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Stars that Fission[1] REBECKA TUMBLIN, JAMES IMAMURA, University of Oregon, KATHRYN HADLEY, Oregon State University, WILLIAM DUMAS, ERIK KEEVER, University of Oregon — Binary stars are estimated to comprise upwards of half of all main-sequence stars, yet very little is known about their formation process. Binary stars are thought to form via four possible scenarios: fission, capture, cloud fragmentation, and disk fragmentation. In the Fission scenario, as the protostar contracts toward the main-sequence, rotational energy becomes increasingly important. If the star spin-up reaches a break-up velocity, a short-period close binary pair could form. Based on previous nonlinear studies of solitary differentially rotating polytropic stars, it is generally believed that the fission process can not form binary pairs. We modeled the nonlinear evolution of $3D$ differentially rotating polytropic stars surrounded by inviscid polytropic disks and found that, in some cases, rapidly rotating stars unstable to the bar-mode instability fission in the presence of a circumstellar disk. We find that circumstellar material tends to reduce the inward force of gravity, thereby allowing the rotational energy to dominate the system. In systems with sufficient flattening, an $m = 2$ bar mode develops, and the system develops two central objects which rotate on independent axes while orbiting a common center of mass.

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