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A heavy impurity immersed in a Bose-Einstein Condensate ZOE YAN, CARSTEN ROBENS, YIQI NI, MARTIN ZWIERLEIN, Massachusetts Institute of Technology — Impurities immersed in a bosonic bath represent a fundamental problem in many-body physics. These Bose polarons give rise to a wealth of new quantum phenomena, both in solid state systems and in ultracold atomic mixtures. We report on the creation and study of Bose polarons using degenerate fermionic 40K atoms immersed in a Bose-Einstein condensate (BEC) of 23Na. We observe the formation of the quasiparticles (the Bose polarons) and measure their energy landscape via radio-frequency ejection spectroscopy. Energies are measured across a variety of interaction strengths by tuning an interspecies magnetic Feshbach resonance. Besides measuring static properties such as polaron energy, we study collective oscillations between the majority BEC atoms and the impurities, demonstrating a strong locking of the two species' motion when their interaction strengths approach the unitary limit. Such measurements of polaron properties will inform work on a wide range of quantum phenomena, including high-Tc superconductivity and superfluid helium mixtures.

Zoe Yan
Massachusetts Institute of Technology

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