**General Distance Balancing for Quantum Locally Testable Codes**

Min-Hsiu Hsieh

Hon Hai Quantum Computing Research Center, Hon Hai Research Institute

In this paper, we prove a lower bound on the soundness of quantum locally testable codes under the distance balancing construction of Evra et al. arXiv:2004.07935 [quant-ph]. Our technical contribution is that the new soundness of the quantum code is at least the old soundness divided by the classical code length (up to a constant factor). This allows us to use any classical code with independent checks when distance balancing, where previously only the repetition code had been considered for qLTCs. By using a good classical LDPC code, we are able to grow the dimension of the hypersphere product codes arXiv:1608.05089 [quant-ph] and the hemicubic codes arXiv:1911.03069 [quant-ph] while maintaining their distance and locality, but at the expense of soundness. From this, and also by distance balancing a chain complex of Cross et al. arXiv:2209.11405 [cs.IT], we obtain quantum locally testable codes of new parameters.