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Interplay of quantum resources: magic-protected entanglement

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Entanglement and magic (non-stabilizerness) are widely regarded as necessary for quantum universality and potential advantage. Yet the form in which they must appear within a quantum state remains unclear. We introduce an operational diagnostic of their interplay: \emph{magic-protected entanglement}, defined as entanglement remaining after optimal stabilizer (Clifford) processing. This reframes the heuristic "entanglement~+~magic" as a sharp operational question: how much entanglement is intrinsically linked to magic. This perspective endows the state space with structure, distinguishing \emph{T-magic}–type states, where magic is injected locally and entanglement can often be removed by stabilizer processing, from \emph{W-magic}–type states (including Dicke and non-stabilizer hypergraph families), whose entanglement cannot be completely undone by Clifford circuits. The resulting separation enables a principled discussion of nonlocal quantum resources.

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