Questions 1

1. Use the atomic masses of ^{1}H and ^{4}He (from any physical data handbook) to show that 0.7% of the rest mass is converted to energy during the nuclear fusion process in the Sun.

2. Calculate the effective temperature of the Sun given that it has a radius, $R=7.10^{8}$ m, and luminosity, $L=4.10^{26}$ W.

3. Calculate the wavelength at which the continuum emission from the star Betelgeuse with $T_{eff}=3500$ K peaks. In which part of the electromagnetic spectrum does this fall?

4. Evaluate the total flux of radiation from the Sun reaching the Earth. How would this compare with the flux from one of the nearest stars Alpha Centauri – a solar like star 1.3 pc away? (1 pc = $3.1\text{x}10^{16}$ m).

5. Assuming that the Sun emits like a blackbody such that the flux at the surface is given by $f_\nu = \pi B_\nu$ estimate the radio flux observed at the Earth at a frequency of 5 GHz. Convert this from SI units ($Jm^{-2}s^{-1}Hz^{-1}$) to the commonly used unit of flux in radio astronomy – the Jansky (Jy) – where 1 Jy = 10^{-26} $Jm^{-2}s^{-1}Hz^{-1}$. Then calculate what this radio flux would be if we were to observe Alpha Centauri from Earth.