TRR 142
Tailored Nonlinear Photonics

TRR Guest Scientist Lecture / Seminar

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Quantum optomechanics with single photons

Abstract:

Quantum optomechanics uses the radiation-pressure interaction and the tools of quantum optics to manipulate the motion of mechanical resonators at a quantum level. The field is currently receiving a surge of interest for its potential to contribute to both fundamental and applied science with current research directions including table-top tests of quantum gravity and the development of high-precision weak-force sensors. This talk will describe two recently developed techniques for quantum state engineering of mechanical motion by heralding with single photon counters. Firstly, a technique to perform single phonon addition and subtraction to a mechanical degree of freedom will be described [1]. An interesting feature of this protocol is that the addition and subtraction operations can be performed in a coherent superposition allowing for continuous-variable quantum state orthogonalization. Secondly, recent experimental work observing mechanical interference fringes will be described [2]. This second approach allows the wave-like behaviour of mechanical oscillators to be probed and brings the generation of macroscopic superposition states within reach of current technology.

[1] M. R. Vanner, M. Aspelmeyer, M. S. Kim, Phys. Rev. Lett. 110, 010504 (2013).
[2] M. Ringbauer, etal., arXiv:1602.05955 (2016).

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