Stars and Galaxies

Coursework Sheet 7

1. Evaluate the temperature of a dust grain at distances of 10^{-4} and 1 pc from a massive young main sequence star with a luminosity of 10^6 $L_\odot$. Calculate the wavelength of peak emission for each of these dust temperatures. $L_\odot$=4.0x10^{26} W, 1 pc = 3.1x10^{16} m and Stefan's constant σ=5.8x10^{-8} $Wm^{-2}K^{-4}$.

(5 marks)

2. A supernovae explosion ejects 10 solar masses of material from the envelope of the massive star. How far does it travel in parsecs before sweeping up an equivalent mass of the interstellar medium if the medium is made up of pure hydrogen atoms at a number density of 10^6 atoms m^{-3}? ($M_\odot$=2.0x10^{30} kg, 1 parsec=3.1x10^{16} m, mass of hydrogen atom 1.7x10^{-27} kg)

(3 marks)

3. Assume the spiral pattern in our Galaxy rotates at half the speed of the stars. Taking the typical width of a spiral arm to be 1 kpc, estimate the time that the Sun spends inside an arm during a single passage through an arm.

(2 marks)