CANDIDATE PROTOSTARS IN THE VICINITY OF 30 DORADUS

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ABSTRACT. Four candidate protostars have been identified, with luminosities of 1-5x$10^4 L_\odot$ and masses of 10-20$M_\odot$, in a magnitude-limited near-infrared survey of the 30-Dor complex. Each is associated with a dense knot in the nebular arcs. We suggest that both the knots and the associated star formation result from the compression of interacting arcs of mass-loss winds from hot massive stars in the central cluster and other nearby clusters. This mode of star formation appears to be highly efficient. In the 30-Dor region there is a clear spatial separation of the young blue stars and older red stars, strengthening the evidence for a multiple starburst in the region.

1. Introduction

The 30-Dor region of the Large Magellanic Cloud (LMC) is a giant complex of ionised gas, young stars and optically thin dust. Its youth and morphology, together with indicators of continuing star formation, such as the H_2O maser source (Whiteoak & Gardner 1986), and the presence of probable early O stars embedded in dense molecular knots (Walborn & Blades 1987), suggest that massive star formation is still occurring in close proximity to R 136. We have undertaken an investigation of the stellar population in the central region of 30 Dor using infrared imaging and photometry. Our aim has been to determine the presence and nature of any candidate protostars (as defined by Gatley *et al.* 1981) in the hot, tenuous and turbulent environment.

2. Observations

A region of approximately 5'x7' centred on R136 was imaged at J (1.25μm) and K (2.20μm), with the infrared photometer spectrometer (IRPS) on the Anglo-Australian Telescope (AAT). Imaging was undertaken in the DC scanning mode (described by Hyland *et al.* 1984) using an aperture of 3.5 arcsec. The survey is complete to a 3σ limit of 14.8 at J, and 13.0 at K. Chopping photometry of a number of the reddest sources found in the survey, as well as CVF spectrophotometry of three sources from 2.0 - 2.45μm, were obtained.

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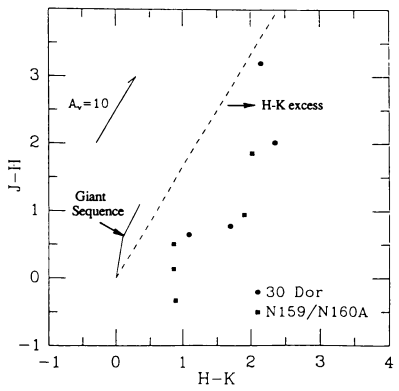

Figure 1a. J-H v H-K diagram

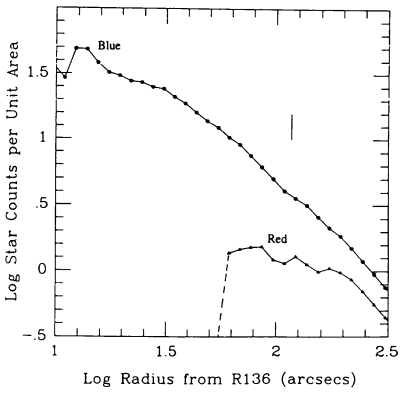

Figure 1b. Distribution of blue and red stars

Table 1. Protostar Candidates in 30 Doradus

Object	RA (1950)	Dec (1950)
P1	05 39 07.5	-69 06 36
P2	05 39 01.7	-69 05 28
P3	05 38 55.3	-69 07 32
P4	05 39 08.4	-69 05 48

3. Results and discussion

The survey has identified four candidate high mass protostars from their near-IR colours (Table 1). In the J-H v. H-K diagram (Fig.1) these lie in the region typical of dust enshrouded hot core sources. Their luminosities lie in the range $5x10^4L_\odot > L > 10^4L_\odot$, and their inferred masses in the range $10\text{-}20M_\odot$. Two are close to the peaks of far-IR emission (Werner *et al.* 1978), but higher resolution far-IR data is needed to determine if either is responsible for a particular enhancement in the emission. However, each of the four sources is aligned with a knot of optical [OIII] nebular emission, probably representing significant density enhancements in the ionsed gas. The two sources identified by Walborn & Blades (1987) as early O stars are similarly embedded in such [OIII] density enhancements, and are suggested to be optically visible signs of recent star formation. The two results add significantly to the idea that the interaction of strong stellar winds from the cluster core and other nearby young clusters provides the initial compression of the ambient medium into star-size blobs, initiating further star formation within the region. For gas clumps of the size and density implied, this mode of star formation is very efficient (20-70%).

There are two distinct populations of young blue and older red supergiants in the region (Hyland *et al.* 1978). Present data show clearly that the two groups differ in their spatial distribution (Fig.1b); the blue stars are strongly centrally concentrated, the red more annularly distributed. We suggest that the latter are the remains of a group of high mass stars, $M>20M_\odot$, formed in a burst of star formation $\sim 2x10^7$ years ago, and speculate that the mass loss winds from

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these stars colliding with the large mass of neutral gas in the region may have been instrumental in initiating the formation of the cluster itself.

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