复旦大学物理系 Colloquium

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Emergent Classicality in general multipartite states and channels

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Abstract: In a quantum measurement process, classical information about the measured system spreads throughout the environment. Meanwhile, quantum information about the system becomes inaccessible to local observers. Here we prove a result about quantum channels indicating that an aspect of this phenomenon is completely general. We show that for any evolution of the system and environment, for everywhere in the environment excluding an O(1)-sized region we call the “quantum Markov blanket,” any locally accessible information about the system must be approximately classical, i.e. obtainable from some fixed measurement. The result strengthens the earlier result of Brand˜ao et al. (Nat. comm. 6:7908) in which the excluded region was allowed to grow with total environment size. It may also be seen as a new consequence of the principles of nocloning or monogamy of entanglement. Our proof offers a constructive optimization procedure for determining the “quantum Markov blanket” region, as well as the effective measurement induced by the evolution. Alternatively, under channel-state duality, our result characterizes the marginals of multipartite states.

Xiaoliang Qi, Professor of Physics, received his bachelor’s degree in physics from Tsinghua University in 2003, and PhD degree in physics from Institute for Advanced Study, Tsinghua University in 2007.From 2007 to 2009, he worked as Research Associated in Stanford Linear Accelerator Center. And from 2009 to 2010 he was Postdoctoral Researcher in Microsoft Station Q, UC Santa Barbara. He became an Assistant Professor at Stanford University in 2009 and became Associate Professor in 2014 and promoted to Professor in 2019. He received Sloan Fellowship of Solan Foundation in 2010 and Packard Fellowship of David and Lucile Packard Foundation in 2011. He won Hermann Kummel Early Achievement Award, in Many-Body physics in 2011 and The New Horizons in Physics Prize in 2015. He became an Simons Investigator of Simons Foundation in 2018. His current research interest is the interplay of quantum entanglement, quantum gravity and quantum chaos. He is also interested in topological states and topological phenomena in condensed matter systems.

References:
arXiv: 2001.01507