Nanofiber Quantum Networks

Fact Sheet

Project Information

NANOQUANT

Grant agreement ID: 616920

Project closed

Start date
1 June 2014

End date
31 May 2019

Funded under
Specific programme: "Ideas" implementing the Seventh Framework Programme of the European Community for research, technological development and demonstration activities (2007 to 2013)

Total cost
€ 1 993 526,00

EU contribution
€ 1 993 526,00

Coordinated by
TECHNISCHE UNIVERSITAET WIEN
Austria

Objective

We propose to establish nanofiber-based atom-light interfaces as quantum-enabled fiber-optical components for quantum information processing and communication (QIPC). The key ingredient of this interface is a nanofiber-based optical dipole trap which stores laser-cooled atoms in the evanescent field surrounding the nanofiber. In this evanescently coupled atom-waveguide-system, even a few hundred atoms are already optically dense for near-resonant photons propagating through the nanofiber.

In combination with the proven good coherence properties of nanofiber-trapped atoms, these highly efficient light-matter interfaces are thus perfectly suited for the implementation of practical QIPC devices. More specifically, the first goal of this project is to realize quantum memories which allow one to directly store and retrieve the quantum state of fiber-guided photons. The efficiency of the retrieval process will highly benefit from the fact that conservation of energy and momentum stabilizes the emission of the stored light into the nanofiber-guided mode. Furthermore, nanofiber-coupled atomic ensembles can provide a strong optical non-linearity which, due to the waveguide-geometry, scales with the square root of the length of the sample and can be much larger than for freely propagating light beams. The second goal of this project is to explore and to maximize this non-linearity until it prevails down to the single photon level. This single-photon non-linearity would enable optical quantum switches and photon-photon quantum gates which are essential for implementing deterministic optical quantum computation. The final goal is then to interconnect these components in order to demonstrate three different fiber-optical quantum network applications: highly efficient photon counting using fiber-coupled quantum memories, highly efficient heralded entanglement of two fiber-coupled quantum memories, and a non-linear interaction between two single-photon pulses.

Fields of science (EuroSciVoc)

engineering and technology > electrical engineering, electronic engineering, information engineering > electronic engineering > computer hardware > **quantum computers**

natural sciences > physical sciences > theoretical physics > particle physics > **photons**

Programme(s)

FP7-IDEAS-ERC - Specific programme: "Ideas" implementing the Seventh Framework Programme of the European Community for research, technological development and demonstration activities (2007 to 2013)

Topic(s)

ERC-CG-2013-PE2 - ERC Consolidator Grant - Fundamental Constituents of Matter

Call for proposal

ERC-2013-CoG
See other projects for this call

Funding Scheme

ERC-CG - ERC Consolidator Grants

Host institution

TECHNISCHE UNIVERSITAET WIEN

EU contribution

€ 1 993 526,00

Total cost

No data

Address

KARLSPLATZ 13
1040 Wien
Austria

Region

Ostösterreich > Wien > Wien

Activity type

Higher or Secondary Education Establishments

Principal investigator

Arno Rauschenbeutel (Prof.)

Links

Contact the organisation Website
Participation in EU R&I programmes
HORIZON collaboration network

Beneficiaries (1)

TECHNISCHE UNIVERSITAET WIEN

Austria

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