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Fermions with long-range interactions using a matrix-product-states approach

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The long-range t - V model of fermions on a lattice is known to exhibit a transition between a Luttinger liquid phase and a Mott insulator phase [1]. At insulating densities, one can tailor the potential energy of the model in such a way that one forces a quantum phase transition to either another insulating charge-density-wave phase, a bond-order phase or a Luttinger liquid [2]. We show how to construct a matrix product operator representation of the Hamiltonian of the t - V model and we present phase diagrams calculated using the matrix-product-states approach [3]. We compare these phase diagrams with results obtained in the atomic limit.

References

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3. D. Perez-Garcia et al., Quantum Inf. Comput. 7, 401 (2007); F. Verstraete et al., Adv. Phys. 57, 143 (2008).

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