RevMexAA (Serie de Conferencias), **40**, 192–192 (2011)

THE HII REGIONS OF M51 AND NGC 4449. BEHAVIOR OF THE MEAN ELECTRON DENSITY

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With ACS-HST images we produced continuum subtracted photometric maps in Hα for the galaxies M51 and NGC 4449. From the Hα luminosity (L), equivalent radius (R) and coordinates of the HII regions with respect to the galaxy centers (over 2000 regions for M51, over 200 regions for NGC 4449), we derived the mean luminosity weighted electron density, $\langle n_e \rangle$, for each region.

Plotting these densities against the radii of the regions (see Figure 1) we find excellent fits for $\langle n_e \rangle$ varying as $R^{-1/2}$ (the exponent is -0.56 for M51 and -0.45 for NGC 4449). In qualitative terms, the larger regions have lower mean electron densities. These are only two galaxies, but the trends can at this stage be usefully summarized by the same expression.

Also, plottig $\langle n_e \rangle$ against the galactocentric radius (r), we found exponential fits with scale lengths of close to 10 kpc for both galaxies. In Figure 2 we show the plots of $\langle n_e \rangle$ against galactocentric radius, r. The principal feature here is the exponential fit (linear in the log scale for $\langle n_e \rangle$), which has the form $\langle n_e \rangle = \langle n_e \rangle_o \, e^{-r/h}$, where $\langle n_e \rangle_o = 12 \pm 1$ cm^{-3} and the scale length is $h = 9 \pm 1.0$ kpc. This is similar to that found by Tilanus & Allen (1991) for HI in M51. The results for NGC 4449 are similar, with $h = 11$ kpc. Hunter et al. (1998) observed an HI disc with a central dense component embedded in a larger component of 18 kpc in radius.

Taking our cue from M51, which has an HI scale length of 9 kpc and a limiting HI radius of 15 kpc (Meijerink et al. 2005), we find that the HII region scale length of NGC 4449, as for M51, is comparable to the HI scale length, implying quasi-pressure equilibrium for the HII regions.

For details about the data and processing, see Gutiérrez & Beckman (2010) and Gutiérrez et al. (2011).

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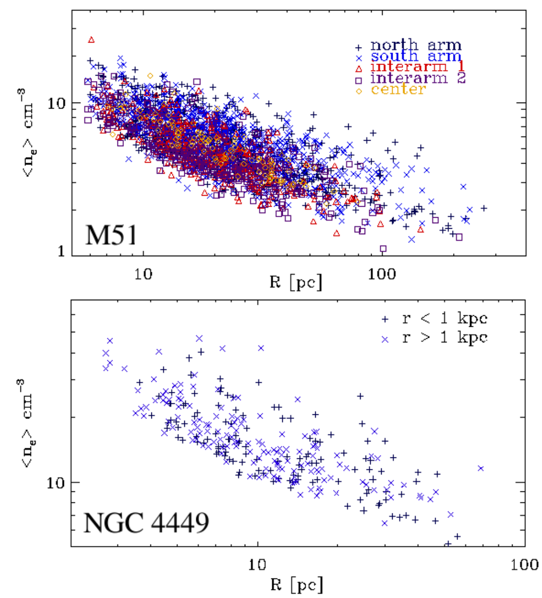

Fig. 1. Plots of $\langle n_e \rangle$ against the radii of the regions.

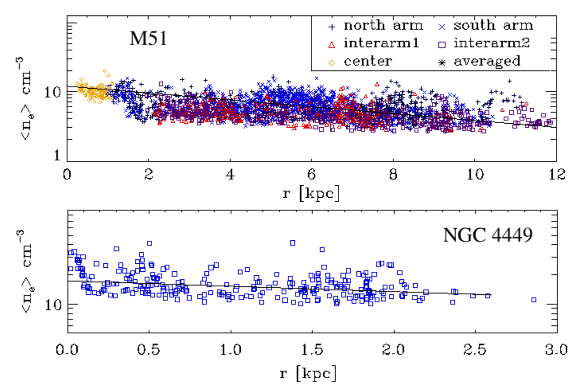

Fig. 2. Plots of $\langle n_e \rangle$ against r for M51 and NGC 4449. For M51, we distinguished among the regions found in arms, interarm zones, and the central kpc. For both galaxies the dependence of $\langle n_e \rangle$ on R were corrected.

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