# Partial Differential Equations and Applied Mathematics Seminar

## Synchronization across hierarchical networks

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Many oscillating biological and physical systems, ranging from firing neurons, to swimming nematodes, to power-grids, exhibit spontaneous emergent behaviors resulting from nonlinear coupling. The Kuramoto model is a canonical model used to understand and predict such synchronization. In this talk we highlight some recent advances in the study of Kuramoto oscillators on networks with hierarchical structures. In the first part of the talk, we will discuss the role of higher-order coupling on simplicial complexes. Using linear stability analysis, we show that there are unstable states which can be stabilized only by combining several interaction terms simultaneously. In the second part of the talk, we present a framework for studying synchronization on self-similar fractal domains. Using a combination of techniques from topology and calculus of variations, we classify and construct stable equilibria of Kuramoto oscillators on fractals. This latter work is in collaboration with Georgi Medvedev.

**Friday, October 9th, 2026 at 11:00 AM**
*Korman Center, Room 245*

`www.math.drexel.edu/~cf823/pde_seminar/index.html`
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