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NEW INFRARED OBSERVATIONS OF IRS1, IRS3, AND THE ADJACENT NEBULA IN THE OMC-2 CLUSTER

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Recent reports show that near infrared reflection nebulae are often observed around embedded protostellar objects. We report new observations of the infrared cluster of low luminosity protostars in Orion Molecular Cloud 2 (OMC2). We have determined that the asymmetric distribution of the extended emission seen about IRS1 is in fact another infrared reflection nebula. Observations of near infrared polarimetry, photometry, and spectrophotometry were carried out at the NASA Infrared Telescope Facility October 1982 and January 1983.

Figure 1 (Gatley et al , 1974) gives an overview of the OMC-2 cluster at 2.2μm. This cluster is located ~12' northeast of the Trapezium cluster and covers a region of ~1'. Far infrared measurements (Thronson et al , 1978) give a total luminosity of 2100 $L_\odot$ for OMC-2. This discussion will be limited to the IRS1, IRS3 and adjacent nebula region. Observations of the other sources will be discussed elsewhere (Pendleton et al , in preparation). The relatively large spatial extent and high surface brightness of the OMC2/IRS1 region make it a good choice for modelling infrared reflection nebulae and dust grain properties.

Figure 2 and 3 provide contour maps of IRS1, IRS3, and the nebula at 2.2 and 3.8μm, respectively. The percentage polarization P_K and P_L, are superposed on the contour maps. The values are indicated by the length of the heavy line at each point. The position angle of the maximum electric vector is shown by the orientation of each line. The high degree of polarization seen in the extended emission region indicates that the observed infrared emission is produced by scattering by dust grains, making this region an infrared reflection nebula. The systematic variation of the position angles indicates that IRS1 is the illuminating source for the grains because in each case the position angles lie perpendicular to a line pointing towards IRS1.

The energy distributions show that the spectral shape is fairly constant throughout the nebula which indicates there is probably little internal extinction within this region. The nebula appears brighter than the illuminating source at the shorter wavelengths, as shown in Figure 4. Integrated surface brightness values show that the nebula is ~5 times brighter than IRS1 at K. From the energy distributions we can see IRS1 has a more pronounced ice band absorption feature at 3.1μm. These points suggest that there is more extinction along our direct line of sight to IRS1 than along a line from IRS1 to the scattering grains and then to us.

The distribution of the extended emission around IRS1 is similar to the reflection nebula seen in NGC 7538 (Werner et al. 1979). The asymmetric shapes of the two nebulae are similar and in each case there is excess extinction along our line of sight to the illuminating source. These observations reveal that asymmetries in the distribution of matter and radiation in regions of star formation are common phenomena which can be probed by infrared polarimetry.

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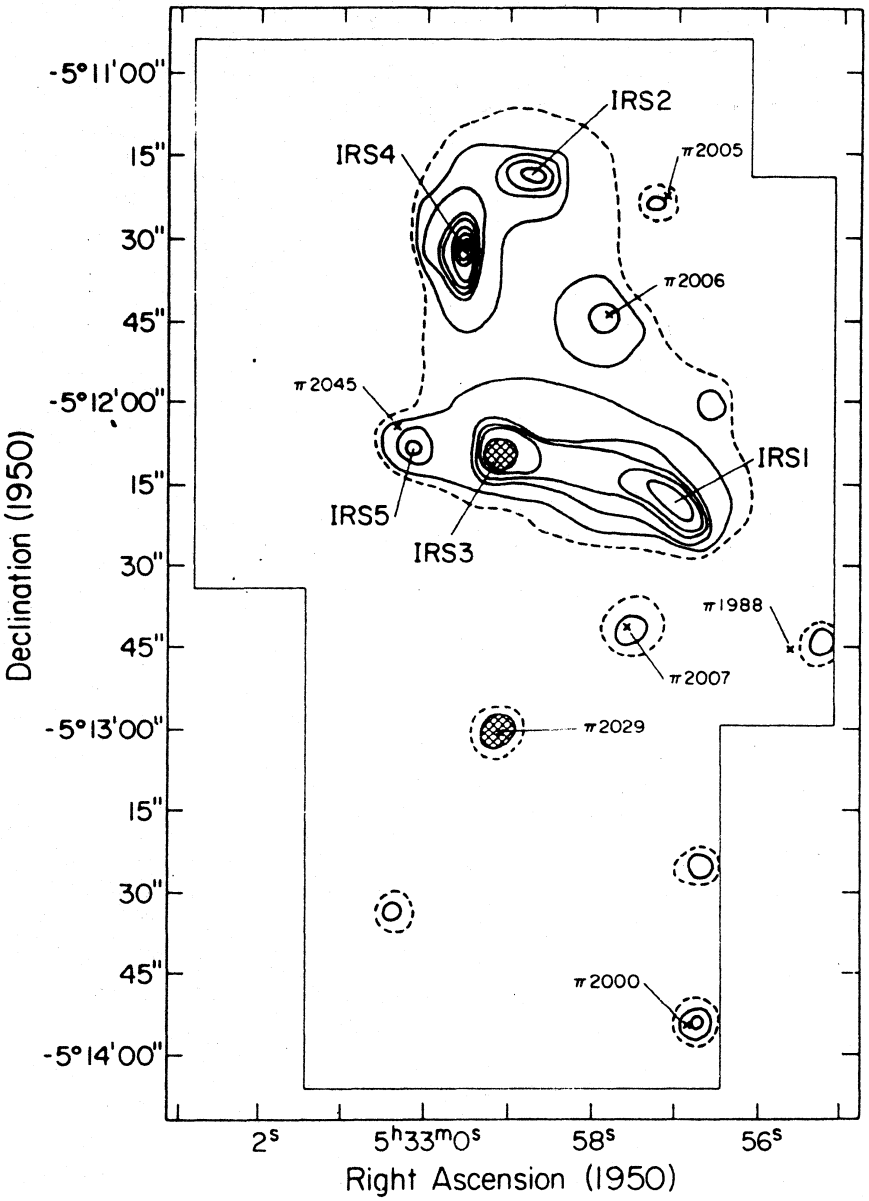

Figure 1. - A 2.2-μ map of OMC 2 made by taking successive right ascension scans with a resolution of 7".5 is shown. The difference in the contour levels is ∿0.02 fu in a 7".5 beam, and the dashed curve represents a half-contour interval. The five discrete infrared sources are labeled IRS 1 through IRS 5. IRS2 and IRS 3 are unresolved; the flux density of IRS 3 is 1.3 fu. The objects numbered with π refer to visible stars identified by Parenago (1954).

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Surface Brightness and Polarization Maps of OMC2-IRS1
IRS3 and Adjacent Nebula at 2.2 and 3.8μm

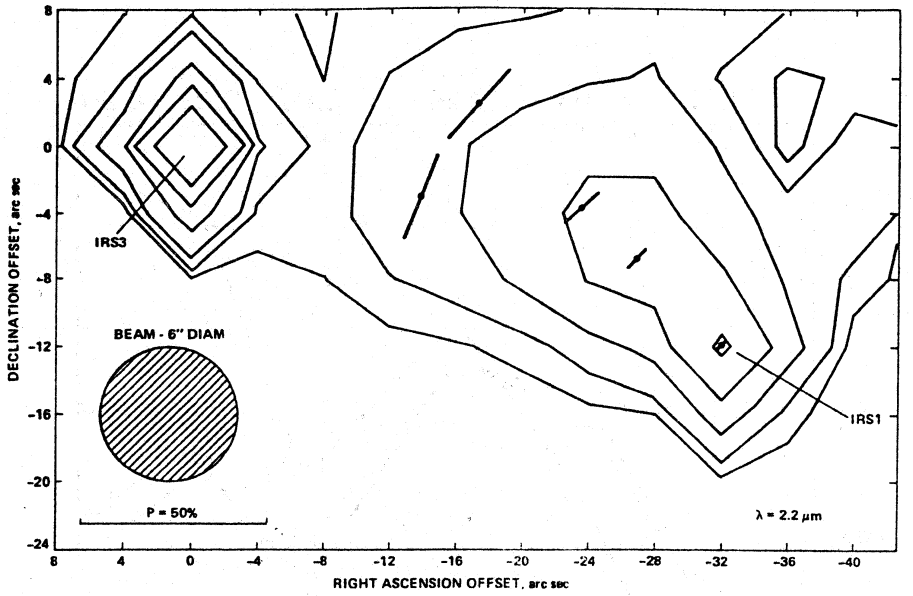

Figure 2. The 2.2μm map made using a 6" beam on a 4" grid. Contour intervals are 0.02, 0.03, 0.06, 0.13, 0.25, and 0.5 times the IRS3 peak value of 0.2 Jy into a 6" beam.

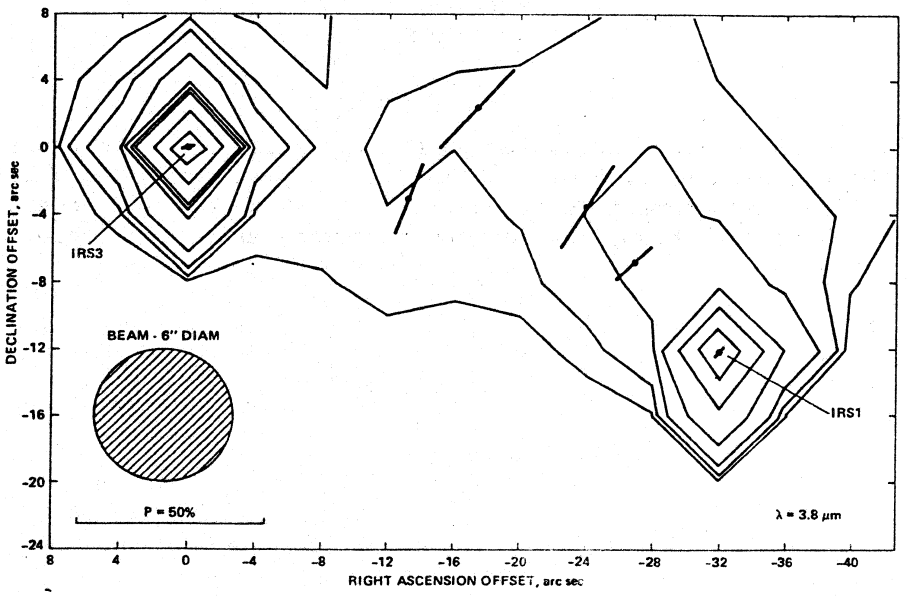

Figure 3. The 3.8μm map made using a 6" beam on a 4" grid. Contour intervals are 0.008, 0.02, 0.03, 0.06, 0.13, 0.25, and 0.5 times the IRS3 peak value of 3.5 Jy into a 6" beam.

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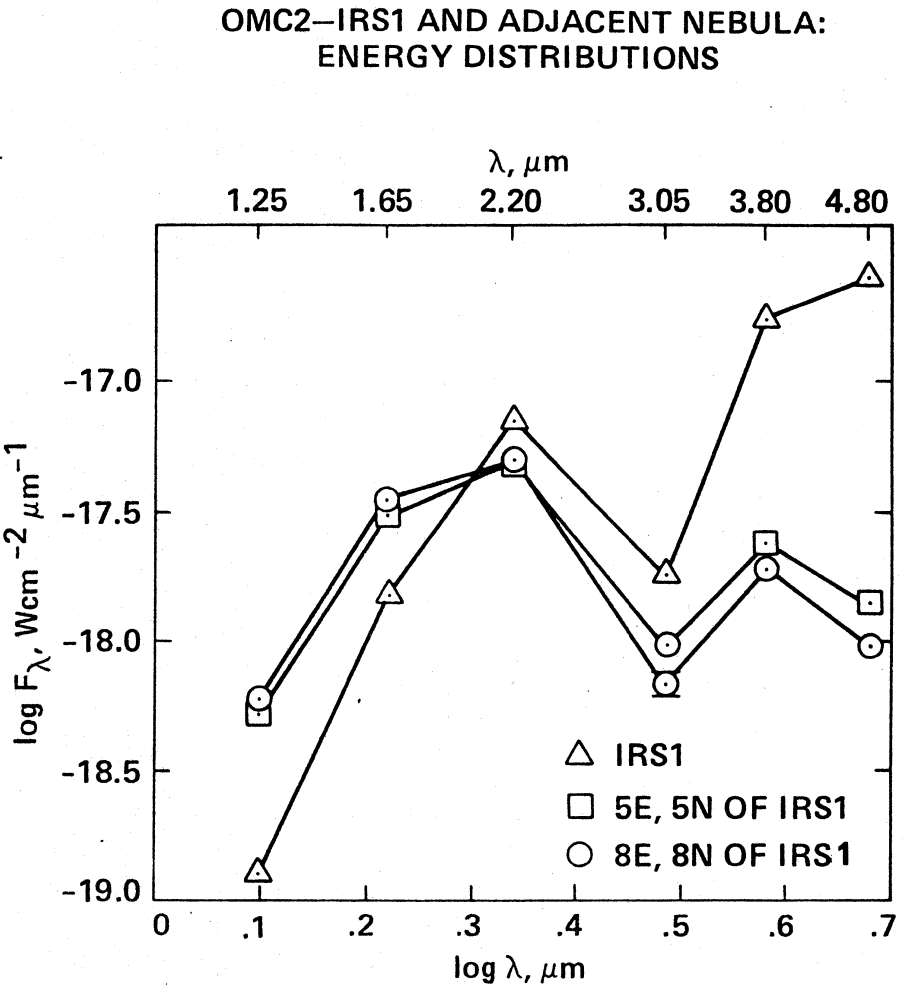

Figure 4. 1.25 to 4.8um broadband photometry energy distributions of IRS1, a position (5"E, 5"N) of IRS1, and a position (8"E, 8"N) of IRS1. IRS1 measurements were made using a 4" beam; all others were made using a 4" beam; all others were made using a 6" beam.

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