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A new strongly interacting Bose-Fermi mixture of ^{23}Na and ^{40}K[1]

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— We have created a quantum degenerate Bose-Fermi mixture of ^{23}Na and ^{40}K with widely tunable interactions via broad interspecies Feshbach resonances. Over thirty Feshbach resonances between ^{23}Na and ^{40}K were identified, including p-wave multiplet resonances. Observed broad Feshbach resonances opens up a path to study the fate of an impurity interacting with its environment, a fundamental problem in condensed matter physics. We study the interaction of an impurity immersed in a Bose-Einstein condensate of ^{23}Na. We perform radio-frequency spectroscopy on the impurity atom and the bath, which is expected to probe the spectral features characteristic for polaronic dressing: A delta-like peak in addition to a broad pedestal coming from the interactions between the impurity and the phonons in the condensate. Our system, with its widely tunable interactions, promises to be an ideal system to study the evolution from Bose polarons to Fermi polarons as the imbalance between ^{23}Na and ^{40}K is varied.

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