1145-51-259 **Michal Adamaszek**, **Henry Adams*** (henry.adams@colostate.edu) and **Florian Frick**.
Metric reconstruction via optimal transport.

Given a sample of points X in a metric space M and a scale $r > 0$, the Vietoris–Rips simplicial complex $\mathrm{VR}(X;r)$ is a standard construction to attempt to recover M from X up to homotopy type. A deficiency of this approach is that the Vietoris–Rips complex $\mathrm{VR}(X;r)$ is not metrizable if it is not locally finite, and thus cannot recover metric information about the metric space M. Even worse, the inclusion map $X \hookrightarrow \mathrm{VR}(X;r)$ need not always be continuous! We attempt to remedy these shortcomings by defining a metric space thickening of X, which we call the *Vietoris–Rips thickening* $\mathrm{VR}^m(X;r)$, via the theory of optimal transport. When M is a complete Riemannian manifold, we show that the the Vietoris–Rips thickening satisfies Hausmann's theorem ($\mathrm{VR}^m(M;r) \simeq M$ for r sufficiently small) with a simpler proof: homotopy equivalence $\mathrm{VR}^m(M;r) \to M$ is canonically defined as a center of mass map, and its homotopy inverse is the (now continuous) inclusion map $M \hookrightarrow \mathrm{VR}^m(M;r)$. Furthermore, we describe the homotopy type of the Vietoris–Rips thickening of the n-sphere at the first positive scale parameter r where the homotopy type changes. (Received September 25, 2018)