Abstract

In this thesis we study and characterize an erbium atomic beam emerging from a high-temperature oven system. This is the first step towards the production of a quantum-degenerate gas of Er. Er is a rare-earth element and its quantum mechanical interaction properties are yet rather unexplored. Its exceptionally large magnetic moment of $7\,\mu_{\mathrm{B}}$ makes Er especially interesting, since it allows studies on the physics of dipolar quantum gases. In addition, Er shows an unusual electronic configuration and a complex energy level scheme, promising rich scattering properties and offering many possibilities for laser cooling.

Since Er has a high melting point temperature of more than 1500 °C, the oven system for the production of a thermal atomic beam requires specific engineering. This includes thermal shielding, heated apertures, special crucible materials as well as reliable control- and security systems. We characterize the atomic beam emerging from the oven by absorption spectroscopy and fluorescence imaging on the strong 401 nm transition. Based on our measurements, we optimize the collimation setup and we find the ideal operation temperature to be $T \simeq 1250\,^{\circ}\mathrm{C}$ with a corresponding atomic flux of $3 \times 10^{10}\,\mathrm{s}^{-1}$ injected into the Zeeman slower.