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Quantum distillation: dynamical generation of low-entropy states of strongly correlated fermions in an optical lattice SALVATORE MANMANA, Institute of Theoretical Physics, EPF Lausanne, CH-1015 Lausanne, Switzerland, FABIAN HEIDRICH-MEISNER, Department Physik, LMU Munich, Germany, MARCOS RIGOL, Department of Physics, Georgetown University, Washington, D.C. 20057, USA, ALEJANDRO MURAMATSU, Institute for Theoretical Physics III, University of Stuttgart, Germany, ADRIAN FEIGUIN, Department of Physics and Astronomy, University of Wyoming, Laramie, Wyoming 82071, USA, ELBIO DAGOTTO, Materials Science and Technology Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831, USA — Correlations between particles can lead to subtle and sometimes counterintuitive phenomena. We analyze one such case, occurring during the sudden expansion of fermions in a lattice when 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. We propose that this effect could be used for cooling purposes in experiments with two-component Fermi gases.

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