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A Classical Analog to Entanglement Reversibility

In this talk I describe intriguing similarities between the quantum theory of entanglement and the classical theory of secret key. Just as entanglement can be shared by two or more quantum systems, secret correlations can be shared by two or more classical systems, whose states are described by probability distributions. Entanglement cannot be increased under local (quantum) operations and classical communication, and likewise secret correlations cannot be increased under local (classical) operations and public communication. Analogous to the tasks of entanglement distillation and formation are the classical tasks of secret key distillation and secrecy formation.

An old open problem in entanglement theory involves characterizing the states that possess reversible entanglement; i.e. states whose rate of entanglement distillation equals its rate of entanglement cost. In this talk, I introduce a similar notion of reversible secrecy. When one of the honest parties holds a binary random variable, the structure of distributions possessing reversible secrecy can be identified exactly. An indispensable tool used in this analysis is a conditional form of the Gacs-Korner common information. Finally, I describe how the structure of distributions possessing reversible secrecy can be related to the structure of quantum states possessing reversible entanglement.