

AST 250 – Spring 2018

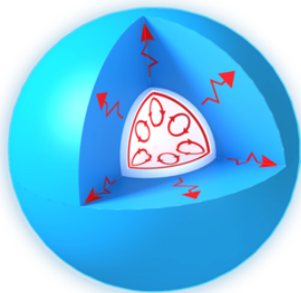
Homework Due: Friday February 23

19. (a) The main sequence lifetime of a star may be estimated assuming a constant luminosity and that the only source of energy is fusion. Use the empirical relationship between mass and luminosity of main sequence stars, derive the scaling relationship between main sequence lifetime and mass of the star (i.e. how does main sequence lifetime depend on mass?).

(b) The Sun has a main sequence lifetime of ~ 10.7 billion years and will burn only 10% of its total Hydrogen in its core. Low-mass stars are fully convective (see Figure) meaning that hydrogen is cycled throughout the structure of the star and thus a larger fraction of the mass is burned in fusion. Assume 75% of the total mass of a $0.15 M_{\text{sun}}$ red dwarf burns via the p-p chain. What is the main-sequence burning lifetime of this star? How many times longer than the present age of the Universe (13.8 billion years) is that main sequence lifetime? (Hint: make use of your scaling law from part a).

Heat Transfer of Stars

> 1.5 solar masses



0.5 - 1.5 solar masses



< 0.5 solar masses

