SEMINAR: Sufficient Wigner negativity implies genuine multipartite entanglement

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Seminar Room

Wigner negativity and genuine multipartite entanglement (GME) are key nonclassical resources that enable computational advantages and broader quantum-information tasks. In this work, we prove two theorems for multimode continuous-variable systems that relate these nonclassical resources. Both theorems show that sufficient Wigner negativity-either a sufficiently-large Wigner negativity volume along a suitably-chosen two-dimensional slice, or a sufficiently-large nonclassicality depth of the center-of-mass mode of a system-certifies the presence of GME. Moreover, violations of the latter inequality provide lower bounds of the trace distance to the set of non-GME states. Our results also provide sufficient conditions for generating GME by interfering a state with the vacuum through a multiport interferometer, complementing long-known necessary conditions. Beyond these fundamental connections, our methods have practical advantages for systems with native phase-space measurements: they require only measuring the Wigner function over a finite region, or measuring a finite number of characteristic function points. Such measurements are frequently performed with readouts common in circuit/cavity quantum electrodynamic systems, trapped ions and atoms, and circuit quantum acoustodynamic systems. As such, our GME criteria are readily implementable in these platforms.

Hosted by: Prof. Dr. Antonio Acin