

TITLES and ABSTRACTS

Arbesfeld Noah

TBA

Bellamy Gwyn

Resolutions of symplectic quotient singularities.

In this talk I will explain how one can explicitly construct all crepant resolutions of the symplectic quotient singularities associated to wreath product groups. The resolutions are all given by Nakajima quiver varieties. In order to prove that all resolutions are obtained this way, one needs to describe what happens to the geometry as one crosses the walls inside the GIT parameter space for these quiver varieties. This is based on joint work with Alistair Craw.

Bouthier Alexis

Perverse Sheaves and Affine Springer Theory

Affine Springer fibers are the local counterparts of Hitchin fibers. So far, Hitchin fibration was easier to handle as it is finite dimensional and fibers behave better in family. In the local situation, we consider a Affine Springer fibration, which can be seen as an intermediate of the usual Springer fibration and Hitchin fibration. We show that in this infinite-dimensional context, we can build a theory of perverse sheaves, such that the fibration is small and the pushforward of the dualizing sheaf is perverse irreducible, obtained as the intermediate extension of the situation over a nice locus. Joint work with D. Kazhdan and Y. Varshavsky.

Braverman Alexander

TBA

Davison Ben

The less perverse filtration in K3 categories

There is a perverse filtration on the Borel-Moore homology of the stack of representations of the preprojective algebra, arising from dimensional reduction and cohomological DT theory, for which the BPS Lie algebra is the first perverse piece. It turns out there is a "less" perverse filtration that can be defined (though not studied) without any Jacobi algebras etc., which has the universal enveloping algebra of the BPS Lie algebra as its zeroth graded piece. As an application of the purity of the mixed Hodge module underlying this algebra, we prove Halpern-Leistner's purity conjecture for the Borel-Moore homology of the stack of semistable sheaves on a K3 surface.

de Cataldo Mark

The Hodge numbers of O'Grady 10 via Ngô strings

I report on the joint work [arXiv:1905.03217](https://arxiv.org/abs/1905.03217) with A. Rapagnetta and G. Sacca', where we compute the Hodge numbers of the irreducible holomorphic symplectic variety known as

O'Grady 10, this being the last known example of such a variety, for which these invariants were not known before. Deforming the O'Grady manifold, turns it into a weak abelian fibration in the sense of Ngô. We then exploit what we call Ngô strings (promoted from topology to mixed Hodge theory), which are summands in the decomposition theorem for weak abelian fibrations arising from the action of a group scheme on the fibration. This is not enough, we need to do the same for a companion fibration whose total space we understand. We then relate the two and conclude via a calculation in the Grothendieck group of polarizable pure Hodge structures. When the deformation is a moduli space of pure dimension one sheaves on a K3 surface, we determine the Hodge structure in terms of the one of the K3 surface.

Fujita Ryo

Graded quiver varieties and singularities of normalized R-matrices for fundamental modules

The normalized R-matrices are realized as intertwining operators between tensor products of two finite-dimensional simple modules of the quantum loop algebras. They can be seen as matrix-valued rational functions in spectral parameters, whose denominators determine when the tensor product modules become reducible. In this talk, we present a unified formula expressing the denominators of the normalized R-matrices between the fundamental modules of type ADE. It has an interpretation in terms of representations of the Dynkin quivers and can be proved in a unified way using the geometry of Nakajima's graded quiver varieties. As a by-product, it yields a geometric interpretation of Kang-Kashiwara-Kim's generalized quantum affine Schur-Weyl duality when it arises from a collection of fundamental modules.

Gukov Sergei

SL(2,C) character varieties and DT-invariants

Hausel Tamas

An enumerative approach to $P=W$

We introduce an enumerative approach to the $P = W$ conjecture, which identifies the perverse filtration of the Hitchin system on the cohomology of the moduli space of Higgs bundles with the weight filtration of the corresponding character variety. Our technique only uses the structure of the equivariant intersection numbers on the moduli space of Higgs bundles, and nothing from the topology of the Hitchin map. In the rank 2 case starting from the known intersection numbers of the moduli of stable bundles, we derive the equivariant intersection numbers on the Higgs moduli, and then verify the top perversity part of our enumerative $P = W$ statement for even tautological classes from the existence of polynomial solutions to the Discrete Heat Equation satisfying particular vanishing properties. For odd classes, we derive a determinantal criterion for $P = W$. This is joint work with Simone Chiarelllo and Andras Szenes.

Heinloth Jochen

TBA

McGerty Kevin

On hyper-Kähler Kirwan surjectivity.

A classical result of Kirwan shows that the cohomology of a GIT quotient is naturally a quotient of the equivariant cohomology of the original space, in other words, the natural pull-back map is surjective. Taking into account the relationship between symplectic and GIT quotients, one is led naturally to the analogous question for hyper-Kähler quotients, or in algebraic geometry, holomorphic symplectic reductions. In this setting we do not have a clear general picture, but there are now a number of striking results: surjectivity, holds for quiver varieties, but fails for Higgs bundles, which can be viewed as infinite dimensional hyper-Kähler reductions. We will describe a family of finite dimensional examples where surjectivity fails.

Mellit Anton

The curious hard Lefschetz property for character varieties

I will talk about a way to decompose the character variety of a Riemann surface of arbitrary rank with prescribed semisimple generic local monodromies into cells where each cell looks like a product of an affine space and a symplectic torus. This can be thought of as abelianization. As an application, we deduce the curious hard Lefschetz property conjectured by Hausel, Letellier and Rodriguez-Villegas, which claims that the operator of cup product with the class of the holomorphic symplectic form is an isomorphism between complementary degrees of the associated graded with respect to the weight filtration on the cohomology.

Mereb Martin

Some counting techniques for character varieties

We will go over some techniques to count points of character varieties over finite fields. The goal is to find polynomials that give, at least for sufficiently many primes, the exact number of points. This is usually done through arithmetic harmonic analysis, a sort of Fourier transform involving the character tables of finite groups, or some Hecke algebras, depending on the problem. These counting functions relate to certain geometric invariants of the complex variety and permit to conjecture their Hodge structure.

Rodriguez-Villegas Fernando

Kirillov-Reshetikin and the Kac polynomial at $q=1$

I will describe how the asymptotics of Hua's formula for the Kac polynomial of an arbitrary quiver leads to an expression for its value at $q=1$ analogous to the fermionic formulas of Kirillov-Reshetikin.

Schedler Travis

Singularities of Moduli of 2-Calabi-Yau's: Quiver and character varieties

Many moduli spaces appearing in algebraic geometry and topology admit a symplectic structure on the smooth locus, such as: character varieties and moduli of Higgs bundles on Riemann surfaces, moduli of sheaves on K3 surfaces, and Nakajima quiver varieties. At singularities they are often known to étale-locally have quiver models. Thanks to work with Bellamy, this implies geometric

properties such as normality and factoriality, or existence of symplectic resolutions. I will explain how this falls under a general framework of moduli of sheaves/modules over 2-Calabi-Yau. A theorem of Bocklandt-Galluzzi-Vaccarino provides the local model, once one establishes the 2CY property. I will explain a theorem in joint work with Kaplan which carries this out for character varieties of open surfaces, or more generally multiplicative quiver varieties (building on earlier results with Bellamy and with Tirelli).

Schrader Gus

TBA

Shen Junliang

Hitchin systems, hyper-Kaehler geometry, and the $P=W$ conjecture

The $P=W$ conjecture by de Cataldo, Hausel, and Migliorini suggests a surprising connection between the topology of Hitchin systems and Hodge theory of character varieties. In this talk, we will focus on interactions between compact and noncompact hyper-Kaehler geometry. Such connections, together with symmetries coming from the moduli of compact hyper-Kaehler manifolds, lead to new progress on the $P=W$ conjecture. This is joint work with Mark de Cataldo and Davesh Maulik.

Wyss Dimitri

Irregular open de Rham spaces and quivers with multiplicities

Open de Rham spaces are moduli spaces of connections on the projective line with poles along a fixed divisor. If the divisor is reduced, Hausel, Letellier and Rodriguez-Villegas computed the (virtual) Hodge polynomial of the resulting moduli space and identified it with the pure part of the mixed Hodge polynomial of the corresponding character variety. The purity conjecture by the same authors predicts, that this relation holds already on the level of cohomology rings.

In joint work with Tamas Hausel and Michael Wong, we extend their results to non-reduced divisors. The main new ingredient is a formula for the (motivic) Fourier transform of a regular semi-simple adjoint orbit in certain non-reductive groups. We also identify these irregular open de Rham spaces with moduli spaces of representations of quivers with multiplicities, similar to a construction of Crawley-Boevey in the regular case.