<u>Homework Assignment #1</u>

Due: 8 February

Problem 1 (20 Points)

Eq.[3.21] (Lecture 3) gives the differential form of the radiative transfer equation that is expressed in terms of the volume extinction coefficient. Re-write this equation in terms of the mass extinction coefficient and then derive a general solution of the radiative transfer equation (similarly to Eq.[3.23]).

Problem 2 (30 Points)

The net flux is defined as the integral of a normal component of the intensity over the all solid angles (over 4π). Starting with this definition, show that $F_{net,\lambda} = F_{\lambda}^{\uparrow} - F_{\lambda}^{\downarrow}$,

where $F_{\lambda}^{\uparrow}$ and $F_{\lambda}^{\downarrow}$ are the hemispherical upwelling and downwelling fluxes, respectively.

Problem 3 (20 Points)

Consider an isotropic radiation field such the radiation emitted by a blackbody.

1) Show that for isotropic radiation, the monochromatic hemispherical flux is $F_{\lambda} = \pi I_{\lambda}$.
2) Calculate the net monochromatic flux for the isotropic radiation.

Problem 4 (30 Points)

The Rayleigh-Jeans approximation of the Plank function provides a basis for radiative transfer calculation in the microwave spectrum. Derive this approximation and estimate its accuracy at two different temperatures.

Instruction: To compute Planck function go to

http://shadow.eas.gatech.edu/~vvt/PlanckFunctionS.htm