Ay190 – Worksheet 11

David Vartanyan

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1

Column 1 is the mass, Column 2 the radius, Column 3 is the temperature, Column 4 is the density, columny 5 is the infall velocity and Coulumn 6 is the electron fraction. Column 7 is the rotation velocity (0).

We differentiate temperature and density since the temperature plot has a small increase going outwards for a certain radii. We would not expect density bumps.

See Fig 1.

2

I create an equidistant grid and interpolate using inbuilt interpolate.splev.

3

I follow the template from ws8. I run into trouble in 2 areas. First, I could not figure how to to extrapolate data to the origin of the star at radius 0. Thus, my boundary conditions were applied at radius 10^7 cm. I do not know how inaccurate this will be. Second, the expression in equation 3 on ws12 does not reduce to expression 2 at outer radius. This is because expression three will evaluate density at the outer radius whereas two uses an integrated average to find msas.

You can see in Fig 2 that the endpoints do not agree, and near the 'origin' of $R = 10^7$ cm we differ by about 3 orders. We plot error normalized to analytical solution to show convergence in Fig. 3.

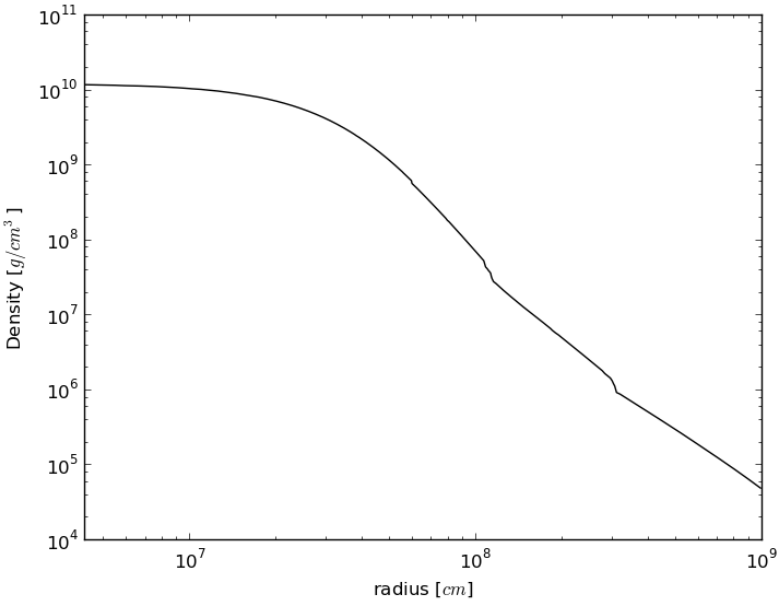

Figure 1: Density vs Radius

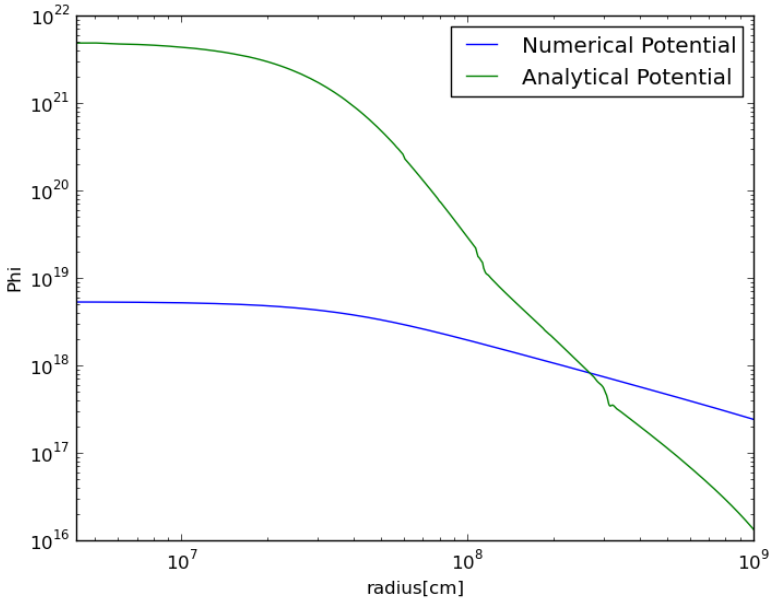

Figure 2: Gravitational Potential vs Radius

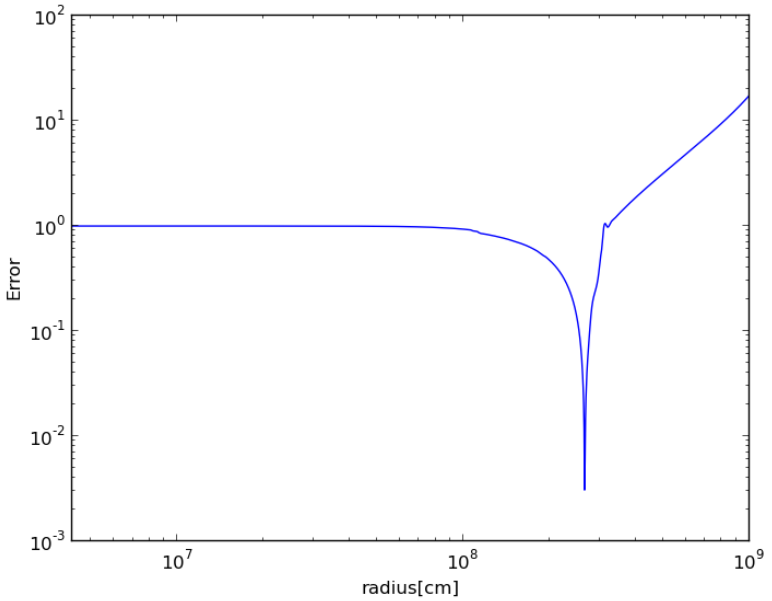

Figure 3: Error vs Radius