P113b ALMA-IMF: ALMA Transforms our View of the Origin of Stellar Masses

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The study of massive protoclusters is a requirement to investigate the origin of the initial mass function (IMF) in the typical, extreme environments where high-mass stars are born.

Recent ALMA imaging of a young massive protocluster revealed the first definitive case of a core mass function (CMF) whose shape is different from the IMF. In contrast, the CMF shape in more evolved but still embedded massive clusters more closely resembles the IMF. This raises the intriguing possibility of CMF evolution with time. We aim to determine when and by which physical processes the CMF of massive protoclusters is reconciled with the canonical IMF.

We propose to investigate the CMF evolution of massive protoclusters with the 15 most massive pc^2 clouds at distances < 6 kpc. We focus on 1) investigating the distribution of 0.5-200 $M_\odot$ cores at 1 and 3 mm at the 2000 AU core size; 2) characterizing the core mass evolution through gas inflows toward individual cores and gas outflows driven by protostars; and 3) compare massive protocluster CMFs to the IMF and determine which variables (such as inflows, outflows, or forming filaments) might be correlated with CMF evolution toward the IMF shape.

Here we present the overall strategy and first early results on this ALMA large program.