复旦大学物理系 物质科学报告

Time: 2:00pm, Tuesday, 2018.5.22

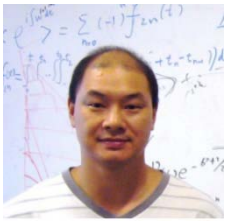
Location: Physics Building (Jiangwan), Room C108

Quantum Sensing – Applications of a little bit of quantum information

Renbao Liu

Department of Physics, The Chinese University of Hong Kong

Quantum computers will one day revolutionize our technologies and lives but require control of many quantum bits (qubits), which is still beyond the reach of current technology. Here we show that even the control of one single qubit can already facilitate useful quantum technologies. The control and measurement of a single qubit associated with the nitrogen-vacancy center in diamond has been exploited for ultrasensitive magnetometry and single-molecule nuclear magnetic resonance (NMR), recently hertz-resolution single-spin NMR achieved. We also find that decoherence of a qubit is fundamentally connected to the thermodynamics of the environment in the complex plane of physical parameters. Based on that finding, we observed the Lee-Yang zeros, which was studied in theories by T. D. Lee and C. N. Yang in 1952 but never observed in experiments before. A new type of phase transitions, which occur in the time domain, is associated with singularity of thermodynamic functions in the complex plane. A bit of quantum information has already a lot of applications. That may be just the tip of an iceberg.



Prof. Renbao Liu got his BSc degree in 1995 from Nanjing University, Department of Physics and PhD degree in 2000 from Institute of Semiconductors, Chinese Academy of Science. After postdoctoral researches in Center for Advanced Study, Tsinghua University and in Department of Physics, University of California – San Diego, he joined The Chinese University of Hong Kong (CUHK) in 2005 as a faculty member of Department of Physics, where has been a full professor since 2014. His research interests include condensed matter physics, quantum optics, nonlinear optics, quantum computing, and quantum sensing. He was awarded, among other honors, CUHK Young Researcher Award (2010), Distinguished Fellow of Faculty of Science, CUHK (2013), Huang Kun Prize (2013), and CUHK Research Excellence Award (2014).