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Quantum process tomography of near-unitary maps AMIR KALEV, CHARLES BALDWIN, IVAN DEUTSCH, Univ of New Mexico — We study the problem of quantum process tomography given the prior information that the implemented map is near to a unitary map on a d-dimensional Hilbert space. In particular, we show that a perfect unitary map is completely characterized by a minimum of $d^2 + d$ measurement outcomes. This contrasts with the d^4 measurement outcomes required in general. To achieve this lower bound, one must probe the system with a particular set of d states in a particular order. This order exploits unitarity but does not assume any other structure of the map. We further consider the more general case of noisy quantum maps, with a low level of noise. Our study indicates that transforming to the interaction picture, where the noiseless map is represented by a diagonal operator, can provide a useful tool to identify the noise structure. This, in turn, can lead to a substantial reduction in the numerical resources needed to estimate the noisy map.

Amir Kalev
Univ of New Mexico

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