TEXAS GEOMETRY AND TOPOLOGY CONFERENCE

The 62nd meeting of the Texas Geometry and Topology Conference was held at Texas A&M University on November 8-10, 2019. This conference was partially supported by National Science Foundation Grant DMS-1812040 and Texas A&M University. Speakers reported on recent research. All plenary speakers provided abstract.

Meeting 62. Texas A&M University, November 8-10, 2019.

Irina Bobkova, Texas A&M, *Picard groups in chromatic homotopy theory*

Computation of the stable homotopy groups of spheres is a long-standing open problem in algebraic topology. I will describe how chromatic homotopy theory uses localization of categories, analogous to localization of rings and modules, to split this problem into easier pieces, called chromatic levels. Each chromatic level is a symmetric monoidal category, and we can study their Picard groups. I will talk about classical results about these groups, and about current work on understanding the Picard group at the second chromatic level.

Andreas Cap, Vienna, *Cartan geometries*

Cartan geometries provide a description of manifolds that carry certain types of geometric structures as "curved analogs" of homogeneous spaces. My talk will start by outlining this concept and its role in connecting classical geometry, in particular Klein's Erlangen program, to differential geometry. Next, I will briefly discuss examples for which the concept is of interest. Finally, I will sketch an application of this point of view to the study of automorphism groups of geometric structures.

Andreas Cap, Vienna, *Geometric compactifications and parabolic geometries*

The talk discusses applications of the theory of parabolic geometries to the study of geometric compactifications. The focus is on the simplest examples of conformal and projective structures. Parabolic geometries admit a uniform description as Cartan geometries and it turns out that holonomy reductions of Cartan connections provide a conceptual approach to a variety of different types ofcompactifications. I will discuss the example of conformally compact metrics, including Poincare-Einstein metrics, as well as an analogous concept that builds on projective differential geometry from this perspective. Also, applications to compactifications of symmetric spaces will be discussed briefly.

Mikhail Gromov, Courant and IHES, *Metric inequalities for manifolds with positive mean curvatures and positive scalar curvatures*

We overview main topics and ideas in spaces with their scalar curvatures bounded from below, and present a more detailed exposition of several known and some new geometric constraints on Riemannian spaces implied by the lower bounds on their scalar curvatures.

John Lott, Berkeley, *Almost Ricci-flat 4-manifolds*

A manifold is almost Ricci-flat if it admits a sequence of Riemannian metrics with diameter one, for which the Ricci curvature goes to zero uniformly. I will describe results about

the topology and geometry of almost Ricci-flat 4-manifolds in the noncollapsed case (joint work with Vitali Kapovitch) and in the collapsed case.

Mikhail Lyubich, Stony Brook, *Conformal dynamics: Julia sets, Kleinian groups, and Schwarz reflections*

We will discuss the interplay between three branches of Conformal Dynamics: iteration of (anti-)rational maps, actions of Kleinian groups, and dynamics generated by Schwarz reflections in quadrature domains. We will present examples of matings between anti-quadratic maps and the triangle modular group, and of the Julia reasization for the classical Apollonian gasket. We will also describe the group of quasisymmetries for some classes of Julia sets, including the Apollonian one, certain Sierpinski carperts, and the Basilica. The Thompson group will naturally emerge in the latter case.

Mateusz Michałek, Leipzig, *From topology to algebraic geometry and back again*

We will present applications of secant varieties in topology through k-regular embeddings. An embedding of a variety in an affine space is called k-regular if any k points are mapped to linearly independent points. Numeric conditions for the existence of such maps are an object of intensive studies of algebraic topologists dating back to the problem posed by Borsuk in the fifties. Current world record results were obtained by Pavle Blagojevic, Wolfgang Lueck and Guenter Ziegler. Our results relate k-regular maps to punctual versions of secant varieties. This allows us to prove existence of such maps in special cases. The main new ingredient is providing relations to the geometry of the punctual Hilbert scheme and its Gorenstein locus. The talk is based on two joint works: with Jarosaw Buczynski, Tadeusz Januszkiewicz and Joachim Jelisiejew and with Christopher Miller.

Kirsten Wickelgren, Duke, *An arithmetic count of rational plane curves*

There are finitely many degree d rational plane curves passing through 3d-1 points, and over the complex numbers, this number is independent of (generically) chosen points. For example, there are 12 degree 3 rational curves through 8 points, one conic passing through 5, and one line passing through 2. Over the real numbers, one can obtain a fixed number by weighting real rational curves by their Welschinger invariant, and work of Solomon identifies this invariant with a local degree. It is a feature of A1-homotopy theory that analogous real and complex results can indicate the presence of a common generalization, valid over a general field. We develop and compute an A1-degree, following Morel, of the evaluation map on Kontsevich moduli space to obtain an arithmetic count of rational plane curves, which is valid for any field k of characteristic not 2 or 3. This shows independence of the count on the choice of generically chosen points with fixed residue fields, strengthening a count of Marc Levine. This is joint work with Jesse Kass, Marc Levine, and Jake Solomon.

Tian Yang, Texas A&M, *Some progress on the volume conjecture for the Turaev–Viro invariants*

In 2015, Qingtao Chen and I conjectured that at the root of unity exp(2i/r) instead of the usually considered root exp(i/r), the Turaev-Viro and the Reshetikhin-Turaev invariants of a hyperbolic 3-manifold grow exponentially with growth rates respectively the hyperbolic and the complex volume of the manifold. In this talk, I will present a recent joint work with Giulio Belletti, Renaud Detcherry and Effie Kalfagianni on an infinite family of cusped

hyperbolic 3- manifolds, the fundamental shadow links complement, for which the conjecture is true.

Demographics

Of the 8 speakers, 6 were male and 2 were female.

There were 149 registered participants including speakers and organizers. Here is a breakdown in terms of gender, race/ethnicity, and rank:

Gender	
Male	118
Female	27
No response	4

Race/ethnicity	
White	60
Hispanic or Latino	8
Black or African-American	4
Asian	61
Two or more races	5
No response	11

Rank	
Senior Faculty	28
Junior Faculty/Postdoc	31
Graduate student	82
Undergraduate student	1
Special	7