Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

New Facility to Probe Physics With Degenerate Bose and Fermi Gas SUBHADEEP DE, Joint Quantum Institute, National Institute of Standard and Technology and University of Maryland, MD, USA, DANIEL L. CAMPBELL TEAM, ABIGAIL R. PERRY TEAM, RYAN PRICE TEAM, IAN B. SPIELMAN TEAM — A new facility to produce dual species degenerate Bose and Fermi gas is under construction at JQI. This apparatus is designed to create degnerate mixtures of bosonic rubidium (^{87}Rb) and fermionic lithium (^{6}Li). A degenerate Bose-Fermi mixture supports many quantum phase transitions, giving an experimental platform to study many-body statics, dynamics, and perhaps precision measurements. High T_c superconductivity could be probed, where fermions are bound into Cooper pairs by boson mediated interactions. Dual species heteronuclear molecules with large permanent electric dipole moment may lead to a system for implementing quantum bits. A spin-polarized, non-interacting, degenerate ^{6}Li gas coupled to ^{87}Rb atoms in an optical lattice will give rise to a long range, spin-dependent interactions to realize quantum magnetism and potentially supersolidity. Far red-detuned lattices are far weaker, in recoil units, for Li as compared to Rb. So, in the Mott phase of Rb - one atom per lattice site - the three body recombination of Li-Li-Rb is greatly suppressed. Thus the wide ^{87}Rb-^{6}Li Fesbach resonance at 1.1 kG is expected to effectively control fermion mediated interactions.

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Date submitted: 17 Nov 2010 Electronic form version 1.4