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Combining Ultracold Quantum Gases of Ytterbium and Lithium Atoms[1] RICHARD J. ROY, WILLIAM H. DOWD, RAJENDRA SHRESTHA, SUBHADEEP GUPTA, University of Washington — Ultracold atomic gases are fruitful systems in which to study exotic quantum phenomena such as Bose-Einstein condensation, superfluidity, and BCS pairing of fermions like that in superconductors. In this regard, single atomic species experiments have covered significant ground in studies of few and many-body physics. However, the addition of a second species opens up a large variety of new physics to be explored. Recent advances in the field of ultracold mixtures include the coherent production of heteronuclear diatomic molecules, and the subsequent coherent control of the many molecular degrees of freedom (e.g. rotational, vibrational, and electronic) with the use of external fields. This forms the starting point for realizing a number of quantum information and computation applications and studies of controlled chemical reactions. Here we report recent progress towards the creation of ultracold molecules of lithium and ytterbium, including the successful realization of a novel, long-lived mixture of ground state lithium and metastable excited state ytterbium atoms.

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