TITLES AND ABSTRACTS

MARKO AND DIRK

Speakers, titles and abstracts

- **Monday**

2pm
Michael Borinsky:
Asymptotics for graph complex Euler characteristics
I will report on a work on the asymptotic growth rate of the top-weight Euler characteristic of $M_{g,n}$ and on an ongoing joint work with Karen Vogtmann on the topology of $Out(F_n)$. In both cases, graph complexes, which compute the cohomology of the respective spaces, are instrumental. Proofs of the asymptotic growth rate of the Euler characteristics in each case establish the existence of large amounts of unexplained cohomology both in the odd-degree for $Out(F_n)$ and the top-weight cohomology of $M_{g,n}$.

3:45pm
Sam Payne:
Weight two cohomology of moduli spaces of curves, via graph complexes
The weight zero compactly supported cohomology of moduli spaces of curves $W_0H_c^*(M_{g,n})$ is naturally isomorphic to the cohomology of the genus g part of the standard commutative graph complex with n marked external vertices, by results from earlier joint work with Melody Chan and Søren Galatius.

In this talk, I will discuss more recent joint work with Thomas Willwacher, using commutative graph complexes with additional decorations on the external vertices, similar to those appearing in work of Fresse-Turchin-Willwacher on the embedding calculus to study the next nontrivial weight-graded piece of the compactly supported cohomology of moduli spaces of curges, $gr_2^W H_c^*(M_{g,n})$. Among other results, we show that $\dim H^{4g-k}(M_g)$ grows at least exponentially with g, for k in $\{8, 9, 11, 12, 14, 15, 16, 18, 19\}$.

- **Tuesday**

11am
Marko Zivkovic:
Orienting graph complexes - from hairy to commutative graph complexes
Recent results about oriented hairy graph complexes add new combinatorial connections between various graph complexes and their oriented counterparts in the process called 'orienting'. We will explain that connection in the natural order, from hairy graph complexes with labelled hairs, through unlabelled hairs, to basic Kontsevich commutative graph complexes.

2pm
Oliver Schnetz:
Invariant graphical functions and a proof of the wheels conjecture
We suggest that Francis Brown's invariant integrals have a canonical formulation in terms of sums of graphical functions in various even dimensions. We use this expression to give an elementary proof of the conjectured formula for the invariant integral of the odd wheels in terms of single zetas.

3:45pm
Ben Ward:
Lie graph homology model for grt_1
I will describe a new graph complex which is constructed from Lie graph homology as input but which computes commutative graph homology as output. Particular emphasis will be placed on how known features of the Grothendieck-Teichmuller Lie algebra are reflected in Lie graph homology.

- **Wednesday**

2pm
Gaetan Borot:
Moments of asymptotic multicurve counts
The number of multicurves of length smaller than p on a hyperbolic surface X of genus g with n boundaries grows like $B([X])p^{6g-6+2n}$, where the prefactor depends only on the point $[X]$ in the moduli space. Arana-Herrera recently showed that B is L^2 with respect to the Weil-Petersson measure. In some aspects which I will delimitate, the Weil-Petersson geometry of the moduli space of bordered surfaces with very large boundaries approaches the geometry of the combinatorial moduli space (i.e. the cell complex of metric ribbon graphs) introduced by Kontsevich in 1991. There is a similar function B_{comb} when one considers multicurves on metric ribbon graphs. Contrarily to the hyperbolic case, $B_{comb}([X])$ can be computed explicitly, and I will explain that it is only L^{s-} on the combinatorial moduli space, for $s < 2$ that depends non-trivially on g and n. The method of proof relies on a convex optimisation problem and identification of sub-ribbon graphs leading to the worst divergences.

This is joint work with Severin Charbonnier, Vincent Delecroix, Alessandro Giacchetto and Campbell Wheeler.

3:45pm
Karen Yeats:
Dyson-Schwinger equations, trees, graphs, and chord diagrams
I'll start by overviewing the combinatorial perspective on Dyson-Schwinger equations and proceed to some more recent thoughts elaborating on some features of chord diagram expansions.

- **Thursday**

11am
Francis Brown:
Laplacians for graph with external legs, and canonical Feynman integrals.
In this talk I will explain how to extend the tropical Torelli map, which is defined for graphs without external legs, to the case of Feynman graphs which have external kinematics and particle masses. It involves a generalised Laplacian matrix whose determinant is the second Symanzik polynomial related to earlier work of Bloch and Kreimer. Using bi-invariant forms for the general linear group, we can subsequently define canonical integrals for graphs depending on kinematics. They are generalised Feynman integrals which are always finite, satisfy some interesting algebraic relations, and may potentially be used to detect classes in certain graph complexes.

2pm
Ralph Kaufmann:
Cubical Feynman categories, cubical complexes and spines
Together with C. Berger we show that using the W-construction which we defined together with B. Ward for cubical Feynman categories constructs moduli spaces and their combinatorial (Kontsevich-Penner) compactifications. These are related through a spine construction which can be understood as an interplay between cubes, cones and simplices. In a separate step with J. Zuniga, we can use blow-ups to generate a tower of moduli spaces which includes the DM-compactification and the KSV compactification. This setup depends on the inclusion of trees, or better forests, into connected graphs and generalizes to a relative setting depending on a factorization system as we shall discuss. This opens the construction of moduli space and compactifications to other settings such as Outer space and further unexplored territory. If time permits, we will also discuss the connections to B_+ operators and matrices for variations in the Cutkosky rules as given in the program of Bloch and Kreimer to these combinatorics.

3:45pm
Melody Chan:
The top-weight rational cohomology of A_g
In joint work with Madeline Brandt, Juliette Bruce, Margarida Melo, Gwyneth Moreland, and Corey Wolfe, we recently identified new top-weight rational cohomology classes for moduli spaces A_g of abelian varieties, by using computations of Voronoi complexes for $GL_g(\mathbb{Z})$ of Elbaz-Vincent–Gangl–Soulé. In this talk, I will try to explain these results from the beginning, surveying some of the main techniques and ingredients.

- **Friday**

11am
Gavril Farkas:
Resonance and fundamental group of hyperplane arrangements
The Chen ranks of a group are subtle invariants of its lower central series that turn out to be amenable to computations via homological methods. Suciu (based on earlier work of Sullivan, Dimca, Papadima and others) conjectured that in the case of hyperplane arrangements, the Chen ranks are essentially combinatorial and proposed a formula for them in terms of the components of the associated resonance variety. I will discuss a resolution of this conjecture using algebraic geometric methods. Joint with Aprodu, Raicu and Suciu.

2pm
Karen Vogtmann:
Graph complexes and outer space
I will go over the construction of Outer space, its simplicial closure and its bordification, and explain the relationship to Kontsevich's commutative, Lie and associative graph complexes.