

# 8th Annual Davis Math Conference

## Schedule and Abstracts

Organizers: Kirill Paramonov and Jingyang Shu

January 11th 2018

### 1 Schedule

Breakfast	9:00 AM	
Introductory Remarks	9:25 AM	Jordan Snyder
Partial Differential Equations	9:30 AM	Joseph Biello
Mathematical Physics	10:05 AM	John Murray
TBA	10:30 AM	TBA
Topology	11:05 AM	Kevin Lamb
Number Theory	11:30 AM	Elena Fuchs
Optimization	12:05 PM	William Wright
Lunch	12:30 PM	
Computational Mathematics	1:30 PM	Thomas Strohmer
Machine Learning	2:05 PM	Kirill Paramonov
Mathematical Biology	2:30 PM	Robert Guy
Combinatorics	3:05 PM	Chaim Even Zohar
Department Tea	3:30 PM	

## 2 Abstracts

### 2.1 Partial Differential Equations

**Joseph Biello**

Title: TBA

Abstract: TBA

### 2.2 Mathematical Physics

**John Murray**

Title: Higher Algebra and Quantum Field Theory

Abstract:

Though the experimental predictions of quantum field theories are astoundingly accurate, we are far from having a complete mathematical description of these theories. We will explore a formalism using new ideas from higher algebra to advance us toward that goal. In particular, we will describe how one deformation quantizes functions on the simplices of a derived stack. From a physical perspective, this process defines perturbation theory about classical field configurations including those that model tunneling between vacua.

### 2.3 Probability

**TBA**

Title: TBA

Abstract:

TBA

### 2.4 Topology

**Kevin Lamb**

Title: TBA

Abstract:

TBA

## 2.5 Number Theory

**Elena Fuchs**

Title: TBA

Abstract:

TBA

## 2.6 Optimization

**William Wright**

Title: An Eigenvalue Optimization Method for Phase Retrieval

Abstract:

Phase retrieval is the process of recovering the phase of an unknown signal using only the magnitudes of some signal observations. Some common applications are X-ray crystallography, electron microscopy, speech processing, and astronomical imaging. A wide variety of methods exist for retrieving phase, yet most do not allow for much noise in the observations. A phase retrieval method was recently developed [Friedlander, 2016] which handles noise, leading to an eigenvalue optimization problem. This underlying eigenvalue problem has a unique structure which we exploit using modern eigenvalue methods to increase the efficiency of the phase retrieval process.

## 2.7 Computational Mathematics

**Thomas Strohmer**

Title: Mathematics of Data Science

Abstract:

I will talk about some recent research my collaborators and I have conducted in the field of data science. Topics include blind deconvolution, convex and nonconvex optimization, data clustering, and deep learning.

## 2.8 Machine Learning

**Kirill Paramonov**

Title: TBA

Abstract:

TBA

## 2.9 Mathematical Biology

**Robert Guy**

Title: TBA

Abstract:

TBA

## 2.10 Combinatorics

**Chaim Even Zohar**

Title: Patterns in Random Permutations

Abstract:

Every  $k$  entries in a permutation of order  $n$  can have one of  $k!$  different relative orders, called *patterns*. How many times does each pattern occur in a large random permutation? We analyze the distribution of pattern densities, using representations of the symmetric group.