Webs in Algebra, Geometry, Topology and Combinatorics
Poster Session Abstracts
December 9, 2025

Webification of symmetry classes of plane partitions and partial promotion
Ashleigh Adams, North Dakota State University

Webs are graphical objects that give a tangible, combinatorial way to compute and classify tensor invariants. Recently, [Gaetz, Pechenik, Pfannerer, Striker, Swanson 2023+] found a rotation-invariant web basis for SL_4, as well as its quantum deformation $U_q(\sl_4)$, and a bijection between move equivalence classes of $U_q(\sl_4)$-webs and fluctuating tableaux such that web rotation corresponds to tableau promotion. They also found a bijection between the set of plane partitions in an $a\times b\times c$ box and a benzene move equivalence class of $U_q(\sl_4)$-webs by determining the corresponding oscillating tableau. In this paper, we similarly find the oscillating tableaux corresponding to plane partitions in certain symmetry classes. We furthermore show that there is a projection from $U_q(\sl_4)$ invariants to $U_q(\sl_r)$ for $r=2,3$ for webs arising from certain symmetry classes. This is joint work with Jessica Striker.

Parabolic Orlik--Solomon invariants in type-A
Trevor Karn, Texas A&M University

We provide a presentation for the invariants of certain parabolic subgroups of the type-A Orlik--Solomon algebra.

Global fluctuations of random standard Young tableaux
Gabriel Raposo, University of California Berkeley

We characterize the law of large numbers and the central limit theorem behaviors for random partitions. As an application of these results, we present a framework to obtain conditional Gaussian Free Field fluctuations for height functions associated with random standard Young tableaux. To prove these results we develop algebraic formulas for operators on the Gelfand–Tsetlin algebra of the symmetric group.

Cyclic Sieving for Staircase Plane Partitions via Crystals and Electrical Networks
Jesse Kim, University of Florida

We prove a cyclic sieving result for the action of promotion on the staircase plane partitions of height two. Our proof uses an interpretation of this action in terms of invariants of tensor powers of spin representations that was recently studied by Pappe--Pfannerer--Schilling--Simone. In our proof, we also use the bush basis of the degree two part of the coordinate ring of the space of electrical networks, which was recently introduced by Gao--Lam--Xu. Moreover, we explain how the existence of an electrical canonical basis in all degrees would yield cyclic sieving for promotion of staircase plane partitions of all heights.

Diagonal supersymmetry for coinvariant rings
John Lentfer, University of California Berkeley

The classical coinvariant ring was generalized by Haiman (1994) to the diagonal coinvariant ring, which consists of a polynomial ring in two sets of variables quotiented by the ideal generated by polynomials invariant under the diagonal

action of the symmetric group, without constant term. Recently there has been much interest in studying (k,j)-bosonic-fermionic coinvariant rings, which are defined analogously for k sets of commuting (bosonic) and j sets of anticommuting (fermionic) variables. We prove the "diagonal supersymmetry" conjecture of Bergeron (2020), which asserts that the multigraded Frobenius series of a (k,j)-bosonic-fermionic coinvariant ring can be expressed in terms of universal coefficients, super Schur functions, and Frobenius characters. We compute some of these universal series coefficients and discuss applications.

Evacuation of rectangular standard Young tableaux corresponds to reflection of sl_n webs
Kerry Seekamp, Smith College

Web graphs form a family of planar directed graphs with a boundary that can be used to model quantum sl_n-invariant vectors. Standard Young tableaux on an n×k rectangle naturally index a basis for sl_n web graphs. We show that the evacuation of a standard Young tableau corresponds to the reflection of its associated web graph, up to equivalence under a specific set of edge-flip relations. This extends a result of Patrias and Pechenik for the cases n=2,3 and mirrors analogous results about rotation of web graphs corresponding to promotion of tableaux by Peterson-Pylyavskyy-Rhoades for n=3 and Gaetz-Pechenik-Pfannerer-Striker-Swanson for n=4. We employ an intermediate object called a multicolored noncrossing matching, which is closely related to the notion of strandings recently introduced by Russell and Tymoczko. This work was also co-authored by Julianna Tymoczko.

A Geometric Approach to the Links-Quivers Correspondence for Rational Links
Jonathan Higgins, University of Illinois at Urbana-Champaign

The colored HOMFLY-PT skein module evaluation of a rational tangle is a linear combination of "basic webs," and it can be computed by applying twist rules to the skein module element of the trivial tangle. Taking the closure of these objects gives the colored HOMFLY-PT "polynomials" for the corresponding rational links. The Links-Quivers correspondence conjectures that the generating function for these invariants can be put in a "quiver form" so that computing the entire generating function reduces to computing a quadratic form and two linear forms. Stosic and Wedrich proved the conjecture for rational tangles and links, but their proof left open the question of how the quiver relates to them geometrically. I give a direct geometric description of the quadratic form in terms of the second symmetric product of the punctured plane.

Twists, Higher Dimer Covers, and Web Duality for Grassmannian Cluster Algebras
Elise Cantania, University of Minnesota

We study a twisted version of Fraser, Lam, and Le's higher boundary measurement map, using face weights instead of edge weights, thereby providing Laurent polynomial expansions, in Plücker coordinates, for twisted web immanants for Grassmannians. In some small cases, Fraser, Lam, and Le observe a phenomenon they call "web duality," where web immanants coincide with web invariants, and they conjecture that this duality corresponds to transposing the standard Young tableaux that index basis webs. We show that this duality continues to hold for a large set of SL_3 and SL_4 webs. Combining this with our twisted higher boundary measurement map, we recover and extend formulas of Elkin–Musiker–Wright for twists of certain cluster variables. We also provide evidence supporting conjectures of Fomin–Pylyavskyy as well as one by Cheung–Dechant–He–Heyes–Hirst–Li concerning classification of cluster variables of low Plücker degree in the coordinate ring of Gr(3,n). This is joint work with Esther Banaian, Christian Gaetz, Miranda Moore, Gregg Musiker, and Kayla Wright.

Lifting sl2 Skeins to Weighted Cycles on Weaves
William Hurst, The University of North Carolina at Chapel Hill

We introduce a quantum algebra homomorphism lifting sl2 skeins on marked surfaces to weighted cycles on weaves. sl2 skeins can be Ore localized to quantum cluster algebras, as shown by Greg Muller. sl2 weaves on marked surfaces map to the quantum torus via merodromy maps on weighted cycles (Daping Weng's work), and these are tied to quantum cluster algebras as well. We describe the quantum algebra lifting in terms of an ideal triangulation on a marked surface and provide some examples of this lifting. We show that this lifting is well-defined and that it is compatible with the mutation operation we see in sl2 weaves and sl2 quantum cluster algebras.

Webs and Maximally Inflected Curves?
Frank Sottile, Texas A&M University

This poster will present a surprising and conjectural connection between maximally inflected plane curves of degree d+2 and sl_3-webs. Under a natural identification of each with 3xd standard tableaux, the web appears to encode the topology of the curve, including its Welschinger invariant. This behavior persists when the flexes (ramification points) collide, and the webs acquire ramification data (a refinement of 'collapsed' webs). There is also a natural identification of real rational functions to curves whose tableaux has 12..d in its first row. The corresponding operation on the corresponding web recovers a known relation between rational functions and nets. While this relation is somewhat conjectural, it would have remarkable consequences in real algebraic geometry and enriched enumerative geometry. This represents joint work with Brazelton, Karp, Levinson, and McKean.

K0-Ring of Spanning Line Configurations and Pipe Dream Combinatorics
Michael Ruogan Zeng, University of Washington

The variety of spanning line configurations is a smooth quasiprojective cellular variety that has many interesting connections to Schubert calculus, ordered set partitions, aka Fubini words. Pawlowski-Rhoades showed that its cohomology ring has a Borel-style presentation as a generalized coinvariant algebra with a basis closely related to Schubert polynomials. The Grothendieck group of a variety is a commutative ring that measures how vector bundles over the variety decompose into simpler pieces. We establish a general relationship about the Grothendieck group of an open complement of cell closures and quotient rings. Using that, we show that the Grothendieck group, the Chow ring, and the cohomology of the variety of spanning line configurations are all isomorphic to the same generalized coinvariant algebra. Motivated by this computation, we identify a Grothendieck basis for the generalized coinvariant algebra and define classical and bumpless pipe dreams for Fubini words.

Cluster algebras on electrical networks and on the Grassmannian
Lazar Guterman, Hebrew University of Jerusalem

An electrical network with n boundary vertices induces a matrix called the response matrix which measures the electrical properties of the network. The set of response matrices of all electrical networks has a characterization in terms of positivity of circular minors. Alman, Lian and Tran constructed a cluster algebra on the set of circular minors, which encodes the tests for positivity of these minors. Lam established the embedding of the set of electrical networks with n boundary vertices into the totally nonnegative Grassmannian $Gr_{\ge0}(n-1,2n)$. The coordinate ring of the Grassmannian has a cluster algebra structure as was proved by Scott. Given an electrical network, we find a relation between circular minors of its response matrix and Plücker coordinates of its image in the Grassmannian. Using this property, we prove that for an odd n the two cluster algebras, on circular minors and on the

Grassmanian, become isomorphic after a natural freezing and subsequent trivialisation of a certain variables in their initial seeds. We apply this isomorphism in order to relate the tests for positivity of circular minors to tests for positivity in the Grassmannian. The poster is based on a joint work with Boris Bychkov and Anton Kazakov.