(idw)

idw - Informationsdienst Wissenschaft
Nachrichten. Termine. Experten

Pressemitteilung

Humboldt-Universität zu Berlin
Ina Friebe

26.10.2022
http://idw-online.de/de/news803567

Forschungsprojekte
Physik / Astronomie
überregional

Funding in the millions for superatoms threaded along optical nanofibers

Team of three researchers with participation from Humboldt-Universität to receive 8 million euros in funding from the European Research Council

Both a future tap-proof quantum Internet and the quantum computer use principles and methods of quantum optics, which deals with the interaction of photons, i.e. light particles, with quantum emitters such as atoms or molecules. Particular progress has recently been made in the field of nonlinear quantum optics. There, one investigates photons that attract or repel each other in a similar way to electrically charged particles. The knowledge gained in this way advances the fundamental understanding of light-matter interaction and could enable the realization of key devices for quantum communication and quantum information processing. However, photons do not interact under normal circumstances. If this is to be changed, it has to be ensured, so to speak, that they cannot avoid each other and meet simultaneously at one and the same atom.

This task will be addressed by the research project "Superatom Waveguide Quantum Electrodynamics" (SuperWave) over the next six years. SuperWave receives a prestigious Synergy Grant from the European Research Council (ERC) and is funded with more than 8 million euros. The project is coordinated by Arno Rauschenbeutel from the Department of Physics at Humboldt University and his colleagues Sebastian Hofferberth from the University of Bonn and Thomas Pohl from Aarhus University. The project team combines the expertise and methods of three research groups that have previously conducted quantum optics research individually. "This is a fantastic recognition. The ERC Synergy Grant will enable us to establish a new research field together with the teams from Aarhus and Bonn and to push it forward," explains Arno Rauschenbeutel. "Since there has been already a lively exchange and collaboration between the three of us before, I am sure we will have a lot of fun doing research together."

SuperWave is about guiding photons through optical nanofibers along which so-called superatoms are lined up. Arno Rauschenbeutel's group uses such optical fibers, which are more than 100 times thinner than a human hair, to have guided photons interact with ordinary atoms. This has enabled pioneering experiments in the field of waveguide quantum electrodynamics. To further increase the probability of atom-photon interaction, SuperWave now uses a trick perfected by Sebastian Hofferberth. It allows a few thousand atoms in optical tweezers to be made to behave like a single giant atom. This superatom is larger than the cross-section of the nanofiber, so photons can no longer get past it. What sounds simple, however, poses a whole series of challenges. To overcome them, the research team relies on the long-standing expertise of Thomas Pohl, who has studied superatoms and waveguide quantum electrodynamics from a theoretical perspective and has contributed many ideas and concepts to the two fields.

"The Synergy Grant for Arno Rauschenbeutel and his team indeed is great news for Berlin," says Prof. Christoph Schneider, Vice President for Research at Humboldt-Universität zu Berlin. "This research will increase Berlin's position as a major location for the development and use of quantum technologies. The SuperWave project complements research of the Berlin Quantum Alliance and the Einstein Research Unit on Quantum Processors and Quantum Computing, both hosted at the Berlin University Alliance, in a very fruitful and senseful ways." With the Berlin Quantum Alliance that is about to be launched, the State of Berlin supports projects in the field of quantum technology and

quantum computing with a total of 25 million euros over a period of 5 years.

wissenschaftliche Ansprechpartner:

Arno Rauschenbeutel
Department of Physics
Humboldt-Universität zu Berlin
Phone: +49 30 2093 82152
E-mail: arno.rauschenbeutel@hu-berlin.de

URL zur Pressemitteilung: https://erc.europa.eu/news/erc-2022-synergy-grants-results To the ERC press release

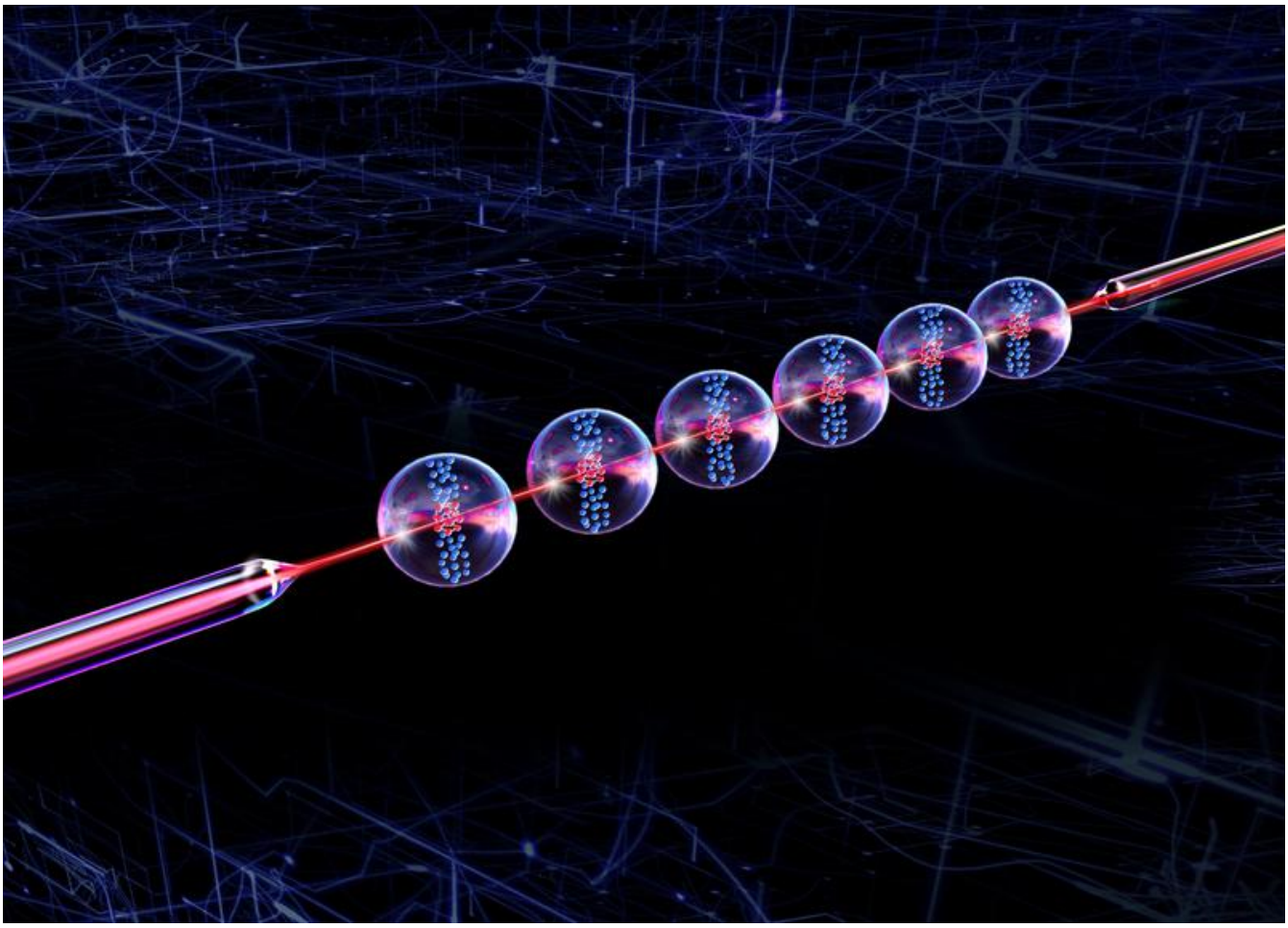

Illustration of a tapered optical fiber with a nanofiber waist along which an array of superatoms is lined up
Humboldt-Universität zu Berlin