Protostars in the Molecular ISM: Probing their Structure with SCUBA at the JCMT

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Although dense, cold molecular clouds do not dominate the volume of the ISM, it is now understood that $\sim$ 90% of the mass of the ISM is in the form of molecular gas. These clouds are the subjects of intense study as it is within them that still denser cores form and then collapse, creating new stars. In the early 1980's, the IRAS satellite yielded striking images of the high densities of young stars hidden by dark dust inside these clouds. However, it is the submillimeter regime which is regarded as ideal for the study of protostellar candidates: sources which are actively accreting material through infall. Because these sources remain deeply embedded in their parent molecular cloud cores, they are virtually undetectable in the infra-red regime. Thus, single dish techniques favour the submillimeter, where their intensity is high and resolution is favorable to their detection. Nevertheless, until the commissioning of the SCUBA detector on the JCMT in 1997, only the brightest protostellar sources ($>$ 5 Jy) were detectable due to limited receiver sensitivity. SCUBA now permits us to observe sources 100 times fainter than previously possible. Thus, we can now image the regions surrounding young stars rather than just detect the brightest central peaks. I will present maps of sources in several star-forming regions obtained with SCUBA at 850 and 450 μm. An understanding of the physical structure of these objects may be within observational grasp, and this will finally provide rigorous tests of theoretical models, which differ primarily in their predictions about the density structure of uncollapsed objects. Models of the singular isothermal sphere predict that uncollapsed material will obey $\rho \propto r^{-2}$ (Shu 1977), while the more recent logotropic model of McLaughlin & Pudritz (1996) predicts $\rho \propto r^{-1}$. Both predict $\rho \propto r^{-1.5}$ once material has collapsed.