The Small. Scale Structure of TMC1 -D

Probing on the Scale of 5000 AU with ('(S

T. B. H. Kuiper
W. D. Langer
R.-S. Peng
T. Velusamy

Jet Propulsion Laboratory
California Institute of Technology
Mail code 169-506
Pasadena, California, USA 91109

We report on the analysis of fully sampled high spatial (50 arcsec) and spectral (4 m s^{-1}) maps of the CCS 45 GHz transition of 'J' MC] core D, supplementing observations of the 22 GHz transition report.ed by Langer et al 1995. The objective was to study the structure of young dense gas prior to the formation of a protostellar core. The observations were made with a 34-m antenna of NASA's Deep Space Network at Goldstone, California. Figure 1 shows one of the velocity maps.

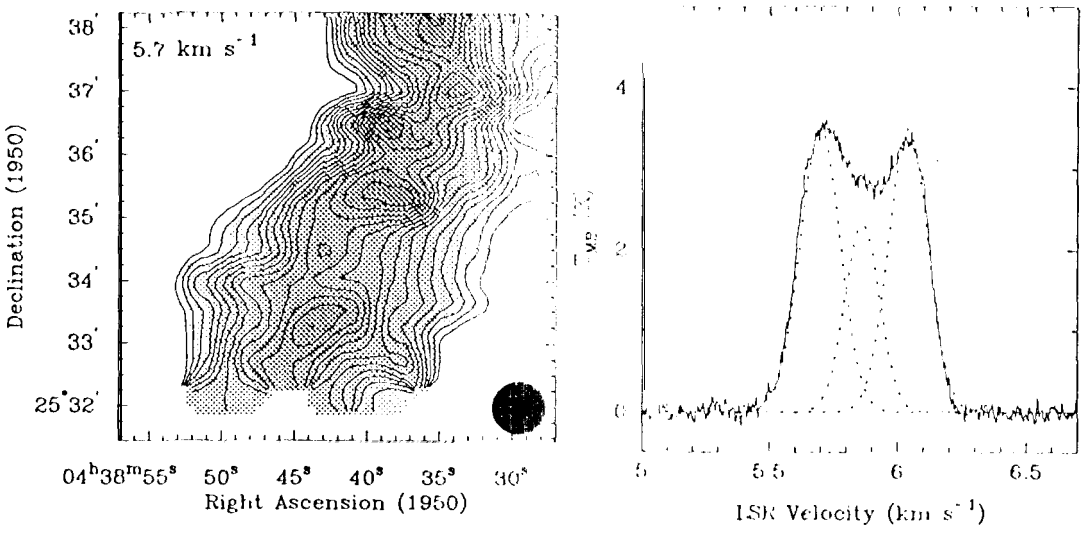

Figure 1. *Left: Channel map of one of the three principal velocity components present in TMC1 core D with seven clumps identified. Right: A representative spectrum showing the three principal velocity components.*

Nineteen clumps were identified in all three velocity components. Figure 2 shows that the new data (open triangles) are consistent with those of Benson & Myers (1989; hereafter BM) and show that the ΔV vs M relation extends down to at least 0.2 $M_\odot$ (with a corresponding size of about 0.035 pc or 6000 AU). The BM sources have linewidths which are about 0.4 of those predicted by the laws of Larson (1981) and Bally et al (1987). This suggests that there is a difference between the cold quiescent cores selected by BM and the average clouds in the Galaxy, of which the clouds in Orion (Tatematsu et al 1993) may be considered representative. The clumps in TMC1 core D appear to belong to the BM class of objects.

Although the clump statistics provided by only one of the TMC cores are marginal, Figure 3 suggests that the mass spectrum is comparable to that for clouds with masses > 5 $M_\odot$, which have a spectral index of around -1.6 (Tatematsu et al 1993) or -1.7 (Stutzki & Gusten 1990). Elsewhere we discuss evidence for the build-up of a protostellar core by the coagulation of such clumps (Kuiper et al 1996, Langer et al 1996).

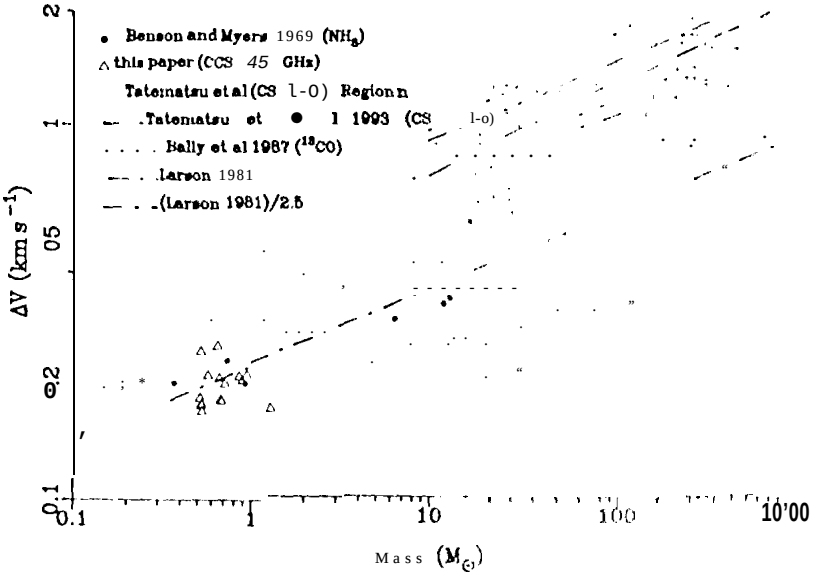

Figure 2. *Linewidths as a function of mass for the clumps in TMC1-D, compared with the quiescent clouds of Benson and Myers (1989) the clouds in Orion (Tatematsu et al 1993), and various empirical laws for typical Galactic clouds.*

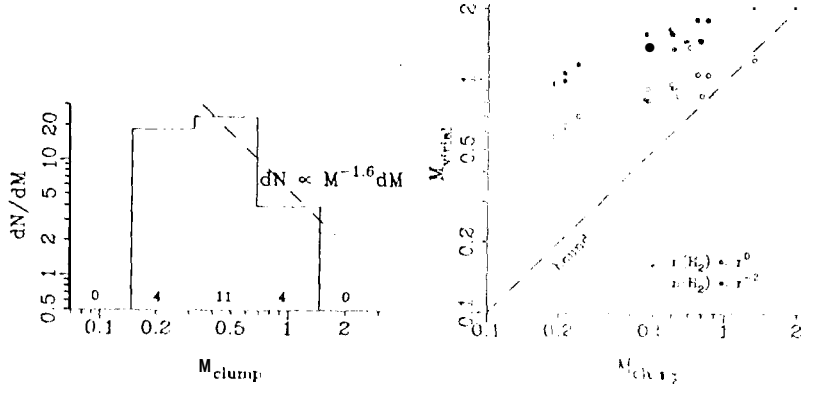

Figure 3. *Left: Clump mass spectrum, with the number of clumps in each bin shown along the bottom. The spectral index of 1.6 fits the Orion molecular cloud cores (Tatematsu et al 1993). Right: The virial mass computed for two different assumptions about the density distribution in the clumps, plotted vs estimated mass.*

References

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