The Evolution of Dust and Gas Structure in Star-Forming Clouds

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Abstract

We investigate the physical properties of dust and gas in molecular clouds using photometric and spectroscopic data and compare them to theoretical models of grain growth via coagulation and ice mantles. From these results in hand, we then examine the mass and temperature structures of the IRDC and its surrounding giant molecular cloud, especially comparing results derived from infrared extinction mapping and sub-mm dust emission observed with Herschel. The probability distribution functions (PDFs) of a set of scale region derived from these methods are in good agreement and show a peak at about 0.02 g cm⁻³.

Part 1 Column Density PDF of an IRDC and GMC

We consider the properties of a complete sample of 3632 gasless and cold star-forming [IRDC (SHCAR10+11)] sampled with Spitzer-IRAC imaging and the density tracers (DR2Herschel-PACS and Spitzer-RAT dudes, respectively. We find evidence of a flattening of the opacity law as mass surface density increases, consistent with theoretical models of grain growth via coagulation and ice mantles. From these results in hand, we then examine the mass and temperature structures of the IRDC and its surrounding giant molecular cloud, especially comparing results derived from infrared extinction mapping and sub-mm dust emission observed with Herschel. The probability distribution functions (PDFs) of a set of scale region derived from these methods are in good agreement and show a peak at about 0.02 g cm⁻³.

Part 2 Clump Evolution During Star Cluster Formation

We estimate the mass of the clumps that are studied in Part 2 by utilizing complete ATNF CO isotope survey data. In order to derive the column density from CO isotopes, we need to assume a constant CO and HCO⁺ abundance (Barnes et al. 2011). This assumption is justified by the fact that the CO and HCO⁺ abundance in the IRDCs is similar to that in the interstellar medium. The results presented here are based on a sample of IRDCs selected from the literature.

References


References