Rydberg atoms in miniaturized devices

Yi-Hsin Chen
Department of Physics, National Sun Yat-Sen University, Kaohsiung, 80424, Taiwan

I will first give an overview of the studies of electromagnetically induced transparency (EIT), Rydberg-state EIT, and quantum-state manipulation in laser-cooled atomic ensembles. For the applications in quantum information science, we turn to the study of the nonlinear optics in miniaturized systems with thermal vapors such as optical nanofibers, photonic-crystal fibers, microcells, and waveguides. With Rydberg atoms in miniaturized devices, we are able to generate multiple quantum-bits and quantum gates due to the strong atom-atom interaction. The single-photon sources based on strongly interacting Rydberg atoms via four-wave-mixing (FWM) and photon blockade effect from a room temperature microcell has been realized. Finally, a proposal of building an array of Rydberg atoms in nanofibers and optical waveguides will be discussed.