

Towards Third-Stage Cooling of Thulium Atoms with a Narrow Transition at 506.2 nm

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Deep laser cooling of thulium atoms is an important step in two rapidly developing applications. It would help with ground state cooling for optical lattice clock [1] and provide a better starting point for Bose-Einstein condensation [2].

Currently, experiments with thulium atoms implement two-stage laser cooling, with the last stage using 530.7 nm transition of 350 kHz natural linewidth and achieving a cloud temperature of 10-20 μ K. We are investigating the possibility of using the third stage of laser cooling with a closed transition at 506.2 nm. Its linewidth of 7.8 kHz corresponds to a Doppler limit of 190 nK, which is less than the recoil limit.

After the initial experiments with this transition [3], we have confirmed that it is suitable for optical lattice recapture. There is also a possibility of loading atoms from the first-stage magneto-optical trap directly into the "third-stage".

References

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