

## Problems

**Problem 10.1.** Consider a plane-parallel almost-grey atmosphere in which weak lines are superimposed on a grey continuum opacity. The line opacity at the center of each line is 10% of that in the continuum. Assume that the atmosphere is in LTE and that the temperature structure is given by the Eddington approximate solution to the grey atmosphere taking into account only the continuum opacity.

- (a) Obtain an approximate expression for the absorption depth  $A_\nu$  at the center of each line as a function of the dimensionless frequency analog  $\alpha = h\nu/KT_{\text{eff}}$ . (You may use the Eddington-Barbier approximation for the emergent flux from a plane-parallel atmosphere.)
- (b) Graph  $A_\nu$  against  $\alpha$  for  $0 \leq \alpha \leq 5$ .
- (c) Explain why lines of a given opacity contrast appear deeper in the Wien part of the spectrum than those in the Rayleigh-Jeans part of the spectrum.