

# Math News

**October 1, 2012**

Published by and for the Department of Mathematics

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## **Number Theory Seminar** **Level Stripping of Siegel Modular Forms** **Rodney Keaton, Clemson**

Tuesday October 2<sup>nd</sup> 11:00 AM  
LeConte 312

Let  $f$  be an elliptic eigenform of level  $Nl^a$ , where  $a$  is a positive integer,  $l$  is an odd prime, and  $N$  is a positive integer relatively prime to  $l$ . A result of Ribet gives the existence of an eigenform  $g$  of level  $N$  such that the eigenvalues of  $f$  away from the level remain congruent to the eigenvalues of  $g$  (mod  $l$ ). This result was important in proving the equivalence of Serre's modularity conjecture and Serre's refined conjecture. As Herzig and Tilouine have recently made a Serre like conjecture for Siegel modular forms of genus 2, it is natural to ask if a level stripping result similar to Ribet's will hold in this setting. In this talk, after providing necessary background, we will present results in this direction.

## **ACM Seminar** **Micro/Nano-scale Two-phase Heat Transfer** **Chen Li, USC Mechanical Engineering**

Tuesday October 2<sup>nd</sup> 2:30-3:30 PM  
LeConte 312

Two-phase heat transfer is the most efficient heat transfer mechanism and widely employed in energy conversion, thermal management and fluid control. Interface plays imperative roles in governing local liquid supply and distribution, bubble dynamics, droplet dynamics, and hence, the overall heat transfer and hydrodynamic processes. Three topics are covered in this talk. 1) Self-excited and modulated two-phase oscillations. 2) A unified two-phase flow pattern and associated flow boiling phenomena. 3) Boiling on hydrophobic-hydrophilic composite interfaces, which were synthesized from functionalized multiwall carbon nanotubes (FMW-CNTs) by introducing hydrophilic functional groups on the surfaces of pristine MWCNTs.

## **Analysis Seminar** **Haar Null Sets** **Steve Dilworth, USC**

Wednesday October 3<sup>rd</sup> 1:15-2:15 PM  
LeConte 312

Although there is no Lebesgue measure in infinite-dimensional spaces, one can make sense of a property holding "almost everywhere". We define the class of Haar null sets and establish its basic properties (hereditary and closed under translation and countable unions). The main application is a Banach space version of Rademacher's theorem on the a.e. differentiability of Lipschitz functions.

## **Combinatorics Seminar** **Towards a Structured Baranyai Theorem** **Gyula Katona, Renyi Institute**

Thursday October 4<sup>th</sup> 1:00-2:00 PM  
LeConte 312

Baranyai's theorem states that if  $k$  divides  $n$  then there are  $\binom{n-1}{k-1}$  partitions of the  $n$ -element set into  $k$ -element subsets in such a way that every  $k$ -element subset occurs in exactly one of these partitions. However nothing is known about the pairwise relation of the partitions. We will show some results moving in this direction. The objects considered here will be families of  $\ell$  pairwise disjoint  $k$ -element sets rather than partitions (one can call them partial partitions). We say that two partial partitions are far if there are no two pairs of classes in these partitions with pairwise intersection more than  $k/2$ . It is proved that if  $n$  is large, one can find such partial partitions far from each other in such a way that every  $k$ -element subset, with a few (bounded number) exceptions, is in one of them exactly once.



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## **Department Colloquium**

### **The combinatorics and geometry of $E_7$ Steven Sam, Miller Fellow, UC at Berkeley**

Thursday October 4<sup>th</sup> 3:30 PM

LeConte 412

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.

## **Algebra & Logic Seminar**

### **The Finite Lattice Representation Problem and intervals in Subgroup Lattices of Finite Groups**

**William DeMeo, USC**

Friday October 5<sup>th</sup> 3:30-4:30 PM

LeConte 312

A long-standing open problem in universal algebra is to characterize those lattices that are isomorphic to congruence lattices of finite algebras. It has been shown that this problem is equivalent to the problem of characterizing those lattices that are intervals in subgroup lattices of finite groups. In the last two meetings, I gave an overview of some of our new results related to this problem. Specifically, we discussed ways to expand and extend a finite algebra so that its congruence lattice grows in predictable ways. We also discussed "interval enforceable" properties of finite groups and how they

might help us solve the main problem. In this week's seminar, I will discuss these topics in greater detail and supply proofs of many of the claims I've made in our previous two meetings.

## **Department Colloquium**

### **Cryptology, Isoperimetric Problems, and Shadows**

**Guyla Katona, Renyi Institute**

Monday October 8<sup>th</sup> 3:30 PM

LeConte 412

For Katona's abstract, please visit [http://www.math.sc.edu/seminar\\_colloquia/katona2012.pdf](http://www.math.sc.edu/seminar_colloquia/katona2012.pdf)

