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VLT/NACO NEAR-INFRARED IMAGING AND SPECTROSCOPY OF N88A IN THE SMC

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1 Introduction

N88A in the Small magellanic Cloud (SMC) is a high excitation 'blob' belonging to a rare class of compact HII regions in the Magellanic Clouds (Mcs). These objects now generically named HEBs are probably the final stages in evolution of the ultra compact HII regions. In contrast to typical HII regions of the MCs greater than 50 pc and powered by a large number of stars, HEBS are dense and smaller in diameter (1-3pc). They are affected by local dust where the ionizing stars are enshrouded. The study of star formation in the Mcs is easier than in our Galaxy because their known and relatively small distance and low interstellar extinction. Their distance also permits to study not only individual stellar objects but also extended ones in a same CCD frame.

Among the HEBs, N88A is the brightest and the most extincted and is part of the large complex N88 located east of the main body of the SMC. Numerous multiwavelengths studies have been made on this peculiar object. Nevertheless, many uncertainties remain, especially due to the strong extinction or the lack of spatial resolution, to understand its true nature. Here we present our results of the first NIR high spatial resolution (0.1-0.2 arcsec) observations (J, H, Ks and L' imaging and Ks-band spectroscopy) of N88A and its environment in the SMC, performed with the adaptative optics camera NAOS/CONICA at the ESO VLT (Fig. 1, central image).

2 Results

Our IR data reveal for the first time a morphology of N88A in unprecedented detail, and using colour-magnitude and color-color diagrams several young sources with infra-red excess are detected.

- NIR high spatial resolution images of N88A have shown that N88A is formed by a tight cluster of diameter 2 .5 arcsecs superposing a circular continuum emission centered on a bright star (Fig. 1-Ks).

- The JHK magnitude and color diagrams have revealed that the resolved stars in N88A could be massive young stellar objects (YSOs) of class II, as well as three stars stars located east of the central bright star along a H_2 filament. They also show that numerous stars in N88 exhibit IR-excess.

- L' band observations have pointed out a bright emission peak in the component L1 without counterpart in JHK (Fig. 1-L'). This peak could be classified as a MYSO of Class I (Lada 2000)

- The central bright star (♯19) is assumed to be an O7V type. As the ionizing source derived by radio observations (Indebetouw et al 2004) is of type O5, several other stars should contribute to the ionization of N88. This is strengthened by the I(He 2.11 m/I(Brγ) ratio (Hanson et al 2002) indicating that the ionizing source of N88A has a spectral type earlier than O7 star.

- The H_2 band image (Fig. 2) shows that N88A is composed of three bright knots where massive star formation should take place . From spectroscopy we show that the excitation mechanism is caused predominantly by PDRs and not by shocks.

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3 Conclusions

The observations of N88A at IR high spatial resolution have shown the stellar complexity of the HEB N88A, as well as its unusual bright dust emission. This object, of dimension similar to the trapezium in Orion in our galaxy, appears a very good candidate for studies of young massive stars in low-metallicity

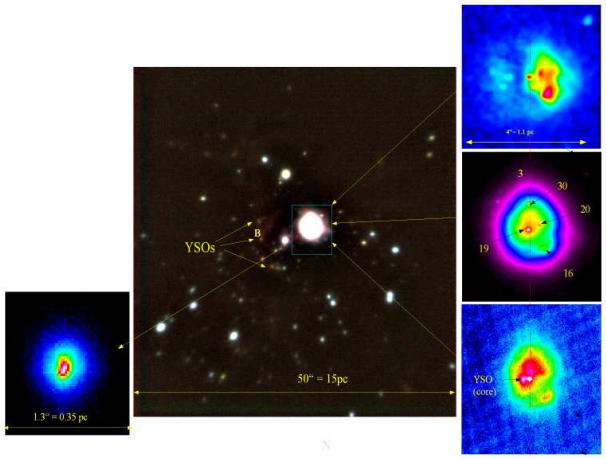

Fig. 1. Central image: False-color image of the N88 region obtained with NACO *(blue is assigned to the J band, green to the H band and red to the Ks band)*. **Right row from top to bottom**: close-up of N88A in the y(547), Ks and L' bands *(in Ks and L' images YSOs candidates are indicated by arrows)*. **1) y(547)-band**: Hubble observations (Heydari et al 1999) have revealed a complex structure consisting of two inhomogeneous wings separated by a north south absorption lane. The bright western wing contains two faints stars corresponding to our stars ♯19 and ♯20 as well as a dark spot to the the south. **2) Ks-band**: Using similar spatial resolution IR observations, the morphology of N88A appears more homogeneous. It consists of a bright continuum centered on a bright star of magnitude Ks = 14.9. A cluster of at least 10 resolved embedded stars is detected. The stars ♯16, ♯19, ♯20 and ♯30 are expected to be YSOs. From color-magnitude diagram they can be classified as massive. (*We consider to be YSOs the objects observed just before a normal OB star emerges from its natal birth environment.*) **3) L'-band**: The bright core of magnitude 14 is classified YSO of class I (K-L .4.5 mag) and coincides with the HST lane. **Left image**: close-up of N88B showing at least three components.

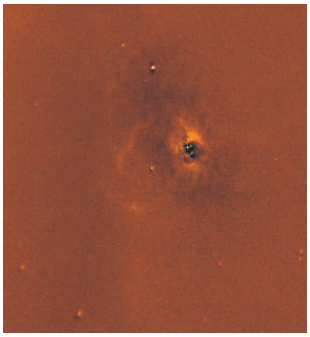

Fig. 2. H_2 2.12 μm emitting region (Size 42"x 40"). Three bubbles are visible around the young bright star of N88A. Around N88B a filament is in interaction with the eastern bubble. This is also noticed in the HST Hα image.

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