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Magnetic polarons from kinetic frustration in the doped triangular Hubbard model

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Itinerant spin polarons - bound quasiparticle states of magnons and charge dopants - have been predicted to emerge in two-dimensional Fermi-Hubbard models with frustration. These polarons are expected to be robust even at high temperatures since their binding energy is on the tunneling, rather than superexchange, energy scale. Indirect signatures of their existence have been observed in transition metal dichalcogenide heterostructures, but a direct experimental observation is still outstanding.

We present results from our atomic triangular Fermi-Hubbard quantum simulator, which incorporates a bilayer imaging technique that allows us to access arbitrary n-point spin and charge correlation functions. Over a wide range of interactions, we observe the enhancement of antiferromagnetic ordering in the local environment of a hole dopant. Around a charge dopant, we witness enhanced ferromagnetic correlations, constituting the first direct observation of Nagaoka polarons in an extended system. Additionally, higher order 4-point correlations allow us to directly compare the strengths of kinetic and superexchange magnetism in our system. Our results pave the path to studying more complex multi-particle bound states that can lead to hole pairing at high temperatures in frustrated systems.

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