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Equilibrium and Dynamics of a Bose-Fermi Quantum Mixture with Strong Mass Imbalance KRUTIK PATEL, BRIAN DESALVO, GEYUE CAI, CHENG CHIN, James Franck Institute, Enrico Fermi Institute, Department of Physics, University of Chicago — We present our work with quantum degenerate mixtures of bosonic ^{133}Cs and fermionic ^{6}Li. Due to the strong mass imbalance and differing quantum statistics, the Bose-Einstein condensate (BEC) is fully immersed in the much larger degenerate Fermi gas. By tuning the magnetic field near an interspecies Feshbach resonance, we control the interactions between the BEC and surrounding fermions. This allows the study of equilibrium phases and dynamics of Bose-Fermi mixtures as a function of scattering length. In equilibrium, mean field theory predicts Bose-Fermi mixtures exhibit three distinct phases. With weak interactions, the components are miscible. With strong attractive interactions there should be a collapse, and with strong repulsive interactions the components should phase separate. However, this picture has proved overly simplistic. We observe no such collapse in our system and find a regime where fermions are fully confined by the BEC. To study dynamics, we measure frequency shifts and damping rates of the bosonic dipole oscillations as a function of interspecies interaction strength. For weak interactions, we observe shifts of the frequency and damping rates consistent with the mean-field calculation. For strong interactions the data disagree with this model.

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