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H II Regions in the Dwarf Galaxy UGC-A 86

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The uncertain nature of the dwarf irregular galaxy UGC-A 86 (VIIZw009) makes it a very interesting object for studying star formation at the low end of the galaxy luminosity function. Saha and Hoessel (1991) find that this object is composed of two main parts, one of which appears more resolved than the other. The more resolved component has an excess of blue stars, suggesting that it is currently undergoing star formation. Thus, they argue that UGC-A 86 could be either a superposition of unrelated galaxies, two interacting galaxies, or a single galaxy. However, surface photometry performed by Richter *et al.* (1991) indicates that it is a single galaxy with an exponential luminosity profile. Richter *et al.* also find UGC-A 86 to be extremely dusty and to be associated with the infrared source IRAS 3550+6657. The uncertainty is compounded by the large ambiguity in the distance, though a heliocentric H I velocity of 80 ± 7 km s^{-1} (Huchtmeier & Richter 1989) suggests that it is either a member of the Local Group or perhaps the IC 342 group. In this work we adopt a distance of 1.5 Mpc and a reddening of $E(B-V) = 0.65$.

We have observed UGC-A 86 in Hα in order to measure its current star formation rate. This is part of a larger project to study the star formation rates and histories of a complete sample of dwarf galaxies in the Local Group and other nearby groups. In this paper we present the H II region luminosity function and size distribution for UGC-A 86 and compare them with previous observations of similar dwarf galaxies.

Hα and continuum CCD images of UGC-A 86 were obtained with the KPNO 0.9-m telescope on December 13, 1991. The Hα image was taken through a 38 Å half-power bandwidth interference filter centered on 6569 Å while the continuum image was taken through a filter centered on 6092 Å. Observations of BD+28 4211 provided absolute flux calibration. We attempted to match the point-spread functions in the two images to get the optimum continuum subtraction. Also, to aid our identification of the H II regions we enhanced the calibrated Hα image using an unsharp masking technique developed by Drew Phillips.

We have identified a total of 114 H II regions in UGC-A 86. Fluxes for each region were measured inside the isophote corresponding to 2×10^{-17} erg cm^{-2} s^{-1} $arcsec^{-2}$. The effective diameter of an H II regions is defined by $D = 2\sqrt{Area/\pi}$. The cumulative diameter distribution is shown in Figure 1. We find that the diameter distribution is fairly well described by the exponential law $N(> D) = N_0 \exp(D/D_0)$. A least-squares fit to the binned data (for $D > 29$ pc) yields $D_0 = 19 \pm 1$ pc. Use of the maximum likelihood method (Ye 1992), for which the data does not need to be binned, gives $D_0 = 20 \pm 2$ pc, which is similar to D_0 for the irregular galaxies NGC 1569 and Ho II (Hodge 1983)

The Hα luminosity function is shown in Figure 2. The upper end of the luminosity function is consistent with a power law distribution $N(L) = AL^a dL$. A least-squares fit to the upper end of the luminosity function gives $a = -2.0 \pm 0.2$. This is slightly steeper than average for dwarf irregular galaxies but is not inconsistent with previous values of a between -1.5 and -1.8 (Strobel *et al.* 1991).

A complex of H II regions is found at each of the components identified by Saha and Hoessel. In fact, half of the total Hα luminosity, $L_{H\alpha} = 9 \times 10^{38}$ erg s^{-1}, comes from the southeast component. This supports their inference that UGC-A 86 is currently undergoing star formation. Our detection of Hα regions over the entire optical extent of the galaxy suggests that this is not a chance superposition of galaxies. Accurate optical or H I velocities should be able to distinguish whether this is one galaxy or an interacting pair. Future work should also include a search for Cepheids or planetary nebulae in order to resolve the uncertainty in the distance, and spectroscopy of the bright H II regions in order to determine the abundances.

REFERENCES

Hodge, P. W. 1983, AJ, 88, 1323

Huchtmeier, W. K. & Richter, O. G. 1989, A General Catalog of H I Observations of Galaxies (Springer, New York)

Richter, G. M., Schmidt, K.-H., Thänert, W., Stavrev, K. & Panov, K. 1991, Astron. Nach., 312, 309

Saha, A. & Hoessel, J. G. 1991, AJ, 101, 465

Strobel, N. V., Hodge, P. & Kennicutt, R. C. 1991, ApJ, 383, 148

Ye, T. 1992, MNRAS, 255, 32

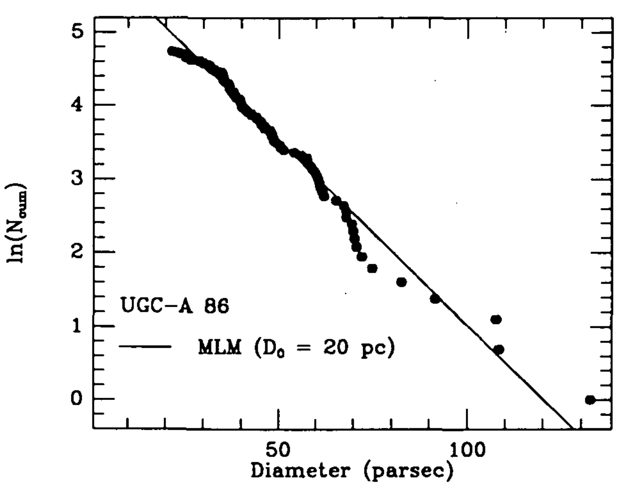

Fig. 1: Cumulative diameter distribution.

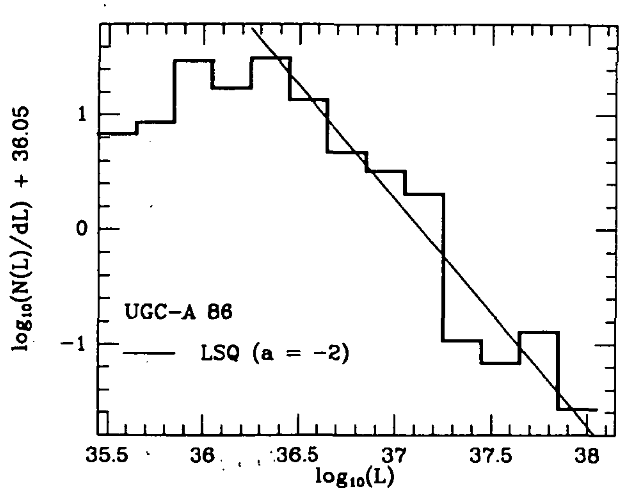

Fig. 2: HII region luminosity function.