P120a Statistical Analysis of the Core-scale Fragmentation in High-mass Star-forming Regions with ALMA

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Most high-mass stars ($> 8M_{\odot}$) form in binary systems. At least 3 mechanisms have been proposed to explain binary formation. However, it is still unclear due to the lack of sensitive and high-resolution observations to separate mechanisms. Fragmentation occurs on various spatial scales and is likely to be a hierarchical process. In this study, as a first step to understand the formation process of binary and multiple stellar systems in high-mass regime, we observed 30 high-mass star-forming regions to study the core-scale and disk-scale fragmentation. Here we present the preliminary work at the core-scale fragmentation. Thermal Jeans and turbulent Jeans fragmentation have been suggested to explain the observe separation of cores in high-mass star-forming regions. The statistical determination of the separation distribution between the cores can provide clues as to which fragmentation process is dominant. We have analyzed 230 GHz dust continuum observations of massive star-forming clumps obtained with ALMA on the spatial resolution of 500–1000 AU (0.3″). A structural analysis tool, Dendrogram, was used to identify 378 high-density cores in 22 regions. The separation distribution between each core was obtained by using the Minimum Spanning Tree technique. The results show that the closest separation between cores is roughly within the range of 600–20000 AU, with a pronounced peak at 3000–4000 AU. Preliminary results show that, this peak is of the order of the thermal Jeans length. Core scale fragmentation processes may be dominated by thermal gravitational instability rather than turbulence.