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The effect of radiative cooling on clump formation in self-gravitating disks WILLIAM DUMAS, JIM IMAMURA, University of Oregon, KATHRYN HADLEY, Oregon State University, REBECKA TUMBLIN, ERIK KEEVER, University of Oregon — One pathway to the formation of multiple stellar systems is the fragmentation of a rotationally supported disk formed after initial gravitational collapse of a rotating interstellar cloud. Recent observations of the system Barnard 5 (Pineda et al. 2015) consisting of a protostar and four condensations, and the triple protostar system L1448 IRS3B (Tobin et al. 2016) point to the important role that gravitational instability likely plays in the formation of multiple stellar objects. We investigate the effect of radiative cooling on massive self-gravitating disks surrounding a central stellar point mass ranging from 0.1 to 0.4 of the disk mass. Linear analysis shows that in the absence of cooling the growth of instability is dominated by modes related to the Jeans instability named J-modes (Hadley et al. 2014). Calculations are performed using the hydrodynamics code CHYMERA. Equilibrium models are evolved using a parameterized cooling function with cooling rates that lead to constant cooling time scales from 0.5 to 10 times the orbital period at density maximum in the disk. In contrast to most published studies of fragmentation of disks into clumps, we find that fragmentation is found even for the weakly cooled models. Models with higher star to disk mass ratio develop more clumps.

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