

**The Hong Kong Polytechnic University  
Department of Applied Mathematics**

**Seminar Series on Young Scholars in Optimization and Data Science**

**Diagrammatic Monte Carlo Methods for Open Quantum Systems**

**By**

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**Abstract**

In reality, all quantum systems we study are coupled to uninteresting environment which we call bath, causing the system to exhibit some classical behaviour. In this talk, we aim to study the spin dynamics coupled to a harmonic bath. Such dynamics can be represented as a sum of infinite diagrams following a derivation that is similar to Feynman's methodology where each diagram stands for an integral. This sum can then be evaluated by sampling the diagrams using Monte Carlo. Afterwards, we introduce bold diagrams which are defined as the sum of many diagrams with similar structures. We will discuss how we can take advantage of bold lines to accelerate the computations and reduce the variance of Monte Carlo. In particular, we will consider a specific diagrammatic method called the inchworm method and some of its extensions. We will also reveal the limitations of the current method and point out some future directions.

**Biography**

Dr. Siyao Yang is currently a postdoctoral instructor at Department of Statistics at University of Chicago. Before joining UChicago, he obtained his PhD in applied mathematics at National University of Singapore in 2020, and then became a research fellow at NUS until August 2023. Siyao Yang's main research interest lies in the numerical modelling and simulations in quantum physics. He is also working on multiscale modeling in kinetic gas theory and dimensionality reduction using tensor network.

**Date: 13 November 2023 (Monday)**

**Time: 10:00-11:00 (Hong Kong Standard Time GMT +8)**

**Venue: Online Talk via Zoom (Meeting ID: 984 0819 7759; Passcode: 1113)**

**Speaker: Dr. Siyao Yang, The University of Chicago**

**Host: Dr. Ruijian Han, The Hong Kong Polytechnic University**

**Click to join:**

<https://polyu.zoom.us/j/98408197759?pwd=QVFvSUIYUk52VDVzc0JpamZlEQjNvZz09>



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