# AST 300B – Spring 2018
In-class/take-home Problems Due: Wednesday Jan. 31

11.   A spherical cloud with radius R and a temperature T emits thermally with emissivity & absorption coefficients j_ν & α_ν. Assume that the cloud is at a distance d with d >> R and negligible background radiation field.

   (a)   In the optically thin limit, what is (1) the intensity observed toward the center of the cloud and (2) the flux density observed at the Earth from the entire cloud [Hint: how are j_ν and L_ν related] ?

   (b)   In the optically thick limit, what is (1) the intensity observed toward the center of the cloud and (2) the flux density observed at the Earth from the entire cloud?
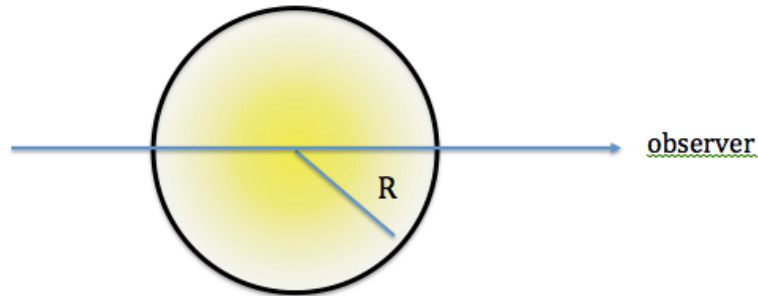
12.   HI may be observed through the 21 cm (1.420 GHz) spin-flip transition. A quasar is observed through two thermal phases (CNM and WNM) of Galactic HI with temperatures T_c and T_w that are constant in each phase. F_ν is the un-attenuated flux density (erg s^{-1} cm^{-2} Hz^{-1}) of the quasar and Ω is the solid angle of the quasar. If the HI peak optical depths of the WNM and CNM phases are τ_w and τ_c, then write down the formal expression for the flux density observed at the HI frequency.