

# Operator algebras in quantum information theory

Rupert Levene

In this project, we will explore questions arising in quantum information theory through the lens of operator algebras.

The mathematics of quantum mechanics is rooted, historically, in the theory of operator algebras. Much attention has been focussed in recent years on quantum computing and the underpinning quantum information theory, and many fascinating questions have arisen as a result of this, mainly in a finite-dimensional matricial context. On the other hand, it is natural to take a broader operator-algebraic (and infinite-dimensional) viewpoint of such questions; see for example, [1, 2].

A student taking up this project would benefit from a strong background in functional analysis.

## References

- [1] Jason Crann, David W. Kribs, Rupert H. Levene, and Ivan G. Todorov. Private algebras in quantum information and infinite-dimensional complementarity. *Journal of Mathematical Physics*, 57(1):015208, 2016.
- [2] Jason Crann, David W. Kribs, Rupert H. Levene, and Ivan G. Todorov. State convertibility in the von Neumann algebra framework. *Communications in Mathematical Physics*, 378(2):1123–1156, Sep 2020.