**Saturday, April 12**

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<th>Time</th>
<th>MSB 1147</th>
<th>MSB 2112</th>
<th>MSB 3106</th>
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<tr>
<td>8:30-9:00am</td>
<td>Registration in MSB Lobby</td>
<td>Opening Remarks in MSB 1147</td>
<td>Ben Hester (<a href="mailto:benjamin@mathpost.asu.edu">benjamin@mathpost.asu.edu</a>) Arizona State University Relaxed Graph Pebbling</td>
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<td>9:00-9:10</td>
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<td>Derrick Stolee (<a href="mailto:dstolee@math.unl.edu">dstolee@math.unl.edu</a>) University of Nebraska-Lincoln On Minimum Rectilinear Partitioning</td>
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<td>9:15-9:40</td>
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<td>Luis Serrano (<a href="mailto:lserrano@umich.edu">lserrano@umich.edu</a>) University of Michigan Noncommutative P-Schur functions, the shifted plactic monoid, and applications</td>
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<td>9:40-10:30</td>
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<td>Steven Sam (<a href="mailto:ssam@berkeley.edu">ssam@berkeley.edu</a>) University of California, Berkeley A bijective proof for a theorem of Ehrhart</td>
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<tr>
<td>10:30-10:55</td>
<td>Break in MSB 2208 (Alder Room)</td>
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<td>Csaba Biró (<a href="mailto:biro@math.gatech.edu">biro@math.gatech.edu</a>) Georgia Institute of Technology On-line algorithms on partially ordered sets</td>
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<td>10:55-11:00</td>
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<td>11:00-11:50</td>
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<td>Andrew Baxter (<a href="mailto:baxter@rutgers.edu">baxter@rutgers.edu</a>) Rutgers University A translation method for finding bijective proofs</td>
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<td>11:50-12:00</td>
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<td>12:00-2:00pm</td>
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**Keynote address by Arun Ram in MSB 1147: Symmetric functions d'après Macdonald**

This talk will be a road map to Macdonald’s classic book on Symmetric functions, highlighting the combinatorics, representation theory and geometry coded by symmetric function identities.
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<tr>
<td>Kelli Talaska (<a href="mailto:ktalaska@umich.edu">ktalaska@umich.edu</a>)</td>
<td>Zajj Daugherty (<a href="mailto:daughert@math.edu">daughert@math.edu</a>)</td>
<td>Matthew Morin (<a href="mailto:ajmorin@interchange.ubc.ca">ajmorin@interchange.ubc.ca</a>)</td>
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<tr>
<td>University of Michigan</td>
<td>University of Wisconsin, Madison</td>
<td>University of British Columbia</td>
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<tr>
<td>Planar networks and the totally nonnegative Grassmannian</td>
<td>Combinatorics of graded diagram algebras</td>
<td>Distinguishing Certain Graphs via the Chromatic Symmetric Function</td>
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<td>We will examine Postnikov’s boundary measurement map associating to each planar network a point in the Grassmannian. We will give a formula for the Pfaffian coordinates of this map; it can be viewed as a generalization of Lindström’s result for acyclic planar networks.</td>
<td>Many diagram algebras (e.g. ( CS_k ), the Brauer algebras, Hecke algebras, etc.) arise as tensor power centralizer algebras, algebras of operators which preserve symmetries in a tensor space. The classical case, studied by Frobenius and Schur around 1900, provided the link between the representation theory of the symmetric group and the general linear group. In this talk, I will use combinatorial tools to explore the representation theory of graded diagram algebras and their complimentary Lie algebras.</td>
<td>Given a simple graph ( G = (V, E) ), the chromatic symmetric function of the graph is given by ( X_G = \sum_{\kappa:</td>
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<tr>
<td>Steve Butler (<a href="mailto:sbutler@math.ucsd.edu">sbutler@math.ucsd.edu</a>)</td>
<td>Andrew Berget (<a href="mailto:berget@math.umn.edu">berget@math.umn.edu</a>)</td>
<td>Amanda Ruiz (<a href="mailto:alruiz@sfsu.edu">alruiz@sfsu.edu</a>)</td>
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<tr>
<td>University of California, San Diego</td>
<td>University of Minnesota</td>
<td>San Francisco State University</td>
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<tr>
<td>An Erdős-Ko-Rado problem on the strip</td>
<td>A symmetric group representation for matroids</td>
<td>The Isomorphism Theorem for Cotransversal Matroids</td>
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<td>A family of subsets of ([n]) is said to be intersecting if any two of the sets share a common element. The well-known Erdős-Ko-Rado Theorem gives an upper bound on the maximum size of a family of ( k ) element sets which are intersecting. More generally, Erdős-Ko-Rado type problems can be given for any combinatorial object where intersection is well defined. In this talk we will consider an Erdős-Ko-Rado problem related to strips (which can be thought of as a sequence of squares labeled ( 1, 2, \ldots, n )) and give some basic results about the maximal size of an intersecting family in this setting.</td>
<td>This talk will be about how the dependent sets of a matroid give rise to a symmetric group representation. I will show how this module behaves with respect to some simple matroid operations and determine how it decomposes when the matroid is uniform. I will also explain how to determine the multiplicity of a hook shape in such a module.</td>
<td>Given two graphs, it is of interest to know whether the cotransversal matroids they generate are isomorphic. We define local moves on a graph which preserve the matroid, and prove that any two graphs which give rise to the same cotransversal matroid can be obtained from each other by these local moves.</td>
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<td>Cesar Ceballos (<a href="mailto:ca.ceballos954@uniandes.edu.co">ca.ceballos954@uniandes.edu.co</a>)</td>
<td>Kagan Kurusuno (<a href="mailto:kurusuno@math.psu.edu">kurusuno@math.psu.edu</a>)</td>
<td>Michelle Edwards (<a href="mailto:michelle@math.uvic.ca">michelle@math.uvic.ca</a>)</td>
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<tr>
<td>Universidad de los Andes</td>
<td>The Pennsylvania State University</td>
<td>University of Victoria</td>
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<tr>
<td>Colorations of fine mixed subdivisions of simplices</td>
<td>( k )-marked Durfee symbols</td>
<td>Independent Domination Critical and Bicritical Graphs</td>
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<td>There is a surprising relationship between the geometry of ( d ) flags in ( \mathbb{C}^d ) and fine mixed subdivision of simplices. Ardila and Billey conjecture that the possible locations of the simplices in a fine mixed subdivision are precisely the bases of the matroid of lines that result from intersecting ( d ) complete flags in ( \mathbb{C}^d ). A relationship with this problem arises in the case of triangulations of products of simplices, tropical geometry, tropical oriented matroids and colorations of fine mixed subdivisions of simplices. For each fine mixed subdivision, are assigned different colors to each of the simplices and spread via the mixed cells; to do this, it appears so natural configuration of permutations on the edges of the initial simplex. I have characterized that in dimension ( 2 ) a configuration of permutations can be achieved through this process if and only if it does not appear ( a_1 \ldots a_n b_1 \ldots b_m ) in the sides of the triangle, and I provide evidence to conjecture that the same is true in every dimension. I also have shown that for every permutation that is achievable there is a unique choice of the positions of the simplices that are generating, and I give a very beautiful and easy way to obtain these positions. Finally, this method proved to be a very powerful tool to attack this kind of conjectures, and I give some applications of this.</td>
<td>In a recent paper, Andrews defined ( k )-marked Durfee symbols, which are generalizations of the ordinary Durfee symbol. He assigned ( 1, \ldots, \ell ) ranks to a ( k )-marked Durfee symbol, which reduce to Dyson’s rank for ( k = 1 ). He then provided and proved many related congruences and identities. This talk will focus on a combinatorial explanation for ( k = 2 ) case of a recurrence stated in the paper (the general case also, as time allows). This is joint work with Cilanne Boulet, Cornell Univ.</td>
<td>A graph is independent domination critical if the removal of any vertex reduces the independent domination number and it is independent domination bicritical if the removal of any two vertices reduces the independent domination number. In this talk we will investigate various construction methods and diameter results for such graphs. This is joint work with A. Finbow and G. MacGillivray.</td>
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4:00-4:25

Patrick Boland (boland@math.umass.edu)
University of Massachusetts - Amherst
Compilations of locally symmetric spaces
I study Satake and toroidal compactifications of locally symmetric spaces. The boundary at infinity of Satake compactifications correspond to faces of certain convex polytopes. Toroidal compactifications are defined using polyedral cone decompositions. I plan to introduce these compactifications and their combinatorial models for the spaces $SL_3(\mathbb{Z})/SL_3(\mathbb{R})/SO(3)$ and $Sp_4(\mathbb{Z})/Sp_4(\mathbb{R})/U(2)$.

4:30-4:55

Chris Severs (chris.severs@asu.edu)
Arizona State University
The rank of $A_1^{n-1}(Asc_n)$
In recent years there has been much research involving the associahedron, a polytope that has many combinatorial interpretations and generalizations. In our study of the discrete homotopy group of $Asc_n$, the simplicial complex of all triangulations of an $(n+3)$-gon, we are naturally led to its exchange graph, which corresponds to the 1-skeleton of the associahedron.

We prove that the Abelianization of the discrete fundamental group $A_1^{n-1}(Asc_n)$ has rank $(n+2)$ and that $A_1^{n-1}(Asc_n)$ is isomorphic to a free group on $(n+2)$ generators. This is joint work with Hélène Barcelo and Jacob White.

5:00-5:25

Jacob White (white@mathpost.asu.edu)
Arizona State University
Discrete homotopy groups on the face lattice of the cube
Discrete homotopy groups for simplicial complexes and graphs were recently introduced by Barcelo et al. One interesting application was the proof that the $n - 4th$ discrete fundamental group of the order complex of the boolean lattice is isomorphic to the (classical) fundamental group of the complement of the $k$-equal arrangement. In the course of proving this theorem, Barcelo and Smith use an exchange graph that turns out to be the 1-skeleton of the permutohedron.

In this talk, we generalize these constructions and results to the face lattice of the cube, and thus to the type $B$ permutohedron and to the type $B$ $k$-equal arrangement. This is joint work with H. Barcelo.

5:30-5:40

Nick Newman (newman@auburn.edu)
Auburn University
Enclosures of $\lambda$-fold Triple Systems
Over the past five years, Hurd et al considered the problem of enclosing a triple system $TS(v, \lambda)$ into a triple system $TS(v + s, \lambda + m)$, focusing on smallest possible enclosings. In this paper, their result is generalized using a new proof based on a graph-theoretic technique.

Four constructions are presented; they are exhaustive in the sense that, for each possible congruence of the parameters $s$ and $m$, at least one construction can be applied to obtain an enclosing. In each construction, the value of $s$ is restricted.

5:30-6:00

Emilie Hogan (ehogan@math.rutgers.edu)
Rutgers University
Somos and Somos-like Sequences: Surprisingly integral sequences
Somos-$k$ is defined by the following quadratic recurrence

$$S(n)S(n-k) = \sum_{i=1}^{\lfloor \frac{n}{k} \rfloor} S(n-i)S(n-k+i)$$

with initial conditions $S(j) = 1$ for $j \leq k$. For $k = 2, 3, ..., 7$ these recurrences, in which you divide by $S(n-k)$ at every step, surprisingly give rise to sequences consisting entirely of integers. I will explain this phenomenon and also give a new infinite family of recurrences that carry this same property.

5:30-6:00

Elizabeth Kopin (ekopin@math.rutgers.edu)
Rutgers University
Low Distortion Embeddings of Metric Spaces and Graph Theory
When can we map a set of data from an arbitrary metric space into a ‘nice’ metric space - $\mathbb{R}^n$ or $\mathbb{R}^d$ under the $p$-norm ($p \neq 2$), for example - without losing too much information about our original data? Distortion gives us a way to quantify how much information we will lose, and studying low distortion embeddings gives a family of results about when this is possible and (just as interesting!) when it must be impossible. These characterizations are important in finding fast algorithms for problems in various fields.

I am particularly interested in the negative results (i.e. when will we not be able to embed into a ‘nice’ space), because they sometimes lean heavily on graph theory. Every graph has a natural shortest path metric, but it’s a bit surprising that it goes the other way - every finite metric space in some sense comes from a finite weighted graph. This lets us use existing graph theory results to try to find poorly-embeddable metric spaces. In this talk I will try to give a brief introduction to this area (following a book chapter by Indyk and Matousek), particularly focusing on applications of graph theory.
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| 9:00-9:25am  | Dumitru Stamate (stamate@umn.edu) University of Minnesota and University of Bucharest  
On sequentially Cohen-Macaulay posets | Michelle Snider (msnider@math.ucsd.edu) University of California, San Diego  
Positivity of K-theoretic Littlewood-Richardson Numbers: Unifying Two Approaches | Philippe Choquette (philcho@mathstat.yorku.ca) York University  
Hopf algebras and species |
| 9:30-9:55am  | Daniel Wells (dwell@ms.uky.edu) University of Kentucky  
Generalized Flips and the cd-Index | Eric Clark (eclark@ms.uky.edu) University of Kentucky  
Computing the Bracket of Excedance Words | Brandon Humpert (bhumpert@math.ku.edu) University of Kansas  
A Generalization of Stanley’s Chromatic Symmetric Function |
| 10:00-10:25am| Martha Yip (yip@math.wisc.edu) University of Wisconsin - Madison  
Combinatorics of Shi arrangements | Brendon Rhoades (rhoad030@math.umn.edu) University of Minnesota/MSRI  
Cyclic Sieving, Promotion, and Representation Theory: I Did My Homework From GSCC 2007 | Paul Horn (phorn@math.ucsd.edu) University of California, San Diego  
The spectral gap of a random subgraph of a graph |
| 10:30-11:00am| Break in MSB 2208 (Alder Room)                                            |                                                                         |                                                                         |
Subdivisions of matroid polytopes

It is a pleasant feature of the theory of matroids that a vast number of equivalent points of view are available. One of these which has gained prominence recently is that of a matroid as a polytope. From this perspective one finds that many significant functions \( f \) on matroids are evaluations of polytopal subdivisions: given a subdivision of the polytope of a matroid \( M \) into the polytopes of other matroids \( \{ M_i \} \), \( f(M) \) can be expressed as a certain sum of the \( f(M_i) \). I’ll introduce the polytopal viewpoint of matroids, and present one or two strong evaluations of which a number of standard matroid invariants are evaluations.

This talk is based on joint work with Felipe Rincon and Federico Ardila.

Shishuo Fu (fu@math.psu.edu)
The Penn State University-University Park
Combinatorial Proof of One Congruence For The Broken 1-diamond Partition

In one of their collaborative papers, George E. Andrews and Peter Paule continue their study of partition functions via MacMahon’s Partition Analysis by considering partition functions associated with directed graphs which consist of chains of diamond shape. They prove a congruence related to one of these partition functions and conjecture a number of similar congruence results. My first and major goal in this talk is to reprove this congruence by constructing an explicit way to group partitions so as to explain the congruence combinatorially. Then I keep the essence of the method and manage to apply it to a different combinatorial object.

Kathleen Kiernan (kiernan@math.wisc.edu)
University of Wisconsin - Madison
Codes that Identify Vertices in Graphs

Given an undirected graph \( G \) is there a subset of the vertices \( C \) such that each vertex \( v \) is covered by a different non-empty collection of elements of \( C \)? If so, \( C \) is called an \( r \)-identifying code in \( G \). (A vertex \( c \in C \) \( r \)-covers itself and any vertices connected to it by a path of length \( r \).) We look for identifying codes that include few vertices. We will discuss bounds on identifying codes for various classes of graphs, and also discuss what happens when either an edge or a vertex is removed.

Jeffrey Doker (doker@math.berkeley.edu)
UC Berkeley
Matroid Polytopes as Minkowski Sums

Lots of familiar combinatorial objects can be described in terms of things called Matroids, and every Matroid can be represented as a polytope. It turns out that these Matroid polytopes, as well as some other related polytopes, can be decomposed into nice Minkowski sums of simplices.

Kurt Luoto (kwluoto@math.washington.edu)
University of Washington, Seattle
A quasisymmetric decomposition of Schur functions

Schur functions constitute one of the most studied bases for the algebra of symmetric functions. They form a \( \mathbb{Z} \)-basis for the symmetric functions, with nonnegative integer structure constants, which are the famous Littlewood-Richardson coefficients. In turn, the symmetric functions form a subalgebra of the quasisymmetric functions. In recent work, Haglund and Mason have found a decomposition of Schur functions into quasisymmetric functions, yielding a new \( \mathbb{Z} \)-basis for the quasisymmetric functions. For the time being we are calling these quasiSchur functions. While this basis does not in general have nonnegative structure constants, it has been empirically observed that the product of a quasiSchur function by a Schur function is positive in the quasiSchur basis. So far we have been able to establish Pieri rules for such products, and we hope to find analogs of other well-known formulas for Schur functions.

Joint work with Jim Haglund, Sarah Mason, and Stephanie van Willigenburg.

Florian Block (blockf@umich.edu)
University of Michigan
Schur polynomials and puzzles

Schur polynomials play an important role in representation theory, in the study of symmetric functions and in the cohomology of the Grassmannian. The question “How do they multiply?” is fundamental in all these fields. One way to answer it is the famous Littlewood-Richardson rule. I’ll show you a different way using triangular puzzles invented by Knudson and Tao.

This puzzle rule is so great (also) because it easily generalizes to “equivariant” Schur polynomials just by introducing one “equivariant” puzzle piece.

I will start from scratch assuming nothing about Schur polynomials, cohomology etc.

Alex Fink (fink@math.berkeley.edu)
UC Berkeley
Subdivisions of matroid polytopes

Keynote address by Ron Graham in MSB 1147: Euclidean Ramsey Theory

Ramsey theory is a branch of combinatorics which studies unavoidable regularity in large structures. In this talk, I will describe a variety of results and open problems of this type which have a geometrical flavor. A typical (still unsolved) problem of this type is this: Is it true that in any 4-coloring of the points of the Euclidean plane, there is always a pair of points with the same color which are distance 1 from each other?

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