LOCALIZATION AND GLASSY DYNAMICS OF MANY-BODY QUANTUM SYSTEMS

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When classical systems fail to explore their entire configurational space, intriguing macroscopic phenomena like aging and glass formation may emerge. Also closed quanto-mechanical systems may stop wandering freely around the whole Hilbert space, even if they are initially prepared into a macroscopically large combination of eigenstates. Here, we report numerical evidences that the dynamics of strongly interacting lattice bosons driven sufficiently far from equilibrium can be trapped into extremely long-lived inhomogeneous metastable states. The slowing down of incoherent density excitations above a threshold energy, much reminiscent of a dynamical arrest on the verge of a glass transition, is identified as the key feature of this phenomenon. We argue that the resulting long-lived inhomogeneous pattern is in turn responsible for the lack of thermalization observed in large finite size systems. Such a rich phenomenology could be experimentally uncovered upon probing the out-of-equilibrium dynamics of conveniently prepared quantum states of trapped cold atoms which we hereby suggest.[1]

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[1] G. Carleo, F. Becca, M. Schiro, and M. Fabrizio, Scientific Reports **2**, 243 (2012).