Semester Project
Due Friday December 5

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

This is a larger semester project, which will be worth 3 homework assignments. This is required extra work for graduate students. Undergraduates are welcome to do it for extra credit.

Choose one problem from any of the problems listed below.

**Numerical Questions**

1. Write a Saha Solver for Helium. It should be able to calculate the ionization fractions for fixed density $n$ or for fixed gas pressure $P_g$. Describe how you could generalize it to include more elements. Use partition functions from the Tables in Allen.

2. Write a solver for the Lane-Emden equation. Check that it gives the right results in the three analytic cases. Find the value of the Chandrasekhar mass for a white dwarf and for a “star” held up by the pressure of degenerate neutrons.

3. Write a Henyey solver as described in class. Test it on the analytic polytropes. I will give you a short writeup to guide you.

4. Write a Feautrier Solver for the Grey Transfer Problem. I will give you a short writeup to guide you.

5. Use EZWEB to follow the evolution of a 5 M$_\odot$ star in the HR Diagram. Plot and label the various stages. Now create a few models and show an Isochrone diagram for 700 Million years. Lower the metallicity, repeat the Isochrone diagram and discuss the results. If you are not familiar with IDL this might be a pretty difficult project.

**Qualitative Questions**

6. Read the review article by Icko Iben, 1967, Annual Reviews of Astronomy and Astrophysics, Volume 5. Describe in detail the evolutionary track of a 5 M$_\odot$ star.

7. Read the review by Chabrier and describe how the mass function differs from the Salpeter mass function. That is, summarize the detailed mass function.

