

Supremacy of quantum senses

【摘要】

In the fields of computing and communications, quantum supremacy is well known. Quantum sensing can improve resolution, sensitivity, and accuracy of imaging, detection, and metrology. The question is, does quantum sensing have the so-called quantum supremacy, i.e., can it accomplish certain tasks that classical methods cannot? There are studies indicating that the answer may be positive. For example, Aharonov et al found that using quantum measurements, certain physical experiments can be exponentially accelerated. Our study also shows that quantum probes can probe the thermodynamics of environmental systems in the complex plane by using the intrinsic complex phase factors brought about by quantum evolution. In addition, we can select two different effects, namely, the probe-driven evolution of the environment or the environment-driven evolution of the probe, by preparing the initial state of the probe and selecting a certain measurement basis, so that we can detect any type of quantum correlations and realize the exponential expansion of the accessible correlations in an environment. Future research may reveal more aspects of quantum supremacy in detection applications.

【报告人简介】



Professor Renbao Liu received his bachelor's degree from Nanjing University in 1995 and his Ph.D. degree from the Institute of Semiconductors, Chinese Academy of Sciences in 2000. From 2000 to 2002, he was a postdoctoral researcher at Tsinghua University, and from 2002 to 2005, he was a postdoctoral fellow at the University of California, San Diego. Since 2005, he has been teaching at the Chinese University of Hong Kong as an assistant professor, associate professor and professor. His research interests include condensed matter physics, quantum optics, nonlinear optics, quantum computing, and quantum sensing. He is the recipient of the Huang Kun Prize (2013) and the Willis E. Lamb Prize in Laser Science and Quantum Optics (2022). He is a Fellow of the Optical Society of America, a Fellow of the IoP (UK), a Hong Kong RGC Senior Research Fellow, a New Cornerstone Investigator, and the Choh-Ming Li Professor of Physics at the Chinese University of Hong Kong.

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