Title:

Towards a sharp non-asymptotic theory for structured random matrices (and tensors)

Abstract:

Matrix Concentration inequalities such as Matrix Bernstein inequality (Oliveira and Tropp) have played an important role in many areas of pure and applied mathematics. These inequalities are intimately related to the celebrated noncommutative Khintchine inequality of Lust-Piquard and Pisier. While these tend to be optimal when the underlying matrices are commutative, they are known to be sub-optimal in several other instances.
Recently, we have leveraged ideas from Free Probability to fully remove the sub-optimal dimensional dependencies in these inequalities in a range of instances, yielding sharp bounds in many settings of interest.
In this talk I will describe these results, some of the recent and ongoing work that it has sparked, and several open problems.
Includes joint work with: March Boedihardjo (MSU); Ramon van Handel and Giorgio Cipolloni (Princeton); Petar Nizic-Nikolac, Anastasia Kireeva, Kevin Lucca, and Dominik Schroder (ETH); Xinmeng Zeng (Stanford); Dustin Mixon (OSU); Dmitriy Kunisky (Johns Hopkins); Thomas Rothvoss (U Washington); Haotian Jiang (U Chicago); Sivakanth Gopi (MSR).