

Speaker Karlsruhe Days of Optics & Photonics 2023



Abstract: Uncovering the Unforeseen: A Scientific Expedition through Atoms and Photons

Prof. Dr. Arno Rauschenbeutel

The interaction of a single-mode light field with a single atom or an ensemble of atoms is governed by conceptually simple equations and has been extensively studied. Still, the vectorial properties of light combined with the multilevel structure of real atoms and their collective response yield rich and surprising physics. In our group, we are investigating this topic using nanophotonic components, such as subwavelength-diameter optical fibers and whispering-gallery-mode resonators, to couple light

and atoms. I will present three effects that we have 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 significantly from the actual position. Third, an ensemble of atoms can change the photon statistics of laser light transmitted through the ensemble, yielding pronounced bunching or anti-bunching. Interestingly, these effects are not limited to a nanophotonic setting and even occur for freely propagating light fields.

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Biography:

Arno Rauschenbeutel did his PhD in the group of Serge Haroche at ENS. He was Senior Scientist at the University of Bonn, Full Professor at the University of Mainz, and leader of the Applied Quantum Physics Group as well as Director of Atominstitut at TU Wien. Since 2018, he is an Alexander von Humboldt Professor and the leader of the Fundamentals of Optics and Photonics Group at HU Berlin. His research focuses on quantum optics, nanophotonics, as well as cavity and waveguide quantum electrodynamics. His group has pioneered the use of sub-wave-length-diameter optical fibers in quantum optical experiments. Arno Rauschenbeutel received a Marie Curie Excellence Award (EC), a European Young Investigators Award (ESF), a Lichtenberg-Professorship (VolkswagenFoundation), an ERC Consolidator Grant, an Alexander von Humboldt Professorship (Alexander von Humboldt Foundation), and an ERC Synergy Grant. He recently became the spokesperson for the Berlin Quantum Alliance, a newly formed initiative that aims to make Berlin an internationally visible center for research and development in quantum technologies.

Statement:

Optics and photonics are my passion and Karlsruhe is one of the most renowned training and research centers in these fields. That is why I am looking forward to the „Karlsruhe Days of Optics & Photonics“ with great enthusiasm.