All-optical Bose-Einstein Condensation of Chromium atoms and rf spectroscopy of cold Cr_2 molecules

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The study of quantum gases made of chromium atoms is compelling for several reasons. Being accessible to laser manipulation, chromium has a most abundant bosonic isotope ^{52}Cr and a 9-percent abundant fermionic isotope ^{53}Cr. Most importantly, Cr atoms carry an exceptionally large magnetic moment of 6 μ_B. Consequently, Cr provides a valuable tool to study the physics of dipolar quantum gases as demonstrated in [1].

We present our recent achievement of a chromium Bose-Einstein Condensation (Cr-BEC) [2] using an all-optical procedure along with two innovative techniques:
- continuous accumulation of metastable ^{52}Cr atoms in a mixed optical and magnetic trap [3];
- fast and intense rf sweeps to average to zero the magnetic potential and optimize the transfer efficiency from the Cr-MOT to the optical trap [4].

We also report on the rf spectroscopy and association of weakly bound Cr_2 molecules in the decatriplet $^{13}\Sigma_g^+$ state. These latter experiments are performed in the vicinity of a d-wave Feshbach resonance at low magnetic field. Though the association rate is at present fairly low, we can study the spectroscopic properties of these cold trapped high-spin chromium molecules.

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References

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