Stars and Galaxies

Coursework Sheet 3

1. Use the mass-luminosity relation for main sequence stars to estimate the range of luminosities corresponding to the observed range of masses of 0.08 to 100 $M_\odot$.

(2 marks)

2. What is the corresponding range in main sequence lifetimes for the range of masses in question 1? Take the main sequence lifetime of the Sun to be 10^{10} years and give your answers in years.

(2 marks)

3.

a) Using its mass and radius, calculate an average density for the Sun.

(1 mark)

b) Most white dwarf stars have a mass of about 0.6 $M_\odot$ and a radius similar to the Earth. What is their average density?

(1 mark)

c) Most neutron stars have a mass of about 1.4 $M_\odot$ and a radius of about 10 km. What is their average density?

(1 mark)

d) An effective size – the so-called Schwarzschild radius, R_S - for a black hole of mass M can be derived by equating its escape speed to the speed of light. Look up or derive a formula for the Schwarzschild radius and evaluate it for a 10 $M_\odot$ black hole? How does it compare to the neutron star?

(3 marks)