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Shortcuts to adiabaticity in quantum many-body systems: a quantum dynamical microscope ADOLFO DEL CAMPO, Los Alamos National Laboratory — The evolution of a quantum system induced by a shortcut to adiabaticity mimics the adiabatic dynamics without the requirement of slow driving. Engineering it involves diagonalizing the instantaneous Hamiltonian of the system and results in the need of auxiliary non-local interactions for matter-waves [1,2]. Here experimentally realizable driving protocols are found for a large class of single-particle, many-body, and non-linear systems without demanding the spectral properties as an input. The method is applied to the expansion of a trapped ultracold gas which spatially scales up the size of the cloud while conserving the quantum correlations of the initial many-body state. This shortcut to adiabatic expansions acts as a quantum dynamical microscope [3]. [1] Adolfo del Campo, Shortcuts to adiabaticity by counter-diabatic driving, Phys. Rev. Lett. 111, 100502 (2013). [2] Adolfo del Campo, Marek M. Rams, Wojciech H. Zurek, Assisted finite-rate adiabatic passage across a quantum critical point: Exact solution for the quantum Ising model, Phys. Rev. Lett. 109, 115703 (2012) [3] Adolfo del Campo, Frictionless quantum quenches in ultracold gases: a quantum dynamical microscope, Phys. Rev. A 84, 031606(R) (2011).

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