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Evidence for Many-Body Localization in an Ultracold Fermi-Hubbard Gas[1]

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Many-body localization (MBL) is a promising new paradigm for understanding disorder-induced localization in interacting quantum systems at non-zero temperature. We observe the emergence of an insulating state consistent with MBL in a strongly correlated atomic Fermi gas trapped in a disordered optical lattice, a closed system that realizes the disordered Fermi-Hubbard model. In measurements of disorder-induced localization obtained via mass transport, we detect three phenomena characteristic of MBL. We measure localization of this strongly interacting system at non-zero temperature, and we observe interaction-driven delocalization. We also observe localization that persists as the temperature and energy density of the gas are increased.

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