

Radiative process in Astrophysics: Problem Set 1

Yiqiu Ma*

- 1: Show the relationship between the distribution function $f(t, \nu, \vec{r}, \vec{\Omega})$ in the class with the distribution function usually defined in statistical physics $f_s(t, \vec{r}, \vec{p})$.
- 2: R&L, 1.1, based on the results, tells us what is the defect of photography done through pin-hole camera.
- 3: R&L, 1.6,
- 4: R&L, 1.7, and qualitatively describe what could be the similarity and difference between neutrino transfer and photon transfer?
- 5: Suppose that a sphere emits perfectly black body radiation of temperature T , a) Show by integrating over angles and over the surface of the sphere what is the luminosity. b) The Sun (assumed as a black body) has $R = 6.96 \times 10^{10} \text{cm}$ and $L = 4 \times 10^{33} \text{erg/s}$, What is the sun's effective black body temperature? c) Now consider calculating the flux from the sun at earth.
- 6: Laser: A trivial application of radiative transfer equation. Please try to phenomenologically study the solution of radiative transfer equation in a laser medium. Also show us that this is a non-equilibrium phenomenon.

*Electronic address: myqphy@hust.edu.cn