HW 6
AY 123, Spring 2003
Due Tues May 13, beginning of class

Problem 1. Stellar Model

In class, we derived the four equations of structure for a spherical, stationary star. Create and explore the properties of a stellar model for a star that is matched to your level of comprehension of the material and numerical sophistication. You should provide plots of P, ρ, T, M etc as a function of r and be prepared to discuss them in class on Tuesday May 13.

Choose one of the following in ascending order of complexity.

a) (Only for the desperate). A cold white dwarf of solar mass. Use the relativistic EoS from KW. If you are careful you will be able to get a model by shooting from the center. A surface boundary condition $P(R) = 0$ will suffice.

b) A fully convective, ZAMS 0.2 $M_\odot$ star. You can use the ideal gas equation of state and the pp energy generation. Check that your model is full convective. You will have to fit iteratively, at an interior radius and use photospheric boundary conditions.

c) A ZAMS solar model with an outer convection zone. You can use Kramers opacity in the interior and pp energy generation.

d) A more sophisticated solar model using a composition gradient that matches the evolved solar model, opacity from tables as presented in earlier homeworks, pp and CNO energy generation. You will still miss some features such as the Coulomb corrections to the EoS, radiation pressure, entropy gradient near the solar surface and rotation but this should be pretty good.

e) A ten solar mass ZAMS star with a convective core. You will need to use proper opacities for the envelope and include radiation pressure.