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Tuesday, January 26, 2021, at 10:00 (Boston)
15:00 (UK/Eire) 16:00 (C.Europe) 23:00 (China)
Mathematical Picture Language Seminar

Zoom at: https://harvard.zoom.us/j/779283357?pwd=MitXVm1pYUlJVzZqT3lwV2pCT1ZUQT09

Fault-tolerant Coding for Quantum Communication

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Abstract: Designing encoding and decoding circuits to send messages reliably over many uses of a noisy channel is a central problem in communication theory. When studying the optimal transmission rates achievable with asymptotically vanishing error, it is usually assumed that these circuits can be implemented using noise-free gates. While this assumption is satisfied for classical machines in many scenarios, it is not expected to be satisfied in the near-term future for quantum machines, where decoherence leads to faults in the quantum gates. As a result, fundamental questions regarding the practical relevance of quantum channel coding remain open. By combining techniques from fault-tolerant quantum computation with techniques from quantum communication, we initiate the study of these questions. As our main result, we prove threshold theorems for quantum communication, i.e. we show that coding near the (standard noiseless) classical or quantum capacity is possible when the gate error is below a threshold. (Joint work with Alexander Müller-Hermes, https://arxiv.org/abs/2009.07161)