) Calculate the visual extinction A_V (mag) that would correspond to $\tau = 1$ at $\lambda = 0.5$ mm. Assume that the dust has a mass opacity at $\lambda = 0.5$ mm of $\kappa_\nu \sim 5$ cm^2/g of dust (OH5 dust), that the gas mass to dust mass ratio is 100, that $R_V = 3.1$, and that the gas in the cloud is entirely molecular hydrogen. Is assuming optically thin emission at $\lambda = 0.5$ mm a good assumption?

(b) Is assuming optically thin emission at $\lambda = 50$ μm a good assumption? $\kappa_\nu \sim 300$ cm^2/g of dust (OH5 dust) at $\lambda = 50$ μm.

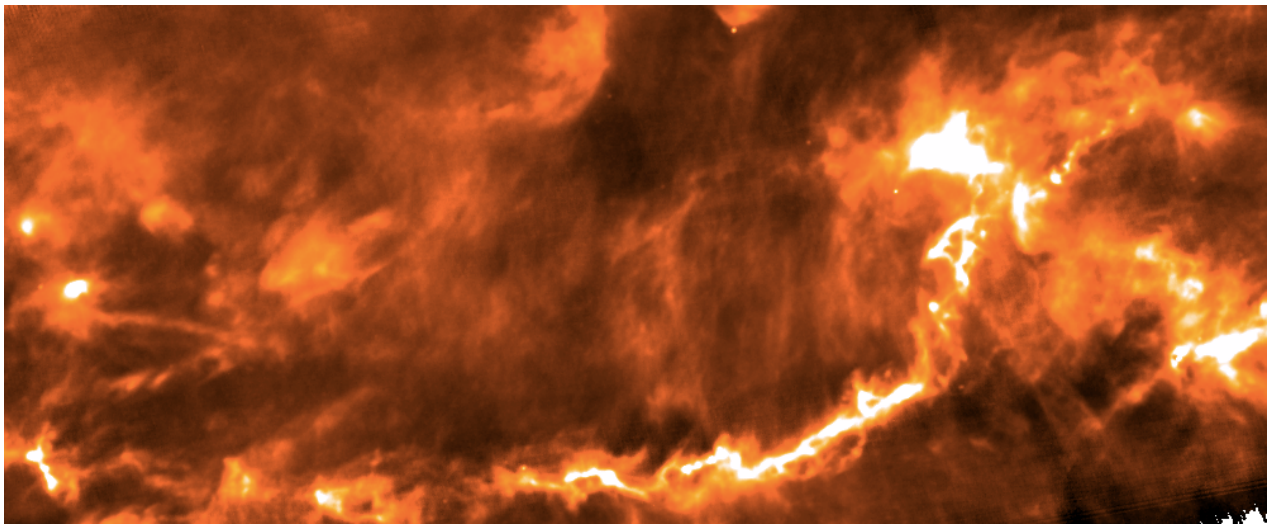

FIGURE 1: Thermal dust emission at 500 μm from the central Taurus molecular cloud observed by the *Herschel Space Observatory*.