

Seminar

Thermodynamic aspects of quantum channels

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Every aspect of quantum information processing can be understood as the manipulation of quantum channels. Therefore, it becomes pertinent that the resources required to manipulate quantum channels are properly accounted for. In this talk, I will present our recent work on the thermodynamics of quantum channels, in which we establish the notions of channel erasure, preparation, and distillation under thermodynamic constraints and connect them to the information-theoretic properties of quantum channels, such as the channel relative entropy. We also introduce the notion of the free energy of a quantum channel, which can be established as a resource monotone of an asymptotically reversible resource theory of channels. It attains a clear operational meaning as twice the asymptotic rates of athermality distillation and formation under Gibbs preserving superchannels. Consequently, we establish that the optimal extractable work, while converting one channel to another through the asymptotic athermality distillation and formation tasks, equals the difference of their free energies. A quantitative characterization of the optimal thermodynamic work gain or expenditure in quantum information processing constitutes a key step toward formulating the thermodynamics of quantum processes.

Thursday, May 7th 2026

14:30 Hrs (Tea / Coffee 14:15 Hrs)

Seminar Hall, TIFRH