日本天文学会2026年秋季年会

Assessment of fragmentation mechanism of high-mass star-forming cores

〇Kongcheng Liu[1] Patricio Sanhueza[1] Qiu-yi Luo[2] (1.Department of Astronomy, School of Science, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan 2.Center for Astrophysics | Harvard & Smithsonian, 60 Garden Street, Cambridge, MA 02138, USA)

The Digging into the Interior of Hot Cores with ALMA (DIHCA) survey collected data for 30 massive star-forming regions in two ALMA configurations. The compact configuration is sensitive to cores of a few thousand au scales, and the extended configuration reveals how these cores fragment into condensations of a few hundred au scales. Applying the dendrogram packages, we identified 583 star-forming cores and calculated their physical properties, including mass, radius, column density, surface density, and volume density. Using the presence or absence of embedded condensation within the cores, we separated the cores into three populations: empty cores (E cores) without embedded condensations; cores holding single condensations (S cores), implying no further fragmentation; and cores holding multiple condensations (M cores).

By performing a Kolmogorov–Smirnov test, I found that for mass, three populations are statistically different from each other. For radius, M cores tend to have larger radii than S cores and E cores, but there are no statistical differences between the radii of S cores and E cores. For three kinds of densities, E cores tend to have smaller densities, and there are no significant differences between the densities of S cores and M cores. This result confirms our predictions and prior research that the fragmentation of multiple condensations is not contributed solely by Jeans' fragmentation. As the Jeans fragmentation predicts, higher density cores will fragment into multiple condensations easier, but we see no statistical differences between the densities of S cores and M cores.

Our next step consists of assessing the differences among these 3 populations when the turbulence is included. If turbulent fragmentation is important, we expect the M cores to have larger Mach numbers.