Dipolar Chromium BECs
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Bose-Einstein condensates (BECs) made of 52Cr atoms reveal new phenomena, due to the presence of the long-range and anisotropic dipole-dipole interactions (see for example [1]). In this talk, I will describe the effect of dipolar interactions on the properties of multi-component (spinor) Cr condensates at extremely low magnetic fields. Due to its anisotropy, the dipolar interaction introduces magnetization-changing collisions, which dynamically frees the magnetization of the gas. We have thus observed a demagnetization of the BEC when the magnetic field is quenched below a critical value $B_c$ corresponding to a phase transition between a ferromagnetic and a non-polarized ground state. The phase transition is due to an inter-play between spin-dependent interactions and the linear Zeeman effect [2]. We have also studied the thermodynamic properties of spinor Cr atoms, and we have observed that above the critical field $B_c$, the ferromagnetic nature of BECs leads to the spontaneous magnetization of the cloud when BEC is reached [3]. I will also describe the control of magnetization-changing collisions in optical lattices. We investigate a scheme in which dipolar relaxation is resonant when the energy released in dipolar relaxation matches a band excitation resonance [4]. This scheme, which may produce correlated pairs of rotating states in each lattice site, can be viewed as the equivalent of the Einstein-de-Haas effect. Although rotation is not yet produced in our experiment, I will present first experimental results of these dipolar resonances, which show a pronounced anisotropic behaviour.