Tarea Unidad 4

Pols → 2.2, 2.3, 2.4, 2.5, 3.5, 5.3, 5.4, Lamers → 4.1

With the help of the hydrostatic equilibrium and virial theorem, estimate the central pressure in a star and average temperature inside a star, respectively, with mass M_* and radius R_*.

A region in the interior of a star with 2.5 M_{Sun} has T ~1.5×10^7 K and P ~ 6.4×10^{16} dyne/cm^2. A numerical model for this star predicts a temperature gradient dT/dP ~ 1.0×10^{10} K/(dyne/cm^2). Is this region convective or radiative?

Suppose that a star of mass *M* and radius *R* has a density distribution $\rho(r) = \rho_c(1 - {}^{r}/_{R})$, where ρ_c is the density at the center of the star. (This isn't a particularly realistic density distribution, but for this calculation that doesn't matter.)
(a) Calculate ρ_c in terms of *M* and *R*. For all the remaining parts of the problem, express your answer in terms of M and R rather than ρ_c.
(b) Calculate the mass *m(r)* interior to radius *r*.
(c) Calculate the total gravitational binding energy of the star.
(d) Using hydrostatic equilibrium, calculate the pressure *P(r)* at radius *r*. You may assume that the *P(R)* = 0.
(e) Assume that the material in the star is a monatomic ideal gas. Calculate the total internal energy of the star from *P(r),* and show that the virial theorem is satisfied.