Stellar Populations as Building Blocks of Galaxies
Proceedings IAU Symposium No. 241, 2006
A. Vazdekis & R. F. Peletier, eds.

doi:10.1017/S174392130700840X

The outer disk stellar populations in M31

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Abstract. The outer regions of M31 contain significant substructure. Here we investigate the origins of the substructure in three fields close to the major axis of M31 using colour-magnitude diagrams produced from HST-ACS.

Ground based imaging of M31 (Ferguson *et al.* 2002) has shown that its outer regions contain significant substructure. Several fields probing different regions of the substructure have been observed with HST-ACS (see e.g. Ferguson *et al.* (2005)).

Preliminary results from three fields - Outer Disk, Warp and G1 Clump - along the major axis to the south-west of the centre of M31, are described here. The Outer Disk and Warp fields are at projected radii of 26.4 kpc and 25.5 kpc respectively. The Outer Disk field is directly on the major axis, whereas the Warp field is slightly below. The G1 Clump field is slightly further out, at a projected radius of 29.6 kpc, and was placed on the sub-structure that lies close to the G1 globular cluster (hence the name G1 Clump).

Results: Figure 1 shows the colour magnitude diagrams (CMDs) of the three fields. There are various common features in each CMD, some of which vary in relative strength between the fields. Each CMD contains a broad red giant branch (RGB), with a strong red clump and weaker RGB and AGB bumps. The Warp and G1 Clump fields have very similar looking RGBs. In the Outer Disk field the CMD features (e.g. the red clump) are extended along the reddening vector, implying that dust is present. The strength of the blue plume, due to young stars, varies from field to field, and is strongest in the outer disk field. The CMD of the Warp field contains an additional plume of stars with $m_{606,0}$-$m_{814,0}\approx0.4$, $m_{814,0} > 25.2$, that is not seen in the other fields. This plume is likely due to a population with age between 1 and 2 Gyrs.

Figure 2 shows the luminosity functions of the RGB in the Warp and G1 clump fields, normalized by the total number of stars. As indicated by the CMDs, the RGBs of the two fields are very similar, including the position and relative number of red clump stars.

The G1 clump field can be modelled by a relatively high metallicity population with [M/H]≈-0.4 and a wide range in age of at least 10 Gyr (Faria *et al.* 2007). The properties (metallicity, recent star formation rate) of the G1 clump field are consistent with those of the outer disk in M31, suggesting that the G1 clump may be due to disrupted M31 disk. Disrupted disk can potentially also explain the similarity of the intermediate and old populations in the G1 clump, warp and outer disk, and indeed in other fields around M31 (see contribution by J. C. Richardson *et al.* in these proceedings).

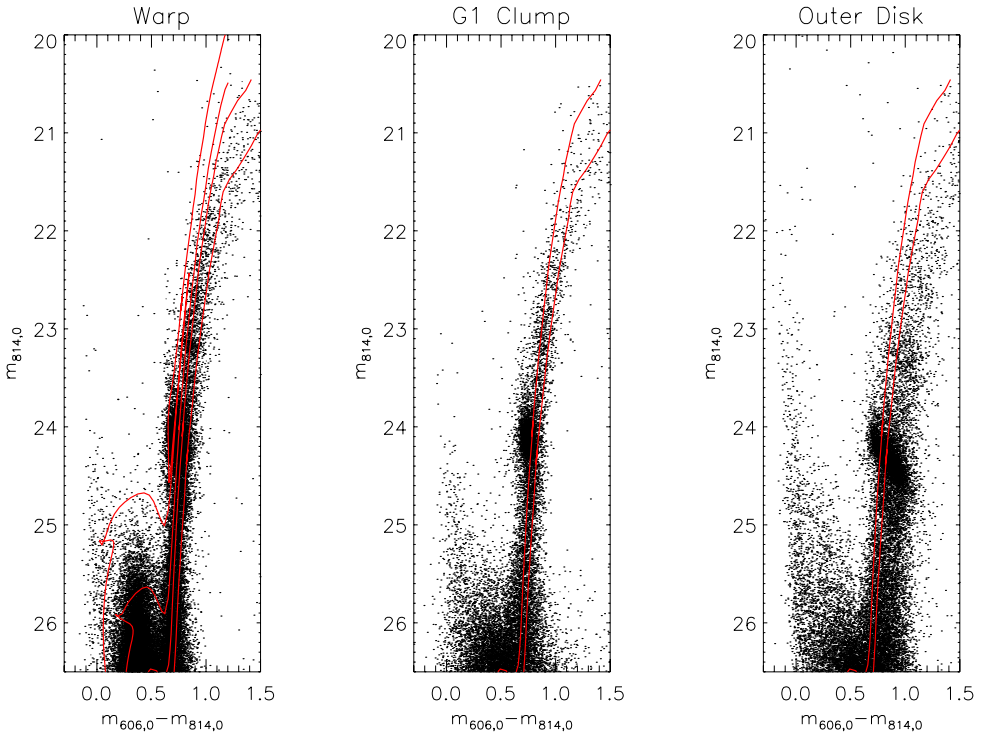

Figure 1. Colour Magnitude Diagrams of the three fields. The two isochrones marked on all the CMDs have ages 4 Gyr and metallicities [M/H]=-0.7 and -0.4. In addition two younger isochrones with ages 1 and 2 Gyr and metallicity, [M/H]=-0.4, are marked on the warp field.

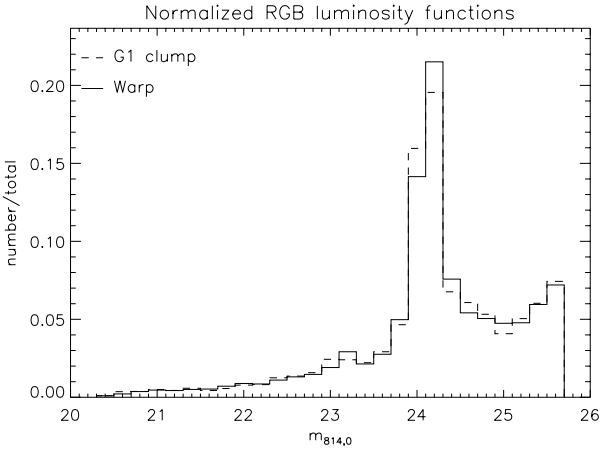

Figure 2. Normalized luminosity functions of the RGB in the Warp and G1 Clump fields

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https://doi.org/10.1017/S174392130700840X Published online by Cambridge University Press