Core mass function, kinematic and massive star formation in protocluster G286.21+0.17 revealed by ALMA

- Yu Cheng

G286.21+0.17 is a massive protocluster at a distance of 2.5 kpc. We have mapped a field of 5.3'×5.3' towards G286 with the Atacama Large Millimeter/submillimeter Array(ALMA) in band 6(1.3mm) at a resolution of 1.0″ (2500AU). We measure the core mass function (CMF) with continuum emission in the central region, exploring various core detection algorithms, which give source number ranging from 60 to 125, depending on parameter selection. For masses M *leq* 1 Msol, the fiducial dendrogram-identified CMF can be fit with a power law of the form dN/dlogM $\propto$ Mα with $\alpha \sim 1.24 \pm 0.17$, consistent with the index of the Salpeter stellar initial mass function of 1.35. Deuterated species N2D+ is detected in about one third of the core sample and all these cores are distributed in the outer region of the cluster, possibly tracing new generation star formation triggered by feedback. The velocity dispersion of different cores, measured with N2D+ and C18O, is about 1.52km/s, larger than that required for virial equilibrium ($\sim$1.04km/s). The molecular outflow in this region is dominated by a large scale ($\sim$0.5pc) wide- angle bipolar component, which is driven by the central brightest core of G286. Interestingly, extra uv coverage during an antenna configuration transition in observation has given us a glimpse into small substructures of this massive core ($\sim$65Msun). We managed to map it with a large dynamic range of resolutions from down to 0.05″, corresponding to 125AU in linear resolution. The core exhibits clear hierarchical fragmentation at different scales. In the 0.12″ resolution map, the core is clearly resolved into a binary system separated by about 600AU, along with multiple weak condensations nearby. With the highest resolution available ($\sim$0.05″), one of the binary component exhibits even further fragmentation at the scale of 150AU. Our observation reveals e a multiple protostellar system of YSOs at the center of a protocluster with at least intermediate mass, and potentially able to form massive stars. We discuss the implications of these results for star and star cluster formation theories.

Clusters