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The Formation of Low-mass Multiple Systems in1 High-mass Cluster-forming Regions

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Most stars form in multiple systems, profoundly influencing numerous astronomical phenomena intrinsically linked to multiplicity. However, our knowledge of the process by which multiple stellar systems form remains incomplete and is biased toward nearby molecular clouds forming only low-mass stars, which do not represent the typical stellar population of the Galaxy. Most stars form within dense cores in clusters alongside high-mass stars, as the Sun likely did. Here, we report deep ALMA dust continuum observations at 160 au spatial resolution, revealing an unprecedented 67 low-mass multiple systems embedded in 23 high-mass cluster-forming regions. The companion separation distribution exhibits a distinct peak at ~1000 au, in contrast to the 4000 au peak observed in nearby low-mass regions, likely resulting from core fragmentation. We demonstrate that the environment in which multiple systems form affects the characteristic initial fragmentation scale, with multiples formed in high-mass cluster-forming regions having separations more similar to those found in main-sequence stars. In addition, the multiplicity fraction remains constant as stellar density increases.

Presenter: Ms LUO, Qiuyi (Shanghai Astronomical Observatory, CAS)

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