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Lanczos recursion on a quantum computer for the Green's function and ground state

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A state-preserving quantum counting algorithm is used to obtain coefficients of a Lanczos recursion from a single ground state wavefunction on the quantum computer. This is used to compute the continued fraction representation of an interacting Green's function for use in condensed matter, particle physics, and other areas. The wavefunction does not need to be re-prepared at each iteration. The quantum algorithm represents an exponential reduction in memory over known classical methods. An extension of the method to determining the ground state is also discussed.

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