ELECTROMAGNETICALLY-INDUCED TRANSPARENCY WITH CU_2O RYDBERG EXCITONS IN THE PRESENCE OF PHONON COUPLING

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Rydberg excitons in Cu_2O have emerged as a platform of strongly interacting particles with great potential for both fundamental phenomena as well as optical applications. A central problem is a strong absorptive background underlying the spectrum, stemming from the excitons' coupling to optical phonons and constricting the effect of exciton interactions [1]. Here, we analyze how and under which conditions electromangnetically-induced transparency (EIT) can suppress this background [2]. After developing a Hamiltonian theory that captures the single-photon absorption spectrum, we investigate the optical response in two-photon absorption as a function of yet unknown system parameters, see Fig. 1. Depending on these parameters, the background and exciton spectrum can partially or even fully be separated, essentially switching off the coupling to the phonon dynamics. This procedure also provides a direct handle on the experimental determination of these quantities and places limits required for optical applications. Our findings pave the way for the exploitation of Rydberg blockade with Cu_2O excitons in EIT setups.

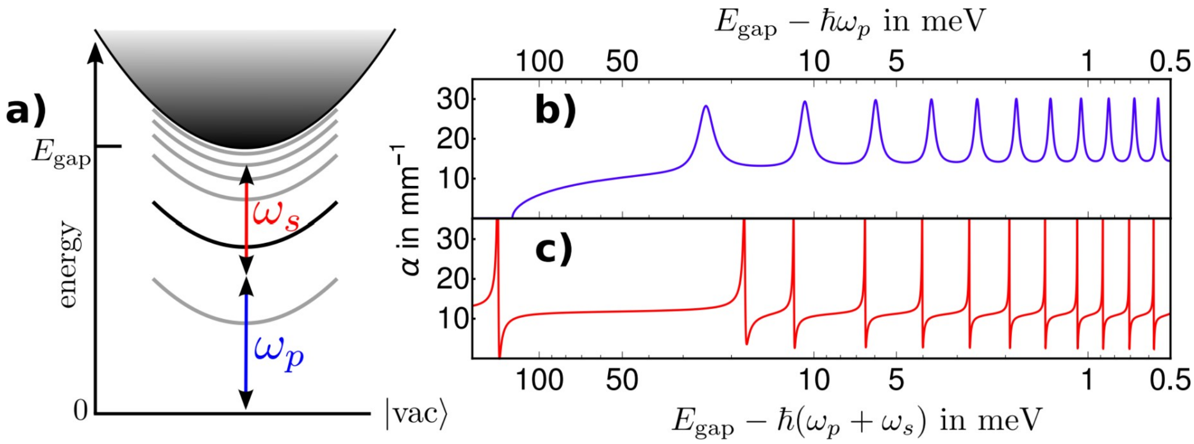

Fig. 1. a) Two-laser setup with the first laser pumping a low-lying *p*-exciton and the second coupling to a Rydberg *s*-exciton. b) single-photon absorption showing the background superimposing the *p*-states. c) adding the second laser with appropriate system parameters suppresses the resonance and the background, thus maximizing the absorption contrast.

References

[1] F. Schöne, N. Naka, H. Stolz, *Phys. Rev. B*, 2017, **96**, 115207.

[2] V. Walther, P. Grünwald, T. Pohl, *in preparation*.