DEEP MULTI-COLOUR STARCOUNTS

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Starcounts remain one of the most effective methods of probing the structure of the Galactic stellar populations. However, studies of the distribution at large distances above the Plane demand accurate photometry extending to faint magnitudes ($V > 20$), and such datasets are still rare. We (Reid & Majewski 1993) have analyzed data from one field — Majewski's (1992) UJF observations of SA57, the North Galactic Pole field. Our results revealed significant discrepancies with the standard model of the Galaxy (see refs. in Reid & Majewski), notably a paucity in the number of halo stars by a factor of two and the presence of a factor of two more disk stars than predicted — sufficient stars that the disk is the majority stellar population, outnumbering halo stars 2:1 even at $V = 21$. Majewski et al. (1993) has obtained UJFN photographic data for several other fields, and Fig. 1 shows a preliminary comparison of these observations with the predictions of the best-fitting SA57 model. Given that none of the parameters have been modified, the agreement is surprisingly good.

In our model, the Galactic disk is divided into a series of sub-components — young disk, intermediate-age (2 Gyr) disk, old disk and extended disk/intermediate population, with vertical

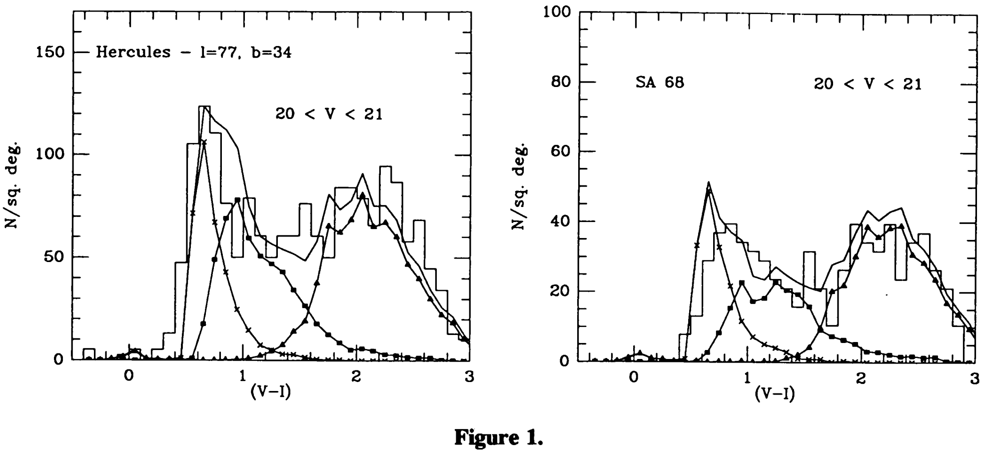

Figure 1.

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scaleheights of 100, 250, 325/400 and 1400 pc. respectively. (The two youngest components make negligible contributions to the counts at faint magnitudes.) These, combined with a de Vaucouleur's law, axial ratio c/a = 0.8 halo, normalised locally to 0.15% of the disk number density, well matches the available starcounts.

Two notable features of this model are the higher scaleheights adopted for the old disk (400 pc. for $M_v > +8$) and the intermediate population. In the latter case, our scaleheight is nearly twice that of the Besançon model (Robin, this conference), but the local density that we adopt is 2.5% of $\rho_o(disk)$, as opposed to 5 - 6% in the latter model. This illustrates one of the uncertainties affecting starcount analyses — each sub-population makes its strongest contribution to the general starcounts at a particular distance above the Plane. Hence, one can trade off scaleheight against local normalisation to match the data. Our justification for a larger scaleheight rests on our re-analysis of the Gilmore & Reid (1983) SGC data, inverting the (V, (V-I)) counts to give $\rho(z)$. Independent observations to test the SGC analysis clearly are required.

The same inherent degeneracy affects our analysis of the old disk. We have interpreted the excess in M-dwarfs (an excess confirmed in Robin's analysis [this conference]) as reflecting a larger scaleheight for the lower luminosity stars. Schmidt-based starcounts at brighter magnitudes, however, require scaleheights of no more than ~ 350 parsecs for disk stars with $M_v \leq +8$. We could achieve the same consistency by increasing the local number density of low luminosity stars by 75% — although this would not sit well with local luminosity function studies. Finally, it is likely that exponential distributions are not the ideal density-law to adopt for the disk. Direct determinations are required, particularly for the lower-luminosity stars, and we are currently obtaining wide-field CCD observations with the 1-metre Swope at Las Campanas to investigate this and other outstanding questions.

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