武汉物数所理论交叉部学术交流报告

Reflecting on an alternative (parity-time-symmetric) quantum theory, and its analog in optics

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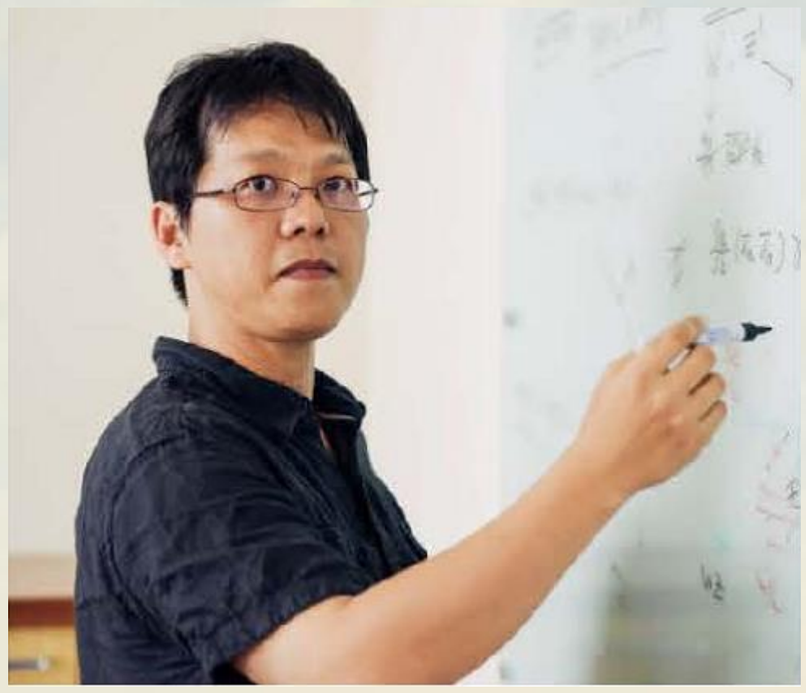
About the lecturer:



Ray-Kuang Lee, received his BS degree from department of Electrical Engineering of National Taiwan University (EE/NTU) in 1997, and his MS degree and PhD degree from Institute of Electro-Optical Engineering of the National Chiao Tung University (IEO/NCTU), in 1999 and 2004 respectively. After his graduation, he continued staying in IEO/NCTU as a postdoctoral fellow in 2005.

Currently, he is an adjunct Professor in the department of Physics, National Tsing-Hua University, the affiliate Scientist of the Physics division, National Center of Theoretical Science, for the research areas in Atom-Molecular-Optics/Interdisciplinary Physics.

Prof. Lee's research was recognized as an interdisciplinary work to the societies from theoretical physics, applied photonics, and laser engineering. And due to his contributions, he received the Outstanding Research Award, Ministry of Science and Technology(2015), the Young Investigator Award from the Academic Sinica, Taiwan (2012), and so on.

Abstract:

By no-signaling principle, we showed that parity-time (PT)-symmetric quantum theory as an extension of the quantum theory to non-Hermitian Hamiltonians is either a trivial extension or likely false as a fundamental theory. In addition to the implementation PT-symmetric optical systems by carefully and actively controlling the gain and loss, we show that a 2 × 2 PT-symmetric Hamiltonian has a unitarily equivalent representation without complex optical potentials in the resulting optical coupler. Through the Naimark dilation in operator algebra, passive PT-symmetric couplers can thus be implemented with a refractive index of real values and asymmetric coupling coefficients. Moreover, we show that the amplification effect in weak measurement on a conventional quantum system can be used to effectively simulate a local broken P T -symmetric Hamiltonian system, with the pre-selected state in the PT -symmetric Hamiltonian system and its post-selected state resident in the dilated Hamiltonian system.

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