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Cold Cs atoms inside a hollow-core photonic-crystal fiber CHRISTOPHER HAAPAMAKI, TAEHYUN YOON, JEREMY FLANNERY, GOLAM BAPPI, RUBAYET AL MARUF, OMAR ALSHEHRI, MICHAL BAJCSY, Institute for Quantum Computing, University of Waterloo — Ensembles of quantum emitters, in particular ensembles of cold atoms, are an important platform for implementing optical nonlinearities potentially controllable by single photons, with applications ranging from classical and quantum information processing to studies of quantum-mechanical phenomena in condensed matter and atomic systems. The enhancement of light-matter interaction is a crucial stepping stone for these nonlinearities and one of the ways to achieve it is by simultaneously confining photons and the atomic ensemble inside a hollow-core optical waveguide. In recent years, optical nonlinearities controlled by several hundred photons were demonstrated with laser-cooled Rb atoms confined in a red-detuned dipole trap inside a hollow-core photonic-crystal fiber. Here, we report our progress on an experiment for trapping ensembles of laser-cooled Cs atoms inside such fiber with magic-wavelength dipole trap and discuss the outlooks of this system for implementing nonlinear optics with single photons, including possible ways to modify the photonic environment of a hollow optical waveguide to achieve further enhancement of light-matter interactions.

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