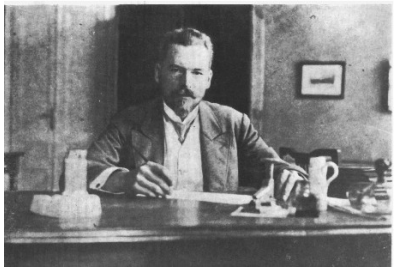

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Non-equilibrium criticality in the synchronization of lattices of self-sustained oscillators

Sunday, 24 September 2023 17:05 (25 minutes)

The study of synchronous dynamics has traditionally focused on the identification of threshold parameter values for the transition to synchronization, and on the nature of such transition. The dynamical process whereby systems of self-sustained oscillators synchronize, however, has been much less studied. While one might reasonably expect such a process to be strongly system-dependent, in Ref. [1] we have recently shown that indeed it contains some robust universal features, which originate in a mathematical connection existing between synchronization models and the equations of surface growth processes. By means of a detailed numerical study of one-dimensional systems of phase oscillators and several limit-cycle oscillators, we provide evidence indicating that the synchronization process in these systems is characterized by forms of generic scale invariance associated with the universality classes of kinetically rough interfaces with columnar disorder. Moreover, the phase fluctuations around the average growth follow a ubiquitous Tracy-Widom probability distribution, which is frequently associated with the Kardar-Parisi-Zhang nonlinearity. Synchronization and surface growth processes thus seem to be much more closely related than previously anticipated.
[1] R. Gutiérrez and R. Cuerno, Phys. Rev. Research 5, 023047 (2023).

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