



THE UNIVERSITY OF  
**CHICAGO**

THE COMMITTEE ON  
COMPUTATIONAL AND  
APPLIED MATHEMATICS

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## Computational and Applied Mathematics Colloquium

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**Joint colloquium with the Department of Statistics**

**MONTIE AVERY**

Department of Mathematics and Statistics  
Boston University

Universal spreading into unstable states

THURSDAY, January 11, 2024, at 4:00PM  
Jones 303, 5747 South Ellis Ave. Chicago, IL 60637

### ABSTRACT

The emergence of complex spatial structures in physical systems often occurs after a simpler background state becomes unstable. Localized fluctuations then grow and spread into the unstable state, forming an invasion front which propagates with a fixed speed and selects a new stable state in its wake. The mathematical study of these invasion processes has historically been limited to systems with restrictive monotonicity properties (in PDE terms, a comparison principle). Such systems, however, inherently cannot describe the formation of complex spatiotemporal patterns, which is of particular interest both in nature and in manufacturing applications. On the other hand, formal calculations in the physics literature have long outlined a universal approach for predicting invasion speeds and associated selected states, valid for systems which do not obey comparison principles and instead exhibit complex spatiotemporal dynamics. This prediction scheme is often referred to as the marginal stability conjecture. In this talk, I will discuss the first proof of the marginal stability conjecture and explore how this can be used to make concrete predictions for physical systems.

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