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# Verification of quantum technologies

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As quantum technologies advance, the ability to engineer increasingly large quantum devices has experienced rapid development. In this context, the verification of large entangled systems represents one of the main challenges in the employment of such systems for reliable quantum information processing. Though the most complete technique is undoubtedly full tomography, the inherent exponential increase of experimental and post-processing resources with system size makes this approach infeasible at even moderate scales. For this reason, there is currently an urgent need to develop novel methods that surpass these limitations. In this talk I will review novel techniques [1] focusing on a fixed number of resources (sampling complexity), and thus prove suitable for systems of arbitrary dimension. Specifically, a probabilistic framework requiring at best only a single copy for entanglement detection is reviewed, together with the concept of selective quantum state tomography, which enables the estimation of arbitrary elements of an unknown state with a number of copies that is low and independent of the system's size. These hyper-efficient techniques define a dimension demarcation for partial tomography and open a path for novel applications.

**References**

1. J. Morris, V. Saggio, A. Gočanin and B. Dakić, Quantum Verification and Estimation with Few Copies, Adv. Quantum Technol. 2100118 (2022), https://doi.org/10.1002/qute.202100118.

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