Abstract:

We use a cryogenic helium buffer-gas to cool samples of atoms and molecules to temperatures as low as 1 Kelvin.

Using cold atomic ytterbium and electromagnetically induced transparency (EIT), we have created a strong coherent coupling between the atomic ensemble and light. Unlike traditional EIT experiments, which couple light to the electron state, with atomic ytterbium we can couple light directly to pure nuclear spin states. Through this interaction, we have created a nuclear memory for photons with a lifetime on the order of 1 second.

We also produce cold samples of atoms and molecules for studying cold chemical reactions, with an emphasis on tunneling-driven reactions and spin-control of reactions. Measurements of cryogenic chemical reactions of Li and CaH will be presented.