Strongly enhanced inelastic collisions in a Bose-Einstein condensate near Feshbach resonances

The properties of Bose-Einstein condensed gases can be strongly altered by tuning the external magnetic field near a Feshbach resonance. Feshbach resonances affect elastic collisions and lead to the observed modification of the scattering length. However, we found that this is accompanied by a strong increase in the rate of inelastic collisions. The observed three-body loss rate increased when the scattering length was tuned to both larger or smaller values than the off-resonant value [1]. The maximum measured increase of the loss rate was several orders of magnitude. Sweeps of the magnetic field through the resonance resulted in loss of most of the atoms in one microsecond. These observation are not explained by theoretical treatments and indicate molecular and many-body physics which is not yet accounted for. The strong losses impose severe limitations for using Feshbach resonances to tune the properties of Bose-Einstein condensates. A new Feshbach resonance in sodium at 1195 G was observed which has a region of negative scattering length on the low field side of the resonance which can therefore be directly approached without crossing any other resonance.

1. J. Stenger, S. Inouye, M.R. Andrews, H.-J. Miesner, D.M. Stamper-Kurn, and W. Ketterle, Phys. Rev. Lett. **82**, 2422 (1999).