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Entanglement and beyond: Quantum information properties of on-shell scattering

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Recently it has been noticed that many familiar quantum field theories (QFTs) may minimize or maximize the amount of entanglement in a scattering process. Studying the quantum information (QI) properties of final states for on-shell scattering will help establish whether fundamental physics can be formulated in terms of QI principles. We first present a universal relation between final state entanglement entropy and (semi)-inclusive cross sections. This implies a growing behavior of the entanglement entropy in the very high energy limit, which hints at a connection between micro- and macroscopic physics. We then go beyond the concept of entanglement and consider the notion of magic, which quantifies the computational advantage of quantum states over classical algorithms. A novel bound for magic in 2-qubit systems is derived, which suggests new connections between magic and entanglement as well as other principles in QFTs.

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