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Entanglement growth in the disordered Fermi Hubbard model

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How isolated quantum systems reach thermal equilibrium is a long-standing question of continuing interest. The absence of equilibration in some systems is also well known, notably Anderson localization in noninteracting systems with quenched disorder. More recently, the term many-body localization has been applied to interacting systems in which equilibration is suppressed by disorder. While its persistence in the thermodynamic limit remains an open question, this effect is observed in experiments which are necessarily done in finite size systems and finite times. Most of the theoretical work in this area has focused on systems in which there is just one local degree of freedom—spin or charge. Meanwhile, systems with multiple coupled degrees of freedom are of interest, not least because most experimental studies of many-body localization use cold atoms described by the Hubbard model with two local degrees of freedom—spin and charge. Focusing on the case of the disordered Fermi Hubbard model, we ask How does disorder in charge influence localization in spin? How does entanglement grow with time? and What are the charge and spin contributions to this growth?

Keyword-1

disorder

Keyword-2

Fermi-Hubbard

Keyword-3

entanglement

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