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Observation of Magnetically Induced Trap Loss of Ultracold Thulium Atoms

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Abstract. We report the observation of influence of homogeneous magnetic field on an optical lattice losses of ultracold thulium atoms. The atomic cloud temperature was T = 15 mK. The dependence of trap population on a value of magnetic field has a broad resonance in the low-field region with a center at B = 0.4 G. We also have measured a decrease of optical lattice lifetime in a presence of resonance magnetic field. The observed magnetically-induced trap losses are assumed to be Feshbach resonance which is a dependence of an atomic scattering length on magnetic field.

Keywords: ultracold atoms, Feshbach resonance.

Thulium is a rare earth element with a high ground state magnetic moments (4mB). Therefore, it is a promising object for study dipole-dipole interactions and for quantum simulations. Furthermore, low-field Feshbach resonances are expected in an ultracold thulium gas. Our group deals with an investigation of collisional properties of ultracold thulium atoms.

To study cold collisions we prepare a cold atomic ensemble trapped in an optical lattice. For this purpose we perform a laser cooling of thulium atoms in a magneto-optical trap (MOT) [1]. A cooling process consists of two stages: the first-stage cooling at a broad transition at wavelength 410.6 nm and natural linewidth 10 MHz and the second-stage cooling at weak transition at wavelength 530.7 nm and natural linewidth 350 kHz [2]. This procedure allows us to obtain 106 atoms with a temperature about 10 mK in a MOT. An optical lattice is present during all the MOT loading cycle and after MOT is switched off about 50% of MOT atoms stay trapped into it. An optical lattice is formed by two counter-propagating laser beam at wavelength 532 nm with a power up to 4 W focused into MOT region. A depth of its confining potential is estimated at 100 mK so a recapture efficiency is determined by spatial MOT and optical lattice overlapping.

After preparing atoms in an optical lattice we switch on a magnetic field for 200 ms and then measure number of atoms stayed in the trap. A homogeneous magnetic field is formed by pair of coils in a Helmholtz configuration. The dependence of trap population on magnetic field value is given in the fig. 1. There is a broad resonance in the low-field region with a center at B = 0.4 G, the position of the resonance doesn't depend on a sign of magnetic field. We assume that an observed magnetically-

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induced trap loss is Feshbach resonance which is a dependence of an atomic scattering length on magnetic field.

The temperature of atomic cloud during trap losses measurement was about 10 mK. Now we are working on decreasing of a temperature for a further study of thulium collisional properties and Feshbach resonances which are an important tool to control the interaction between the atoms.

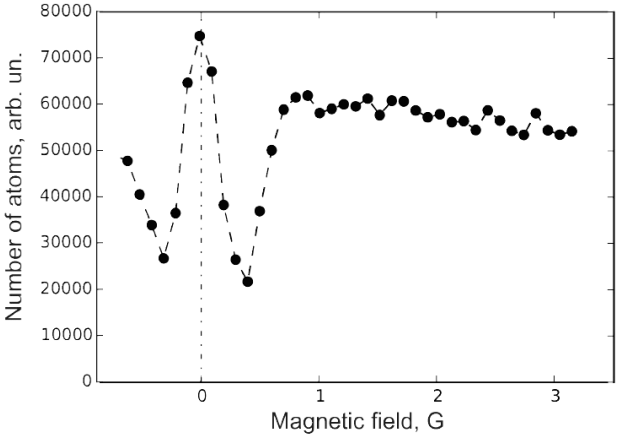

Figure 1. Dependence of optical lattice population on magnetic field value.

References

1. D. Sukachev, A. Sokolov, K. Chebakov, A. Akimov, S. Kanorsky, N. Kolachevsky and V. Sorokin, Phys. Rev. A **82**, 011405 (2010)
2. G.A. Vishnyakova, E.S. Kalganova, D.D. Sukachev, S.A. Fedorov, A.V. Sokolov, A.V. Akimov, N.N. Kolachevsky, V.N. Sorokin, Laser Physics **24**, 074018 -074024 (2014)