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Entanglement area law for long-range interacting systems ZHEXUAN GONG, MICHAEL FOSS-FEIG, Joint Quantum Institute, FERNANDO G.S.L. BRANDAO, Microsoft Research, ALEXEY V. GORSHKOV, Joint Quantum Institute — Area laws for entanglement provide crucial insight into the low-energy behavior of many-body systems and are intimately connected to the efficiency of classical computational methods. For 1D systems, an area law was rigorously proven for ground states of gapped Hamiltonians with local interactions and for states with exponentially decaying correlations. In the presence of long-range interactions, the proof of an area law for gapped ground states becomes much more challenging because long-range interactions can change the effective dimensionality of the system and introduce correlations decaying slower than an exponential. Based on recent theoretical advances that reveal strong remnants of locality in quenched systems with power-law decaying interactions, we prove an area law for a large class of gapped Hamiltonians with long-range interactions. As an intermediate step, we prove tight bounds on the decay of ground-state correlations.

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