



UNIVERSITY OF
SOUTH CAROLINA
College of Arts and Sciences

Math News

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Number Theory Seminar

Date & Time: Tuesday September 25th 11:00 AM

Location: LeConte 312

Speaker: Richard Oh, USC

Topic: Cryptanalysis of Small-valued Secret Exponents in RSA Cryptosystems

Information: In this talk, we will explore the vulnerability of RSA Cryptosystems due to poor implementation. In particular, when the secret exponent is small, a continued fractions algorithm will allow for factorization of the two large primes of the modulus, regardless of how well chosen they are. Furthermore, the algorithm used to expose this weakness runs in polynomial time. Joint work with Skip Garibaldi of Emory University.

Applied and Computational Seminar

Date & Time: Tuesday September 25th 2:30-3:30 PM

Location: LeConte 312

Speaker: Mark J. Uline, USC Chemical Engineering

Topic: Lipid Layers: From Fundamentals to Biosensor Applications

Information: The cell membrane is a highly efficient machine that is involved in a variety of cellular processes such as cell adhesion, ion conductivity, and cell signaling to name a few. We can use the fundamental understanding of the complex coupling of interactions between the lipids and proteins that make up the cell membrane to aid us in the rational design of therapeutic and biosensing devices. To that end the thermodynamics of phase separation in mixed lipid-cholesterol bilayers is studied using a highly detailed molecular theory for lipids that explicitly incorporates the conformations of the molecules and all of their relevant intra and intermolecular interactions. The phase diagrams and exact derived expressions are then used to determine the partition coefficients of protein chain anchors into biologically relevant coexisting phases as a function of temperature and degree of saturation of the chain anchors. The predictions are in excellent agreement with experimental observations. The ability of lipid molecules to respond to changes in the environment are then used to study the directionality of nematic ordering in a liquid crystal thin film in contact with a lipid monolayer. Changes in the nematic order induced by the packing of the lipid chains provides a platform for biosensors, as has been mostly developed in the experiments of Professor Nicholas Abbott's research group at the University of Wisconsin Madison. The predictions of the changes in orientation and phase behavior induced by the lipid layer provide for a microscopic understanding of the driving forces of the effects observed in the experimental systems. This theoretical work represents a major step forward in our understanding of the interactions of lipid layers with liquid crystal thin films and the results can be used as a design platform in sensor applications.

Pi Mu Epsilon/Gamecock Math Club Fall Initiation & Student Seminar

Date & Time: Tuesday September 25th 6:00-8:00 PM

Location: LeConte 311

Speakers: Chanequa Roy & Emily McDowell, USC

Topic: Fibonacci sequence and Math Induction

Information: In 1202, Leonardo Fibonacci introduced the Fibonacci numbers $\{f_n\}_{n=1}^{\infty}$ in his studies involving the growth of a population of rabbits. The numbers are recursively defined by

$$f_1 = 1$$

$$f_2 = 1$$

$$f_n = f_{n-1} + f_{n-2} \quad \text{for } n \geq 3.$$

Since, the Fibonacci numbers have been used to model many natural phenomena.

For example, the number of bootjacks on a palmetto tree, South Carolina's official state tree, is a Fibonacci number. USC math major Chanequa Roy will present her summer research on Fibonacci numbers. She studied with Dr. Johnson through the SCAMP program. Then USC graduate student Emily McDowell will give a presentation on math induction. And then, for fun, we will work together in groups on some math induction problems.

Analysis Seminar

Date & Time: Wednesday September 26th 1:15-2:15 PM

Location: LeConte 312

Speaker: Ralph Howard, USC

Topic: Riemannian metrics with L^∞ coefficients.

Information: We discuss length structures in the sense of Gromov and show that a Riemannian metric tensor with coefficients that have very low regularity, only being L^∞ , define a length structure on a manifold. This is joint work with Reed Harris and John Schulte.

Combinatorics Seminar

Date & Time: Wednesday September 26th 3:30-4:30 PM

Location: LeConte 312

Speaker: Aaron Dutle, USC

Topic: Graph Odometry

Information: A delivery company sets up shop on a vertex v of an edge-weighted graph G . Unluckily, the company truck is too large to make a U-turn (except at the company lot), so every trip made must be a non-backtracking closed walk from v . After making each delivery, the driver records the distance traveled, i.e., the sum of the weights of the edges traveled, counted with multiplicity. What conditions must our graph satisfy so that the weight of every edge can be determined? How many walks are needed? Does the location of the start vertex matter? We address these and other questions.

Algebra and Logic Seminar

Date & Time: Friday September 28th 3:30-4:30 PM

Location: LeConte 312

Speaker: William DeMeo, USC

Topic: The Finite Lattice Representation Problem, Part II

Information: A long-standing open question in universal algebra asks whether every finite lattice is isomorphic to the congruence lattice of a finite algebra. Last week we discussed a range of well known methods for constructing a finite algebra with a given congruence lattice. In this week's seminar I will describe some new procedures for expanding and extending a finite algebra so that its congruence lattice changes in predictable ways. To demonstrate the approach, I'll provide some concrete examples using GAP and the Universal Algebra Calculator.

Department Colloquium

Date & Time: Thursday October 4th 3:30 PM

Location: LeConte 412

Speaker: Steven Sam (Miller Fellow, Univ. of California at Berkeley)

Topic: The Combinatorics and Geometry of E_7

Information: Exceptional objects can be thought of as an accident in classification schemes, but often have a rich structure all to themselves. In this talk, we'll explore some of the combinatorics and geometry related to the exceptional object E_7 (its root system, Weyl group, Lie algebra, ...) which comes from the Cartan-Killing classification of simple Lie algebras. This object was studied by classical geometers long before this classification, and remains an object of interest today. We will discuss topics such as reflection arrangements, finite geometry, plane quartic curves, Kummer varieties, Vinberg's theta-representations, and toric geometry. The plan is to illustrate the beauty of this exceptional object in an accessible way.

Thank you for submitting information to be included in the weekly newsletter. Please keep your information coming! All information for the math newsletter should be sent to the Department by 10 AM on Monday of each week. Please e-mail it to sealey@mailbox.sc.edu