N159A: A REGION OF ACTIVE STAR FORMATION IN THE LMC

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ABSTRACT. The Large Magellanic Cloud (LMC) HII region N159A is shown to be a group of ionized regions, some of which overlap, rather than a single HII region. There are at least 11 stars earlier than B2 in this region

1. Introduction

N159A is the brightest of the group of HII regions forming N159, which is located in a large complex of neutral and ionized hydrogen, molecular material, and dust, lying south of the 30-Doradus Nebula. N159A lies in the direction of a molecular cloud (Johansson & Booth 1989), along with the IR source IRAS 05401-6947 (Schwering 1988), which proves the presence of hot luminous stars.

2. Observations and reduction

U, B, V, R, I, Hα, Hβ, and [0III] 5007 CCD frames (1.6 arcmin E-W by 2.5 arcmin N-S) were obtained at the ESO 2.2-m telescope. At a scale of 0.258 arcsec/pixel, the stellar images are adequately sampled. For the stellar photometry reductions we have used DAOPHOT (Stetson 1987), supplemented with our own iterative procedure (Chireux *et al.* 1989) - based on Stetson's suggestions - to correct for the bright, highly variable nebular background. The UBVRI magnitudes are tied in with Landolt (1983) standards and the Hα, Hβ, and [0III] frames were calibrated with absolute fluxes previously measured with a Fabry-Perot spectrophotometer (Caplan & Deharveng 1985).

3. The colour-magnitude diagrams

These show a well-defined main sequence including several probable OB stars. Most of our stars in the direction of N159A belong to this main sequence, and have a mean visual extinction of 1.3 mag. Other features of the CMD are: a clump of He-core-burning stars, centred at V=19.3, B-V=1.06; a red giant branch extending from the clump to V-16.7, B-V=1.68; and a few deviant stars, one of which is very probably a Galactic field star.

Although the bright MS stars must be quite young - less than 10 Myr - both the position of the clump and that of its red giant extension match those of the LMC cluster NGC 1651, for which

R. Haynes and D. Milne (eds.), The Magellanic Clouds, 232–233.

Mould *et al.* (1986) and Seidel *et al.* (1987) determine an age of 2.0±1.0 Gyr and a metallicity [Fe/H]=-0.5±0.3. The clump and red giant stars thus seem to be LMC field objects not associated with the HII regions.

4. Locations of the hot stars; new small HII regions

UBV colours alone are not sufficient for picking out the very early type stars that ionize the gas (although the magnitudes often leave little doubt that we are dealing with quite massive stars). However, when we look at the positions of these stars in the Hα image, we see clearly which ones are truly sources of ionizing photons.

Our Hα, Hβ, and [0III] images show that N159A is not a single HII region, but a group of ionized regions, some of which overlap. Furthermore, several small regions at the periphery are seen as distinct. The bright HII region N159A is ionized by a close pair of stars (1.0 arcsec, or 0.24 pc), the dominant one probably being an 06. All the other exciting stars in the field are less massive, in agreement with the degree of excitation of the gas deduced from the [0III]/Hβ ratio. N159A itself is highly excited, which confirms that the dominant exciting star is quite early; the [OIII]/Hβ ratio, greater than 5, suggests 06 or earlier. A few of the HII regions have no identified exciting star; these are undoubtedly hidden by dust.

5. Conclusions

Star formation is particularly active in this region. This very small field (4 arcmin^2) contains at least ten HII regions, of which seven have identified exciting stars. The distribution of spectral types at the upper end of the main sequence is approximately one 06 star, one 07-08 star, two 09-B0 stars, and seven B0-B2 stars.

6. References

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