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Field-theoretical Study of the Bose Polaron - Challenges for Quantum Simulation with ultracold Atoms RICHARD SCHMIDT, Harvard-Smithsonian Astrophysical Observatory, STEFFEN PATRICK RATH, Technical University Munich — We study the properties of the Bose polaron, an impurity strongly interacting with a Bose-Einstein condensate, using a field-theoretic approach and make predictions for the spectral function and various quasiparticle properties that can be tested in experiment. We find that most of the spectral weight is contained in a coherent attractive and a metastable repulsive polaron branch. We show that the qualitative behavior of the Bose polaron is well described by a non-selfconsistent T-matrix approximation by comparing analytical results to numerical data obtained from a fully selfconsistent T-matrix approach. The latter takes into account an infinite number of bosons excited from the condensate. Finally we discuss the implications of our results for the attempted quantum simulation of the Froehlich Hamiltonian using ultracold atoms.

Richard Schmidt
Harvard-Smithsonian Astrophysical Observatory

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