Schedule of talks.

Thursday (April 10)
Morning session

9:20-10:10

Wlodzimierz Kuperberg (Auburn University)

Variations on the Hadwiger theme

Abstract. The Hadwiger number of a convex body K is the maximum number of mutually non-overlapping translates of K that can touch K. We consider several variations of this notion, by replacing translates of K with its μ-homothetic images with either $\mu > 0$, $\mu < 0$, or combinations of μ and $-\mu$. In yet another variation, the non-overlapping homothets of K touch the boundary of K from inside. Many open problems and a few examples will be discussed.

Thursday (April 10)
Morning session

10:30-11:20

Sergei Tabachnikov (Penn State and Brown University)

Circumcenter of Mass and the generalized Euler line

Abstract. I shall define and study a variant of the center of mass of a polygon, called the Circumcenter of Mass. The Circumcenter of Mass is an affine combination of the circumcenters of the triangles in a non-degenerate triangulation of a polygon, weighted by their areas, and it does not depend on the triangulation. For an inscribed polygon, this center coincides with the circumcenter. The Circumcenter of Mass satisfies an analog of the Archimedes Lemma, similarly to the center of mass of the polygonal lamina. The line connecting the circumcenter and the centroid of a triangle is called the Euler line. Taking an affine combination of the circumcenters and the centroids of the triangles in a triangulation, one obtains the Euler line of a polygon. The construction of the Circumcenter of Mass extends to simplicial polytopes and to the spherical and hyperbolic geometries.

Thursday (April 10)
Morning session

11:40-12:30

Oleg Musin (The University of Texas at Brownsville, Institute for Information Transmission Problems of Russian Academy of Sciences)

Generalizations of Sperner, Tucker and Fan lemmas

Abstract. The famous Sperner, Tucker and Ky Fan lemmas are combinatorial analogs of the Brouwer and Borsuk-Ulam theorems. In this talk we will consider several generalizations of these lemmas.

Thursday (April 10)
Afternoon session

2:20-3:10

Robert Connelly (Cornell University)

with Alex Smith, Jeff Shen, and Will Dickinson

Periodic planar disk packings

Abstract. There are some interesting relations between density estimates of certain packings of equal circles in a triangular torus and an old conjecture of L. Fejes Toth about finite rearrangements of triangular lattice packings with one disk removed. There are results about periodic packings being jammed and remaining so with respect to finite coverings.

Thursday (April 10)
Afternoon session

3:30-4:20

Peter Dragnev (Indiana University – Purdue University Fort Wayne)

On the separation of optimal spherical configurations

Abstract. Spherical configuration with some optimal properties have wide-ranging application in science. In this talk we shall survey briefly the topic and focus on minimal energy configurations and in particular on their separation properties. Our techniques naturally lead to investigation of optimal configurations in the presence of external field. Numerical computations will be presented as well.

Thursday (April 10)
Afternoon session

4:40-5:30

Hiroshi Nozaki (Aichi University of Education)

A dual concept of spherical s-distance sets.

Abstract. A dual concept of spherical s-distance sets is a connected regular graph with distinct $s+1$ eigenvalues. In this talk, we explain why it is, and show a linear programming bound for the size of a regular graph. The LP bound is given by only distinct eigenvalues without multiplicities.

Friday (April 11)
Morning session

9:20-10:10

Luis Montejano (Universidad Nacional Autónoma de México)

with J.C. Díaz, A. Hansberger, L. Martinez, A Montejano, and D. Oliveros

Fractional Turan theorems

Abstract. Let $\mathfrak{G}$ be a family of graphs closed under induced subgraphs. We say that $\mathfrak{G}$ satisfies Turan property if given $\beta \in (0,1)$ there is $\alpha \in (0,1)$ (depending only on $\mathfrak{G}$ and β) such that if $G \in \mathfrak{G}$ and $|E(G)| \geq \beta\binom{|V(G)|}{2}$, then there is a clique of G of size bigger than $\alpha|V(G)|$.

Furthermore, if $\alpha = \frac{\beta}{K}$ for some constant $K > 0$, then we say that $\mathfrak{G}$ satisfies the linearly fractional Turan inequality.

For example, if $\mathfrak{G}$ is the family of intersection interval graphs, the fractional Helly theorem precisely states that $\mathfrak{G}$ satisfies the linearly fractional Turan inequality.

Let $\mathfrak{G}$ be a family of graphs closed under induced subgraphs. The Turan numbers for the family $\mathfrak{G}$ are defined as follows:

$$T(\mathfrak{G}, k, n) = \text{maximal number of edges of a graph in } \mathfrak{G}, \text{ with } n \text{ vertices, without a complete graph } K_{k+1}.$$

In this talk we present the following theorem.

Theotem. Let $\mathfrak{G}$ be a family of graphs closed under induced subgraphs. Then the following is equivalent.

a) The family $\mathfrak{G}$ satisfies the linearly fractional Turan property,

b) there is a constant K such that $T(\mathfrak{G}, k, n) < Knk$,

c) there is a constant $q > 0$ such that for every $G \in \mathfrak{G}$, we have that $\chi(G) \leq q\omega(G)$, and

there is a constant $\lambda > 0$ such that for every bipartite graph $B \in \mathfrak{G}$

$$|E(B)| \leq \lambda |V(B)|,$$

d) there is a constant c such that for every $G \in \mathfrak{G}$, $d(G) < c\omega(G)$.

This result includes many interesting families of graphs closed under induced subgraphs like for example the class of split graphs, interval graphs, claw free graphs, chordal graphs, etc In this talk, we shall discuss also the fractional Turan behavior of the class of intersection graphs of boxes in $\mathbb{R}^d$.

Friday (April 11)
Morning session

10:30-11:20

Alexey Garber (Moscow State University)

with Alexey Balitsky and Roman Karasev

Another ham sandwich in the plane

Abstract. The famous ham sandwich theorem claims that for any d "nice" measures we can find a hyperplane that slices all measures into equal parts. Recently Rade Živaljević proved that it is possible to cut a half of every of d nice measures in $\mathbb{R}^d$ by a union of several cones of a simple fan translated by some vector. In particularly, two-dimensional version of this theorem claims that for every 3-fan and every two nice measures μ_1 and μ_2 there is a translation of some cone from this fan that divides both measures μ_1 and μ_2 into equal parts.

In this talk we will discuss several generalizations of Živaljević's theorem on the Euclidean plane. We show that every two nice measures in the plane can be partitioned into equal parts by translation of an angle from arbitrary k-fan when k is odd and in some cases when k is even. We also give some counterexamples for certain fans and measures.

The research is partially supported by a grant of the Dynasty Foundation and by the grant "Leading Scientific Schools" NSh-4833.2014.1.

Friday (April 11)
Morning session

11:40-12:30

Masashi Shinohara (Shiga University)

with Akihiro Munemasa (Tohoku University)

A new generalization of Ramsey number $R(s, t)$

Abstract. In this talk, we propose a new generalization of Ramsey numbers which seems to be untreated in the literature. Instead of requiring the existence of a monochromatic clique, we consider the existence of a clique which avoids one of the colors in an edge coloring. This new number is called complementary Ramsey number. This definition is natural when we consider sub-structures of k-distance sets.

We establish their connections to other combinatorics and determine infinitely many non-trivial complementary Ramsey numbers.

Friday (April 11)
Afternoon session

2:20-3:10

András Bezdek (Auburn University and Renyi Institute of Math, Budapest)

Things I learned about infinite cylinders

Abstract. Over the years I worked on various cylinder packing/covering problems including the ones concerning densest cylinder packings, thinnest cylinder coverings, mutually tangent cylinders and cylinders touching a given sphere. I will review the status of these problems and mention some open questions.

Friday (April 11)
Afternoon session

3:30-4:20

Elena Poletaeva (The University of Texas - Pan American)

with Vera Serganova

On Kostant's Theorem for Lie superalgebras

Abstract. A finite W-algebra is a certain associative algebra attached to a pair $(\mathfrak{g}, e)$, where $\mathfrak{g}$ is a complex semisimple Lie algebra and $e \in \mathfrak{g}$ is a nilpotent element. It is a result of B. Kostant that for a regular nilpotent element e, the finite W-algebra coincides with the center of $U(\mathfrak{g})$.

We study finite W-algebras for simple Lie superalgebras in the case when e is an even regular (principal) nilpotent element. Kostant's result does not hold in this case.

J. Brown, J. Brundan and S. Goodwin have recently described the principal finite W-algebras for $\mathfrak{gl}(m|n)$ as certain truncations of a shifted version of the super-Yangian of $\mathfrak{gl}(1|1)$. We show that the principal finite W-algebra for the queer Lie superalgebra $Q(n)$ is isomorphic to a factor algebra of the super-Yangian of $Q(1)$.

Saturday (April 12)
Morning session

9:20-10:10

James Maissen (The University of Texas at Brownsville)

Extending group actions

Abstract. We show sufficient criteria for a group of homeomorphisms acting on a metric space X to extend to one acting on a given compactification of X. One might think that merely requiring each of the individual homeomorphisms to extend would suffice, but we give examples for when the extension can fail when one of the criteria is not met. A quick strengthening of the theorem is also presented (and thanks given for those suggesting it), and finally applications of this theorem are to be given to illustrate its usefulness.

Saturday (April 12)
Morning session

10:30-11:20

Sho Suda (Aichi University of Education)

Characterizations of (almost) tight complex two codes

Abstract. A complex two code is a finite subset in the complex unit sphere with two non-real inner products for any distinct points. From inner products of a complex two code, we obtain an orientation of the complete graph, which is called a tournament. In this talk we will provide the upper bound of complex two codes and characterize (almost) tight examples in terms of spectrum of skew-adjacency matrices of tournaments. This includes a new characterization of skew Hadamard matrices.

Saturday (April 12)
Morning session

11:40-12:30

Wiktor J. Mogilski (Univeristy of Wisconsin – Milwaukee)

The fattened Davis complex and weighted L^2-(co)homology of Coxeter groups

Abstract. Associated to a Coxeter system (W, S) there is a contractible simplicial complex Σ called the Davis complex on which W acts properly and cocompactly by reflections. Given a positive real multiparameter $\mathbf{q}$, one can define the weighted L^2-(co)homology groups of Σ and associate to them a nonnegative real number called the weighted L^2-Betti number. Unfortunately, not much is known about the behavior of these groups when $\mathbf{q}$ lies outside a certain restricted range, and weighted L^2-Betti numbers have proven difficult to compute. In this talk I will propose a program to compute the weighted L^2-(co)homology of Σ by considering a thickened version of this complex. The program proves successful provided that we can understand the weighted L^2-(co)homology of non-spherical special subgroups of W. I will then specialize to a certain class of Coxeter groups and perform some computations.