



THE HONG KONG UNIVERSITY OF SCIENCE & TECHNOLOGY

Department of Mathematics

SEMINAR ON APPLIED MATHEMATICS

**On the simulation and
convergence of quantum Gibbs samplers**

By

Prof. Bowen Li

City University of Hong Kong

Abstract

Lindblad dynamics and other open-system dynamics provide a promising path towards efficient Gibbs sampling on quantum computers. In this talk, we build upon the structural characterization of KMS detailed balanced Lindbladians by Fagnola and Umanita, and develop a family of efficient quantum Gibbs samplers, akin to the classical Markov chain-based sampling algorithm. Compared to the existing works, our quantum Gibbs samplers have a comparable quantum simulation cost but with greater design flexibility and a much simpler implementation and error analysis. We shall also discuss some results on the mixing properties of primitive hypocoercive Lindblad dynamics. We derive fully constructive exponential decay estimates for the convergence of these dynamics in the L2-norm. Our analysis relies on establishing a quantum analog of space-time Poincare inequalities. Moreover, we also show that adding a coherent term can accelerate the convergence of Lindblad dynamics in general.

Date : 27 December 2024 (Friday)

Time : 3:00pm – 4:00pm

Venue : Room 4502 (near Lift 25/26)

All are Welcome!