Creation of the optically trapped ultracold sodium molecules via a Feshbach resonance

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Abstract:

Recently it has become possible to create ultracold molecular gases from precooled atomic condensates. Feshbach resonance, which originates from the degeneracy of free atomic state and molecular bound state, has been utilized to form molecules in an atomic condensate by adiabatic magnetic-field sweep. Because of the high conversion efficiency and the tunability of the inter-molecular interaction, this method is one of the most promising way to realize momentum-correlated pair of atoms (BCS pair), and to study BEC-BCS cross over of paired atoms.

I'm gonna give a talk on the recent experiments we have done with ultracold molecules composed of bosonic sodium atoms. We have produced 10^5 molecules, which corresponds to the phase space density of more than 20 in our trap conditions. We have measured the typical evidence of the condensation of "falling cloud like a rock." We have also studied the dissociation and decay of those molecules. In the negative scattering-length side of Feshbach resonance (where BCS paired state is predicted to exist for molecules composed of fermions), molecules dissociate into free atomic states. This dissociation mechanism is understood by the intuitive explanation considering the density of states of atoms.

Related publications:

[1] K. Xu, T. Mukaiyama, J. R. Abo-Shaeer, J. K. Chin, D. E. Miller and W. Ketterle, Phys. Rev. Lett. 91, 210402 (2003).

[2] T. Mukaiyama, J. R. Abo-Shaeer, K. Xu, J. K. Chin, W. Ketterle, cond-mat/0311558.