NORTHERN ARIZONA UNIVERSITY

Department of Mathematics & Statistics

Honors Week 2017

Thursday 27 April

4:00
SAS 221

STUDENT TALK: What is a sandpile group?

5:00
SAS 221

Awards Ceremony & Scholarship Presentations

6:00
SAS 2nd Floor

Reception

What is a sandpile group?

The theory of sandpile groups started in 1987, when physicists Bak, Tang, and Wiesenfeld created an idealized version of a sandpile in which sand is stacked on the vertices of a (combinatorial) graph and is subjected to certain avalanching rules. The long-term dynamics of this system is encoded by the set of recurrent sandpiles. This set has the structure of a finite abelian group. This group has been discovered in different contexts and received many names: the sandpile group (statistical physics), the critical group (algebraic combinatorics), the group of components (arithmetic geometry), and the Jacobian of a graph (algebraic geometry).

Algebraically, the sandpile group is isomorphic to the cokernel of the (reduced) Laplacian matrix of the underlying graph. Among many beautiful properties, the order of the sandpile group equals the number of spanning trees of the underlying graph. In this sense, the sandpile group is a more subtle isomorphism invariant of a graph.

In this talk, I will provide an introduction to the subject and showcase a few of my favorite results. Some of these results were obtained in collaboration with students in many undergraduate research projects over the last few years.

Dr. Luis David García Puente

is Associate Professor of Mathematics at Sam Houston State University. His research focuses on computational and applied algebraic geometry. He has directed research projects for 15 years, involving close to 100 undergraduate students in his work.

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