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【532】Quantum verification with few copies

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As quantum technologies advance, the ability to generate increasingly large quantum states 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. Other methods aiming at probing only certain properties of the system such as entanglement detection via witness operators generally demand much less effort, but still consume large number of copies for reliable estimates, which may go beyond the reach of the large-scale regime. For this reason, there is currently an urgent need to develop novel techniques that surpass these limitations. In this talk I will review novel techniques 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 opens a path for novel applications.

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