Ultrastrong optomechanical coupling for quantum optomechanics experiments and novel radiation-pressure devices

From 2012-01-01 to 2013-12-31, closed project

Project details

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<th>Total cost:</th>
<th>Topic(s):</th>
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<tr>
<td>EUR 186 028,80</td>
<td>FP7-PEOPLE-2010-IEF - Marie-Curie Action: &quot;Intra-European fellowships for career development&quot;</td>
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<th>EU contribution:</th>
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Coordinated in: Switzerland

Funding scheme: MC-IEF - Intra-European Fellowships (IEF)

Objective

"The coupling between light and mechanical motion through radiation pressure enables both fundamental experimental research into the quantum behavior of macroscopic objects as well as new technological applications such as light-actuated high-frequency resonators. Crucial to both is the realization of strong optomechanical coupling. We propose to develop novel optomechanical systems that exhibit ultrastrong interactions between light and motion to achieve cooling of a mechanical oscillator to the quantum ground state and to demonstrate new optomechanical functionality. Miniaturized silica toroidal resonators supported by 'spokes' serve as optomechanical resonators with small effective mass and ultra low loss, which are expected to enable ground state cooling. Moreover, we will use two-dimensional photonic crystal cavities in which phononic and photonic modes are highly co-localized to achieve ultrastrong coupling between a cavity mode and high-frequency mechanical oscillations. These systems can perform as all-optically tunable GHz oscillators. The strong coupling and low effective masses of these systems, as well as straightforward integration on a chip, make photonic crystal cavities promising candidates for a next generation of cryogenic quantum experiments. Finally, we will explore for the first time the possibilities of optomechanics in plasmonic systems, which concentrate electromagnetic fields in nanoscopic volumes to achieve giant light-matter interactions.

The applicant, Ewold Verhagen, performed his PhD research at the FOM Institute for Atomic and Molecular Physics in Amsterdam, The Netherlands. He published a total of 15 papers in the field of nanophotonics. His main achievements include the demonstration of adiabatic nanofocusing of light and the realization of angle-independent negative index metamaterials at optical frequencies. The host is the Laboratory of Photonics and Quantum Measurement at the EPFL, led by Tobias Kippenberg."
Coordinator
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Activity type: Higher or Secondary Education Establishments

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Subjects
Education and Training - Employment issues - Network technologies

Last updated on 2015-03-10
Retrieved on 2018-10-31

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