Enhanced light-light interactions by controlling external degrees of freedom on a photonic chip

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Recently, hollow-core waveguides have been introduced for a new class of atom photonic chips that allows for large light-matter and light-light interactions at ultralow power levels [1-3]. At the same time, it has also been shown that this photonic platform lends itself to implementation of novel optical particle manipulation techniques, taking advantage of the planar waveguide-based architecture [4-6].

In this talk, I will review these new methods for controlling the external (motional) degrees of freedom of a particle. Specifically, a new type of all-optical trap, an integrated Zeeman slower, and applications of optical particle manipulation to enhancing light-light interactions in coherent atomic media will be discussed.