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Coherent Rydberg Excitation in Thermal Microcells

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In order to create quantum devices based on the Rydberg blockade mechanism, it is necessary to have a confinement of the excitation volume to less than the blockade radius in a frozen gas of atoms; i.e. the excitation times need to be shorter than the timescales of the respective dephasing mechanisms. While ultracold gases seem to be the obvious choice, our approach utilizes thermal atomic vapor in small glass cells [1] which offer multiple advantages like good optical access and scalability. Such a system can be realized by confining the atoms to geometries in the micron regime. Decoherence effects like resonant interactions of the Rydberg atoms with polaritonic excitations in the glass have been studied and can be minimized by the appropriate choice of Rydberg states [2]. Using a bandwidth-limited pulsed laser system for the Rydberg excitation we observe coherent Rabi oscillations on the nanosecond timescale. In collaboration with Renate Daschner, Harald Kuebler, Bernhard Huber, Thomas Baluktsian, Andreas Koelle, James Shaffer, and Tilman Pfau.

[1] Baluktsian, T., et. al. Opt. Lett. 35, 1950 (2010)
[2] Kübler, H., et. al. Nature Photon. 4, 112-116 (2010)