Clay Research Conference 2024

Abstract of Talks

Ana Caraiani (Imperial)

Title: The cohomology of Shimura varieties - a survey of recent developments

Abstract: Shimura varieties are highly symmetric algebraic varieties that play an important role in the Langlands program. In the first part of the talk, I will try to give you a sense of what they are like, with a focus on their different kinds of symmetries. In the second part of the talk, I will survey a recent class of results about the vanishing of the cohomology of Shimura varieties with torsion coefficients. To give you a sense of the breadth of the subject, I will mention both connections to the geometric Langlands program and applications to long-standing problems, such as the modularity of elliptic curves.

Mark Andrea de Cataldo (Stony Brook)

Title: The P=W Conjecture in Non Abelian Hodge Theory

Abstract: The complex singular cohomology groups of a projective manifold can be described in at least three ways via the de Rham Theorem and the Hodge Decomposition. By taking into account integral cohomology, we obtain three different descriptions of the singular cohomology groups with coefficients in the non-zero complex numbers GL_1. Now, replace GL_1 with a complex algebraic reductive group G, e.g. GL_n. The Non Abelian Hodge Theory of Corlette, Simpson et al. establishes a natural homeomorphism between three distinct complex algebraic varieties parametrizing three different kinds of structures on the projective manifold associated with the reductive group: representations of the fundamental group into G, flat algebraic G-connections, G-Higgs bundles. The case G=GL_1, which is Abelian, recaptures the de Rham and Hodge Decomposition. The three complex algebraic varieties of Non Abelian Hodge Theory have naturally isomorphic cohomology groups. However, by taking into account their distinct structures of algebraic varieties, the cohomology groups carry additional distinct structures. The P=W Conjecture seeks to relate two of these structures, at least in the case of compact Riemann surfaces. This talk is devoted to introducing the audience to this circle of ideas and related developments.

Timothy Gowers (Cambridge)

Title: Some recent developments in combinatorics

Abstract: Over the last few years, a surprising number of extremely stubborn open problems in combinatorics have suddenly yielded. Some have been solved completely, while for others there have been leaps forward that far exceed any progress made for several decades. It is a remarkable time to be alive for a combinatorialist: in this talk I shall describe some of these recent breakthroughs and try to convey some of the excitement I (and many others) feel about them.

Rahul Pandharipande (ETH Zürich)

Title: Cycles on the moduli space of abelian varieties

Abstract: I will explain developments in the study of cycles on the moduli space of abelian varieties with connections to the moduli space of curves, the cohomology of the Lagrangian Grassmannian, and the quantum cohomology of the Hilbert scheme of points of the plane.