SYNERGISTIC EPIDEMICS: MULTISTABILITY AND DYNAMIC HIGHER-ORDER INTERACTIONS ON NETWORKS

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Spreading processes in real-world systems—whether diseases, behaviors, or innovations—often involve nonlinear dynamics shaped by local context and reinforcement. In this talk, we present our work on synergistic epidemics, where transmission depends on a node's neighborhood state, introducing dynamic higher-order interactions into classical models. Using analytical and numerical approaches across diverse topologies—from lattices to heterogeneous real networks—we uncover rich dynamics: multistability, explosive contagion, and bifurcations up to codimension 4. Notably, synergy and network heterogeneity interact in unexpected ways: low-degree nodes can sustain endemicity, while hubs may trigger abrupt outbreaks—reversing expectations from non-synergistic models. Our results deepen the theoretical understanding of spreading dynamics and inform control strategies that account for nonlinear, context-sensitive effects.

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