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香港中文大學
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Institute of Theoretical Computer Science and Communications

ITCSC Seminar

Can we teleport a quantum clock? Fundamental limits to the use of entanglement to simulate quantum communication

By
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2:30pm – 3:30pm

Rm121, 1/F., Ho Sin Han Engineering Building, CUHK

Abstract:
In the standard quantum teleportation protocol, the direct transfer of a quantum system from a sender to a receiver can be perfectly simulated by the transfer of a finite amount of classical bits, provided that the sender and receiver share a sufficient amount of entanglement. Extending this idea to a different scenario, one can take a quantum version of Eddington's clock synchronization---where a quantum clock (i.e. a quantum system undergoing periodic evolution) is transferred from the sender to the receiver---and try to convert it into a new protocol where the direct transfer of the clock is replaced by the use of entanglement along with the transfer of classical bits. In this talk I will show that such a protocol is impossible: in the absence of previous synchronization, a quantum clock cannot be transferred perfectly using any finite amount of quantum entanglement and any finite amount of rounds of classical communication. In general, the equivalence between entanglement and the direct transfer of quantum systems breaks down in the absence of a shared reference frames associated to the action of arbitrary compact Lie groups. After establishing this no-go result for perfect teleportation in the absence of shared reference frames, I will discuss some optimal approximate teleportation protocols and compare them with measure-and-prepare protocols based on the estimation of the unknown group element connecting the reference frame of the sender with the reference frame of the receiver.

Related paper: G. Chiribella, V. Giovannetti, L. Maccone, and P. Perinotti, Phys. Rev. A 86, 010304(R) (2012).

Biography:
Giulio Chiribella is currently Associate Professor (tenure track) at Institute for Interdisciplinary Information Sciences, Tsinghua University. He obtained his PhD in 2007 at Pavia University, Italy, under the supervision of Professor Mauro D'Ariano. Before moving to Tsinghua University, he held two postdoctoral positions at Pavia (2006-2009) and Perimeter Institute for Theoretical Physics (2009-2011), and a Senior Postdoctoral Fellowship at Perimeter Institute (2011-2012). In 2010 he has been awarded the Hermann Weyl Prize for new applications of group theoretical methods in Quantum Information. His current research interests include topics in quantum information theory, quantum foundations, and mathematical physics.

******* ALL ARE WELCOME *******

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