

Quantum Channels

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Abstract.

Any process whereby a quantum system passes from a sender to a receiver, possibly interacting with some environment en route, may be regarded as a quantum channel. Mathematically, a quantum channel is a completely positive trace-preserving linear map on density matrices. Unlike classical channels, quantum channels have several distinct capacities, depending on what one is using them for, and what auxiliary resources, such as prior entanglement between sender and receiver, are brought into play. We review these capacities and the known relationships among them, the connections between channel capacities and entanglement measures, and recent work in quantum interactions, which may be viewed as bidirectional channels.