Student Research Session
Session de présentations de recherche par les étudiants
(Org: **Rebecca Abi Abdallah** (Université de Montréal) and/et **Kate Tretiakova** (University of Ottawa))

DYLAN CANT, Université de Montréal

ABDOULAYE DIALLO,
Lamé monodromy and modular Schwarzian equations

We introduce two second-order ordinary differential equations in Schrödinger form: the Lamé equation in the elliptic variable (z), with potential $(n(n+1)\wp(z;\tau)+B)$, and a modular differential equation in the modulus (τ), with a weight-four modular potential. We link the two equations through the period monodromy of the Lamé equation. At spectral values where the period monodromy is not completely reducible, we identify its projective Jordan datum with a projective period class $\mathcal{C}$ and show that $\mathcal{C}$ is equivariant under the modular group.

We then study the permutation monodromy obtained by varying the elliptic modulus. Over the Legendre parameter line, each nonlinear irreducible Type I or marked Type II spectral cover of degree N is simply branched at $N(N-1)$ points and has full symmetric monodromy S_N. We explain how intersections of the marked branch loci govern the Galois groups, including the exceptional quadratic cases.

We will close with the explicit example $n=3$, $B=0$, where the Schwarzian derivative of the projective period class satisfies

$$\{\mathcal{C},\tau\} = 2\pi^2 E_4(\tau).$$

NOHA ELGAREM, University of Toronto
Image Cones and Conjugacy Invariants of Matrix Lie Subalgebras

The classification of Lie subalgebras up to conjugacy is a fundamental problem in Lie theory. An important aspect of this problem is finding invariants that distinguish non-conjugate subalgebras.

In this talk, I present results concerning the *image cone* of a matrix Lie subalgebra $\mathfrak{g}$, defined by

$$\mathrm{im}(\mathfrak{g}) = \{Xv : X \in \mathfrak{g},\ v \in \mathbb{C}^n\}.$$

Although the image cone is closed under scalar multiplication, it need not be a vector subspace. I investigate conditions under which it is a subspace, proving that, among all conjugacy classes of subalgebras of $\mathfrak{sl}_3(\mathbb{C})$, exactly one has an image cone that is not a vector subspace. I also establish that the image cone is a vector subspace for every subalgebra of $\mathfrak{so}_n(\mathbb{C})$ when $n \leq 4$, while this property does not necessarily hold in higher dimensions.

In addition, I introduce and study conjugacy invariants, including the total column rank and total row rank. Together with other structural invariants, these provide a complete set of invariants distinguishing the conjugacy classes of subalgebras of $\mathfrak{sl}_3(\mathbb{C})$.

JOEY FINGOLD, University of Guelph

MUSBAHU IDRIS, Institut Élie Cartan de Lorraine & University of Lorraine

TAMIS PANAGIOTAKIS, University of Toronto

JOHNNA PARENTEAU, University of Regina

YUXUAN SUN, University of Toronto
Some Results in Coxeter Schubert Calculus

In this talk, I will give an overview of Coxeter Schubert calculus following the recent preprint by Bergeron, Gagnon, Spink and Tewari. Coxeter Schubert calculus is the study of intersections of Coxeter Schubert cycles, which may be viewed as torus-invariant subvarieties of Schubert cycles defined via a fixed Coxeter word. I will first give a brief summary of Schubert cycles on complete flag varieties, followed by the construction of Coxeter Schubert cycles and their relations to (ordinary) Schubert cycles. Then, I will present some positivity results in Coxeter Schubert calculus, with a focus on how these results connect to positivity in ordinary Schubert calculus. In particular, all of the results presented are valid in a torus-equivariant setting. No prior knowledge of Schubert calculus will be assumed from the audience.

TALK/PANEL/Q&A,

IZ TECUM, Columbia University