universität innsbruck

Department of Theoretical Physics

Theory Colloquium

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"Entanglement and Quantum Bell nonlocality are one and the same"

Abstract

Bell nonlocality describes a manifestation of quantum mechanics that cannot be explained by any local hidden variable model. Its origin lies in the nature of quantum entanglement, although understanding the precise relationship between nonlocality and entanglement has been a notorious open problem.

In this talk, I will describe a resolution to this problem by developing a dynamical framework in which quantum Bell nonlocality emerges as a special form of entanglement, and both are unified as resources under local operations and classical communication (LOCC). The framework is built on the notion of quantum processes, which are abstract quantum channels mapping elements between fixed intervals in space and time. Entanglement is then identified as a quantum process that cannot be generated by LOCC while Bell nonlocality is the subset of these processes that have an instantaneous input-output delay time. LOCC pre-processing is a natural set of free operations in this theory, thereby enabling all entangled states to activate some form of Bell nonlocality.

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Zoom link:
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