Texas Geometry and Topology Conference

This is a report on the presentations at the 54rd meeting of the Texas Geometry and Topology Conference at Rice University on November 6-8, 2015. This conference was partially supported by National Science Foundation Grant DMS-1510060, and Rice University. Speakers reported on recent research. All plenary speakers provided abstracts. Plenary speakers were encouraged to offer in their abstracts slightly broader discussions of the significance and context of their results.

Meeting 54. Rice University, November 6-8, 2015

Stergios Antonakoudis, Cambridge, *The complex geometry of Teichmüller spaces and bounded symmetric domains*

From a complex analytic perspective, Teichmüller spaces and symmetric spaces can be realised as contractible bounded domains, which have several features in common but also exhibit many differences. In this talk we will study isometric maps between these two important classes of bounded domains equipped with their intrinsic Kobayashi metric.

Mario Bonk, UCLA, *The quasiconformal geometry of fractals - Introductory Talk*

Many questions in analysis and geometry lead to problems of quasiconformal geometry on non-smooth or fractal spaces. For example, there is a close relation of this subject to the problem of characterizing fundamental groups of hyperbolic 3-orbifolds or to Thurston's characterization of rational functions with finite post-critical set.

In recent years, the classical theory of quasiconformal maps between Euclidean spaces has been successfully extended to more general settings and powerful tools have become available. Fractal 2-spheres or Sierpinski carpets are typical spaces for which this deeper understanding of their quasiconformal geometry is particularly relevant and interesting. In my talk I will give a survey on some recent developments in this area.

Mario Bonk, UCLA, *Thurston maps* - Advanced Talk

A branched covering map on a 2-sphere S^2 is a continuous map that is locally modeled on a rational map on the Riemann sphere. A critical point of such a map f is a point in S^2 where f is not a local homeomorphism. Thurston considered branched covering maps for which the forward orbit of each critical point under iteration is finite. These maps are now called Thurston maps.

The study of these maps provides links to areas such as dynamical systems, classical conformal analysis, hyperbolic geometry, geometric group theory, and analysis on metric spaces. In my talk I will give a survey on this subject and discuss some joint work with Daniel Meyer.

Marianna Csornyei, University of Chicago, *Kakeya problem for circular arcs*

We study which planar sets can be moved continuously covering an arbitrary small area. The talk is based on a joint work with Chang, Hera, and Laczkovich.

Bruce Kleiner, NYU, *PI spaces: some new examples and open problems*

After reviewing some background on spaces satisfying Poincaré inequalities, I will discuss some new examples and open questions.

Vlad Markovic, Caltech, *Harmonic maps on hyperbolic spaces*

We prove that any quasi-conformal map of the $(n-1)$-dimensional sphere can be extended to a harmonic quasi-isometry of the n-dimensional hyperbolic space.

Steffen Rohde, University of Washington, *Random metric spaces and conformal geometry*

A common model for a *random surface*, originating in the physics literature, is a triangulation of the sphere with n-faces (modulo homeomorphisms), chosen uniformly at random among all such triangulations. A recent groundbreaking result of Le Gall and Miermont is the existence of the scaling limit as a random metric space (when the triangulation is viewed as a metric space obtained from gluing n equilateral triangles). The work of Miller and Sheffield puts the physicists predictions about the conformal geometry of these spaces within reach. I will give an overview over some of these developments, discuss some of the open questions, and describe related work regarding conformal laminations.

Christina Sormani, CUNY GC and Lehman College, *Sliced filling volumes and the tetrahedral compactness theorem*

The sliced filling volume, $SF(p, r)$, of a sphere, $\partial B(p, r) \subset M^m$, is defined using the Ambrosio-Kirchheim's Slicing Theorem combined with an adaption of Gromov's notion of a Filling Volume. We prove that if a manifold (or more generally an integral current space) satisfies the Tetrahedral Property (a condition on the lengths of sides of top dimensional tetrahedra), then we have a lower bound on this sliced filling volume. We apply this to prove that sequences of integral current spaces, M_j^m, satisfying a uniform tetrahedral property have subsequences which converge in the Gromov-Hausdorff and Intrinsic Flat sense to the same noncollapsed countably H^m rectifiable metric space. This is joint work with Jacobus Portegies appearing in arXiv:1210.3895.

Robert Young, NYU, *Quantifying nonorientability and filling multiples of embedded curves*

Filling a curve with an oriented surface can sometimes be "cheaper by the dozen". For example, L. C. Young constructed a smooth curve drawn on a projective plane in R^n which is only about 1.5 times as hard to fill twice as it is to fill once and asked whether this ratio can be bounded below. We will connect this question to a way of measuring the nonorientability of a manifold in R^n and answer it using methods from geometric measure theory.