Many body effects in a widely tunable Bose-Fermi mixture

PEYMAN AHAMDI, CHENG-HSUN WU, IBON SANTIAGO, JEE WOO PARK, MARTIN ZWIERLEIN, Massachusetts Institute of Technology — A Bose-Einstein condensate immersed in the Fermi sea provides a rich platform for the study of many body effects such as polaron physics, boson-induced superfluidity and models of high-temperature superconductivity. Few bosonic impurities in a Fermi sea form bosonic polarons, dressed quasi-particles that can condense, while few fermionic impurities in a Bose condensate might dress into heavy fermions with an immense increase of the effective mass. In an atom trap, both extremes of boson-fermion imbalance can in principle be realized in one and the same sample. Recently we have realized a Bose-Einstein condensate of $^{41}$K immersed in a Fermi sea of $^{40}$K at $T/T_F=0.3$ and detected a wide Feshbach resonance between them. The mixture’s lifetime is long enough so that bosonic polarons should form at an expected binding energy of about 0.6 $T_F$. In this talk I will summarize our observations and the progress we have made to detect polaron physics in Bose-Fermi mixtures.

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