Standard quantum tomographic procedures are limited in their usefulness due to imperfect knowledge of precalibrated states, measurements, and operations. Gate set tomography (GST) is a tomographic framework introduced to solve this problem of self-referential calibration [arXiv:1310.4492]. GST seeks to simultaneously and self-consistently characterize the set of implemented gates, prepared states, and measurements, effectively modeling the quantum system to be characterized as a black box.

The simplest GST protocol, called linear gate set tomography (LGST), analyzes data from short gate sequences, using only linear algebra, and produces a gate set estimate. In this talk, I will describe LGST, as well as two additional protocols that leverage LGST to extract high-precision estimates from long-sequence data. I then present the performance of gate set tomography in experimental systems (ion traps, neutral atom traps, and silicon quantum dots).

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