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YOUNG AND VERY YOUNG STARS IN NGC 3372, THE CARINA NEBULA

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The advantages of using a telescope of large aperture, like the GTC, for mid-infrared imaging are demonstrated. Examples are given to compare the characteristics of the images in the 8 to 13 μm regime recently taken with the 2.1 m telescope at San Pedro Mártir with those obtained with a 10 meter class telescope. Finally, 10 μm images of the BN/KL object from a 3.6 m telescope and with an 8 m telescopes are directly compared.

For nearly three years, a two-channel near- and mid-infrared camera, CID, has been operating attached to the 2.1 m telescope of the Observatorio Astronómico Nacional at San Pedro Mártir, Baja California, México. Its characteristics are listed in Table 1. In collaboration with Mexican and Italian colleagues, a catalogue of narrow-band diffraction-limited images of compact HII regions in the northern Milky Way is being obtained. Most of the young massive regions are being observed at 8.7 μm, 9.7 μm, 12.5 μm and 18.9 μm. The images are reduced in the usual way and are flux-calibrated. Although most of the regions in our sample are at distances well beyond 1.5 kpc, many nebulae are resolved and in many cases the embedded very young massive objects that excite the HII regions appear multiple. Two examples of these, NGC 7538 and GM 24, are shown in Figures 1 and 2. At a "typical" distance of 1.7 kpc, our spatial resolution (at 10 μm) corresponds to approximately 2000 AU. Our sensitivity limit (for S/N = 10 and on-source integration time of one hour) permits the detection of a class I object (ages of about 10^{4-5} years) with luminosities of about 10^3 $L_\odot$. CariCam on GTC in its imaging mode will have several magnitudes better sensitivity and a spatial resolution five times greater. This, coupled with the ability to perform spectroscopy and polarimetry, will make this instrument a basic tool for studying the details of star formation processes. As a prime example of the expected improvements, we compare in Figures 3 and 4 two 10 μm images of the BN/KL object in Orion taken with the ESO 3.6 m telescope and TIMMI2 with one taken with the Gemini North 8 m telescope with OSCIR, an "older brother" of CariCam, where the differences in spatial resolution are clear.

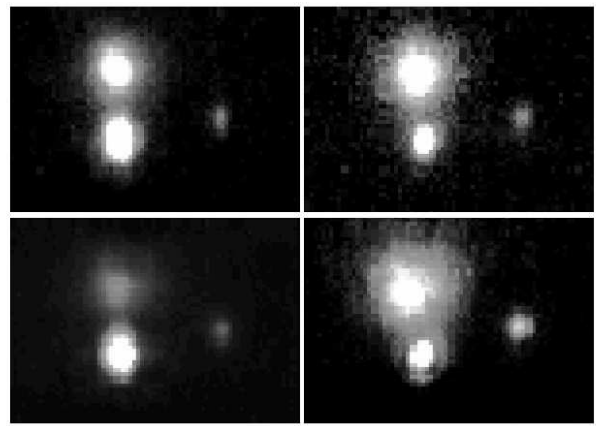

Fig. 1. Direct images of the massive star forming region NGC 7538 at 8.7 μm (upper left), 9.7 μm (upper right), 12.5 μm (lower left) and 18.9 μm (lower right) taken with CID, a mid-infrared camera attached to the 2.1m telescope at San Pedro Mártir. The field of view is 37×26 square arcsec. North is to the top, east to the left.

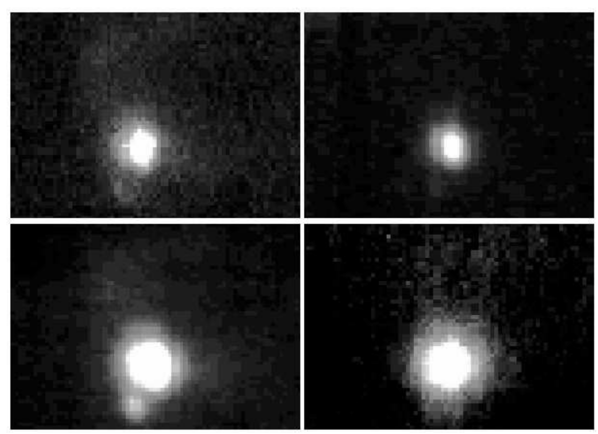

Fig. 2. Direct images of the young embedded cluster GM 24. The field of view is 37×26 square arcsec. North is to the top, east to the left.

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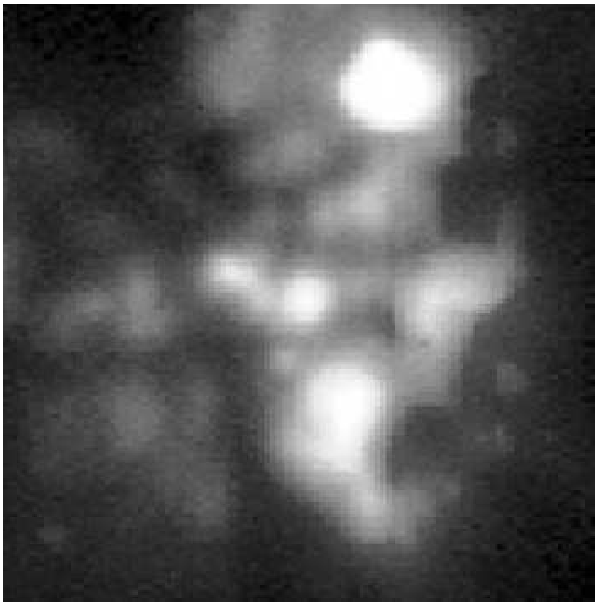

Fig. 3. Direct images of the BN/KL object in Orion taken with the ESO 3.6 m telescope and TIMMI2 at La Silla in N. The field of view is 22×23 square arcsec. North is to the top, east to the left.

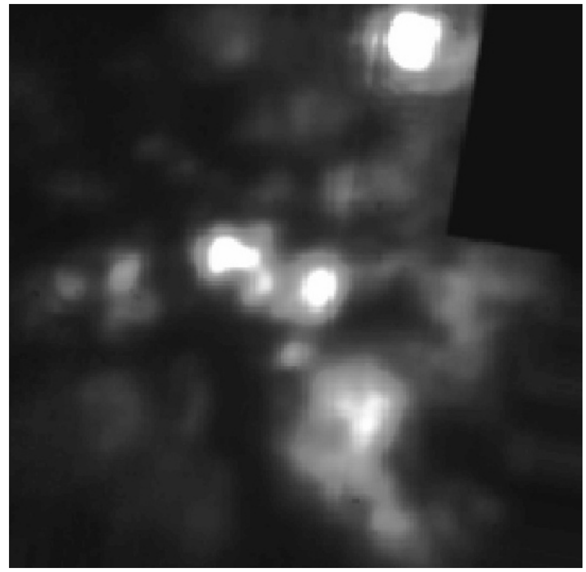

Fig. 4. Direct images of the BN/KL object in Orion taken with Gemini North 8 m telescope and OSCIR at 12.5 μm. The field of view is 22×18 square arcsec. North is to the top, east to the left.

TABLE 1

COMPARATIVE MID-IR IMAGING TABLE.

Telescope	SPM	GTC
Diameter (m)	2.1	10
f ratio	30	17
Instrument	CID-BIB	CanariCam
Detector	Boing	Raytheon
Size (sq. pix.)	128×128	320×240
Scale (arcsec/pix)	0.55	0.08
Field (sq. arcsec)	70×70	26×19
Sensitivity* (mJy)	10	0.04
Resolution† (arcsec)	1.2	0.25

*N/S = 1, 1 hour integration, N filter; †10 μm.