A Spitzer study of dense cores: constraining the earliest stages of low-mass star formation


The identification and detailed characterization of truly pre-stellar cores -- cores that are forming or will soon form stars -- is hindered by observational limitations at long wavelengths. These difficulties can be partially overcome by observing nearby, isolated star-forming regions. Further advances can be made by observing the shadows cast by these cores at Spitzer wavelengths. We present a sample of 14 starless cores observed with Spitzer/MIPS; analogous to IRDCs, our sample of starless cores were selected be viewed in absorption at 8 um, 24 um, and sometimes 70 um (highlighted in red). The observed absorption features, or shadows, are cast by the most embedded and dense core material at the heart of the clouds. Using a simple Jeans mass criterion we find that ~2/3 of the cores selected to have prominent 24 um shadows are collapsing or near collapse, a result that is supported by millimeter line observations (cores with observed blue asymmetries are underlined in blue). Of this subset at least half have indications of 70 micron shadows. All cores observed to produce absorption features at 70 micron are close to collapse. We conclude that 24 micron shadows, and even more so the 70 micron ones, are useful markers of cloud cores that are approaching collapse. We place detailed observational constraints on starless core masses, sizes, and geometries.

Results: dust law constraint and collapse candidate cores

Optical depth maps and CO survey: