Clay Research Conference
October 2, 2019

Abstracts of Talks

Benedict Gross (University of California, San Diego)

Title: On the conjectures of Gan, Gross, and Prasad

Abstract: This is a talk aimed at a general mathematical audience, in which I hope to explain the conjectures we made, some over twenty-five years ago. These conjectures translate central questions in modern number theory, such as the determination of local epsilon factors and the special values of L-functions, into central questions in representation theory, such as the restriction of irreducible representations of classical groups and the periods of automorphic forms. I will motivate these conjectures with some results on the representations of compact Lie groups, then review the relevant number theory, and then discuss the Langlands correspondence (which makes the translation possible). I will review the progress that has been made on these conjectures over the past ten years, and end with an arithmetic conjecture in the same style, which generalizes the formula I found with Zagier.

Alex Lubotzky (Hebrew University of Jerusalem)

Title: First order rigidity of high-rank arithmetic groups

Abstract: The family of high rank arithmetic groups is a class of groups playing an important role in various areas of mathematics. It includes SL(n,Z), for n>2 , SL(n, Z[1/p]) for n>1, their finite index subgroups and many more.

A number of remarkable results about them have been proven including; Weil local rigidity, Mostow strong rigidity, Margulis Super rigidity and the Schwartz-Eskin-Farb Quasi-isometric rigidity.

We will add a new type of rigidity: "first order rigidity". Namely if D is such a non-uniform characteristic zero arithmetic group and L a finitely generated group which is elementary equivalent to it then L is isomorphic to D.

This stands in contrast with Zlil Sela's remarkable work which implies that the free groups, surface groups and hyperbolic groups (many of which are low-rank arithmetic groups) have many non isomorphic finitely generated groups which are elementary equivalent to them.

Joint work with Nir Avni and Chen Meiri (Invent. Math. 217 (219-240) 2019).

Oscar Randal-Williams (University of Cambridge)

Title: Cohomology of moduli spaces

Abstract: For many mathematical structures the collection of all objects having that structure may naturally be assembled into a space, either because the objects can be deformed or because they have symmetries: this is a moduli space. The most naive "classification" of such objects would be a description of the path-components of this moduli space, or in other words its zeroth cohomology, but to understand families of such objects one is led to investigate its higher cohomology.

It is hopeless to say anything in this generality, but topologists have developed some broad principles for studying certain kinds of moduli spaces. I will survey some of these techniques, focussing on moduli spaces of Riemann surfaces and their natural generalisation---from the point of view of differential topology---to higher dimensional smooth manifolds.

Geordie Williamson (University of Sydney)

Title: Challenges in modular representation theory

Abstract: This will be a broad survey talk on interactions between geometry and representation theory, with a focus on representations in positive characteristic ("modular representation theory"). I will outline several basic questions (e.g. for modular representations of the symmetric group) which appear very difficult, and have resisted direct algebraic approaches for over a hundred years. Over the last two decades, a new approach has emerged via geometric representation theory. It turns out that subtle questions concerning torsion in cohomology control these problems, and this allows some progress to be made. Many open questions remain, but at this point there can be no doubt that a fascinating and deep theory awaits us.