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【533】All fermionic non-Gaussian states are magic states for matchgate computations

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Magic states were introduced in the context of Clifford circuits as a resource that elevates classically simulatable computations to quantum universal capability, while maintaining the same gate set. Here we study magic states in the context of matchgate (MG) circuits, where the notion becomes more subtle, as MGs are subject to locality constraints and also the SWAP gate is not available. Nevertheless a similar picture of gate-gadget constructions applies, and we show that every pure fermionic state which is non-Gaussian, i.e. which cannot be generated by MGs from a computational basis state, is a magic state for MG computations. This result has significance for prospective quantum computing implementation in view of the fact that MG circuit evolutions coincide with the quantum physical evolution of non-interacting fermions.

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