



Walther-Meißner-Institut

Bayerische Akademie der Wissenschaften



## Walther-Meißner-Seminar

Walther-Meißner-Institut, Seminar Room 143

**Date:** Wednesday, October 19, 2016, 13:30 h

**Speaker:** Prof. Dr. Menno Poot

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**Title:** Integrated optomechanics and linear optics quantum circuits

**Abstract:**

Integrated optics provides unprecedented flexibility, scaling possibilities, and stability in the design of optical circuits. In this talk I will address two topics in this rapidly developing field. By combining movable structures with electrostatic actuation we developed an opto-electromechanical platform that can be employed as a broadband integrated phase shifter. These devices are also an excellent test ground for optomechanics experiments directed towards the quantum regime. In vacuum, quality factors up to 300 000 are observed in this device. Using nonlinear feedback in combination with parametric squeezing we prepare the resonator in (classical) non-Gaussian states. However, when increasing the parametric driving strength, instabilities occur that limit the amount of squeezing that can be realized. However, by parametrically driving in the presence of a real-time stabilization of the unstable quadrature, 15 dB of thermo-mechanical noise squeezing is demonstrated. Extensions of this technique towards quantum squeezing are discussed.

In the second part, I will discuss our efforts towards fully-integrated linear-optics quantum circuits. Optomechanical devices play an important role in this research. In our vision, superconducting single photon detectors are monolithically embedded on the same chip as the quantum circuitry. To prepare the qubits and to perform tomography on them, our optomechanical phase shifters are employed. We show the design, fabrication, and characterization of the important elements, including directional couplers, photonic CNOT gates, phase detection, and SSPDs.