Zero-error properties of bosonic quantum channels

supervised by

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Bosonic quantum systems provide a wide framework for quantum information processing tasks, and currently model a large variety of experimental approaches in Quantum Computing. *Bosonic Gaussian channels* [2] describe the evolution of these systems, and their capacities have been the subject of intensive study by leading researchers in Theoretical and Mathematical Physics. However, up to date, parameters related to the zero-error properties of such channels have not received considerable attention in the literature. Such properties include the zero-error capacity, whereby the interest lies in the possibility of transferring information over the channel with vanishing probability of error. The purpose of this project is to investigate various concepts pertinent to zero-error transmission in the context of Gaussian channels.

We will follow the operator algebraic approach to zero-error capacities introduced in [1], according to which every quantum channel gives rise to a canonical *operator system* that encodes the zero-error properties of the channel. The required tools will therefore naturally belong to area of Operator Theory. To start working on the project, the student will need a sound background in Linear Algebra and Real Analysis. Since some of the notions are inspired by graphs, an interest in basic Graph Theory will be a bonus.

References

[1] R. Duan, S. Severini and A. Winter, *Zero-error communication via quantum channels, non-commutative graphs and a quantum Lovász θ function*, IEEE Trans. Information Theory 59 (2013), 1164-1174.

[2] A. S. Holevo, *Quantum systems, channels, information*, De Gruyter Studies in Mathematical Physics, 2012.