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Many-body localisation of interacting fermions in a quasi-random optical lattice

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We experimentally observe many-body localization (MBL) of interacting fermions in a one-dimensional quasi-random optical lattice. We identify the many-body localization transition through the relaxation dynamics of an initially-prepared charge density wave. For sufficiently weak disorder the time evolution appears ergodic and thermalizing, erasing all remnants of the initial order. In contrast, above a critical disorder strength a significant portion of the initial ordering persists, thereby serving as an effective order parameter for localization. The stationary density wave order and the critical disorder value show a distinctive dependence on the interaction strength, in agreement with numerical simulations. I will also present recent results on the fate of an MBL system upon coupling to the environment through photon scattering or by coupling identical 1d systems. Finally, progress to observe MBL in a 2d setting of interacting bosons will be presented that can provide a new route for identifying and characterizing the MBL phase transition