FINAL PROJECT REPORT

Complete ISOPHOT (C200) Maps of a Nearby Prototypical GMC: W3 (Spring) or NGC7538 (Fall)

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1. Brief background of proposed science:

We were originally awarded Priority 3 time (~60,000 sec) with ISO to obtain a complete ISOPHOT (PHT32-C200) map of a nearby prototypical giant molecular cloud (GMC). Following the FALL launch and revised estimates for the sensitivity of the ISOPHOT detectors, our program was modified to fit within the time constraints while still carrying out the main science requirements. The revised program requested long strip maps of our FALL target (NGC7538) using sequences of PHT37/38/39 observations with LWS observations of the brightest regions. The large number of AOTs required to cover each GMC required that our observations be spread over four separate proposals (PROP_01, PROP_02, PROP_03, PROP_04) which together comprise a single observing program. Our program was executed in early 1997; nearly 50,000 sec of data were obtained, including all of our requested ISOPHOT C200 observations. None of the LWS data were taken.

2. Scientific Results:

The primary project goal was the determination of the 135–200 μm luminosity of the NGC7538 GMC, with spatial resolution of ~5′. Our secondary goal was to determine the dust temperatures at each position where the photometry is sampled.

The ISOPHOT data, as suspected, indeed proved to be critical for understanding the luminosity sources within GMCs due to the fact that the bulk of the luminosity from GMCs is emitted at wavelengths between ~80-300 μm. Previous observations which we have obtained, both with IRAS all-sky maps at 12, 25, 60, and 100μm, and more recently with the Submillimeter Common User Bolometer Array (SCUBA) with the JCMT on Mauna Kea at wavelengths of 450μm and 850μm provide information only on the short and long wavelength tails of the true spectral energy distribution (SED). Accuartely calibrated ISOPHOT maps in the 100–200μm wavelength range allowed us to determine true distribution of luminosity sources within the cloud, and thus to reach a more detailed understanding of the global energy balance in both massive star-forming cores and the apparently more quiesent bulk of the GMC.

3. Publications resulting from this grant:

The results from our ISOPHOT observations were published as part of James Deane's PhD thesis.

The Spatial Distribution of Infrared Luminosity and Molecular Gas in Giant Molecular Clouds, Deane, J.R., Ph.D. Thesis, University of Hawaii, (August, 2000).