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Operator Algebra Quantum Error Correction and Hybrid Quantum Codes

In this talk, we discuss the generalisation of results in quantum error correction to the operator algebra (OAQEC) framework. A key motivation behind this is current work in hybrid quantum theory where codes are developed for the simultaneous transmission of classical and quantum information over a quantum channel. In quantum error correction, for unital quantum channels (trace preserving completely positive maps), finding unitarily correctable codes for an error channel is equivalent to finding the invariant system (noiseless system) for the error composed with its dual. This procedure, for which there are algebraic methods for computing, makes it immediately clear what the correction operation for the error channel is. In ongoing work, we generalise this result to the OAQEC framework, in which quantum information is manifested in subsystems of an algebraic representation. The extension of said result allows for the construction of codes that are directly spliced together to form hybrid quantum codes, that allow for the simultaneous correction of all "subcodes" with a recovery operation. We also discuss briefly separate but closely related work that investigates parameter-dependent bounds that determine whether given hybrid constructions are correctable with respect to specific error channels. Based on joint work with D. Kribs and B. Zeng.