AST 300B – Spring 2018

In-class Problem Due: Wednesday Feb. 21

23. 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 optical depth parameterized by $\tau(\nu) = \tau_0 (\nu/\nu_o)^\beta$ (N.B. this is works because $\tau \sim \kappa$ and the dust mass opacity is well characterized by a single power-law slope of β at long wavelengths). Assume that the source is small and $F_\nu = I_\nu \Omega$. In the Rayleigh-Jeans limit at long wavelength: (a) what is the spectral index α for blackbody emission and (b) what is the spectral index α for optically thin dust emission with a dust opacity index of β?