Solar Physics 2005-2006: Exercises to Lecture 2

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1 Stellar diameters in HR diagram

Stars of equal radius are located on curves in the HR diagram. Explain why they are located on curves and determine the type of curves.

2 Solar energy output

Calculate the solar energy output using a solar constant of 1.4 kW/m^2.

3 Solar lifetime

Based on the solar energy output obtained in the previous exercise, determine the lifetime of the Sun if the energy is generated based on

1. the Sun is made of coal and oxygen in the right ratio to burn the coal into CO_2 (hint: assume that burning one kg of coal produces 25 MJ of energy).
2. the Sun is made of hydrogen and oxygen in the optimum ratio (hint: the energy release is about 120 MJ per kilogram of hydrogen).
3. gravitational contraction (hint: use the virial theorem to relate thermal and potential energy).
4. the standard fusion processes (hint: make use of the fact that $\frac{m_{4\mathrm{H}}-m_{\mathrm{He}}}{m_{4\mathrm{H}}} = 0.007$ and think about what conditions are required for fusion to occur.)

4 Number of photons from stars

Show the the number of photons coming from a given area on the sky for a given telescope for a resolved star only depends on the star's surface temperature.

5 Problems from Stix

Solve problems 2.1, 2.2, 2.3, 2.10, and 2.19.