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Formation of high-mass multiple-star systems: early migration and stellar mergers

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Massive stars, those several times the mass of the Sun, are typically found in multiple-star systems. A key unresolved question in astronomy is how close binary-star systems, those with separations ⊠ 1 au, form. Because protostellar objects are generally too extended to initially fit into these tight configurations, migration is considered to play an essential in their formation. In this talk, we explore the formation and migration of massive stars at solar metallicity using a simulation that begins with a 6300 solar mass cloud. This simulation achieves spatial and mass resolutions of approximately 1 au and 0.01 solar masses, respectively, while also incorporating feedback processes. Our results indicate that stars more massive than 2 solar masses predominantly assemble in binary- or triple-star configurations, in agreement with observations. In most of these systems, the inner binary hardens by 1–3 orders of magnitude during the first 2 Myr, which represents the total duration of the simulation. Notably, disks are nearly ubiquitous during the hardening phase. Finally, stars more massive than 2 solar masses may undergo multiple stellar merger events during their evolution – up to four for the most massive systems. This suggests a tentative correlation between mass, multiplicity, and merger events in high-mass stars.

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