Mathematical Biology Seminar

Monday, October 30, 2023

3 pm MDT - 457 CAB (in person)

Join Zoom Meeting

https://ualberta-ca.zoom.us/j/98497695684?pwd=SG5pcUVRS0xucW5xd0xBTm1VVCtEUT09

Meeting ID: 984 9769 5684
Passcode: 32123

Chunyi Gai

Department of Mathematics

University of British Columbia

The Nucleation-Annihilation Behavior for Hotspot Patterns of Urban Crime with Police Deployment

A hybrid asymptotic-numerical approach is developed to study hotspot patterns for a three-component 1-D reaction-diffusion (RD) system that models urban crime with police intervention. Our analysis is focused on a scaling regime where there are two distinct competing mechanisms for producing complex spatio-temporal dynamics of hotspot patterns; a mechanism to annihilate hotspots and a further mechanism to nucleate new hotspots from a quiescent background. The nucleation threshold for steady-state hotspot patterns arises from a saddle-node bifurcation point of hotspot equilibria. By deriving a new analytical expression for a hotspot profile, combined with a local normal form analysis, our asymptotic analysis provides a rather accurate prediction of this nucleation threshold. From a numerical computation of the spectrum of the linearization around a two-boundary hotspot pattern, we have identified instability parameter thresholds for both zero eigenvalue crossings and Hopf bifurcations.

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