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Quantum degenerate Bose-Fermi mixture of chemically different atomic species with widely tunable interactions[1]

JEE WOO PARK, CHENG-HSUN WU, IBON SANTIAGO, Massachusetts Institute of Technology, TOBIAS TIECKE, Harvard University, PEYMAN AHMADI, MARTIN ZWIERLEIN, Massachusetts Institute of Technology — We have created a quantum degenerate Bose-Fermi mixture of 23Na and 40K with widely tunable interactions via broad interspecies Feshbach resonances. Twenty Feshbach resonances between 23Na and 40K were identified. The large and negative triplet background scattering length between 23Na and 40K causes a sharp enhancement of the fermion density in the presence of a Bose condensate. As explained via the asymptotic bound-state model (ABM), this strong background scattering leads to a series of wide Feshbach resonances observed at low magnetic fields. Our work opens up the prospect to create chemically stable, fermionic ground state molecules of 23Na-40K where strong, long-range dipolar interactions will set the dominant energy scale.

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