Orion IRc2, Radiated by the Scattering of Emission from Source I

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After the discovery of BN and KL in the Orion Molec- ular Cloud, following infrared observations revealed that the KL nebula splits up into a number of compact " IRc " sources. The most luminous of these, IRc2, was thought to be the dominant energy source for the KL complex. Then, radio continuum point source " I " was found at 1″ south of IRc2 [1,2], and many radio observations have showed evidence of the existence of a young stellar object (YSO) embedded in source I. However, the infrared counterpart of source I have not detected at any wavelength, and the relationship of source I to IRc2 also still remains ambiguous. A direct linkage between IRc2 and source I was revealed with a detailed analysis of the SUBARU/COMICS mid-infrared data [3]. It also shows what IRc2 really is.

Figure 1 shows the mid-infrared images of the BN/KL region obtained with COMICS. The 9.7m optical depth and the 7.8 μm/12.4 μm color temperature distribution are presented in Figure 2. For IRc2, a morphological correlation is seen between the near-infrared image [4] and the optical depth distribution, and the optical depth peak roughly coincides with the 3.8 μm peak position, IRc2-A [4]. The color temperature peak coincides with the position of source I, and no dominant temperature peak is seen at IRc2.

The spectral energy distribution (SED) of IRc2 can be reproduced by a two-temperature model; a 400 K component and a 150 K component. It resembles the SED of a YSO, BN. However, it is plausible that no dominant energy source is embedded because there is no temperature peak in IRc2. It is surprising that the shorter wavelength emission exhibits its intensity peak at the local absorption peak position, when the 3.8 μm emission arises from self-luminous objects embedded in IRc2-A. In addition, considering the polarimetric results [4], the near-infrared emission from IRc2 is most likely to be scattered radiation. Whereas, the distribution of the 400K component resembles with that of near-infrared emission, and the mid-infrared polarimetric study of IRc2 shows the possibility of the mid-infrared emission to be scattered [5]. Therefore, the mid-infrared 400 K component emission from IRc2 is due to the same source with near-infrared emission. The near-infrared emission from IRc2 is reproduced by the scattering of radiation from source I, and so is the mid-infrared emission.

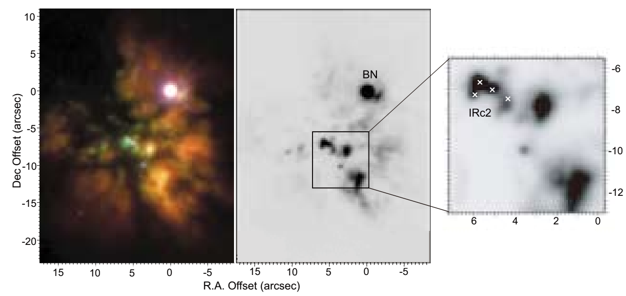

Figure 1: Mid-infrared images of the BN/KL region. Three-color composite image (8.7 μm(blue), 12.4 μm(green), 18.5 μm (red)) (left), 12.4 μm image (center), and the close-up around IRc2 (right). Coordinates are centered on the BN. Crosses show the positions of the 3.8 μm peaks [4].

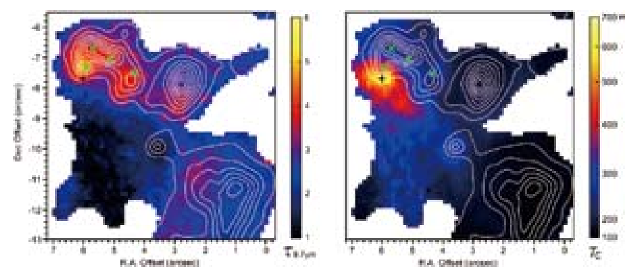

Figure 2: 9.7 μm color-coded optical depth image (left) and the 7.8 μm/12.4 μm color temperature distribution image (right) of the 7.5″ × 7.5″ field around IRc2. The overlaid contour shows the 12.4 μm surface brightness. Crosses show the positions of the 3.8 μm peaks [4], and a plus shows the position of source I.

References

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[2] Churchwell, E., et al.: 1987, *ApJ*, **321**, 516.
[3] Okumura, S., et al.: 2011, *PASJ*, **63**, 823.
[4] Dougados, C., et al.: 1993, *ApJ*, **406**, 112.
[5] Smith, C. H., et al.: 2000, *MNRAS*, **312**, 327.