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Stabilizer entropy of quantum tetrahedra

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How complex is the structure of quantum geometry? In loop quantum gravity, atoms of space are SU(2) 4-valent intertwiners, which describe quantum tetrahedra. The complexity of this construction has a concrete consequence in recent efforts to simulate quantum geometry models and toward experimental demonstrations of quantum gravity effects. There is, then, a computational and an experimental complexity inherent to this class of models. We study this complexity under the lens of Stabilizer Entropy (SE). We show how to calculate the SE of the gauge-invariant basis states and its average in the SU(2)–gauge invariant subspace. States of definite volume are singled out by the (near) maximal SE and provide precise bounds to the verification protocols for experimental demonstrations on available quantum computers.

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