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Collective dynamics of non-transitively coupled active oscillators ARGHYADIP MUKHERJEE, Indian Institute of Science, PAWAN NANDAKISHORE, SHASHI THUTUPALLI, National Center for Biological Sciences-TIFR, NCBS THEORY TEAM — Non-transitive relations between coupled nonequilibrium units are a central feature of many natural and engineered systems ranging from interacting organismal populations to cells in a tissue. As a generalised abstraction for such interactions, we consider a system comprised of units whose internal degrees of freedom are intertwined to their orientation. Specifically, the individual elements are amplitude-phase oscillators with an orientation which can interact with the oscillation phase. An emergent mean field couples their dynamics causing the mesoscopic orientational order of the oscillators to affect their phase dynamics and vice versa. Here, we report on theoretical and experimental results on the emergent dynamics in a system built from mechanical oscillators. We show that the phase space consists of a rich variety of behaviors ranging from orientationally ordered synchronized states, traveling waves and even states with partial ordering. We briefly discuss the biological context for our abstract physical models.

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