TGTC 2018 – University of Houston

February 16–18

All talks are in 232 PGH.

Schedule

Friday

5:00–6:00 pm Alan Reid (Rice University): *Profinite rigidity in low-dimensions I* (talk for graduate students)

6:30–7:30 pm Light buffet, 646 PGH

8:00–9:00 pm Alan Reid (Rice University): *Profinite rigidity in low-dimensions II*

Saturday

8:30–9:00 am Coffee, juice and doughnuts, 646 PGH

9:00–10:00 am Huai-Dong Cao (Lehigh University): *Deformation of Fano Manifolds*

10:30–11:30 am Fangyang Zheng (Ohio State University): *Hermitian manifolds with flat connections*

2:30–3:30 pm Catherine Searle (Wichita State University): *The maximal symmetry rank conjecture for non-negatively curved manifolds*

4:00–5:00 pm Jeffrey Danciger (University of Texas at Austin): *Convex cocompact actions in real projective geometry*

6:00 pm Dinner at Fung's Kitchen, 7320 Southwest Fwy. #115, Houston, TX 77074, phone (713) 779-2288 (`http://eatatfungs.com/`)

Sunday

8:30–9:00 am Coffee, juice and doughnuts, 646 PGH

9:00–10:00 am Fred Xavier (Texas Christian University): *Conformality and Invertibility in* $\mathbb{R}^n$

10:30–11:30 am Eric Rowell (Texas A&M University): *Topological Quantum Computation*

Abstracts

Alan Reid (Rice University)
Profinite rigidity in low-dimensions I

A finitely generated residually finite group G is called profinitely rigid if whenever a finitely generated residually finite group H has a profinite completion isomorphic to that of G, then H is isomorphic to G. Although by now there are many constructions of groups that are not profinitely rigid, there seems to be a growing sense that when G is a free group, surface group or the fundamental group of a finite volume hyperbolic 3-manifold, things are different and these will be profinitely rigid. The first lecture will describe background and examples.

Alan Reid (Rice University)
Profinite rigidity in low-dimensions II

A finitely generated residually finite group G is called profinitely rigid if whenever a finitely generated residually finite group H has a profinite completion isomorphic to that of G, then H is isomorphic to G. Although by now there are many constructions of groups that are not profinitely rigid, there seems to be a growing sense that when G is a free group, surface group or the fundamental group of a finite volume hyperbolic 3-manifold, things are different and these will be profinitely rigid. In the second lecture we will discuss recent progress on this topic.

Huai-Dong Cao (Lehigh University)
Deformation of Fano Manifolds

In this talk, we shall present a new necessary and sufficient condition on the existence of Kahler-Einstein (KE) metrics on small deformations of a Fano KE manifold with nontrivial automorphism group. If time permits, we will also describe a canonical extension of pluri-anticanonical forms from a Fano KE manifold to its small deformations which leads to a simultaneous embedding of a family of Fano manifolds into projective spaces with effective control. This is a joint work with Xiaofeng Sun, S.-T. Yau and Yingying Zhang.

Fangyang Zheng (Ohio State University)
Hermitian manifolds with flat connections

Given a compact Hermitian manifold, there are many metric connections that are unqiuely determined by the metric. The most famous ones include Chern connection, Bismut connection, and Levi-Civita (Riemannian) connection. When the metric is Kahler, all three agrees, while when the metric is not Kahler, they are all distinct. Different connections give different curvature tensors, and it would be natural to try to understand the "space forms" with respect to each connection. In particular, one would like to understand the flat cases as a starting case.

For the Chern connection, the result of Boothby in 1958, following the work of H-H Wong on complex parallelizable manifolds, classified all compact Hermitian manifolds with flat Chern connection. They are exactly the compact quotients of complex Lie groups equipped with left invariant metric.

In this talk, we would like to report some recent progress on the classification of compact Hermitian manifolds with flat Bismut connection or flat Levi-Civita connection. In the Bismut case, which is a joint work with Q. Wang and B. Yang, we were able to give a complete classification of such manifolds, as compact quotients of Samelson spaces, which are well understood. For the Levi-Civita connection, in a recent joint work with G. Khan and B. Yang, we were able to solve the 3 dimensional case, namely, we give a complete clasification of all complex structures on a flat 6-torus that are compatible with the flat metric. We will also discuss our recent joint work with B. Yang on Hermitian manifolds with flat Gauduchon connections.

Catherine Searle (Wichita State University)

The maximal symmetry rank conjecture for non-negatively curved manifolds

Let T^k act isometrically and effectively on M^n, a closed, simply-connected, non-negatively curved Riemannian manifold. Then

1. $k \leq \lfloor 2n/3 \rfloor$;
2. When $k = \lfloor 2n/3 \rfloor$, M^n is equivariantly diffeomorphic to

$$Z = \prod_{i \leq r} S^{2n_i+1} \times \prod_{i > r} S^{2n_i}, \quad \text{with } r = 2\lfloor 2n/3 \rfloor - n,$$

   or the quotient of Z by a free linear action of a torus of rank less than or equal to $2n$ mod 3.

In particular, we have shown that for isotropy-maximal torus actions the conjecture holds. I'll discuss the proof of this result as well as some consequences regarding the classification of manifolds of non-negative curvature with maximal and almost maximal symmetry rank in low dimensions.

This is joint work with Christine Escher.

Jeffrey Danciger (University of Texas at Austin)

Convex cocompact actions in real projective geometry

We discuss a theory of convex cocompactness for discrete subgroups of the projective general linear group acting on projective space. These groups display geometric and dynamical behavior similar to convex cocompact groups in rank one Lie groups (hyperbolic geometry) with some interesting differences. Joint work with Francois Gueritaud and Fanny Kassel.

Fred Xavier (Texas Christian University)
Conformality and Invertibility in $\mathbb{R}^n$

We study the question of estimating the cardinality of a prescribed fiber of a locally invertible map. Let $F : \mathbb{R}^n \to \mathbb{R}^n$ be a local diffeomorphism, $n \geq 3$, and $q \in F(\mathbb{R}^n)$. Using geometric, topological and analytic arguments, we show that if the pre-image of every 2-plane π containing q is a surface conformally diffeomorphic to $\mathbb{R}^2$ – relative to the notion of angle on $F^{-1}(\pi)$ inherited from the Euclidean inner product of $\mathbb{R}^n$, then the point q is assumed exactly once by F. The analogous result in two dimensions fails. In fact, every non-injective local diffeomorphism $\mathbb{R}^2 \to \mathbb{R}^2$ provides a counterexample. On the other hand, if the pre-image of every such π is only assumed to be conformal to a finitely punctured plane (the number of punctures depending on the plane), then q is assumed at most twice.

Eric Rowell (Texas A&M University)
Topological Quantum Computation

Two-dimensional topological states of matter offer a route to quantum computation that would be topologically protected against the nemesis of the quantum circuit model: decoherence. In this talk I will give a mathematicians' perspective on some of the advantages and challenges of this model with an emphasis on the role of topological quantum field theory and braid group representations. I will discuss several foundational problems in computer science/condensed matter, their mathematical formulations and some recent results we have obtained. Time permitting I will introduce a new approach using 3-dimensional media.