SFB/TRR 21 - Seminar
30. März 2011, Ulm

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Control of Interactions between Ultracold Atoms using Frequency-Chirped Light

We use frequency-chirped laser light on the nanosecond time scale to control interactions between trapped ultracold Rb atoms. Pulses of chirped light from a diode laser system excite atom pairs to a long-range attractive molecular potential, leading to a measurable loss from the trap. Matching the time scale of the dynamics to that of the chirp gives the possibility of controlling the collisions. As one example, we compare loss rates for positive and negative linear chirps and observe rather different behaviors. Depending on the center detuning of the chirp, the loss rate for the negative chirp can be either enhanced or suppressed relative to that for the positive chirp. We attribute this to the multiple, in some cases coherent, interactions between the colliding pair and the chirped light as the negative chirp "follows" the resonance condition of the converging atom pair. We have attempted to extend this control by "shaping" chirps to match the collisional dynamics. We have also observed the formation of ground-state molecules using photoassociation with chirped light.

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