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Network quantum information processing

Small quantum networks consisting of several nodes sharing entangled states are within reach with current and near-term technologies. They offer new possibilities for quantum information processing beyond what achievable in standard point-to-point configurations. In this talk, quantum networks are considered in the device-independent scenario where devices are seen as quantum black boxes processing classical information. We first show how the characterization of correlations in quantum networks is related to the study of causal networks. We then present several results illustrating the possibilities these networks offer in the foundations of quantum physics or for the development of quantum information technologies. In the first case, we show how real quantum theory can be falsified in a small network consisting of three observers in an entanglement swapping configuration. In the second, we discuss a proposal for the implementation long-distance device-independent quantum key distribution.