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Exploring Polarons in Ultracold Atoms

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The idea of polarons was originally introduced in solid state physics to describe electrons interacting with lattice vibrations in solids. This concept was later applied to study many other important systems including charge dopants interacting with magnetic excitations in Mott insulators and magnetic semiconductors, dynamical impurities and time dependent perturbations in electron systems, optical and transport properties of mesoscopic electronic systems. In the last few years several new types of polaronic systems have been realized experimentally using ultracold atoms, including Bose and Fermi polarons, multiparticle bound states on Rydberg excitations. I will review theoretical and experimental work in this area and discuss new types of models that can be realized, such as a Bosonic Kondo/Central Spin model.