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Using the sudden expansion as a cooling scheme for interacting fermions in optical lattices FABIAN HEIDRICH-MEISNER, LMU Munich, SALVATORE MANMANA, EPF Lausanne, MARCOS RIGOL, Georgetown University, ALEJANDRO MURAMATSU, University of Stuttgart, ADRIAN FEIGUIN, U Wyoming, ELBIO DAGOTTO, U Tennessee and ORNL — Time-dependent phenomena in ultracold atomic gases are currently attracting a lot of attention, as such phenomena give insights into nonequilibrium properties of interacting particles. We analyze the example of the sudden expansion of fermions in an optical lattice [1]. Our main focus is on the case in which the initial state has a strong admixture of double occupancies. We promote the notion of quantum distillation: during the expansion, and in the presence of strongly repulsive interactions, doublons group together, forming a nearly ideal band insulator, which is metastable with a low entropy. Our analysis employs the density matrix renormalization method, and we present results for experimentally observable quantities such as the radius of the particle cloud. We suggest that the quantum distillation effect could be used for cooling purposes in experiments with two-component Fermi gases [2].
[1] Heidrich-Meisner et al., Phys. Rev. A 78, 013620 (2008)
[2] Heidrich-Meisner et al., Phys. Rev. A 80, 041603(R) (2009)

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