SFB/TRR 21 - Seminar

7. November 2016, Stuttgart

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Magnetism with dipolar atoms

I will present experimental results obtained in the Villetaneuse group in Paris with ultra cold chromium atoms. Due to the high spin (S=3) in the ground state of chromium, there are large magnetic dipole-dipole interactions between chromium atoms. The anisotropy of dipolar interactions frees the magnetization of the gas which adapts to temperature. We observe that the BEC always forms in the lowest energy Zeeman state [1]. By applying a magnetic field gradient, we introduce a selective loss of atoms in spin-excited states, which provides a specific loss channel for thermal atoms. This new cooling mechanism based on spin filtering results in a purification of the BEC and an increased phase-space density [2]. In another set of experiments, we prepare a multi spin component thermal gas at a temperature just above the critical temperature for condensation. We then rapidly cool the gas across the phase transition. We find that the dynamics of Bose-Einstein condensation is drastically modified due to spin-changing collisions arising from relatively strong spin-dependent interactions. Thermalization of the spin degrees of freedom is influenced by the occurrence of BEC, and in turns influences which multicomponent BECs can be produced [3].

[1] B. Pasquiou et al. , Phys. Rev. Lett. 106, 255303 (2011) [2] Naylor et al. , Phys. Rev. Lett. 115, 243002 (2015) [3] Naylor et al. , Phys. Rev. Lett. 117, 185302 (2016)

7. November 2016, 14:30 Uhr

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