

PhD THESIS DEFENSE: From Quantum Source Compression to Quantum Thermodynamics

ZAHRA KHANIAN

November 17, 2020

16:30

Online (Zoom)

This thesis addresses problems in the field of quantum information theory, specifically, quantum Shannon theory. The first part of the thesis is opened with concrete definitions of general quantum source models and their compression, and each subsequent chapter addresses the compression of a specific source model as a special case of the initially defined general models. First, we find the optimal compression rate of a general mixed state source which includes as special cases all the previously studied models such as Schumacher's pure and ensemble sources and other mixed state ensemble models. For an interpolation between the visible and blind Schumacher's ensemble model, we find the optimal compression rate region for the entanglement and quantum rates. Later, we comprehensively study the classical-quantum variation of the celebrated Slepian-Wolf problem and find the optimal rates considering per-copy fidelity; with block fidelity we find single letter achievable and converse bounds which match up to continuity of a function appearing in the bounds. The first part of the thesis is closed with a chapter on the ensemble model of quantum state redistribution for which we find the optimal compression rate considering per-copy fidelity and single-letter achievable and converse bounds matching up to continuity of a function which appears in the bounds.

The second part of the thesis revolves around information theoretical perspective of quantum thermodynamics. We start with a resource theory point of view of a quantum system with multiple non-commuting charges where the objects and allowed operations are thermodynamically meaningful; using tools from quantum Shannon theory we classify the objects and find explicit quantum operations which map the objects of the same class to one another. Subsequently, we apply this resource theory framework to study a traditional thermodynamics setup with multiple non-commuting conserved quantities consisting of a main system, a thermal bath and batteries to store various conserved quantities of the system. We state the laws of the thermodynamics for this system, and show that a purely quantum effect happens in some transformations of the system, that is, some transformations are feasible only if there are quantum correlations between the final state of the system and the thermal bath.

Tuesday November 17, 16:30

Zoom link to join in: <https://us02web.zoom.us/j/87698435234>

Thesis Advisor: Prof Dr Andreas Winter

Thesis Co-advisor: Prof Dr Maciej Lewenstein

More information on the GIQ (UAB) home page:

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Hosted by: Prof Dr Andreas Winter