SFB/TRR 21 - Seminar

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Cooperative two-photon absorption in a BEC of sodium atoms

Cooperative atom-light interaction in cold atomic samples has been the subject of intense investigation in the last few years. In such systems, the Doppler broadening of the spectral lines is negligible and the atom-atom interaction can dominate over the other energy scales. These two ingredients can lead to the cooperative two-photon absorption by a pair of atoms or molecules [1,2]. The first experimental observation of such effect in a cold atomic system was done in a MOT of sodium atoms [3]. In this experiment, the cooperative two-photon excitation peak was observed at halfway between the D1 and D2 transitions and showed a quadratic scaling with respect to the excitation laser intensity, which is the expected signature for the effect. The asymmetric profile of the two-photon excitation line provided an additional evidence of the interaction potential between the two atoms. Here, we present the experimental details of a new machine for producing a Bose-Einstein condensate of 23Na-41K with tunable interactions and propose a set of initial experiments to investigate the cooperative two-photon absorption processes in a BEC of sodium atoms. The increased density of these samples will allow to investigate the dependence of the excitation line shape and intensity in a new regime. The spatial coherence of the BEC can also be studied through the measurement of the two-photon excitation probability as a function of the displacement of two slightly detuned excitation laser beams. And finally, the ability of this system to generate correlated photons at different frequencies will be characterized by temporal correlation measurements of the atomic fluorescence signal.

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