Drexel Analysis Seminar

May 24, 2013

3-3:50 PM, Korman 245

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Title: Chimera states for repulsively coupled phase oscillators.

Abstract: Chimera states represent remarkable spatio-temporal patterns of phase-locked oscillators coexisting with irregular chaotically drifting ones. Surprisingly, they develop in arrays of coupled identical oscillators without any asymmetry - as a manifestation of internal nonlinear nature of dynamical networks.

We discuss the appearance of the chimera states for repulsively coupled phase oscillators of Kuramoto–Sakaguchi type, i.e., when the phase lag parameter $\alpha > \pi/2$ and hence, the network coupling works against synchronization. We find that chimeras exist in a wide domain of the parameter space as a cascade of the states with increasing number of regions of irregularity, so-called chimeras' heads.

We also study the origin of the chimera states and show that they grow from the so-called multi-twisted states. Three typical scenarios for the chimera birth are reported: 1) via saddle-node bifurcation on an invariant curve; 2) via blue-sky catastrophe when two periodic orbits, stable and saddle, approach each other and annihilate eventually in a saddle-node bifurcation; and 3) via homoclinic transition, when the unstable manifold of a saddle comes back crossing the stable manifold giving rise to homoclinic complexity.