**ASTRONOMY 320: RELATIVISTIC ASTROPHYSICS**

**Winter Quarter 1999**

Homework Set 1

Due Wednesday, 14 January 1999

1. Exercise 2.3 in *Black Holes, White Dwarfs, and Neutron Stars* by Shapiro & Teukolsky.

2. Exercise 2.4 in *Black Holes, White Dwarfs, and Neutron Stars* by Shapiro & Teukolsky.

3. Exercise 2.6 in *Black Holes, White Dwarfs, and Neutron Stars* by Shapiro & Teukolsky.

4. Exercise 2.7 in *Black Holes, White Dwarfs, and Neutron Stars* by Shapiro & Teukolsky.

5. Exercise 2.8 in *Black Holes, White Dwarfs, and Neutron Stars* by Shapiro & Teukolsky.

6. Exercise 2.9 in *Black Holes, White Dwarfs, and Neutron Stars* by Shapiro & Teukolsky.

7. Divide the $(\rho, T)$-plane up into the various regimes for the ideal electron gas equation of state by plotting the boundaries between non-relativistic non-degeneracy and degeneracy $(E_F = kT)$, relativistic non-degeneracy and degeneracy $(E_F = kT)$, relativistic and non-relativistic non-degeneracy $(kT = m_e c^2)$, and relativistic and non-relativistic degeneracy $(E_F = m_e c^2)$. Do this for matter composed of pure H, and for matter composed of pure $^{56}$Fe; compare the two plots.