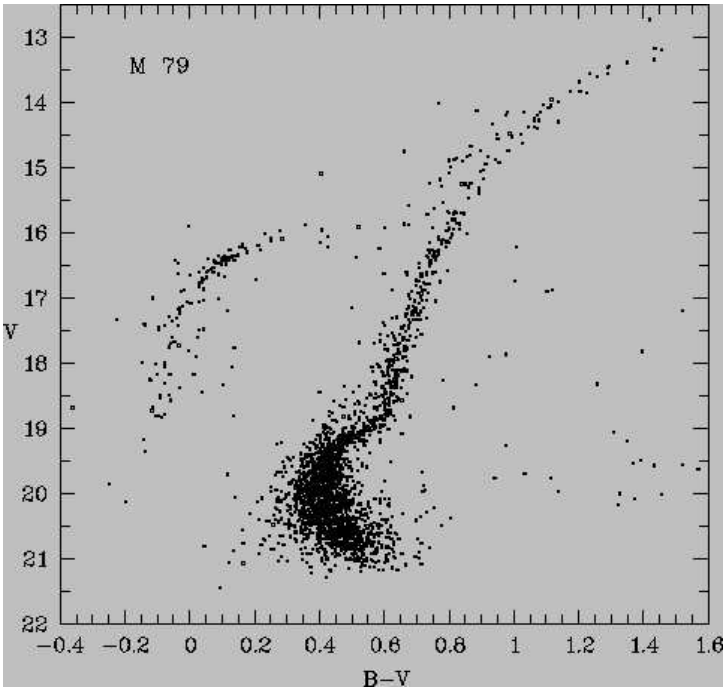
Astronomy 304, STARS

Homework # 12 Due Wednesday, April 23, 2003

Show All Your Work

1. Age of Star Cluster

Determine the age and distance of the cluster whose HR-diagram is shown below.



Carroll & Ostlie, figure 7.7, gives the mass-luminosity relation. Carroll & Ostlie, figure 13.1, gives evolutionary tracks for stars of several masses from 1-15 $M_\odot$. *Astrophysical Quantities* (Allen 1973) gives the following relation between B-V and $T_{\rm eff}$ for main sequence stars:

B - V	T_{eff}
-0.35	40,000
-0.31	28,000
-0.16	15,500
0.00	9,900
+0.13	8,500
+0.27	7,400
+0.42	6,580
+0.58	6,030
+0.70	5,520
+0.89	4,900
+1.18	4,130
+1.45	3,480
+1.63	2,800
+1.8	2,400

2. Stellar Energy Budget

Consider a star which starts life as a 10 $M_\odot$ diffuse interstellar cloud of hydrogen (90%) and helium (10%) (by number). It ends its life as a 2 $M_\odot$ neutron star after having expelled 8 $M_\odot$ of its material in a supernova explosion. During its life it radiated energy at a rate of $L \sim 5 \times 10^4$ $L_\odot$ for about 2.6×10^7 yrs.

(a) Calculate the total (including rest mass) initial and final energy.

(b) Calculate the energy lost during its life and during the supernova explosion.

(c) What are the sources of this energy – give quantitative results.

3. Carroll & Ostlie: Problem 13.10

4. Carroll & Ostlie: Problem 13.16