Department of Physics
THE UNIVERSITY OF HONG KONG

HKU–UCAS
Joint Institute of Theoretical and Computational Physics

Physics Colloquium

Quantum Chaos and Physical Distance Between Quantum States

Date: August 24, 2022 (Wednesday)
Time: 5:00 p.m.
Zoom Online Lecture: https://bit.ly/3dALWg1
Meeting ID: 966 3677 3066
Password: 2859

Prof. Biao WU
Peking University

Abstract:

It has been long argued and accepted that there is no true quantum chaos due to the linearity of the Schrödinger equation. Berry even suggested to change quantum chaos, a confusing oxymoron, to quantum chaology as the study of quantum systems whose classical counterparts exhibit chaos. We show that there is genuine quantum chaos despite that quantum dynamics is linear. This is revealed by introducing a physical distance between two quantum states. Qualitatively different from existing distances for quantum states, for example, the Fubini-Study distance, the physical distance between two mutually orthogonal quantum states can be very small. As a result, two quantum states, which are initially very close by physical distance, can diverge from each other during the ensuing quantum dynamical evolution. This kind of sensitivity to initial conditions is reduced to the one in classical dynamics in the semiclassical limit. In the end, we discuss how nonlinear Newton's equations of motion emerge out of the linear Schrödinger equation.

Biography:

Biao Wu (吴飙) is a Professor of Physics at the International Center for Quantum Materials at Peking University. He received his B.S. in 1992 from Beijing Normal University, M.S. in 1995 from University of Chinese Academy of Sciences in China, and Ph.D. in Physics in 2001 from the University of Texas at Austin in USA. He was a postdoc associate at Oak Ridge National Laboratory, USA before joining the Institute of Physics of Chinese Academy of Sciences. He moved to the current position in 2010. His current research focuses on quantum Hamiltonian algorithm and quantum dynamics. He won the Daniel Tsui Fellowship of Hong Kong University in 2007.

Anyone interested is welcome to attend!

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