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Exploring antiferromagnetic correlations of ultracold atoms in two dimensions

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Near zero temperature, quantum magnetism can non-trivially arise from short-range interactions, however the occurrence of magnetic order depends crucially on the interplay of interactions, lattice geometry, dimensionality and doping. Ultracold atomic Fermi gases in optical lattices constitute an experimental system with unrivalled tunability and detection capabilities to explore quantum magnetism by analog quantum simulation. In this talk I will present our recent experimental studies of the emergence of antiferromagnetic correlations between ultracold fermionic ^{40}K atoms in two dimensions with decreasing temperature. We determine the magnetic susceptibility of the Hubbard model from simultaneous measurements of the in-situ density of both spin components. At half-filling and strong interactions our data approach the Heisenberg model of localized spins with antiferromagnetic correlations. When the system is doped away from half-filling, we observe the disappearance of magnetic correlations. Our observation of the dependence of quantum magnetism on doping paves the way for future studies on the emergence of pseudogap and pairing phenomena away from half-filling.