MICHIGAN 160: A PRECURSOR TO THE LMC ?

L. STAVELEY-SMITH
Australia Telescope National Facility†
Epping, NSW, 2121
Australia

† The Australia Telescope National Facility is operated in association with the Division of Radiophysics by CSIRO

The tidal interaction between the Magellanic Clouds and the Galaxy is an important factor in influencing the physical and dynamical evolution of the Clouds (*e.g.* the Magellanic Stream) as well as the genesis and evolution of their respective stellar populations. However, how important is the influence of the Galaxy ? This is a key question since we know that relatively isolated, magellanic-type galaxies do exist (*e.g.* NGC 3109 and NGC 4449) and have been just as efficient at star-formation as the LMC. It is possible in fact that the star formation in the clouds is primarily stochastic in nature and is relatively insensitive to the global forces which seem to have shaped stellar formation processes in massive spiral and elliptical galaxies. Unsupported by a massive bulge or halo component, cold gas disks are inherently susceptible to radial and bar-like instabilities (Efstathiou *et al.* 1982) which are very efficient at creating the dynamical pressures required for rapid star-formation. With this in mind, a detailed comparison of 'field' magellanic-type galaxies with the LMC and SMC is of some importance.

We have embarked on a detailed morphological, dynamical and spectroscopic study of one such magellanic-type galaxy, Michigan 160 (UGC 12578). Michigan 160 lies in the foreground of the Perseus-Pisces supercluster, at a distance from us of 42 Mpc (Staveley-Smith *et al.* 1990). It has a Holmberg diameter of 1.3 arcmin, and is rather blue with $(B-V)^o_T = 0.29$. The overall optical morphology is shown in grey-scale representation in Fig.1, with contours of neutral hydrogen column density shown superposed. As with the LMC, the HI extends well outside the optical extent of the galaxy and is detectable in our observations to 1.5 Holmberg radii. Although only having an average surface brightness $\mu_B = 23.8^m$ arcsec^{-2}, Michigan 160 is dominated by at least four giant HII regions, each comparable in mass and luminosity to 30 Dor in the LMC. A quantitative spectroscopic study of these HII regions by Axon *et al.* (1988) reveals an oxygen abundance $\log(O/H) = -4.1$, corresponding to a metallicity $Z = 0.1 Z_\odot$. Combined with global photometric parameters (Staveley-Smith *et al.* 1990) and using population evolutionary synthesis models, we have established an approximate stellar age of 3 Gyr. This makes Michigan 160 younger than the age, 4-7 Gyr, inferred for the LMC from stellar photometry (Butcher 1977, Mateo *et al.* 1990). The relative youth of Michigan 160 is evident in the lack of an obvious old stellar bar compared with the LMC's quite prominent bar and the fact that, in terms of HI-to-total mass ratio, it appears to be a factor of six richer in neutral, probably primordial, gas.

Morphologically, there are a number of resolved objects distributed around Michigan 160 which are similar to the disconnected centres in the LMC such as Shapley III. This

R. Haynes and D. Milne (eds.), The Magellanic Clouds, 376–377.

implies that energy from supernovae and main-sequence stellar winds may in itself be sufficient for the physical disruption of low-mass galaxies as well as for the observed mass-metallicity relation (Larson 1974, de Young & Gallagher 1990).

We conclude that Michigan 160 is substantially less evolved than the LMC and that this is probably due to the lack of a massive companion galaxy to provide sufficient perturbing influence for the star-formation to be initiated at such an early stage. The corollary of this is that, because of their similar mass and size, Michigan 160 very likely represents an LMC-type system before massive star-formation has substantially disrupted the morphology and kinematics of the system. A detailed study of similar systems will provide a powerful means to study the likely evolutionary track of the Clouds.

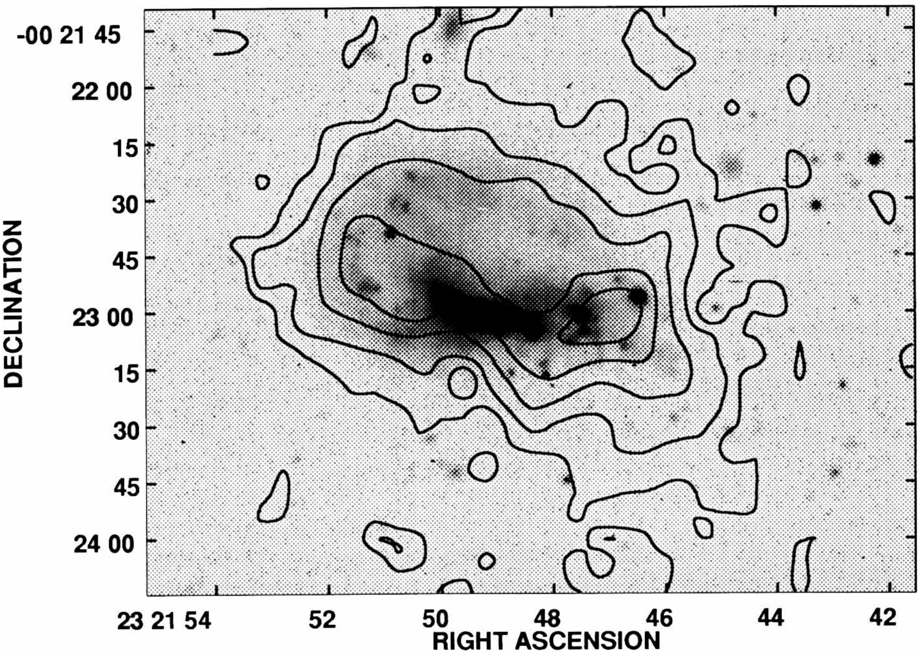

Fig.1: VLA HI column density in steps of 2×10^{20} cm^{-2} on an AAT *B*-image.

References

Axon, D.J., Staveley-Smith, L., Fosbury, R.A.E., Danziger, J., Boksenberg, A. & Davies, R.D., 1988. *MNRAS*, **231**, 1077.

Butcher, H., 1977. *Ap.J.*, **216**, 372.

de Young, D.S. & Gallagher, J.S., 1990. *Ap.J.*, **356**, L15.

Efstathiou, G., Lake, G. & Negroponte, J., 1982. *MNRAS*, **199**, 1069.

Larson, R.B., 1974. *MNRAS*, **169**, 229.

Mateo, M., Bertelli, G. & Chiosi, C., 1990. *Carnegie Inst. Washington preprint.*

Staveley-Smith, L., Bland, J., Axon, D.J., Davies, R.D. & Sharples, R.M., 1990. *Ap.J.*, in press.

https://doi.org/10.1017/S0074180900200910 Published online by Cambridge University Press