SUB-MILLIMETER SPECTRAL LINE OBSERVATIONS IN VERY DENSE REGIONS

Neal J. Evans II, Lee G. Mundy[1], John H. Davis, and Paul Vanden Bout[2], Department of Astronomy and Electrical Engineering Research Laboratory, The University of Texas at Austin, USA

Abstract
In a search for very high density ($n \gtrsim 10^7$ cm^{-3}) regions, the Millimeter Wave Observatory 5-m telescope was used to observe several sub-millimeter lines. The regions studied were Orion A, M17, S140, and NGC2024. The lines were CS(J=7-6), $H_2CO(J_{K-1K1}=5_{15}\rightarrow4_{14})$, and HCN(J=4-3). These data are combined with data at millimeter wavelengths to derive the volume density and the results are compared to those deduced from millimeter lines alone (Snell et al. 1984). In NGC2024, higher densities ($\gtrsim 10^7$ cm^{-3}) are clearly indicated by the sub-mm lines than were derived by Snell et al. In M17, derived densities are also higher, but uncertainties overlap the Snell et al. solutions. The range of densities derived from CS and HCN are consistent. The sub-millimeter lines of these species appear to be good probes of the highest densities present in regions of active star formation.
To improve our knowledge of these protostellar clumps, we plan further sub-millimeter observations, together with more detailed modeling. High spatial resolution in the lower transitions, using either large single dishes or interferometers, may allow us to resolve the clumps. Once a size, or size spectrum, can be determined, a measure of the mass, or mass spectrum, of the forming stars can be computed.
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[1]Currently at Owens Valley Radio Observatory, California Institute of Technology
[2]Currently at National Radio Astronomy Observatory.