Yorkshire Durham Geometry Day 2022

Report of Contributions

Contribution ID: **1** Type: **not specified**

Double disk bundles

Wednesday, 7 December 2022 13:00 (50 minutes)

When searching for examples satisfying certain geometric properties, it is often convenient to examine manifolds constructed by gluing simple pieces together. One common example of such a construction involves gluing disk bundles together along their common boundary. On the other hand, many geometric phenomena impose strong topological conditions on the underlying manifold, such as the existence of a decomposition into a union of disk bundles (glued along a common boundary).

Given that they arise frequently from these two different viewpoints, it thus makes sense to study manifolds which decompose as a union of disk bundles in their own right. In this talk, I will report on joint work with J. DeVito and F. Galaz-García in this direction.

Presenter: KERIN, Martin (Durham University)

Contribution ID: **2** Type: **not specified**

On the Geometry of Configuration Spaces and Particle Systems

Wednesday, 7 December 2022 14:00 (50 minutes)

The configuration space U(X) over a base space X is the space of all locally finite point measures on X. The space U(X) being equipped with the vague topology, the L^2-transportation distance and a point process, it is a Polish extended metric measure space. In this talk, we show that U(X), equipped with the Poisson point process, satisfies synthetic lower Ricci curvature bounds if and only if so does X. As a byproduct, we obtain the Sobolev-to-Lipschitz property on U(X), which confirms the conjecture by Röckner-Schied (J. Funct. Anal. '99). We discuss several applications to the corresponding infinite-particle systems such as the integral Varadhan short-time asymptotic of the heat flow on U(X) and a new characterisation of ergodicity of particle systems in terms of the L^2-transportation distance. If time allows, we also explain the case beyond the Poisson point process. This talk is based on the joint work with Lorenzo Dello Schiavo (Institute of Science and Technology Austria).

Presenter: SUZUKI, Kohei (Durham University)

Contribution ID: **3** Type: **not specified**

Metric geometry of spaces of persistence diagrams

Wednesday, 7 December 2022 16:30 (30 minutes)

Persistence diagrams are fundamental objects in topological data analysis. They are pictorial representations of persistence homology modules, which in turn describe topological features of a data set when viewed at different scales or levels, i.e. along a filtration. However, given a data set, it is possible to obtain different persistence diagrams depending on the filtration, so it is natural to study the space of all persistence diagrams. Such space has several interesting geometric and topological properties.

In collaboration with Fernando Galaz-García (Durham University), Luis Guijarro (Universidad Autónoma de Madrid) and Ingrid Membrillo-Solis (University of Southampton, London Metropolitan University), we study a family of functors that assign to each metric pair (X, A) a metric space of persistence diagrams $\mathcal{D}_p(X, A)$ with points in X and finite p-persistence with respect to A. This construction in the case $(X, A) = (\mathbb{R}^2, \Delta)$ give as a result the usual spaces of persistence diagrams. We will present a continuity result with respect to the Gromov-Hausdorff convergence in the setting of metric pairs, as well as some other properties already known for the usual spaces of persistence diagrams which hold in this generality.

Presenter: CHE, Mauricio (Durham University)

Contribution ID: **4** Type: **not specified**

Amenability and Growth of Closed Geodesics for Regular Covers

Wednesday, 7 December 2022 17:00 (50 minutes)

For compact negatively curved Riemannian manifolds, a classical object of study is the exponential growth rate of closed geodesics, which is the same as the exponential growth rate of volume in the universal cover, and also equal to the topological entropy of the geodesic flow. In this talk, we discuss the question of the growth rate of closed geodesics in noncompact regular covering manifolds and how this relates to the group of deck transformations. We give some historical context to this problem and discuss the perspectives in the dynamics community.

Presenter: DOUGALL, Rhiannon (Durham University)

Contribution ID: **5** Type: **not specified**

Departmenttal Research Colloquim: Spectra and dynamics of hyperbolic surfaces

Wednesday, 7 December 2022 15:00 (1 hour)

A hyperbolic surface is a surface, in the intuitive sense, with a geometry that is negatively curved at every point with the same curvature (-1) everywhere. These are not easy to visualize, but there are many of them.

Two interesting things to study on a hyperbolic surface are the dynamics of the geodesic flow (classical mechanics) and the Laplacian differential operator (quantum mechanics). The geodesic flow is chaotic and so the Laplacian there belongs to a field of study known as quantum chaos. Although these systems are far from being solvable in any sense, they are often the first place that we can see anticipated physical phenomenon rigorously. This is because for a hyperbolic surface, there is further structure (representation theory) that bridges the classical and quantum mechanics.

I will explain all this in simple terms, covering a range of paradigms that hyperbolic surfaces provide us to study.

If I have time, I'll then highlight some recent results in the field.

Presenter: MAGEE, Michael (Durham University)