

Abstract Submitted  
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**Eigenstate Thermalization and the Sign-Structure of Quantum Many-Body Eigenstates**<sup>1</sup> MATTHEW FISHER, UC Santa Barbara, TARUN GROVER, Kavli Institute for Theoretical Physics — Eigenstate Thermalization Hypothesis (ETH) posits that a generic finite-energy density eigenstate of an ergodic quantum system satisfies the “volume law” of entanglement entropy – the bipartite Renyi entanglement entropies associated with a subregion scale in proportion to the subregion’s volume. Here we argue that the volume law for Renyi entropies originates from the intricate “sign structure” of the many body eigenstates. Specifically, we show that the amplitude fluctuations in a many body eigenstate carry very little entanglement compared to the fluctuations in the sign of the wavefunction, and it is the latter which are essential for the aforementioned volume law. We present analytical and numerical results that support these conclusions.

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