AST 300B – Spring 2019

<u>In-class Problem Due: Fri. Feb. 15</u>

17. Let's calculate the long wavelength "spectral index" of dust emission. The spectral index, α, is defined as the power-law slope of the observed flux density over some range of wavelengths: $F_\nu \sim \nu^\alpha$. Consider an ***optically thin*** source of dust emission with emission well described by a source function $B_\nu(T_d)$ over a solid angle Ω, and dust mass opacity parametrized by $\kappa(\nu) = \kappa_0 \, (\nu/\nu_o)^\beta$ (cm^2/g of dust) at long wavelengths. Assume that the source is small and $F_\nu = I_\nu \, \Omega$ is a good approximation.

(a) How does the dust optical depth τ_ν depend on frequency?

(b) In the Rayleigh-Jeans limit at long wavelength what is the spectral index α for (1) blackbody emission and (2) for optically thin dust emission with a dust opacity index of β?