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Charge and spin-specific local integrals of motion in a disordered Hubbard model

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While many-body localization has primarily been studied in systems with a single local degree of freedom, experimental studies of many-body localization in cold atom systems motivate exploration of the disordered Hubbard model. With two coupled local degrees of freedom it is natural to ask how localization in charge relates to disorder in spin and vice versa. Most prior work has addressed disorder in only one of these sectors and often has not used measures of localization which distinguish between charge and spin. Here we explore localization in the Hubbard model with a wide range of independent values of charge and spin disorder, using measures of localization based on charge and spin-specific integrals of motion. Our results show a symmetry between the response of the charge to spin disorder and vice versa, and we find very weak disorder in one channel, so long as the disorder in the other channel is sufficiently strong, results in localization in both channels. Further, the weaker the disorder in the less-disordered channel, the longer the time scale at which localization appears in the dynamics of this degree of freedom.

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