P111b ALMA Pilot Survey of 70 μm Dark, High-Mass Clumps

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In order to characterize the earliest stages of high-mass star formation and constrain theoretical models, we carried out a survey of prestellar, high-mass clump candidates at 1.3 mm with ALMA at 1.2". We made 10-pointings mosaics with the 12 m array, in addition to ACA and total power observations, to fully cover 12 (40 for the whole survey) cold, massive 70 μm dark clumps from the MALT90 survey. In addition to dust continuum emission, 10 molecular lines are included in the spectral setup. Here, we present here results on the dust continuum emission from the pilot survey.

Using the combined 12 and 7 m arrays, we find no high-mass prestellar cores (>30 $M_\odot$). Using dendrograms, we define 450 cores, from which ∼25% are indeed protostellar based on their association with emission from "warm" lines and molecular outflows. The core mass function has an index $\alpha \sim 1$, smaller than the standard initial mass funciton index of 1.35, indicating that at the very early stages, there is an excess of massive cores with respect to low-mass cores. Although there is no high-mass cores, ∼10% of cores have surface densities >1 gr cm^{-2}, suggested by some models as the necessary concentration of mass to allow the formation of high-mass stars. However, these cores needs to accrete a significant amount of mass to become massive and end up forming high-mass stars, as can occur based on recent ALMA observations (Contreras, Sanhueza et. al 2018).