Quantum channels and non-commutative graphs

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Quantum channels are fundamental objects in quantum information theory, the mathematical underpinnings of quantum computing. In this project we will investigate quantum channels by studying their so-called non-commutative confusability graphs [1], which are operator spaces encoding several important information theoretic properties. In particular, the zero-error quantum capacity of a quantum channel is determined by its confusability graph, and can be estimated from it [2]. This project will take this connection between quantum channels and operator spaces further. Potential directions of particular interest include:

- Investigating the (non-zero-error) quantum capacity from this perspective.
- Introducing and applying versions of fractional graph parameters to non-commutative graphs.
- Improving our understanding of the inverse map from operator spaces to quantum channels.

References

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

[2] R.H. Levene, V.I. Paulsen, I.G. Todorov, *Complexity and capacity bounds for quantum channels*, arXiv:1710.06456.