SFB/TRR 21 - Seminar

4. Juli 2013, Stuttgart

Ofer Firstenberg

(Harvard University, Cambridge, MA, USA)

Quantum nonlinear optics with Rydberg polaritons

We realize a quantum nonlinear medium, where propagating photons with a finite effective mass strongly interact. The photon-photon interaction is obtained by coherently exciting Rydberg states in a cold atomic gas. The resulting "Rydberg polaritons" posses large electric dipole moment and interact via the Van-der-Waals force. We are able to vary the interaction potential from real to imaginary, changing the dynamics of the two-photon wavefunction from dispersive (Schrodinger-like) to dissipative (diffusion-like). To characterize the final two-photon state, we use time-dependent quantum tomography and delineate the two-photon bound-state. We observe strong bunching or anti-bunching, and large conditional phase-shifts for two individual photons.

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