ADONIS unveils Ultra-compact H II Regions Morphology

B. STECKLUM, T.L. HAYWARD, M. FELDT AND M. LÖWE

Until recently, the spatial resolution of infrared observations did not permit us to decide whether a single star or a dense stellar cluster powers the Ultra-compact H II regions (UCHRs). From radio interferometric observations, there is evidence for the presence of binary or multiple systems of massive stars. Conventional near-infrared (NIR) imaging has great difficulty in resolving this issue. The typical distance of several kiloparsecs to UCHRs implies that very high angular resolution is required to resolve the star forming complex into single stars. Furthermore, the diffuse radiation (due to thermal emission, recombination lines, and scattering) from the UCHR enhances the background against which the embedded stars have to be detected.

The advent of ADONIS (Adaptive Optics Near Infrared System) at the 3.6m telescope now allows us to disclose UCHR morphology. As an example, we show the first results obtained for one such object in August 1995. The object (G45.45+0.06) is a cometary UCHR (Wood and Churchwell 1989) with a sharp ionisation front almost east-west aligned. A single star of spectral type O 7.5 can account for the observed radio flux. The detection of NH_3 emission indicates the presence of dense molecular gas (Churchwell et al. 1990). The kinematic distance to G45.5+0.06 is 6.6kpc.

The displayed image was obtained with the SHARP II camera (Hofmann et al. 1991) through the K' filter. The FWHM of the stellar profiles is 0.4 (during the observations the seeing monitor reported 1 seeing). This image reveals a cluster of stars, embedded in nebulosity, at the position of the UCHR. A chain of six stars almost coincides with the ionisation front. South of this arc, there is an object with a head-tail structure that does not have an obvious counterpart at radio wavelengths. Deconvolution of this image discloses that a jet like feature emerges from this star which is associated with H emission. The very good spatial resolution could be achieved because it was possible to close the loop on a bright star in the field.

Other targets of our UCHR sample share similar properties which supports the suggestion that the morphology of ionised gas and warm dust are often very different (Hayward et al. 1994). Our adaptive optics and MIR imaging suggests that UCHRs are very compact star clusters with members of different mass and evolutionary state.

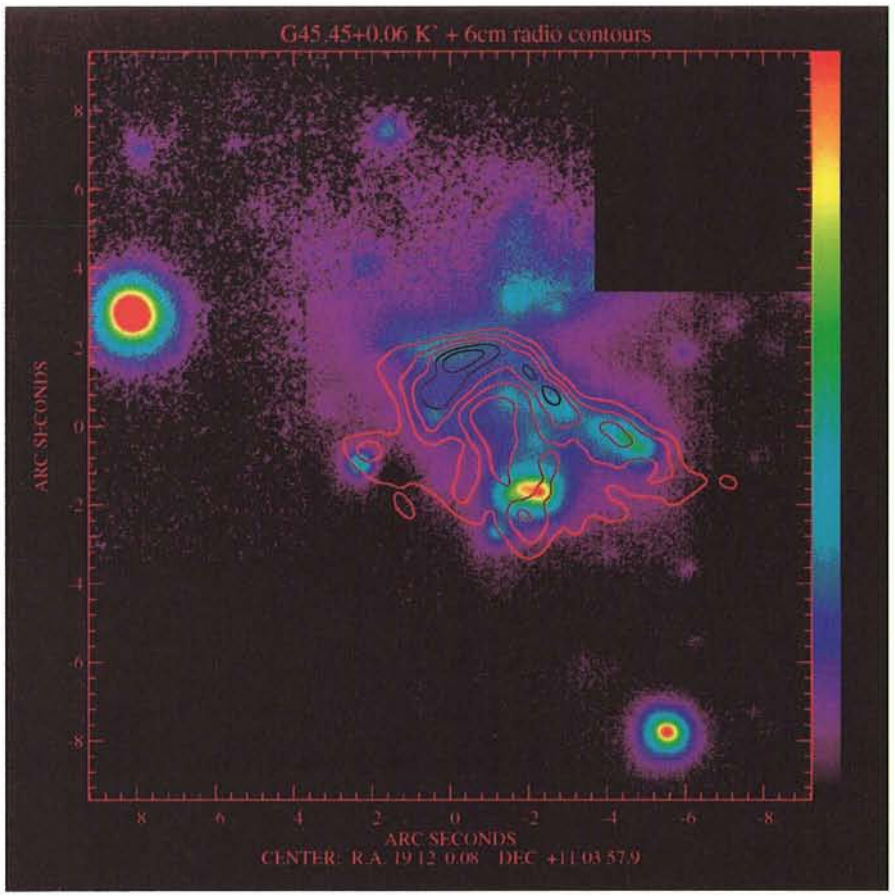

Figure 1.

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First Light on COMIC and SHARP II+

The ESO Adaptive Optics Group and F. LACOMBE, O. MARCO, F. EISENHAUER, and R. HOFMANN

COMIC and SHARP II+, the new high resolution cameras for the ESO adaptive optics system ADONIS, were commissioned in November 1995.

COMIC, developed by a group from Meudon Observatory, operates between 1 and 5μm but is optimized for the 3 to 5μm wavelength region. Two image scales are available: 35 mas/pixel (for J, H