Cycles on Moduli Spaces, Geometric Invariant Theory, and Dynamics

Poster Session Abstracts
Tuesday, August 2, 2016

A generic slice of the moduli space of line arrangements
Kenny Ascher, Brown University

We study the compactification of the locus parametrizing lines with a fixed intersection with a given line, inside the moduli space of line arrangements in the projective plane constructed for weight one by Hacking-Keel-Tevelev and Alexeev for general weights. We show that this space is smooth, with normal crossing boundary, and that it has a morphism to the moduli space of marked rational curves which can be understood as a natural continuation of the blow up construction of Kapranov. In addition, we prove that it is isomorphic to a closed subvarie ty inside a non-reductive Chow quotient. This is joint work with Patricio Gallardo (UGA).

Lyapunov exponents and $SL_2(\CC)$-representation variety
Matteo Costantini, Johann Wolfgang Goethe-Universität

LYAPUNOV EXPONENTS AND $\mathrm{SL}_2(\mathbb{C})$-REPRESENTATION VARIETY

Lyapunov exponents can be defined as numbers describing the dynamics of the geodesic flow on a Riemann surface X with respect to a representation of its fundamental group.
We define special loci of the $SL_2(\mathbb{C})$-representation variety and describe the behaviour of the Lyapunov exponent function on these loci. Our main tool is a result relating Lyapunov exponents to the degree of holomorphic subbundles of the flat bundle induced by a representation.

Universal moduli spaces of vector bundles and the log-minimal model program on the moduli of curves
Matt Grimes, University of Colorado Boulder

Following work of Mumford, Newstead, Seshadri, and Pandharipande, we construct a compactification of the universal moduli space of vector bundles over the moduli space of pseudo-stable curves.

The average number of integral points in orbits
Wade Hindes, The Graduate Center, CUNY

Over a number field K, a celebrated result of Silverman states that if \phi(x)\in K(x) is a rational function whose second iterate is not a polynomial and P\in\mathbb{P}^1(K), then the set of integral points in the forward orbit of P is finite. This poster discusses the "average" number of integral points in orbits.

The Siegel Modular Form Defining $\Omega\mathcal{M}_3^{odd}(4)$
Xuntao Hu, Stony Brook University

We determine an explicit modular form for the locus of hyperflex plane quartics and study the boundary of this locus.

Effective divisors from strata of abelian differentials
Scott Mullane, Boston College

We investigate the effective cone of divisors in the of the moduli space of curves through the subvarieties defined by the strata of abelian differentials.

Smoothing Differentials
Chaya Norton, University of Montreal

In this poster, we will outline a new tool which may be used to describe all possible smoothings of a collection of differentials on any stable nodal curve. The smoothing procedure follows from solving a jump problem on the plumbed Riemann surface which is found by integrating against a Cauchy kernel. An explicit bound of the solution to the jump problem will be given in terms of plumbing parameters.

These results are used in a joint paper with S. Grushevsky and I. Krichever for Real-Normalized differentials and applies more generally.

Ergodic Eaton lens distributions in the plane
Martin Schmoll, Clemson University

We describe Eaton lens distributions in the plane which are ergodic in almost every direction. We construct all quadratic differentials on tori which cover the pillowcase in such a way that their Lyapunov exponents vanish. Then we consider particular representations of their ``universal homology covers'' leading to the Eaton lens distributions. Ergodicity is concluded from the vanishing Lyapunov exponents.

Iterated Monodromy Groups and Invariant Graphs
Anastasia Shepelevtseva, Higher School of Economics

The Iterated Monodromy Group (IMG) provides a complete invariant for a Thurston equivalence class of a post-critically finite branched covering. The notion was introduced by Volodimir Nekrashevich. It is an example of a self-similar group and it is a homomorphic image of the fundamental group of the sphere minus the post-critical set. The IMG can be represented by an automaton (e.g., in terms of the associated Moore diagram). Combinatorial presentation of a branched covering translates into an explicit presentation of its IMG using an invariant graph containing the post-critical set (for topologically expanding Thurston maps, such graphs have been constructed in the paper Mario Bonk, Daniel Meyer "Expanding Thurston Maps"; this construction has been carried over to some other classes of maps by Hlushchanka and others). In this work we approach an explicit algebraic description of the IMGs using the combinatorics of invariant trees.

Gromov-Witten invariants and variation of GIT quotients
Robert Silversmith, University of Michigan

We study a correspondence conjectured by Witten and Ruan known as the Landau-Ginzburg/Calabi-Yau (LG/CY) correspondence. Genus zero Gromov-Witten invariants of a smooth proper variety or orbifold X are, roughly, counts of rational curves on X of a fixed degree. More precisely, they are intersection numbers on Kontsevich spaces of stable maps to X. On the other hand, Fan-Jarvis-Ruan-Witten (FJRW) invariants are intersection numbers on moduli spaces of roots of certain line bundles on an orbifold curve. FJRW invariants are motivated by physics, and are combinatorial in nature. The LG/CY correspondence postulates an explicit relationship between the two sets of invariants. We use a realization of both moduli spaces as spaces of quasimaps, developed by Ciocan-Fontanine and Kim, to verify the conjecture in the case X = [E^3 / \mu_3], where E = V(x^3+y^3+z^3) \subseteq P^2 and \mu_3 acts diagonally. As the main ingredient we establish a new form of mirror symmetry for X compatible with variation of GIT quotients.

Logarithmic structures and the tropical geometry of moduli spaces
Martin Ulirsch, Fields Institute for Research in Mathematical Sciences

The moduli space of tropical curves (and its variants) are some of the most-studied objects in tropical geometry. So far this moduli space has only been considered as an essentially set-theoretic coarse moduli space (sometimes with additional structure). As a consequence of this restriction, the tropical forgetful map does not define a universal curve (at least in the positive genus case). The classical work of Knudsen has resolved a similar issue for the algebraic moduli space of curves by considering the fine moduli stacks instead of the coarse moduli spaces.

In this poster I am going to give an introduction to these fascinating moduli spaces and report on ongoing work with R. Cavalieri, M. Chan, and J. Wise, where we propose the notion of a moduli stack of tropical curves as a geometric stack over the category of rational polyhedral cones. Using

this 2-categorical framework one can give a natural interpretation of the forgetful morphism as a universal curve. The coarse moduli space arises as the set of $\mathbb{R}_{\geq 0}$-valued points of the moduli stack. Moreover, I will also explain how the process of tropicalization for these moduli stacks can be phrased using the moduli space of logarithmically smooth curves.

A compactification of the strata
Chenxi Wu, Cornell University

A Borel-Serre like compactification of the strata of translation surfaces, with application on horocycle orbit closures.

This is an ongoing work with John Smillie.

Orbifold Points on Prym-Teichmüller Curves
Jonathan Zachhuber, Goethe Universität Frankfurt

We compute the number and types of orbifold points for McMullen's Prym-Teichmüller curves in the moduli spaces M_3 and M_4. This is joint work with David Torres-Teigell.