Functional Analysis and Operator Theory Webinar

α-Logarithmic negativity

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The logarithmic negativity of a bipartite quantum state is a widely employed entanglement measure in quantum information theory, due to the fact that it is easy to compute and serves as an upper bound on distillable entanglement. More recently, the κ-entanglement of a bipartite state was shown to be the first entanglement measure that is both easily computable and has a precise information-theoretic meaning, being equal to the exact entanglement cost of a bipartite quantum state when the free operations are those that completely preserve the positivity of the partial transpose [Wang and Wilde, Phys. Rev. Lett. 125(4):040502, July 2020].

In this talk, we discuss a non-trivial link between these two entanglement measures, by showing that they are the extremes of an ordered family of α-logarithmic negativity entanglement measures, each of which is identified by a parameter $\alpha \in [1, \infty]$. In this family, the original logarithmic negativity is recovered as the smallest with $\alpha = 1$, and the κ-entanglement is recovered as the largest with $\alpha = \infty$. We prove that the α-logarithmic negativity satisfies the following properties: entanglement monotone, normalization, faithfulness, and subadditivity. We also prove that it is neither convex nor monogamous. Finally, we define the α-logarithmic negativity of a quantum channel as a generalization of the notion for quantum states, and we show how to generalize many of the concepts to arbitrary resource theories.

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