Observation of subdiffusive dynamic scaling in a driven and disordered Bose gas

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I will showcase a series of recent experiments that explore the fate of a violently driven particle in a box. We begin our experiments with a 39K Bose-Einstein condensate confined to an optical box trap, before turning off the interparticle interactions using a Feshbach resonance, and driving the system with a spatially uniform oscillating force. Already in a 1D world such a drive leads to chaotic behavior, where the system reaches a quasi-equilibrium state with finite energy. In our 3D box-trapped gases, the energy keeps growing as we drive the system, exhibiting subdiffusive dynamic scaling behavior. The resultant far-from-equilibrium momentum distribution is essentially isotropic, and features remarkably uniform low-momentum population, with coherence destroyed. We explain our observations in terms of a random walk that takes place in energy space, arising from the interplay of the underlying 1D driven chaotic state and the presence of weak disorder. Our engineered nonequilibrium states also facilitate studies of equilibration and thermalization far from equilibrium.