DAMOP10-2010-000451

Abstract for an Invited Paper
for the DAMOP10 Meeting of
the American Physical Society

Quantum Degenerate Gases of Atomic Strontium[1]

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This talk will describe the production and properties of a Bose-Einstein condensate of ^{84}Sr and a quantum degenerate mixture of ^{87}Sr (fermion) and ^{88}Sr (boson). ^{88}Sr has a small negative scattering length leading to a maximum condensate size for our trapping conditions of about 10^4 atoms. ^{87}Sr is used to sympathetically cool ^{88}Sr, but it is also of interest for study of quantum degenerate Fermi gases because it has a large nuclear spin (I=9/2). Alkaline-earth metal atoms and atoms with similar electronic structure are of interest for quantum computing proposals, cold collision studies, and investigation of quantum fluids. There are a wealth of isotopes that allow mass-tuning of interactions and creation of various quantum mixtures. The two-valence electrons lead to a singlet ground state and narrow intercombination transitions to metastable triplet states, offering the promise of low-loss optical Feshbach resonances for manipulating scattering lengths. Fermions often have large nuclear spin, which is decoupled from electronic degrees of freedom and leads to a large degree of symmetry and degeneracy in the interaction Hamiltonian. Work done in collaboration with Y.N. Martinez de Escobar, P.G. Mickelson, M. Yan, B.J. DeSalvo, and S.B. Nagel, Rice University.

[1]Supported by the National Science Foundation and the Welch Foundation.