## **High Dimensional Matrix Estimation Problems**

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The lectures will focus on two separate topics.

The first topic is related to the problems of estimation of large low rank matrices, in particular, matrix completion problems. Both noiseless and noisy versions of the problem will be discussed. In the noiseless case, the method is usually based on nuclear norm minimization. We will discuss the results of Candes and Tao and of Gross on noiseless low rank recovery under low coherence assumptions. In the noisy case, the estimation method is based on nuclear norm penalization. Recent results on sharp oracle inequalities will be discussed. In both cases, the results rely on noncommutative Bernstein type inequalities.

The second topic has to do with estimation of spectral projectors of sample covariance opeartors. This is a classical line of research in multivariate statistical analysis related to such methods as principal component analysis. We will discuss new results (joint with Karim Lounici) on asymptotic normality and other asymptotic properties of spectral projectors in the case of Gaussian observations in a high-dimensional setting. Gaussian concentration inequalities play an important role in these problems.