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**Phase Transitions and Metastability in Self-Propelled Particle systems.** AJINKYA KULKARNI, SUMESH THAMPI, MAHESH PANCHAGNULA, Indian Inst of Tech-Madras — Ordered motion of self-propelling microorganisms produce interesting patterns. The objective of this study is to investigate the nature of the transition from disorganized thermal-like motion to organized vortical motion, and the resulting metastability in systems of self-propelled particles. A modified version of the Standard Vicsek Model has been used, where the particles are modeled as soft disks with finite mass, confined in a circular domain. We observe multiple phases as the local co-ordination coefficient is varied. We analyze the nature of transitions by calculating Binder Cumulants of the order parameters. An occurrence of metastability is investigated in the hysteretic region. The switching between the steady states of the system in the hysteretic region has been triggered via artificial nucleation of randomly picked particles spanning the entire domain. In addition, the effect of domain size on the nature of the phase transitions has been studied. Finally the motivation for these phase transitions has been explained via thrust generation ability and the geometry of the confinement.

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