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Dwarf Galaxies: Probes for Galaxy Formation and Evolution

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MULTI–SPECTRAL STUDIES OF THE NEARBY DWARF GALAXIES UGCA 86 AND LMC/SMC

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1. Background

UGCA 86 is an irregular dwarf galaxy in the IC 342 / Maffei I group, just next to the Local Group. It was first mentioned by Zwicky (1968) as VII Zw 009, but not contained in his "Catalogue of Selected Compact Galaxies and of Post–eruptive Galaxies" (1971). It was independently rediscovered by Nilson (1974) and Rots (1979) as UGCA 86 and A 0355 resp. Rots found it by HI observations, and from peculiarities in the HI morphology and kinematics he suspected that it was interacting with IC 342. Thus, the tentatively interesting items: a starforming, low surface brightness dwarf galaxy in an interacting system (one of the nearest), triggered us to engage in more detailed studies.

In a first step, we made detailed surface photometry in U, B and V (Richter et al. 1991). UGCA 86 proved to be one galaxy (which was not trivial; Saha & Hoessel 1991 discussed if it could be a chance superposition or a collision of two independent galaxies, due to the very different appearence of the southern and the central starburst; Miller & Hodge 1992 and the distance measurements of Karachentsev & Tikhonov 1993 support our result) with the typical exponential brightness profile of a spheroidal dwarf galaxy, and contains at least two starburst regions of very different color: a central red one and a blue one in the southern outskirts. There is an infrared source in the IRAS Point Source Catalogue coincident with UGCA 86. The amount of dust indicated by this source is in very good quantitative agreement with what would be required to redden the central starburst by the observed color difference compared to the southern burst. Nevertheless, the straightforward hypothesis, that the color of the central burst is due to dust extinction, is contradicted by the improved, higher resolution data.

2. Improved data

In order to improve the resolution, we deconvolved the IRAS data by the Pyramid Maximum Entropy method (Bontekoe et al. 1994). The results show at least two main components: a source near the centre, but definitely not coincident with the red central starburst; and a source coincident with the southern blue starburst with a long extension. Compared with an Hα image[1], the central

[1] by courtesy of A. Aparicio and C. Alart, who obtained it with the 2.2 m telescope at Calar Alto

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IR–source coincides with a clump of HII–regions and diffuse Hα radiation not prominent in the broadband images. Thus, the red color of the central starburst is not due to dust absorption, but obviously to its higher age compared to the southern one. The extension of the southern IR source coincides with a chain of Hα–filaments, which are in good agreement in direction and bending with the instreaming gas suggested by the HI observations of Rots (1979). Thus, it seems very likely that the southern burst is shock–induced by gas infall.

X–ray observations by ROSAT yielded a point source near the centre which could not yet be definitely identified. The luminosity ($2 \ldots 7 \times 10^{38}$ergs^{-1}; spectrum badly defined due to high foreground absorption) is at the upper end of the LF of the known source classes with exception of the AGNs. Since a compact star cluster (extent and luminosity similar to a globular) lies within the error circle, it is likely a LMXB.

3. High resolution FIR data for SMC/LMC

Because the SMC is similar in size and luminosity to UGCA 86, but is nearer (and thus allows higher linear resolution) by a factor of 30, we began a MaxEnt deconvolution of all IRAS observations (survey and pointed) of the SMC/LMC system[2]. It is not yet completed due to the extreme computational requirements. A first, preliminary result is that some of the shell–like structures in the LMC may be connected to the Mach–cones of high velocity gas clouds which splashed through the disk (Braun 1996).

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[2]in cooperation with Sterrenkundig Instituut "Anton Pannekoek", Amsterdam and SRON, Groningen