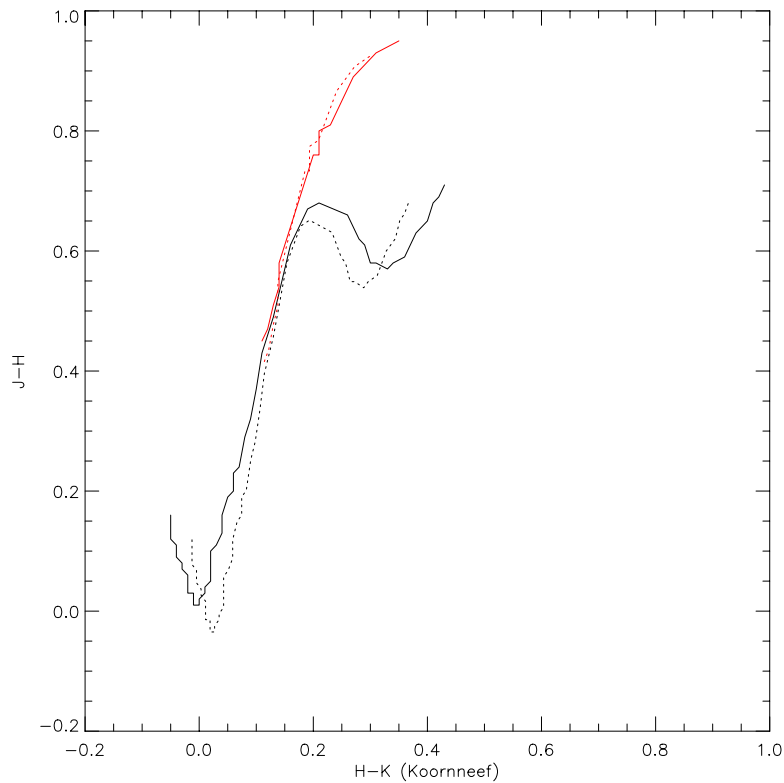


# 2MASS Color-Color Diagram

Wen-Ping Chen 2004/4/2

We start out with the stellar intrinsic JHK colors tabulated in Koornneef (1983, A&A, 128, 84) and plotted as Figure 1. In order to transform the colors to those of the 2MASS, the transformations in Carpenter (2001, AJ, 121, 2851) are used. The 2MASS colors of the Koornneef's data are shown as the dotted lines.



$$(J-H)_{2MASS} = (1.024 \pm 0.024)(J-H)_{Koornneef} + (-0.045 \pm 0.006) ,$$

$$(J-K_s)_{2MASS} = (0.970 \pm 0.015)(J-K)_{Koornneef} + (-0.017 \pm 0.005) ,$$

$$(H-K_s)_{2MASS} = (0.792 \pm 0.056)(H-K)_{Koornneef} + (0.027 \pm 0.005) .$$

Figure 1: (Upper panel) (J-H) versus (H-K) diagram for dwarfs (in black) and giants (in red) in Koornneef (1983). The dotted lines are the colors after transformed to the 2MASS photometry system. (Lower panel): The transformations from Koornneef's system to that of the 2MASS.

We now turn to the intrinsic stellar colors by Bessell & Brett (1988, PASP, 100, 1134), plotted in Figure 2. Figure 3 compares the results of Koornneef and of Bessell & Brett.

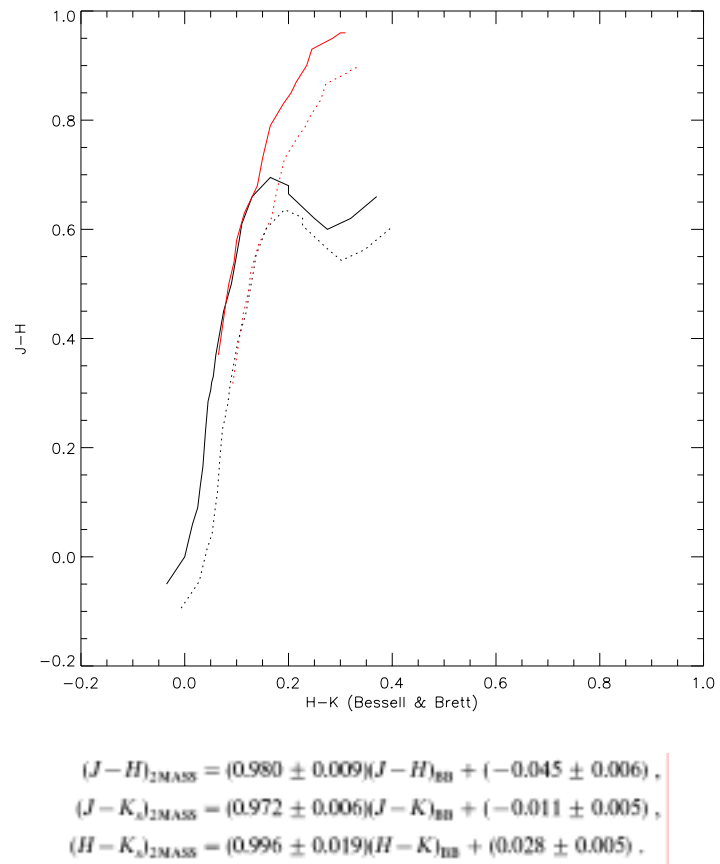


Figure 2: The same as Figure 1, but for Bessell & Brett (1998).

The following is what Bessell & Brett summarize about locations of different class of stars on the (J-H) versus (H-K) diagram.

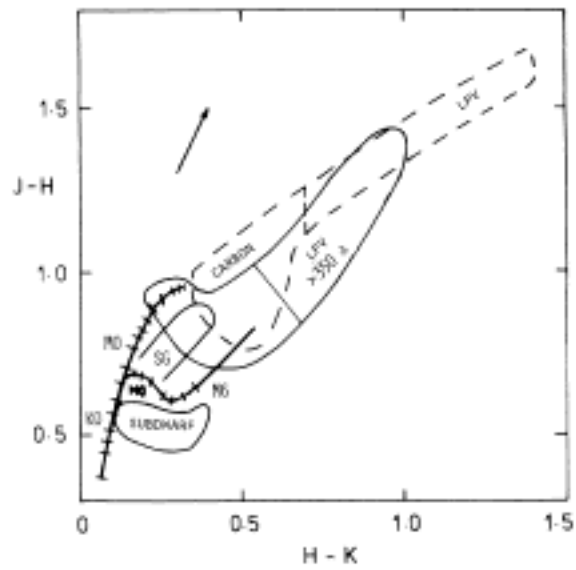


FIG. A2—The (J-H) versus (H-K) diagram showing schematically the regions occupied by G5 to M6 dwarfs and giants, SB and LPP carbon stars, and SB and LPP M7-M10 AGE stars. The arrow indicates the direction of interstellar reddening.

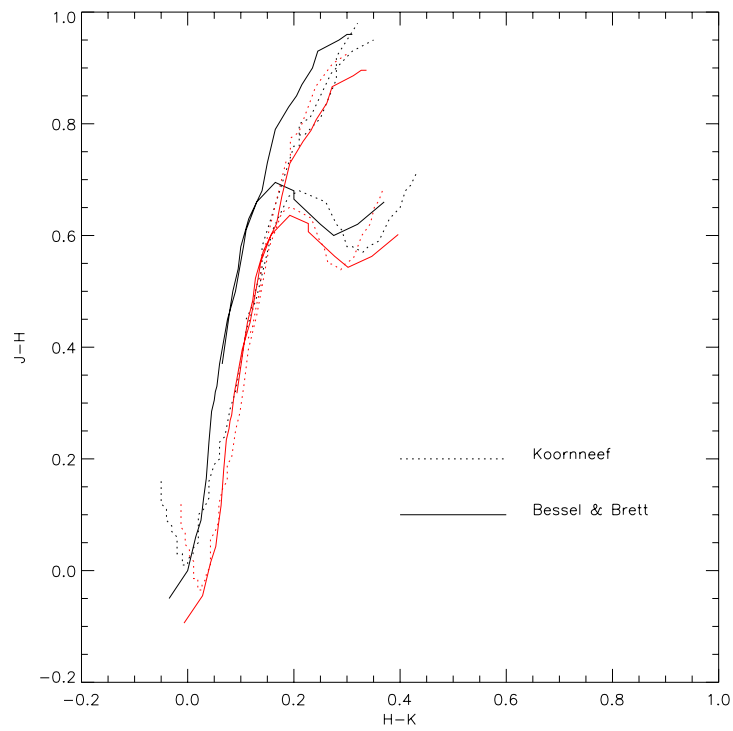


Figure 3: The results for Koornneef and for Bessell & Brett.

The red lines are the 2MASS colors.

Now let us compare the intrinsic colors with 2MASS observations. Figure 4 shows the data for Bica 1, a young open cluster. Only sources brighter than  $K=10$  mag are plotted. The filled circles are for known classical T Tauri stars, open circles are for known weak-lined T Tauri stars, asterisks are for embedded IR sources, i.e., “protostar” candidates. The dotted lines show the possible range of reddening. As can be seen in Figure 4, some stars may be CTTSs.

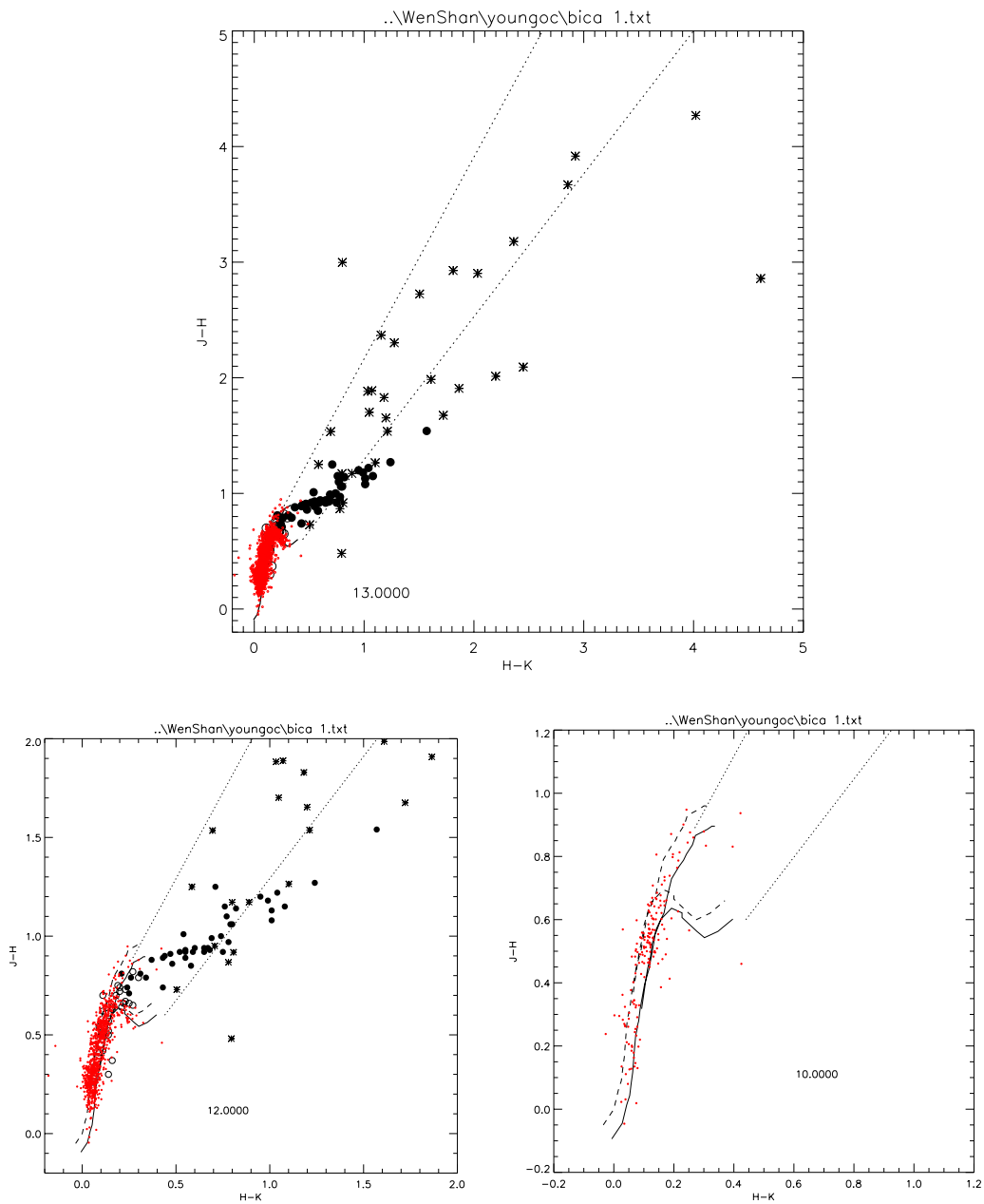
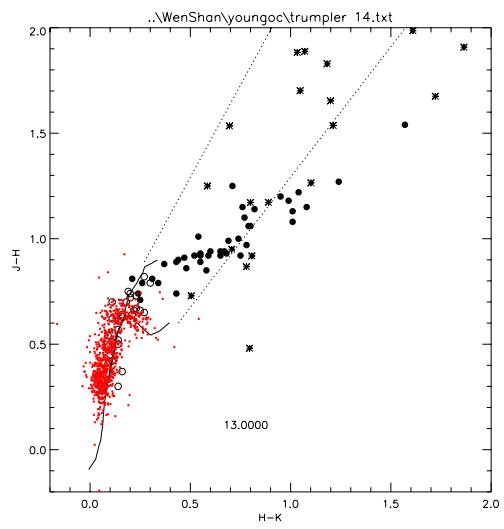
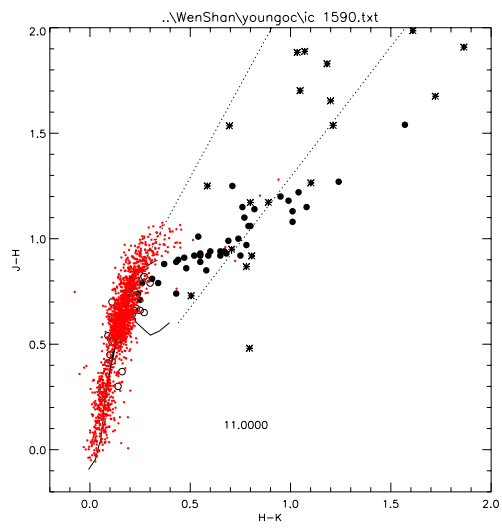
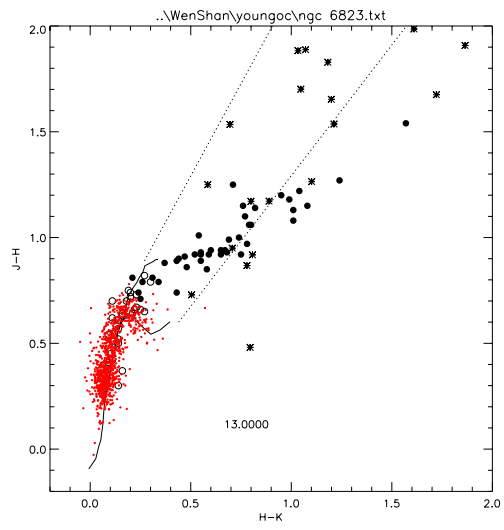
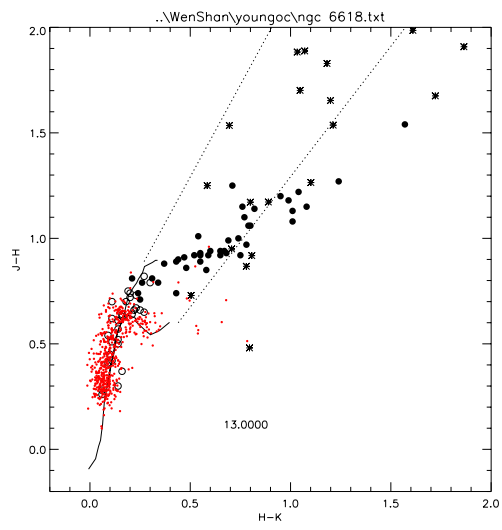


Figure 4: 2MASS data of Bica 1 compared with the Bessell & Brett's intrinsic colors for main sequence and giants.

# Some examples of young clusters



# Some examples of old open clusters

