Homework #1
Due Friday Aug 22

Homework is due by 5:00 pm on the due date. Late homework will not be accepted.

1. LeBlanc 1.1 (You can use an integral table or Mathematica or Python to find that final value of the integral which should be in dimensionless form).

2. LeBlanc 1.3

3. LeBlanc 1.4

4. LeBlanc 1.5

5. We showed in class that \( A_V = R_V E_{B-V} \), where for standard Galactic dust \( R_V = 3.1 \). What is the relationship between \( A_B \) and \( E_{B-V} \), i.e. what is the value of \( R_B \)?

6. LeBlanc 1.2. You will obtain a transcendental equation that you may solve either graphically or by the use of bisection, which should only take about 7 iterations. You can do bisection in an Excel spreadsheet, with a calculator, with Mathematica, Python, Fortran, C, or C++.

7. As we discussed in class the Planck function can be written as

\[
B_\nu = \frac{2h\nu^3}{c^2} \frac{1}{\exp \frac{h\nu}{kT} - 1}
\]

\[
B_\lambda = \frac{2hc^2}{\lambda^5} \frac{1}{\exp \frac{hc}{(\lambda kT)} - 1}
\]

(a) Starting from \( B_\nu \), derive \( B_\lambda \).

(b) For \( T = 5000 \) K, plot \( B_\nu \) and \( B_\lambda \) vs \( \lambda \) on the same plot. You will have to scale \( B_\lambda \) by a large factor to be able to plot them. Indicate the value of \( \lambda_{\text{max}} \) for each of them. Explain why they are the same or different.

(c) Calculate the \( \lambda_{\text{max}} \) for \( B_\nu \) and \( B_\lambda \).

(d) Which is the one used in the traditional Wien displacement law?