Novel Synchronization Phenomena in Coupled Noisy Oscillators: Common-Noise-Induced Synchronization and Reentrant Transition

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In this talk, I will present our recent study on synchronization in coupled noisy oscillators. The talk consists of two issues: (i) common-noise-induced synchronization in a large population of nonidentical oscillators [1] and (ii) reentrant synchronization transition in coupled noisy oscillators [2]. In (i), we consider the Kuramoto model subjected to a common noise. We employ the Ott-Antonsen ansatz, a recent breakthrough in the study of the Kuramoto model, and analytically show that a critical coupling strength for the synchronization transition decreases with noise strength. Thus, common noise promotes synchronization. In (ii), we consider two coupled oscillators subjected to independent noise. It is well known that synchronization occurs when coupling is strong enough compared to the noise strength. Here, we show that even stronger coupling generally destroys synchronization due to the interplay between coupling and noise. Because this transition occurs for strong coupling, the Kuramoto type phase oscillator model, where coupling is given by a function of phase differences, can not reproduce this behavior. We thus employ the Winfree type phase oscillator model [3,4] for its analysis.

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2. H. Kobayashi, H. Kori (in preparation).
3. A.T. Winfree: *Biological rhythms and the behavior of populations of coupled oscillators*, Journal of Theoretical Biology **16**, 15 (1967).
4. J.T. Ariaratnam, S.H. Strogatz: *Phase diagram for the Winfree model of coupled nonlinear oscillators*, Physical Review Letters **86**, 4278 (2001).