


# 复旦大学数学科学学院
# 数学综合报告会

报告题目：**Structured Density Matrix Estimation and Efficient Quantum State Tomography**

报告人：Dr. Dong Xia

（University of Wisconsin-Madison）

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报告地点：光华东主楼 2001

摘要： The density matrices are positively semi-definite Hermitian matrices of unit trace that describe the state of a quantum system. Quantum state tomography (QST) refers to the estimation of an unknown density matrix through specifically designed measurements on identically prepared copies of quantum systems. The dimension of the associated density matrix grows exponentially with the size of quantum system. This talk is on the efficient QST when the underlying density matrix possesses structural constraints.

The first part is on the low rank structure, which has been popular in the community of quantum physicists. We develop mini-max lower bounds on error rates of estimation of low rank density matrices, and introduce several estimators showing that these mini-max lower bounds can be attained up to logarithmic terms. These bounds are established over all the Schatten norms and quantum Kullback-Leibler divergence. This is based on a series of work with Vladimir Koltchinskii.

The second part is built upon decomposable graphical models for quantum multi-qubits system. The goal is to reduce the sample complexity required for quantum state tomography,one of the central obstacles in large scale quantum computing and quantum communication. By considering the decomposable graphical models, we show that the sample complexity is allowed to grow linearly with the system size and exponentially with only the maximum clique size.This is based on an ongoing project with Ming Yuan.

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