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Using Matrix Product State to Solve Scale Invariant Hamiltonian in Efimov Physic

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Matrix Product State (MPS) and Density Matrix Renormalization Group (DMRG) serve as effective variational techniques for investigating the low-energy states within quantum many-body systems, utilizing the underlying entanglement structures. By broadening the scope of MPS as a data representation framework, it becomes more adept at capturing intricate correlations within the system. Recent advancements have expanded the utility of this approach to efficiently address hydrodynamic equations, including the complex dynamics of phenomena like turbulence, and can compress data well. This study endeavors to adapt these methodologies to Efimov physics, which is characterized by unique universal properties and discrete scale invariance. Within this context, two new distinct approaches for generating the inverse of the required $\frac{1}{R^2}$ potential into MPS, thereby reproducing discrete scaling behavior, have been identified, alongside a detailed exploration of associated numerical challenges.

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