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Doping a Hubbard Antiferromagnet in and out of Thermal Equilibrium GEOFFREY JI, MUQING XU, LEV KENDRICK, CHRISTIE CHIU, MARTIN LEBRAT, MARKUS GREINER, Harvard University — Understanding how dopants interact with antiferromagnetism is key to deciphering the mysteries of the Hubbard model. Quantum gas microscopy enables progress towards this goal by allowing for site-resolved measurements of density and correlation functions. We use such a platform to first create a doped 2D Hubbard system in thermal equilibrium. Using novel string observables, we examine how the dopants scramble the spin background in non-trivial ways that are distinguishable from elevated temperatures. We then prepare a system at half-filling with elevated potential at a single site, creating a pinned dopant. We quench the system by releasing the dopant and examine the dynamics in a time-resolved manner. The dopant exhibits a transition from ballistic to sub-ballistic motion; measurements of the spin correlation function show that the dopant motion scrambles the surrounding spin environment during this process. Examination of the Hubbard model both in and out of equilibrium may shed light on the mechanisms behind the highly correlated phases that may exist in the ground state of the doped Hubbard model.

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