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Equilibration dynamics of a many-body quantum system across the superfluid to Mott insulator phase transition ANDREAS MULLERS, CHRISTIAN BAALS, BODHADITYA SANTRA, RALF LABOUVIE, Department of Physics and Research Center OPTIMAS, University of Kaiserslautern, Germany, THOMAS MERTZ, ARYA DHAR, Institute for Theoretical Physics, Goethe-University Frankfurt, Frankfurt/Main, Germany, IVANA VASIC, Scientific Computing Laboratory, Institute of Physics Belgrade, University of Belgrade, Serbia, AGNIESZKA CICHY, WALTER HOFSTETTER, Institute for Theoretical Physics, Goethe-University Frankfurt, Frankfurt/Main, Germany, HERWIG OTT, Department of Physics and Research Center OPTIMAS, University of Kaiserslautern, Germany — We report on the center-of-mass motion of ultracold ^{87}Rb atoms on displacing an underlying potential. The atoms are adiabatically loaded into an optical lattice superimposed onto an optical dipole trap. The CO_2 laser beam forming the dipole trap is then shifted by 1 μm which forces the system out of equilibrium. The subsequent motion of the atoms center-of mass is imaged with a scanning electron microscope for various depths of the optical lattice spanning the superfluid to Mott-insulator phase transition. The observed dynamics range from fast oscillations in the superfluid regime to a steady exponential movement towards the new equilibrium position for higher lattice depths. By piecewise analysis of the system, we can also identify a thermal phase at the edges which moves with velocities in between those of the superfluid and the insulating phase. We will present the experiment and the results of theoretical modelling currently in progress.

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