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Multiplicative domains, complementary quantum channels, and entanglement breaking rank

Quantum entanglement can be studied through the theory of completely positive maps in a number of ways, including by making use of the Choi-Jamilkowski isomorphism, which identifies separable states with entanglement breaking quantum channels, and optimal ensemble length with entanglement breaking rank. The multiplicative domain is an important operator structure in the theory of completely positive maps. In this talk, I'll discuss my recent work with collaborators in which we introduce a new technique to determine if a channel is entanglement breaking and to evaluate entanglement breaking rank, based on an analysis of multiplicative domains determined by complementary quantum channels. We give a full description of the class of entanglement breaking channels that have a projection as their Choi matrix (which turns out to be rather restrictive), and we show the entanglement breaking and Choi ranks of such channels are equal. This talk is based on joint work with Jeremy Levick, Rajesh Pereira and Miza Rahaman.