GIANT H II REGIONS IN M81

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Giant HII regions are important tracers of recent star formation in distant galaxies. For a selection of HII regions in our galaxy where the exciting stars can be identified, Rumstay (1985) finds that the measured Hα and radio continuum luminosities of an HII region correlate with the stellar ionizing flux derived from model atmospheres and the known exciting stars. Therefore, we use flux measurements of giant HII regions as an index of the distribution of O stars in M81.

Using the VLA, Bash and Kaufman (1985) have mapped M81 at λ6 and 20 cm with a resolution of 10" (190 pc, if the distance of M81 is 4 Mpc). About 40 of the radio continuum sources coincide with Hα sources observed by Hodge and Kennicutt (1983). Certain studies (Visser 1980; Leisawitz and Bash 1982) of spiral structure in M81 have compared predicted star formation rates with the global distribution of optical HII regions detected by Connolly et al. (1972). However Connolly et al. do not distinguish bright HII regions from faint ones. The HII regions detected in our VLA survey are giant HII regions with excitation parameter $U > 170$ pc cm^{-2}. These giant radio HII regions are more concentrated in a two-armed pattern and show a more narrow distribution as a function of galactocentric distance R than the HII regions plotted in Connolly et al. As indicated in Fig. 1 the distribution of giant radio HII regions in the plane of M81 exhibits a strong peak near R = 300". Thus M81 may show the same phenomenon that Rumstay and Kaufman (1983) find in M83 and M33; namely, the set of high luminosity HII regions is more sharply peaked in azimuthal and in radial distribution than the set of low luminosity HII regions.

We also compare the Hα and the radio continuum fluxes of the giant HII regions in M81. For each region we convolve the Hα and the radio data to the same resolution, integrate over the same coordinates, and correct both the radio and optical data for local background in the same way. We restrict here to the HII regions where the determination of the local background is the least ambiguous and assume an electron temperature of 10^4 K. For these regions the average radio spectral index is $- 0.09 \pm 0.06$. For 25 sources, the 20 cm and Hα data yield a mean value of 1.0 ± 0.15 magnitudes for the visual extinction A_V(20 cm). For 19 sources, the 6 cm and Hα data yield a mean value for A_V(6 cm)

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of 1.0 ± 0.16 magnitudes. The resulting distribution of extinction as a function of galactocentric R (see Fig. 2) shows considerable scatter at any given R and no strong trend.

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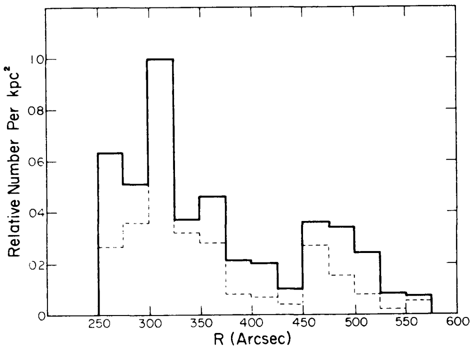

Fig. 1. Radial distribution of giant radio HII regions in the plane of M81. The solid histogram gives the number of giant HII regions per kpc^2; the dashed histogram, the 20 cm flux per kpc^2 from giant HII regions. Both histograms are normalized to one for the 300-325" annulus.

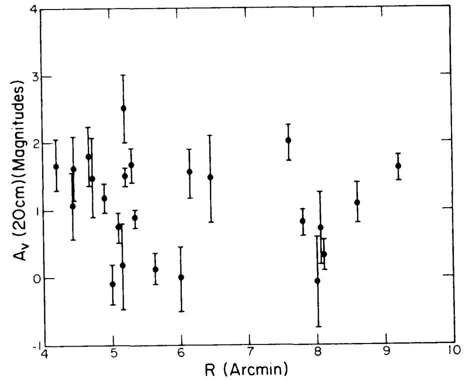

Fig. 2 Radial distribution of visual extinction in the plane of M81; A_V(20cm) is the visual extinction determined from the 20 cm and Hα observations of HII regions.

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