GRADUATE STUDENT WELCOME:
FACULTY LIGHTNING TALKS

Thursday February 25, 2021

Each of these faculty members will present a 10 minute talk to introduce their research field with one cool fact. This is just a sample of the research being done by faculty here to provide a sense of the varied research topics studied at UC Davis.

1:05 − 1:15	Elena Fuchs	**Expander Graphs and Number Theory** What do counting prime solutions to $x^2 + y^2 + z^2 = 3xyz$ and network optimization have in common? In this talk, we will explain how one feeds into the other in a surprising and beautiful way.
1:20 − 1:30	Andrew Waldron	**Geometry and Quantum Mechanics** I work at the interface between geometry and physics. Here's a cool fact I'll talk about: Quantum Dynamics = Parallel Transport
1:35 − 1:45	Abby Thompson	**Intrinsically knotted graphs** I study 3- and 4-dimensional spaces (low-dimensional topology). These can be hard to visualize, and a lot of problems in this area can be approached by studying smaller-dimensional objects inside them. The objects I'll talk about are finite graphs – a collection of points connected by edges – inside the 3-dimensional sphere. Some of these graphs are "intrinsically knotted"; that is, no matter how you imbed them in the 3-sphere, they will always contain a knot. I'll show an example of this phenomena (and some examples of graphs that aren't intrinsically knotted).
1:50 − 2:00	Steve Shkoller	**Singularity formation in fluids** Why do smooth solutions to nonlinear partial differential equations become singular in a finite amount of time? How do shock waves form in three space dimensions? Can we mathematically describe the mechanisms that lead to such behavior, and can we give a precise mathematical description of the singularity itself. I will try to give some insight as to why these questions are important and how we can answer them.

2:05 − 2:15	Eugene Gorsky	**Algebra and Geometry of Link Homology** I will give a brief introduction to link homology, a very active area of research spanning algebra and topology. In the talk, I will outline some of emerging connections between link homology, algebraic geometry, representation theory and combinatorics.
2:20 − 2:30	Monica Vazirani	**Combinatorial Representation Theory** The first several levels of Young's lattice of partitions can be easily drawn by an elementary school student. Yet it encodes deep information, in particular about the representation theory of the symmetric group. I'll talk about some of the combinatorics of this lattice, like using the hook-length formula to count certain walks on it, and what that means algebraically.
2:35 − 2:45	Michael Kapovich	
2:50 − 3:00	Janko Gravner	**Transitive closure under censorship** Suppose that we have some logical statements, which are all equivalent, but we are not aware of this fact. We know of some implications, which we then aim to complete by transitivity, but, at random, some conclusions are forbidden. How much progress can we make? We will see how percolation theory addresses such problems.