

Fig. 2. Observational U-G and G-R colors for Mrk 297 (A,B,C,D,E,F,V with circles) and Mrk 325 (A,B,C,F with boxes).

HIGH-DISPERSION SPECTROSCOPY OF THE CLUMPY IRREGULAR GALAXIES MARKARIAN 297 AND 325

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ABSTRACT. High-dispersion spectroscopic observations with good spectral resolution have been made of the four clumps in the two clumpy irregular galaxies Markarian 297 and 325. Their velocity dispersions in the H α emission line (32–41 km s⁻¹) are larger by about 2 or more than those of the so-called giant HII regions in nearby spiral or irregular galaxies.

1. INTRODUCTION

Markarian 297 (= NGC 6052; hereafter Mrk 297) and Markarian 325 (= NGC 7673; Mrk 325) are typical examples of the clumpy irregular galaxies [hereafter CIGs; cf. Heidmann (1983)]. The star-forming activity in a clump is higher by about two orders of magnitude than that in a giant HII region like 30 Dor in the LMC (Alloin and Duflot 1979; Benvenuti, Casini, and Heidmann 1979, 1982; Taniguchi and Tamura 1981; Duflot-Augarde and Alloin 1982). Therefore, the CIGs have been experiencing starburst phenomena with an exceptionally high star formation rate throughout the whole galaxy. In order to study kinematical conditions of ionized gas in the clumps, we have carried out high-dispersion spectroscopic observations of the four clumps in the above two CIGs.

2. OBSERVATIONS AND RESULTS

Spectroscopic observations were made with the Intensified Reticon attached to the Coudé spectrograph of the 188-cm reflector of the Okayama Astrophysical Observatory. The Reticon used in our observations is a one-dimensional photo diode array of 1024 channels with a pixel size of 25 μm (width) \times 2.5 mm (height). Instrumental resolutions (FWHMs) are 14.5 km s^{-1} for Mrk 297 and 27.5 km s^{-1} for Mrk 325, respectively. Observations were made of the four clumps in the two galaxies. The names of the clumps are taken from Duflot, Lombard, and Perrin (1976) for Mrk 297 and Tamura and Hasegawa (1979) for Mrk 325, respectively. The full width at half maximum (FWHM₀) and the velocity dispersion (σ_0) of the H α emission line are given for each clump in Table I. These values are corrected for instrumental and thermal Doppler ($T = 10^4$ K) broadenings. The full width at zero intensity (FWZI) is also given. In Figure 1, examples of H α emission line profiles (Mrk 325-A and B) are shown together with a typical instrumental profile.

Our main results are summarized as follows. (1) The velocity dispersions of the H α emission lines of the clumps, 32–41 km s^{-1} , are larger by about a factor of 2 than those of giant HII regions in nearby spiral or irregular galaxies (cf. Gallagher and Hunter 1983; Skillman and Balick 1984). (2) The two clumps (Mrk 297-B and Mrk 325-B) show broad wings of FWZI = 420–550 km s^{-1} in the H α emission lines. These wings show the excess emission in the redward portions.

The above characteristics may be attributed to hyper star-forming activity in the clumps. Our results provide upper limits of the virial mass of the clumps of the order of $10^8 M_\odot$ [cf. Boesgaard, Edwards, and Heidmann 1982, see Taniguchi and Tamura (1986) in detail].

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TABLE I. Summary of our Results

Name	FWHM ₀ (H α)	σ_0 (H α)	FWZI (H α)
Mrk 297-B	96.8 km/s	41.1 km/s	550 km/s
Mrk 325-A	75.1	31.9	280
Mrk 325-B	79.8	33.9	420
Mrk 325-C	77.9	33.1	240

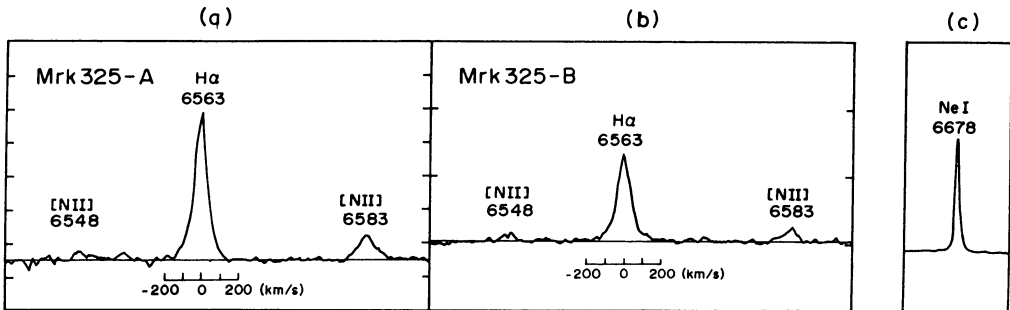


Fig. 1. The H α emission line profiles of two clumps, (a) Mrk 325-A, and (b) Mrk 325-B. A typical instrumental profile (Ne I λ 6678) is also shown in the right panel (c).

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