ABSTRACTS

Soffia Arnadottir: Quantum walks on Cayley graphs. I will give a short introduction to continuous-time quantum walks on graphs. In particular, I will talk about quantum walks on Cayley graphs, and how we can use tools from group theory to study them.

Georgia Benkart: Walking on Graphs: A tour inspired by the McKay Correspondence, Representations, and Invariant Theory.

Sarah Brauner: A Type B analog of the Whitehouse representation. The Eulerian idempotents of the symmetric group and the representations they generate, called the Eulerian representations, are a topic of long-standing interest to representation theorists, combinatorialists and topologists. In this talk, I will focus on a property of the Eulerian representations first studied by Whitehouse: that although the Eulerian representations are defined as S_n representations, they can also be understood via a "hidden" action of S_{n+1}. More surprisingly still, many of the connections between the Eulerian representations and configuration spaces, equivariant cohomology, and Solomon's descent algebra can be "lifted" to this family of S_{n+1} representations, which we will call the Whitehouse representations. I will then discuss recent work generalizing the above scenario to the hyperoctahedral group, B_n. In this setting, configuration spaces will be replaced by certain orbit configuration spaces and Solomon's descent algebra is replaced by the Type B Mantaci-Reutenauer algebra. All of the above will be defined in the talk.

Sunita Chepuri: k-Positivity of the Dual Canonical Basis. Skandera showed that all dual canonical basis elements of $\mathbb{C}[SL_m]$ can be written in terms of Kazhdan-Lusztig immanants, which were introduced by Rhoades and Skandera. We use this result as well as Lewis Carroll's identity (also known as the Desnanot-Jacobi identity) to show that a broad class of dual canonical basis elements of $\mathbb{C}[SL_m]$ are positive when evaluated on k-positive matrices, matrices whose minors of size $k \times k$ and smaller are positive.

Iva Halacheva: Braid group actions, crystals, and cacti. Let $\mathfrak{g}$ denote a semisimple Lie algebra. Lusztig introduced an action of the braid group on any integrable representation of the quantum group of $\mathfrak{g}$. This action was realized categorically in work of Chuang-Rouquier, as shown by Cautis-Kamnitzer, where each braid group generator is upgraded to a complex of functors called a Rickard complex. I will describe a corresponding action of the cactus group on a $\mathfrak{g}$-crystal coming from a representation. In joint work with Licata, Losev and Yacobi, we show that this action can be recovered categorically from the Rickard complexes, when considering the positive lifts of the longest Weyl group elements for certain parabolics in $\mathfrak{g}$.

Patricia Hersh: Posets arising as 1-skeleta of simple polytopes, the nonrevisiting path conjecture, and poset topology. Abstract: Given a polytope P and a nonzero vector c, the question of which point in P has largest inner product with c is the main goal of linear programming in operations research. Key to efficiency questions regarding linear programming is the directed graph $G(P, c)$ on the 1-skeleton of P obtained by directing each edge $e(u, v)$ from u to v for $c(u) < c(v)$ and in particular the diameter of $G(P, c)$. We will explore the question of finding sufficient conditions on P and c to guarantee that no directed path ever revisits any polytope face that it has left; this is enough to ensure that linear programming is efficient under all possible choices of pivot rule. It turns out that poset-theoretic techniques and poset topology can help shed light on this question. In fact, Dominik Preuss recently proved a conjecture of ours that the monotone Hirsch conjecture holds for any simple polytope P and cost vector c such that $G(P, c)$ is the Hasse diagram of a lattice. We will provide history and background along the way in telling this story.

Mee Seong Im: Grothendieck rings of periplectic Lie superalgebras. The Grothendieck group is a fundamental invariant attached to an abelian category, which is defined to be the free abelian group on the objects of the category modulo the relation $[B] = [A] + [C]$ for every exact sequence $0 \to A \to B \to C \to 0$. I will explicitly describe the Grothendieck rings of finite-dimensional representations of the periplectic Lie superalgebras. This is joint with Shifra Reif and Vera Serganova.

Elizabeth Kelley: Rooted Clusters for Graph LP Algebras. LP algebras, introduced by Lam and Pylyavskyy, are a generalization of cluster algebras. Although these algebras are known to have the Laurent phenomenon, positivity remains conjectural in general. Graph LP algebras are a subclass of finite LP algebras whose exchange relations can be encoded by a graph. For graph LP algebras defined by trees, we define a family of clusters called rooted clusters. We prove positivity for these clusters by giving explicit formulas for each cluster variable and give a combinatorial interpretation for these expansions using a generalization of T-paths.

Sabrina Lato: Spectral Moore Bounds. In 1960, Moore asked which graphs have a maximal number of vertices for a given degree and diameter. Such graphs have been studied since then, and a number of extensions of both the Moore bound and Moore graphs have proved fruitful. In 2016, Cioaba, Koolen, Nozaki, and Vermette developed a spectral Moore bound for regular graphs based on the degree and the second-largest eigenvalue of the adjacency matrix. They subsequently improved the bound for regular bipartite graphs, and more recently, I was able to extend their results to semiregular bipartite graphs. I will give a brief overview of the Moore bounds, classical and spectral, and the graphs that meet the bounds.

Ritika Nair: On the Lefschetz property for quotients by monomial ideals containing squares of variables. Let Δ be a simplicial complex on n vertices. The corresponding Stanley-Reisner ring is obtained from $S = k[x_1, \ldots, x_n]$ by quotienting out $I_\Delta = \langle x_{i_1} \cdots x_{i_m} : \{i_1, \ldots, i_m\} \notin \Delta \rangle$, where k is a field of characteristic 0. To the quotienting ideal, we further include the squares of the variables, to get the ideal J_Δ generated by $\{x_1^2, \ldots, x_n^2\}$ and I_Δ. Now, $A(\Delta) = S/J_\Delta$ is a graded artinian algebra. For a general linear form l, $A(\Delta)$ has the *Weak Lefschetz Property* (WLP) if the homomorphism induced by multiplication by l, $\mu_i : A(\Delta)_i \to A(\Delta)_{i+1}$

has maximal rank for all i. In this talk, we aim to characterize the Weak Lefschetz Property of $A(\Delta)$ in terms of the simplicial complex Δ, in some specific cases, for instance, when Δ is a pseudomanifold of small dimension.

Mariia Sobchuk: Quantum indpendence and chromatic numbers. You will hear the brief overview of the quantum independence and chromatic numbers: what they are, what is currently known and some open questions.

Sheila Sundaram: The plethystic inverse of the odd Lie modules. The Frobenius characteristic of the Lie representation of the symmetric group afforded by the free Lie algebra, is known to satisfy many interesting plethystic identities. Here we prove a conjecture of Richard Stanley establishing the plethystic inverse of the sum of the odd-degree Lie characteristics. We obtain an apparently new plethystic decomposition of the regular representation of the symmetric group in terms of irreducibles indexed by hooks, and the Lie representations.

Tina Chen: Bipartite walks and the Hamiltonians. The talk is going to introduce a discrete quantuam walk model called the bipartite walk model. Bipartite walks generate many known and well-studied discrete quantum models, like the arc-reversal walks and vertex-face walks. The Hamiltonian of a bipartite walk helps us to build a connection between the discrete quantuam walk on a bipartite graph and a continuous quantum walk on a weighted graph.

Faith Zhang: Recursive Rank One Perturbations for Pole Placement and Cone Reachability. The role of rank one perturbations in transforming the eigenstructure of a matrix has long been considered in the context of applications, especially in linear control systems. Two cases are examined in this paper: First, we propose a practical method to place the system eigenvalues (poles) in desired locations via feedback control that is computed in terms of recursive rank one perturbations. Second, a choice of feedback control is proposed in order to achieve that a trajectory eventually enters the nonnegative orthant and remains therein for all time thereafter. The latter situation is achieved by imposing the strong Perron-Frobenius property and involves altering the eigenvalues, as well as left eigenvectors via rank one perturbations.