Program - Winter pre-School

Representation Theory

CIRM - 6-10 January 2020

- JOCHEN HEINLOTH (UNIVERSITAT DUISBURG-ESSEN),

  Moduli spaces of sheaves and character varieties

  Abstract: Character varieties are spaces of representations of a finitely generated group. These have a natural algebraic structure as an algebraic variety (or an algebraic stack) and moreover these have seemingly concrete descriptions by equations. Unfortunately, even in very simple cases these turn out to be hard to analyze.

  Simpson proved a famous result that in case the group is a fundamental group of a projective variety, relates these spaces to moduli spaces of sheaves, that can be studied by other methods.

  In these introductory lectures I will try to start with some classical results on character varieties, to get a feeling for the problems involved and learn a bit how these can be understood once one learns a bit about algebraic stacks. Once these methods are in place, it is not hard to understand the parallel geometric questions on moduli of sheaves and so called Higgs bundles. At the end I will try to explain some more recent results and open problems related to the comparison of the geometry of these spaces.

- MYUNGHO KIM (KYUNG HEE UNIVERSITY)

  KLR algebras and quantum affine algebras

  Abstract: We will review the categories of finite-dimensional graded modules over symmetric KLR algebras and the categories of finite-dimensional modules over a quantum affine algebras. We will see that these two classes of categories share some interesting properties in common. For example, there is a way to construct functors between them, called the generalized quantum affine Schur-Weyl duality. And they are also natural sources for monoidal categorification of cluster algebras.

  (1) Definitions and properties of symmetric KLR algebras / Quantum affine algebras

  (2) Generalized quantum affine Schur-Weyl duality functors

  (3) Monoidal categorification of cluster algebras via KLR algebras and quantum affine algebras

- NICOLAS LIBEDINSKY (UNIVERSITY OF CHILE)

  Soergel bimodules and p-Kazhdan-Lusztig theory

  Abstract: In the first talk I will give a very concrete introduction to Soergel bimodules. In the second one, I will explain how to work with Soergel calculus (a category equivalent to the one of Soergel bimodules). In the last lecture I will explain some very interesting new results and open problems related to the p-canonical basis.

- LAURA RIDER (UNIVERSITY OF GEORGIA)

  Constructible sheaves on flag varieties and modular representation theory

  Abstract: Over the last 40 years, constructible sheaves have been an extremely useful tool in Lie theoretic representation theory. More recently, the advent of parity sheaves has lead to many advances in positive characteristic. In these talks, we will introduce constructible sheaves, their operations, and the subcategories of perverse and parity sheaves. Special emphasis will be given to the example of sheaves on flag varieties. As time permits, we will discuss the appearance of these categories in representation theory—more specifically, geometric Satake equivalence, Iwahori Hecke algebras, category O, and modular category O.

- CHANGJIAN SU (UNIVERSITY OF TORONTO)

  Quiver varieties, quantum cohomology and quantum groups

  Abstract: The goal of my lectures is to introduce the work of Davesh Maulik and Andrei Okounkov on the quantum cohomology of Nakajima quiver varieties (arXiv 1211.1287). In particular, we will talk about their construction of a Yangian action on the equivariant cohomology of quiver varieties, and their computation of the quantum connection of the quiver varieties.

Program :

Monday	Tuesday	Wednesday	Thursday	Friday
9h00-10h30 HEINLOTH	9h00-10h30 KIM	9h00-10h30 SU	9h00-10h30 RIDER	9h00-10h30 LIBEDINSKY
10h45-12h15 RIDER	10h45-12h15 LIBEDINSKY	10h45-12h15 KIM	10h45-12h15 HEINLOTH	10h45-12h15 KIM
Lunch	Lunch	Lunch	Lunch	Lunch
	15h30-17h HEINLOTH		15h30-17h SU	
17h30-19h SU	17h30-19h RIDER		17h30-19h LIBEDINSKY	