

AST 300B – Spring 2017
In-class Problem Due: Monday Feb. 13

19. 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 $\kappa_v \sim 5$ cm²/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 has a mean molecular weight of $\mu = 2.34$. Is assuming optically thin emission at $\lambda = 0.5$ mm a good assumption?
- (b) Is assuming optically thin emission at $\lambda = 50$ μ m a good assumption? $\kappa_v \sim 300$ cm²/g of dust (OH5 dust) at $\lambda = 50$ μ m.

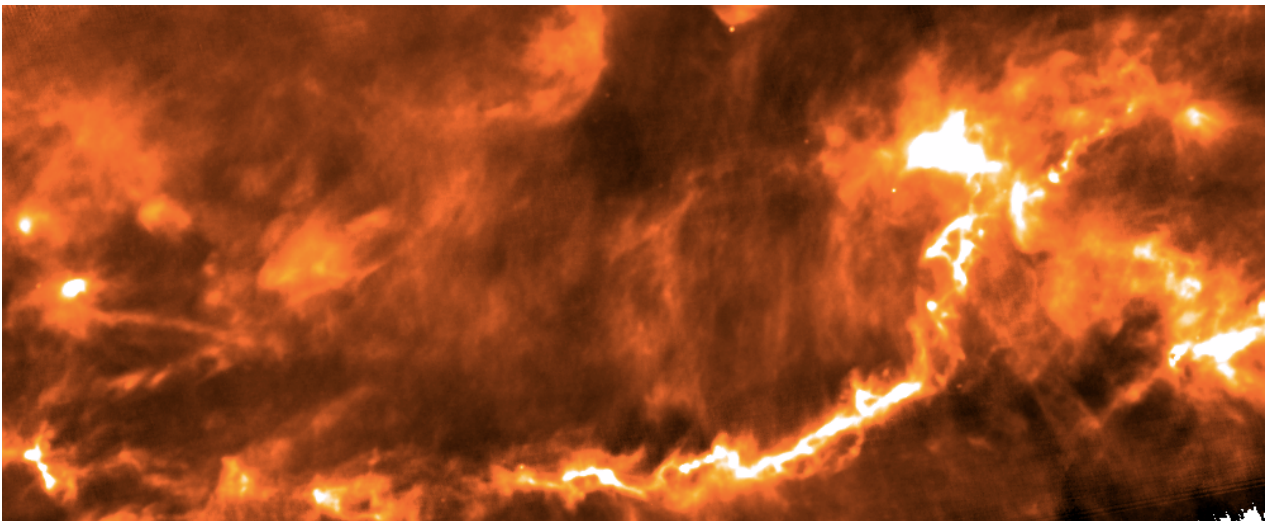


FIGURE 1: Thermal dust emission at 500 μ m from the central Taurus molecular cloud observed by the *Herschel Space Observatory*.