UNYTS 2018 — Upstate New York Topology Seminar

UNYTS 2018 will take place on **Saturday & Sunday, November 10 & 11, 2018**, at the University at Albany, State University of New York. Talks will begin at 10:15 a.m. on Saturday and end by 12:30 p.m. on Sunday, and will be held in UAlbany's Massry Center for Business, room BB-B012; registration and breakfast will be right outside the lecture room.

SAT 10:15–11:00 Inna Zakharevich (Cornell University)

Replacing Algebra with Geometry

ABSTRACT: Quillen's *K*-theory constructs a clean algebraic framework for analyzing how modules are used to construct other modules, and the higher homotopy invariants of such constructions. In his framework there are two important theorems which are not true in less rigid contexts: localization, which constructs a fiber sequence relating the *K*-theory of a category, a subcategory, and their quotient, and dévissage, which relates the *K*-theory of a category to the *K*-theory of a subcategory. However, his framework relies on very rigid algebraic data which makes it unsuitable for many contexts. In this talk we show how to translate his ideas into a geometric context and use it to prove dévissage in this context.

SAT 11:30–12:15 Pedro Ontaneda (Binghamton University, SUNY)

Riemannian Hyperbolization

ABSTRACT: The strict hyperbolization process of R. Charney and M. Davis produces a large and rich class of negatively curved spaces (in the geodesic sense). This process is based on an earlier version introduced by M. Gromov and later studied by M. Davis and T. Januszkiewicz. The Charney–Davis strict hyperbolization of a manifold is also a manifold, but the negatively curved metric obtained is far from being Riemannian because it has a large and complicated set of singularities. We show that these singularities can be removed (provided the hyperolization piece is large). Hence the strict hyperbolization process can be done in the Riemannian setting.

SAT 2:30–3:15 Elizabeth Munch (Michigan State University)

The Interleaving Distance for a Category with a Flow

ABSTRACT: All data has noise, and rigorously understanding how your analysis fares in the face of that noise requires a notion of a metric. The idea of the interleaving distance arose in the context of generalizing metrics for persistence modules from the field of topological data analysis (TDA). Essentially, the idea is that two objects in a category should be distance 0 if there is an isomorphism between them; the distance between two objects should be *almost* 0 if there is *almost* an isomorphism between them. Placed in the right context, we can measure what we mean by an *almost* isomorphism and use this to define a distance. In this talk, we will discuss the generalization of the notion of the interleaving distance to a so-called "category with a flow." We will show that this generalization provides metrics for many different categories of interest in TDA and beyond, including Reeb graphs, merge trees, phylogenetic trees, and mapper graphs. This work is the result of collaborations with Anastasios Stefanou, Vin de Silva, Amit Patel, Justin Curry, and Magnus Botnan.

SAT 3:45–4:30 Timothy Riley (Cornell University)

Conjugator Length

ABSTRACT: The conjugator length function of a finitely generated group G maps a natural number n to the minimal N such that if u and v are words representing conjugate elements of G with the sum of their lengths at most n, then there is a word w of length at most N such that $uw=wv$ in G. I will explore why this function is important and will describe some recent results with Martin Bridson and Andrew Sale on how it can behave.

SAT 5:00–5:45 **Ben Knudsen** (Harvard University)

Connectivity and Growth in the Homology of Graph Braid Groups

ABSTRACT: I will discuss recent work with An and Drummond-Cole showing that the homology of configuration spaces of graphs exhibits eventual polynomial growth, an analogue of classical homological and representation stability results for manifolds. We compute the degree of this polynomial in terms of an elementary connectivity invariant, in particular verifying an upper bound conjectured by Ramos. Along the way, we uncover a new "edge stabilization" mechanism and a family of spectral sequences arising from a small chain model first introduced by Swiatkowski.

SUN 9:00–9:45 **Henry Adams** (Colorado State University)

Metric Reconstruction via Optimal Transport

ABSTRACT: Given a sampling of points from a manifold, what information can one recover about the manifold? A useful tool is the Vietoris–Rips simplicial complex of a metric space X, which has as its simplices the finite subsets of X of diameter less than some fixed scale. If X is a sufficiently dense sample from a manifold, then the Vietoris–Rips complex of X (at small scales) recovers the manifold's topology. For this reason, Vietoris–Rips complexes are commonly used in applications of topology to data analysis. Nevertheless, many questions at larger scales remain open. We describe how the Vietoris–Rips complexes of the circle obtain the homotopy types of the circle, the 3-sphere, the 5-sphere, the 7-sphere, …, as the scale increases. Furthermore, we argue that infinite Vietoris–Rips complexes should be equipped with a different topology: an optimal transport metric that thickens the metric on X.

SUN 10:15–11:00 **Nick Salter** (Columbia University)

Continuous Sections of Families of Complex Algebraic Varieties

ABSTRACT: Families of algebraic varieties exhibit a wide range of fascinating topological phenomena. Even families of zero-dimensional varieties (configurations of points on the Riemann sphere) and one-dimensional varieties (Riemann surfaces) have a rich theory closely related to the theory of braid groups and mapping class groups. In this talk, I will survey some recent work aimed at understanding one aspect of the topology of such families: the problem of (non)existence of continuous sections of "universal" families. Informally, these results give answers to the following sorts of questions: is it possible to choose a distinguished point on every Riemann surface of genus g in a continuous way? What if some extra data (e.g., a level structure) is specified? Can one instead specify a collection of n distinct points for some larger n? Or, in a different direction, if one is given a collection of n distinct points on $\mathbb{C}P^1$, is there a rule to continuously assign an additional m distinct points? In this last case there is a remarkable relationship between n and m. For instance, we will see that there is a rule which produces 6 new points given 4 distinct points on $\mathbb{C}P^1$, but there is no rule that produces 5 or 7, and when n is at least 6, m must be divisible by $n(n-1)(n-2)$. These results are joint work with Lei Chen.

SUN 11:30–12:15 **Julie Bergner** (University of Virginia)

2-Segal Spaces and Algebraic *K*-Theory

ABSTRACT: The notion of a 2-Segal space was defined by Dyckerhoff and Kapranov and independently by Galvez-Carrillo, Kock, and Tonks under the name of decomposition space. Although these two sets of authors had different motivations for their work, they both saw that a key example is obtained by applying Waldhausen's S-construction to an exact category, showing that 2-Segal spaces are deeply connected to algebraic K-theory. In joint work with Osorno, Ozornova, Rovelli, and Scheimbauer, we show that any 2-Segal space arises from a suitable generalization of this construction. Furthermore, our generalized input has a close relationship to the CGW categories of Campbell and Zakharevich. In this talk, I'll introduce 2-Segal structures and discuss what we know and would like to know about the role they play in algebraic K-theory.