Curvature and Topology of Spaces

May 24 - 26, 2019

May 24

9:00-10:00 Xiaochun Rong

A New Proof of Gromov's Theorem on Almost Flat Manifolds, and Its Generalizations.

We will present a new proof for the Gromov's almost flat manifolds theorem, which is a simplified version of a proof of that compact manifolds of almost non-negative Ricci curvature and universal cover not collapsed are diffeomorphic to infra-nilmanifolds.

10:00-10:30 Break

10:30-11:30 Takashi Shioya

Graph manifolds as ends of negatively curved Riemannian manifolds

Let M be a graph manifold such that each piece of its JSJ decomposition has the $H^2 \times$ R geometry. Assume that the pieces are glued by isometries. Then, there exists a complete Riemannian metric on R×M which is an "eventually warped cusp metric" with the sectional curvature K satisfying −1 ≤ K < 0. A theorem by Ontaneda then implies that M appears as an end of a 4-dimensional, complete, non-compact Riemannian manifold of finite volume with sectional curvature K satisfying −1 ≤ K < 0. This is a joint work with Koji Fujiwara.

12:00-14:00 Lunch

14:00-15:00 Luis Guijarro

Geometric Applications of the Transverse Jacobi Equation

In 2007, Burkhard Wilking introduced the transverse Jacobi equation, a far reaching generalization of the standard Jacobi equation that exploits the symplectic nature of the space of Jacobi fields. In this talk, we will introduce this new equation, see how intermediate Ricci curvature arises naturally when studying its comparison theory, and give an array of geometric applications for intermediate Ricci curvature: among them, focal radius rigidity theorems, and soft versions of Wilking's connectivity principle. Joint work with Fred Wilhelm.

15:00-15:30 Tea Break

15:30-16:30 Xiaoyang Chen

Vanishing Theorems of Novikov Cohomology

We will discuss basic properties of Novikov cohomology and some vanishing theorems related to almost nonnegative curvature.

May 25

9:00-10:00 Takao Yamaguchi

Convergence and Collapsing of Spaces with Boundary

In this lecture, I will discuss the convergence and collapsing of spaces with boundary, under a lower curvature bound. In the case of Riemannian manifolds, we assume that the second fundamental forms of boundaries are uniformly bounded. Then we determine the structure of limit spaces and discuss the convergence (joint work with Zhilang Zhang). In the case of Alexandrov spaces, we assume the dimension is three, and classify all the collapsing phenomena with application to the nonnegativity of curvature of three-dimensional spaces with boundary (joint work of Ayato Mitsuishi).

10:00-10:30 Group photo and Tea Break

10:30-11:30 Lee Kennard

Positive curvature and torus representations with connected isotropy groups

A 1930s conjecture of Hopf states that an even-dimensional Riemannian manifold with positive sectional curvature has positive Euler characteristic. In joint work with Michael Wiemeler and Burkhard Wilking, this conjecture is confirmed under the additional assumption that the isometry group has rank at least five. Similar previous results required bounds on the rank that grew to infinity in the manifold dimension. The main new tool is a structural result for representations of tori with the special property that all isotropy groups are connected. Such representations are surprisingly rigid, and we analyze them using only elementary techniques. A full classification of such representations remains an open problem.

12:00 Lunch

Free Discussion

18:00 Banquet

May 26

9:00-10:00 Wilderich Tuschmann

Spaces of Nonnegatively Curved Riemannian Metrics

I will report on general results and open questions about spaces and moduli spaces of Riemannian metrics with non-negative Ricci curvature and other lower curvature bounds on closed and open manifolds, and, in particular, on their higher rational homotopy groups and behaviour under surgery constructions.

10:00-10:30 Tea Break

10:30-11:30 David González Álvaro

Non-Negative Curvature on Vector Bundles

In the first part of this talk we will discuss the existence of non-negatively curved metrics on equivariant vector bundles over homogeneous spaces (respectively over cohomogeneity one spaces with codimension two singular orbits). In the second part we will discuss which vector bundles over such spaces admit an equivariant structure. This is based on joint work (in progress) with Manuel Amann and Marcus Zibrowius.

12:00-14:00 Lunch

14:00-15:00 Masoumeh Zarei

Torus Actions on 4-Dimensional Alexandrov Spaces

In this talk, I will present an equivariant classification for closed, orientable, four-dimensional Alexandrov spaces admitting an iso- metric T^2-action. This generalizes the equivariant classification of Orlik and Raymond of closed four-dimensional manifolds with torus actions. This is a joint work with Diego Corro and Jesús Núñez-Zimbrón.

15:00-15:30 Tea Break

15:30-16:30 Fernando Galaz-Garcia

Sufficiently Collapsed Three-Dimensional Alexandrov Spaces.

In Riemannian geometry, collapse imposes strong geometric and topological restrictions on the spaces on which it occurs. In the case of Alexandrov spaces, which are metric generalizations of complete Riemannian manifolds with a uniform lower sectional curvature bound, collapse is fairly well understood in dimension three. In this talk, I will discuss the geometry and topology of sufficiently collapsed three-dimensional Alexandrov spaces: when the space is irreducible, it is modeled on one of the eight three-dimensional dimensional Thurston geometries, excluding the hyperbolic one. This extends a result of Shioya and Yamaguchi, originally formulated for Riemannian manifolds, to the Alexandrov setting. (Joint work with Luis Guijarro and Jesús Núñez-Zimbrón).