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Entanglement corner dependence in two-dimensional systems: A tensor network perspective

In continuous quantum field theories with sharp corners, the entanglement entropy exhibits a universal contribution tied to the corner geometry. We investigate this intriguing phenomenon through the lens of discretized systems, specifically using infinite projected entangled pair states (iPEPS) on a lattice.
Our work demonstrates that the anticipated corner dependence naturally arises from the geometric structure of iPEPS. Through a rigorous counting argument, we demonstrate that the bond dimension of an iPEPS representation contains a corner-dependent term that matches the predictions for gapped continuous systems.
Crucially, this correspondence holds almost perfectly, but only when averaging over all possible lattice orientations. This highlights a fundamental requirement for accurately discretizing continuous systems. For conformal systems, the corner-dependent term appears only when the system is discretized as a fractal, a scale-invariant technique rarely employed in such studies.
These findings offer a geometric understanding of entanglement corner laws and establish a direct link between analytical field theory predictions and the structure of tensor network representations. Our results provide new insights into the intricate relationship between entanglement in continuous and discrete quantum systems.

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