The Colour Gradient in M31 : Evidence for Disc Formation by Biased Infall ?

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A photochemical evolution model has been used to investigate the chemical and photometric evolution of galactic discs which form by prolonged infall of halo material on a timescale that increases with radius, termed *biased infall*, (Josey & Arimoto, 1991). We find that the decline in the mean age and metallicity of the stellar population with radius generates significant colour gradients in the disc and suggest that biased infall may be responsible for the colour variations which have been observed in a number of spirals. Age variations are found to be the primary factor responsible for gradient production in the U, B and V bands while metallicity effects become increasingly important at longer wavelengths. Our model has been applied to M31, in which strong radial colour gradients have been observed, and we find that its chemical and photometric properties can be largely accounted for if its disc formed on a timescale that increased from 0.7 Gyr at the centre to 5 Gyr at a radius of 10 kpc (see Fig.1).

In our synthesis of the colour profile we have corrected for the bulge contribution and reddening by dust both in our own Galaxy and in M31. The bulge dominates the observed colours at small radii but its influence becomes negligible beyond ~ 5 kpc. The colour variation in the NE half of the disc of M31 is in good agreement with the model predictions, while that in the SW half is significantly redder which suggests that recent star formation in this part of the disc has been supressed.

References:

Josey, S.A. & Arimoto, N., 1991. *Astron. Astrophys.*, accepted.

Walterbos, R.A.M & Kennicutt, R.C., 1987. *Astron. Astrophys. Supp.*, **69**, 311.

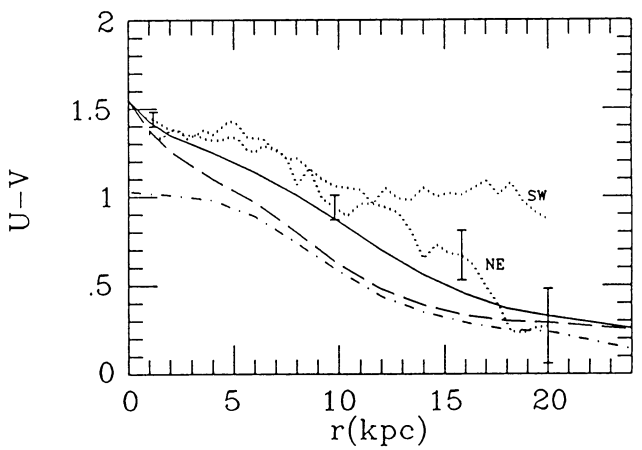

Fig. 1. Model colour profile of M31 disc (dash-dot line), with corrections for the bulge (dashed line) and internal extinction (solid line). Dotted lines are the observed U-V colour profiles of the NE and SW halves of the disc derived, from Walterbos & Kennicutt (1987) and corrected for Galactic extinction.