HANDS ON COMPUTER

Assuming a isothermal EoS,

and a spherically symmetric outflow:

$$\frac{\partial}{\partial r}(\rho u r^2) = 0$$

$$u\frac{\partial u}{\partial r} = -\frac{1}{\rho}\frac{\partial p}{\partial r} - \frac{GM_\odot}{r^2}$$

$$p = c_s^2 \rho$$

1) Show that the equations can be reduced to:

$$F(M, x) = C, \text{ where } M = u/c_s, x = r/r_c$$

2) Plot contour levels of F.

3) Which value of C gives the transonic solution ?

4) Implement a Newton-Raphson method to extract this solution.

5) Which coronal base temperature and density give the solar wind values:

$$u(r = 1\text{ A.U}) = 400\text{ km.s}^{-1}, \quad n_p(r = 1\text{ A.U}) = 6\text{ cm}^{-3}$$

$$u(r = 1\text{ A.U}) = 800\text{ km.s}^{-1}, \quad n_p(r = 1\text{ A.U}) = 3\text{ cm}^{-3}$$