THE GALACTIC DISC EVOLUTION FROM (V, B - V) COUNTS AT THE GALACTIC POLE

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1. Introduction

We test a model of stellar evolution synthesis by comparison with (V, B - V) counts at the pole. The history of the stellar birthrate and dynamical evolution in the disc is explicitly taken into account. The data span a large range of magnitudes from V = 7 to 22, and allow us to put new constraints on the evolution of the galactic disc.

2. The Model

We define a set of models with different Star Formation Rate (SFR) histories and for which we choose an Initial Mass Function (IMF) compatible with the solar neighbourhood luminosity function: a single slope is used for the IMF at low masses (Haywood 1993). The time variation profiles of the SFRs we have tested are illustrated in Fig. 1. Increasing and decreasing SFRs have

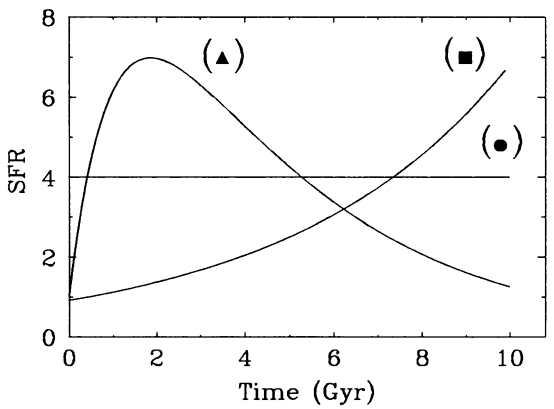

Figure 1. SFR tested in this study.

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a maximum amplitude variation of 7.

The disc is composed of 6 isothermal components with their scale height determined by σ_w through dynamical consistency of the mass model. The maximum value of σ_w is 22 km/s^{-1} for the oldest component. The relative values of the volume density of these 6 isothermal components in the galactic plane are the result of the model of disc evolution, whereas the overwhole normalisation of the disc populations is given by equating our predicted LF to the local LF at $5 \leq M_v \leq 10$.

3. The Galactic Disc at $V < 8.9$ and $b > 70°$

This sample consists of all stars northward of b = 70° and brighter than 8.9 from the Hipparcos Input Catalogue. We have simulated similar catalogues for each of the 3 SFRs. Figure 2 gives the comparison between the SFRs and the B-V distributions for the magnitude interval 6.9 - 8.9.

The model with increasing SFR generates too many young stars. The model with decreasing SFR yields similar but inverse problems: stars are too few at the blue side of the distribution, and too many at the red side. A satisfactory fit is obtained with a constant SFR, or a model in which the SFR in the last 3 Gyrs is comparable to the mean SFR during the history of the disc.

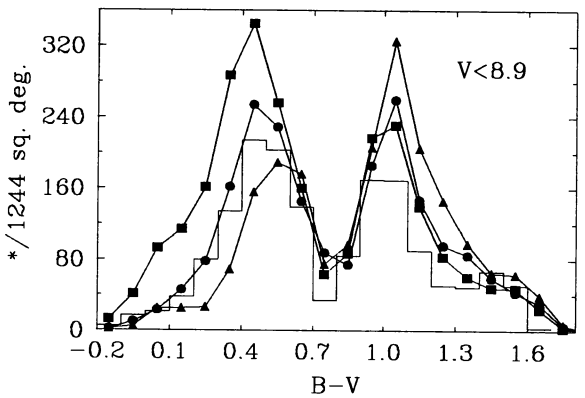

Figure 2. B - V counts at the pole ($V < 8.9$) from the Hipparcos Input Catalogue (histogram).

4. Star Counts from Schmidt Plates at $12 < V < 18$

We have made comparisons with the data from Stobie & Ishida (1987) and Soubiran (1992) (Fig. 3). The model with decreasing SFR clearly overestimates the data (Poissonian uncertainties are negligible for this data set). A model with constant SFR gives a good fit to the counts, while the increasing SFR probably underestimates the number of stars at V = 14 - 16.

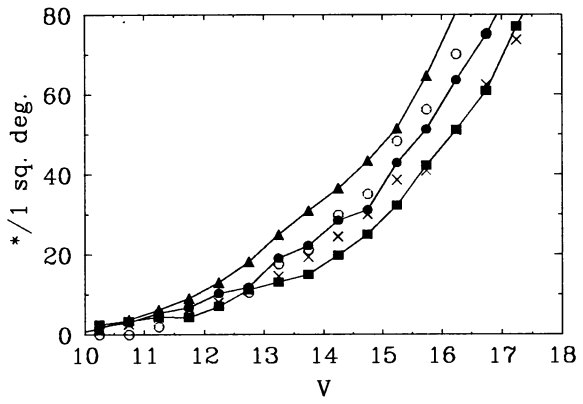

Figure 3. V counts from Stobie & Ishida (1987) (x), (o) from Soubiran (1992).

5. Star Counts at 19 < *V* < 21

Figure 4 shows the B - V distributions from the 3 models compared with the Majewski (1992) counts. The model with constant SFR fits the data within 2 sigmas. While the model with decreasing SFR gives a satisfactory fit (1 sigma), it is in conflict at brighter magnitudes (Fig. 2).

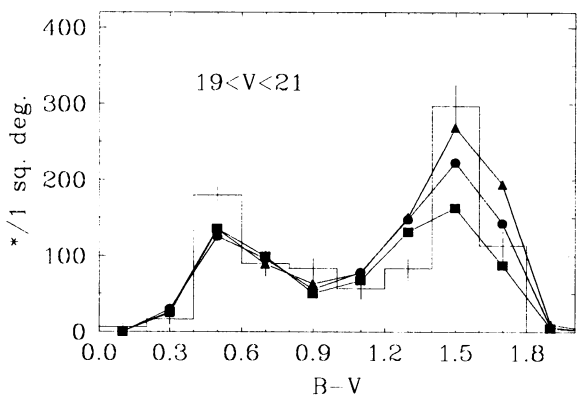

Figure 4. B - V counts from Majewski (1992) (histogram) at the pole.

References

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