

An Atomic Lab on a Chip

Hadiseh Alaeian¹, Artur Skljarow¹, Ralf Ritter¹ Wolfram H.P. Pernice²,
Harald Kübler¹, Robert Löw¹, Tilman Pfau¹

¹ 5. Physikalisches Institut and Center for Integrated Quantum Science and Technology (IQST), Universität Stuttgart, Germany

² Institute of Physics, University of Münster, Germany

Abstract:

The integration of photonic structures with thermal atomic vapors on a chip provides efficient atom-light coupling on a miniaturized scale well beyond the diffraction limit hence, opening a new regime in the field of cavity quantum electrodynamics. In this talk, we present the results of our study on interactions of thermal rubidium atoms with integrated Si_3N_4 and silicon Nano-devices. In the former case, the atoms are probed with a laser at the D_2 transition, whereas in latter the atoms are further excited to the 4D states with an additional excitation at telecom wavelength. Our studies on silicon structures benefit from a stronger mode confinement due to the large reflective index as well as a larger dipole moment. Moreover, we demonstrate novel measurements on the effects of silicon surface potentials on rubidium 4D states. Promising results on ring resonators pave the way towards further investigations of high quality photonic crystal cavities in order to reach the strong coupling regime.

[1] R. Ritter et al., New Journal of Physics 18, 103031 (2016)

[2] R. Ritter et al., Phys. Rev. X 8, 021032 (2018)