Plenary Talk PV XII Fri 9:45 e415

Revisiting Light–Matter Interaction at the Microscopic Scale

— •Arno Rauschenbeutel — Department of Physics, Humboldt Universität zu Berlin, 10099 Berlin, Germany

The interaction of a single-mode light field with a single atom or an ensemble of atoms is described by a simple Hamiltonian and has been extensively studied. Still, the vector-properties of light in conjunctions with the multilevel-structure of real atoms and their collective response results in rich and surprising physics. In our group, we investigate this subject matter using nanophotonic components, such as subwavelength-diameter optical fibers and whispering-gallery-mode resonators, for interfacing light and atoms. I will present three effects that we recently observed in experiments with these systems and that go beyond the standard description of light–matter coupling. First, light which is tightly confined can locally carry transverse spin angular momentum which leads to propagation direction-dependent emission and absorption of light. Second, when imaging an elliptically polarized emitter with a perfectly focused, aberration-free imaging system, its apparent position differs from the actual position. Third, an ensemble of atoms can change the photon-statistics of light transmitted through the ensemble. There, depending on the number of coupled atoms, a collectively enhanced nonlinearity leads to pronounced bunching or anti-bunching.