Homework # 7, due Nov 21

1. White dwarf cooling theory implies that $\tau \propto L^{-5/7}$ where $\tau$ is the age of a white dwarf and $L$ is its current luminosity, assuming that the white dwarf is reasonably old. Assume that the production rate of white dwarfs is constant in time and space. Define the luminosity function $\phi(L)$ to be the space density of white dwarfs per unit interval of log $L$. How does $\phi(L)$ depend upon $L$? Do some research to find observational data for $\phi(L)$. Does it agree with theory? What do the data tell us about the age of the Galaxy’s disk?

2. Show that in a gray atmosphere

$$S(\tau) = J(\tau) = B(\tau).$$

3. Prove the following relations:

$$J(\tau) = \frac{1}{2} \int_0^\infty S(t) E_1 |t - \tau| dt$$

$$F(\tau) = 2 \left[ \int_\tau^\infty S(t) E_2 (t - \tau) dt - \int_0^\tau S(t) E_2 (\tau - t) dt \right]$$

$$K(\tau) = \frac{1}{2} \int_0^\infty S(t) E_3 |t - \tau| dt$$