FUDAN UNIVERSITY

Applied Math Ph.D. Seminar

Recent progress in the stochastic algorithm for the Wigner quantum dynamics

Speaker: Yunfeng Xiong (Peking University)

Time: 2021-04-15, 16:10 to 17:00

Location: Rm 1801, Guanghua East Tower

Advisor: Sihong Shao (Peking University)

Abstract: As a phase space language, the Wigner quantum dynamics bears a close analogy to classical mechanics and its numerical resolution has been drawing growing attention in the past few decades, especially in studying nanoscale semiconductors, quantum many-body systems and quantum tomography. However, the high dimensionality and oscillatory nature of the Wigner function give rise to a formidable challenge in both computation and data storage. In this talk, we will discuss our recent progress in the stochastic algorithm for the time-dependent Wigner equation. We would like to share our experience on how to establish the mathematical framework of the stochastic algorithm for the partial differential equation, how to find out the fundamental numerical sign problem that limits the efficiency of the existing algorithms, how to borrow the basic idea from harmonic analysis, combinatorics, number theory and high-dimensional statistical learning to overcome the notorious sign problem, as well as how to combine all these ingredients to make reliable Wigner simulations in 6-D phase space. These works are joint with Prof. Sihong Shao.