

Out-of-equilibrium physics in spontaneous synchronization

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Spontaneous synchronization is a cooperative phenomenon common in nature which makes oscillators of different frequencies, if strongly coupled, operate together with a single common frequency. Such cooperative effects occur in physical and biological systems over length and time scales of several orders of magnitude. Examples: are flashing of fireflies, rhythmic applause in a concert hall, animal flocking behavior, electrical power-grids, etc. The most celebrated model of synchronization is the Kuramoto model, introduced in 1975, which is simple enough to allow quite a detailed analytical treatment, at the same time capturing several features of realistic systems. After discussing the general dynamical and statistical features of synchronization, I will discuss its out-of-equilibrium physical aspects when uncorrelated Langevin noise is added to the model.