Abstract Submitted
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Engineering Atom-Photon and Atom-Atom Interactions with Silicon Nano-Photonics[1] ARTUR SKLJAROW, 5th Institute of Physics University of Stuttgart and IQST, WOLFRAM PERNICE, Institute of Physics University of Muenster, HARALD KUEBLER, ROBERT LOEW, TILMAN PFAU, HADISEH ALAEIAN, 5th Institute of Physics University of Stuttgart and IQST, 5. PHYSIKALISCHES INSTITUT AND IQST TEAM, AG PERNICE TEAM — Interfacing thermal atomic vapors with Nano-photonics on a chip provides a unique testbed for manipulating the interaction of atoms with photons and other atoms on a miniaturized scale. We studied an integrated silicon photonic chip, composed of several sub-wavelength ridge and slot waveguides, immersed in a micro-cell with rubidium vapor. Employing two-photon excitation, including a telecom wavelength, we observed that the guided mode transmission spectrum gets modified when the photonic mode is coupled to rubidium atoms through its evanescent tail. The tight confinement of the field around the waveguide leads to a large optical non-linearity at the telecom wavelength within the Femto-Watt power range. To benefit further from the small mode volume below the difraction achievable in Nano-devices, we investigated the coupling of atomic vapor to slot waveguides. The slot mode constrains the probed atomic density to an effective one-dimension hence leading to geometry dependent atom-light and atom-atom interactions. The results of this study help to understand the capabilities and limits of hybrid systems of thermal atoms and Nano-photonics and pave the way towards on-chip, integrated and atom-based quantum technologies.

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