**Quantum Capacities of Transducers**

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High-performance quantum transducers, which can faithfully convert quantum information between disparate physical carriers, are essential elements in quantum science and technology. To assess their ability to coherently transfer quantum information, quantum transducers are typically characterized by different figures of merit including conversion efficiency, bandwidth, and added noise. Here we utilize the concept of quantum capacity, the highest achievable qubit communication rate through a channel, to quantify the performance of a transducer. By evaluating the continuous-time quantum capacity across the conversion band, quantum capacity can serve as a single metric that unifies various desirable criteria of a transducer -- high efficiency, large bandwidth, and low noise. Moreover, using the quantum capacities of bosonic pure-loss channels as benchmarks, we investigate the optimal designs of generic quantum transduction schemes implemented by transmitting external signals through a coupled bosonic chain. Under the physical constraint of a bounded maximal coupling rate gmax, the highest continuous-time quantum capacity Qmax≈31.4gmax is achieved by transducers with a maximally flat conversion frequency response, analogous to Butterworth electric filters. We further extend our method to include thermal noise by considering upper and lower bounds on the quantum capacities of transducers and characterize the performance of maximally flat transducers under the effect of thermal loss. arXiv:2203.00012