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Worldline Approach to Few-Body Physics on the Lattice

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We formulate a world-line approach to study few body physics on a space-time lattice and develop a worm type algorithm to extract the low lying energy levels. We show that our formulation is efficient for studying non-relativistic spin-half fermions with both attractive and repulsive interactions and in the presence of mass imbalance, especially in one spatial dimension. Recently, such systems have been studied using the complex Langevin approach, since the traditional auxiliary field formulations suffer from sign problems. Our approach can be easily extended to higher dimensions for bosonic systems without sign problems. For fermionic systems, we study the severity of the sign problem in our formulation as a function of the particle number with various types of interactions.

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