All-solid-state quantum electrodynamics in photonic crystals

Fact Sheet

Project Information

ALLQUANTUM
Grant agreement ID: 258292
Status
Closed project
Start date
1 December 2010
End date
30 November 2015

Hosted by
KOBENHAVNS UNIVERSITET
Denmark

Funded under
FP7-IDEAS-ERC

Overall budget
€ 1 199 648,40
EU contribution
€ 1 199 648,40

Objective

In quantum electrodynamics a range of fundamental processes are driven by omnipresent vacuum fluctuations. Photonic crystals can control vacuum fluctuations and thereby the fundamental interaction between light and matter. We will conduct experiments on quantum dots in photonic crystals and observe novel quantum electrodynamics effects including fractional decay and the modified Lamb shift. Furthermore, photonic crystals will be explored for shielding sensitive quantum-superposition states against decoherence.

Defects in photonic crystals allow novel functionalities enabling nanocavities and waveguides. We will use the tight confinement of light in a nanocavity to entangle a quantum dot and a photon, and explore the scalability. Controlled ways of generating scalable and robust quantum entanglement is the essential missing link limiting quantum communication and quantum computing. A single quantum dot coupled to a slowly propagating mode in a photonic crystal waveguide will be used to induce large nonlinearities at the few-photon level.
Finally we will explore a novel route to enhanced light-matter interaction employing controlled disorder in photonic crystals. In disordered media multiple scattering of light takes place and can lead to the formation of Anderson-localized modes. We will explore cavity quantum electrodynamics in Anderson-localized random cavities considering disorder a resource and not a nuisance, which is the traditional view.

The main focus of the project will be on optical experiments, but fabrication of photonic crystals and detailed theory will be carried out as well. Several of the proposed experiments will constitute milestones in quantum optics and may pave the way for all-solid-state quantum communication with quantum dots in photonic crystals.

**Field of science**

/工程学与技术/电气工程, 电子工程, 信息工程/电子工程/计算机硬件/量子计算机
/自然科学/物理科学/量子物理学/量子光学
/工程学与技术/材料工程/晶体
/自然科学/物理科学/量子物理学/量子光学

**Programme(s)**

**Topic(s)**

**Call for proposal**

ERC-2010-StG_20091028

**Funding Scheme**

ERC-SG - ERC Starting Grant

**Host institution**

KOBENHAVNS UNIVERSITET

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<th>Activity type</th>
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<td>Norregade 10</td>
<td>€ 1 137 954</td>
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<td>1165 Kobenhavn</td>
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Beneficiaries (2)

KOBENHAVNS UNIVERSITET

Denmark
EU contribution
€ 1 137 954

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Record number: 96817

Permalink: https://cordis.europa.eu/project/id/258292/