Abstract Submitted
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Anisotropic optical trapping of ultracold erbium atoms OLIVIER DULIEU, MAXENCE LEPERS, JEAN-FRANCOIS WYART[1], Laboratoire Aimé Cotton, CNRS/Univ. Paris-Sud/ENS Cachan, Orsay, France — We calculate the complex dynamic dipole polarizability of ground-state erbium, a rare-earth atom that was recently Bose-condensed [1]. This quantity determines the trapping conditions of cold atoms in an optical trap. The polarizability is calculated with the sum-over-state formula inherent to second-order perturbation theory. The summation is performed on transition energies and transition dipole moments from ground-state erbium, which are computed using the Racah-Slater least-square fitting procedure provided by the Cowan codes [2]. This allows us to predict several yet unobserved energy levels in the range 25000-31000 cm^{-1} above the ground state. Regarding the trapping potential, we find that ground-state erbium essentially behaves like a spherically-symmetric atom, in spite of its large electronic angular momentum. We find a mostly isotropic van der Waals interaction between two ground-state erbium atoms, with a coefficient C_6^{iso} =1760 a.u.. On the contrary, the photon-scattering rate is strongly anisotropic with respect to the polarization of the trapping light [3].

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[2] R.D. Cowan. *The theory of atomic structure and spectra.* University of California Press (1981).
[3] M. Lepers, J.-F. Wyart, and O. Dulieu. *Phys. Rev. A*, in press (2014).

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