

# BI-CO MATHEMATICS COLLOQUIUM

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***“Train Track Maps and CTs for Free Products”***

***Monday, October 4, 2021***

*Talk at 4:00 – Hilles 109*

**Abstract:**

To a topologist, a free group is the fundamental group of a graph. As a group theorist, I'm interested in (outer) automorphisms of free groups and free products, which I study by thinking of them as symmetries of graphs (or graphs of groups). Here the right kind of symmetry is a rather flabby kind called homotopy equivalence. To really work with homotopy equivalences we need to give them some extra structure, for which the best kind is called a (relative) train track map. (Relative) train track maps have a beautiful connection with the Perron–Frobenius theory of nonnegative integral matrices. A theorem of Bestvina–Handel says that a relative train track map exists for every outer automorphism of a free group. I extended this theorem from graphs to graphs of groups with co-Hopfian edge groups, and extended a strengthening of relative train track maps due to Feighn–Handel, called CTs, from outer automorphisms of free groups to outer automorphisms of free products.

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