[SF-03] Dynamical Timescale inferred from Chemical Distribution in TMC-1

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We present a study of a low-mass star-forming region, Taurus Molecular Cloud-1 (TMC-1), with Spitzer Space Telescope (infrared), MAMBO at IRAM 30m Telescope (dust continuum), FCRAO 14m Telescope (CS (J=2-1) and N2H+ (J=1-0)), and SRAO 6m telescope (C17O (J=2-1) and C18O (J=2-1)). The cold, dark cloud TMC-1 ridge is an ideal source for studying chemical evolution before star formation occurs. According to previous molecular line studies, the cyanopolyyne peak (southeast part of TMC-1) is chemically younger than the ammonia peak (northwest part) due to its lower density. However, in our study, the column density calculated from dust continuum emission, the best tracer of density, is similar at the cyanopolyyne peak and ammonia peak suggesting that the difference in density in two peaks does not cause the differentiation of chemical distributions. The cyanopolyyne peak shows smaller CO depletion compared to the ammonia peak supporting the fact that cyanopolyyne peak is chemically younger. Therefore, we suggest that the differentiated chemical distribution is explained not by difference of density but by dynamical timescale to reach the same density.

[SF-04] On the Internal Dynamics of Dense Starless Cores

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The radial density profile of starless cores exhibits a striking similarity to that of Bonnor-Ebert isothermal gas spheres: the observed profile has a flat top at the central region and declines, in the outskirt, with radial distance r as the power-law of exponent -2, $1/r^2$. The central flat top and the outskirt power-law behavior are two robust features that are seen from the cores even showing clear in-fall signatures. This has led many authors to trigger an in-fall motion in marginally unstable BE spheres and to examine whether the ensuing motion is consistent with the velocity profile deduced from those cores with observed in-fall signatures. We point out that the resulting velocity profile inside the BE spheres may not reach the level deduced from radio observations of various molecular lines. The model based on the BE sphere reproduces the observed density profile faithfully; however, the same BE model fails to deliver the velocity profile. We have also examined, with means of numerical simulations, what would have caused such a fast in-falling motion in the dense cores. To design the numerical experiments, we have made a full use of the virial theorem, in which both terms are kept of the moment of inertia and the external medium. The parameters of our model simulations include, among others, the initial density configuration, the triggering velocity of collapse, and the external pressure. From the simulation results, we divide the parameter space into dynamical domains of sub- and super-sonic collapses, oscillatory equilibrium, and expanding motion. This will help us to understand the internal dynamics of dense starless cores with in-fall signs.