[P-007/SF-1] How do the column density profiles of starless cores relate with their physical properties?

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The column density structures of starless dense cores probably have a close relation to the evolution of the cores and even star formation there and thus are important to understand the early stage of star formation. The density structures of the starless cores are known to usually follow that of the Bonnor-Ebert (BE) sphere, flat in the central region, a power-law decline ($\sim r^{-2}$) for the inner part of the core to the boundary, and a sudden drop at the boundary of the core. However, the BE sphere is only useful for describing inner part of the core, but not realistic for the edge of the core. We employed an asymptotic power law function by M. Tafalla et al. which may better describe density distribution of outer part of the core as well as that of inner part of the cores, to analyze the density profiles of the cores using the 850 micron SCUBA data of James Clerk Maxwell Telescope (JCMT) for 43 starless cores. Physical parameters related to the density structures such as a central density, density contrast, and the core size are derived and investigated how they are related to evolutionary properties of the cores such as a degree of infall asymmetry in molecular spectral lines.

[P-008/SF-2] Molecular Line Profiles from a Core Forming in a Turbulent Cloud

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We calculate the evolution of molecular line profiles of HCO+ and C18O toward a dense core that is forming inside a magnetized turbulent molecular cloud. Features of the profiles can be affected more significantly by coupled velocity and abundance structures in the outer region than those in the inner dense part of the core. The velocity structure at large radii is dominated by a turbulent flow nearby and accretion shocks onto the core, which resulting in the variation between inward and outward motions during the evolution of the core. The chemical abundance structure is significantly affected by the depletion of molecules in the central region with high density and low temperature. During the evolution of the core, the asymmetry of line profiles easily changes from blue to red, and vice versa. According to our study, the observed reversed (red) asymmetry toward some starless cores could be interpreted as an intrinsic result of outward motion in the outer region of a dense core, which is embedded in a turbulent environment and still grows in density at the center.