S N BOSE NATIONAL CENTRE
FOR BASIC SCIENCES
Block JD, Sector III, Salt Lake, Kolkata 700 106

DEPARTMENTAL SEMINAR

Theoretical Sciences

08th October'2021 **3.00PM** **ONLINE**

SPEAKER

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TITLE OF THE TALK

IID and problem specific samples of quantum states from Wishart distributions

ABSTRACT

Random samples of quantum states are an important resource for various tasks in quantum information science, and samples in accordance with a problem-specific distribution can be indispensable ingredients. Some algorithms generate random samples by a lottery that follows certain rules and yield samples from the set of distributions that the lottery can access. Other algorithms, which use random walks in the state space like the Monte Carlo, can be tailored to any distribution, at the price of autocorrelations in the sample and with restrictions to low-dimensional systems in practical implementations. We present a two-step algorithm for sampling from the quantum state space that overcomes some of these limitations. We first produce a CPU-cheap large proposal sample, of uncorrelated entries, by drawing from the family of complex Wishart distributions, and then reject or accept the entries in the proposal sample such that the accepted sample is strictly in accordance with the target distribution. We establish the explicit form of the induced Wishart distribution for quantum states. This enables us to generate a proposal sample that mimics the target distribution and, therefore, the efficiency of the algorithm, measured by the acceptance rate, can be many orders of magnitude larger than that for a uniform sample as the proposal. We demonstrate that this sampling algorithm is very efficient for one-qubit and two-qubit states, and reasonably efficient for three-qubit states, while it suffers from the "curse of dimensionality" when sampling from structured distributions of four-qubit states.

HOST FACULTY

Dr. Sunandan Gangopadhyay
Associate Professor & Seminar Coordinator, THEORETICAL SCIENCES

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