THE UNIVERSITY OF HONG KONG

Institute of Mathematical Research
Department of Mathematics

C O L L O Q U I U M

Indefinite causal order in quantum mechanics

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Abstract

Quantum physics has been long known to challenge some of our fundamental notions about the world, such as locality and the existence of an objective reality. Recently, it has been observed that the quantum framework can in principle give rise to new scenarios, where also the causal relations between events become indefinite. A paradigmatic example of this situation is the quantum SWITCH, an operation that combines two physical processes in an order that is controlled by the state of the quantum system. This talk will present a general framework for describing higher-order operations that combine quantum processes in an indefinite order, discussing the quantum SWITCH as the paradigmatic example. I will show that the quantum switch gives rise to correlations that are impossible to observe when the causal relations between events are well-defined, and can be used to enhance the performance of certain information-processing protocols and to measure certain physical parameters with a precision that is impossible to achieve with any setup that probes physical processes in a definite order.

Date:	June 17, 2024 (Monday)
Time:	4:00 – 5:00pm
Venue:	Room 210, Run Run Shaw Bldg., HKU

All are welcome

Short Biography

Giulio Chiribella is a professor and the director of QICI Quantum Information and Computation Initiative at the Department of Computer Science of The University of Hong Kong. His research interests include quantum networks, the information-theoretic foundations of quantum theory, the ultimate efficiency limits of quantum computers, quantum sensors, and quantum communication systems. Previously, he held faculty positions at Oxford University and Tsinghua University, Beijing.

He is the recipient of the Hermann Weyl Prize 2010, a recipient of an RGC Senior Research Fellowship (2020), a Croucher Senior Research Fellowship (2018), a CIFAR-Azrieli Global Scholar Fellowship, and a Young 1000 Talents of China Fellowship (2012). He serves as a member of the Editorial Board of Communications in Mathematical Physics, a member of the Standing Committee of the International Colloquia on Group Theoretical Methods in Physics (ICGTMP), a visiting professor of the Department of Computer Science of the University of Oxford, a Visiting Fellow of Perimeter Institute for Theoretical Physics, a member of the Young Academy of Sciences of Hong Kong, and a Fellow of the National Virgilian Academy of Sciences, Letters and Arts, Mantova, Italy.