Controlling attainment of spontaneous ordering in many-body interacting systems

Shamik Gupta
Tata Institute of Fundamental Research, Mumbai, India

Consider a thermodynamic system that shows a phase transition between an ordered and a disordered phase. The question we ask is: in the parameter regime in which the system exhibits a disordered phase, can we induce order by manoeuvring the system (i) either by forcefully establishing order in a small subset of the total number of degrees of freedom,(ii) or, by shuffling the inherent properties of the individual system constituents among themselves ? Within the ambit of the Kuramoto model, a paradigmatic nonlinear dynamical many-body system, we discuss both analytical and experimental results on how schemes (i) and (ii) lead to a rich dynamics and, most remarkably, establishing of macroscopic order even in parameter regimes in which the bare dynamics does not support any such ordering. An implication of our results is the proposition of an efficient mechanism for controlling attainment of ordering in many-body interacting systems.