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An infinite-period phase transition versus nucleation in a stochastic model of collective oscillations

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A lattice model of three-state stochastic phase-coupled oscillators has been shown by Wood et al (2006 Phys. Rev. Lett. 96 145701) to exhibit a phase transition at a critical value of the coupling parameter, leading to stable global oscillations. We show that, in the complete graph version of the model, upon further increase in the coupling, the average frequency of collective oscillations decreases until an infinite-period (IP) phase transition occurs, at which point collective oscillations cease. Above this second critical point, a macroscopic fraction of the oscillators spend most of the time in one of the three states, yielding a prototypical nonequilibrium example (without an equilibrium counterpart) in which discrete rotational (C_3) symmetry is spontaneously broken, in the absence of any absorbing state. Simulation results and nucleation arguments strongly suggest that the IP phase transition does not occur on finite-dimensional lattices with short-range interactions.

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