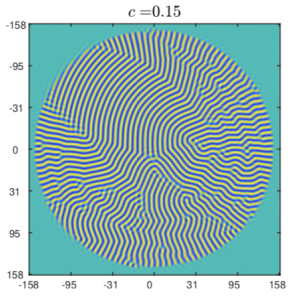
REU: Complex Systems and Pattern Formation

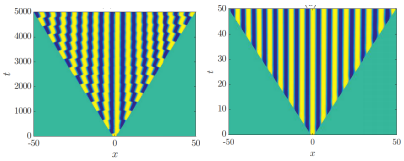
Summer 2020: June 11 – July 22

Pattern formation is the study of mechanisms that lead to the appearance of simple or complex spatial-temporal patterns. It is motivated in part by the observation of strikingly similar patterns in apparently unrelated physical systems. In this REU, participants will conduct mathematical research in the area of pattern formation from a viewpoint of dynamical systems and differential equations, using both analytical and computational tools. No previous research experience is required.



Growing stripes, with and without wrinkles*

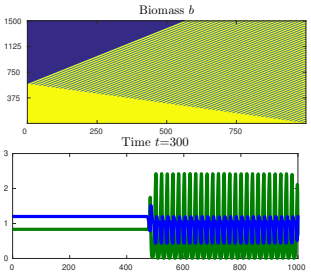
M. Avery†, R. Goh‡, O. Goodloe§, A. Milewski¶, and A. Scheel‖



PHYSICAL REVIEW E **94**, 022219 (2016)

Universal wave-number selection laws in apical growth

Ryan Goh,[1] Rajendra Beekie,[1] Daniel Matthias,[2] Joshua Nunley,[3] and Arnd Scheel[1]



Advection and autocatalysis as organizing principles for banded vegetation patterns

Richard Samuelson [1], Zachary Singer [2], Jasper Weinburd [3], Arnd Scheel [3]
[1] *Trinity College, , USA*
[2] *Carnegie Mellon, , USA*
[3] *University of Minnesota, School of Mathematics, 206 Church St. S.E., Minneapolis, MN 55455, USA*

Abstract

We motivate and analyze a simple model for the formation of banded vegetation patterns. The model incorporates a minimal number of ingredients for vegetation growth in semi-arid landscapes. It allows for comprehensive analysis and sheds new light onto phenomena such as the migration of vegetation bands, their alignment with contour lines, and the interplay between their upper and lower edges.

Program Description:

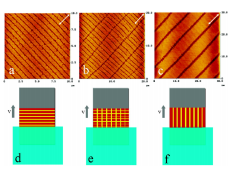
- Six weeks (June 11 – July 22, 2020) at the U of Minnesota Twin Cities, Minneapolis campus.
- Use mathematical analysis and numerical simulations to gain insight into dynamics of patterns
- Projects will be guided and can be tailored to student interest
- Students will be mentored by Professor Arnd Scheel, as well as graduate students Sally Jankovic, Olivia Cannon, and Montie Avery (pictured below, left to right)

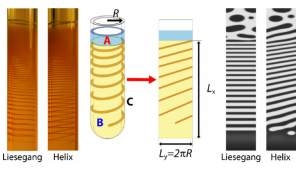
Participants will receive a stipend of $3,000 and up to $2,000 for travel and living expenses

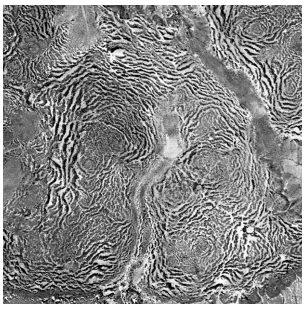
Successful Applicants:

- Need no prior research experience
- Should have had a course in differential equations or dynamical systems
- May have higher-level coursework
- May have familiarity with or an interest in learning Mathematica or Matlab
- Must be US citizens or permanent residents
- Must not complete their undergraduate degree before summer 2020

Women and minority students are especially encouraged to apply







Contact: Arnd Scheel (scheel@umn.edu). Program sponsored by the NSF.

Application Deadline: Febrary 7, 2020. For more information about past projects, and **to apply**, go to:

`http://www.math.umn.edu/~scheel/reu/reu-opportunities.html`