Westfälische Wilhelms-Universität Münster

FACHBEREICH PHYSIK

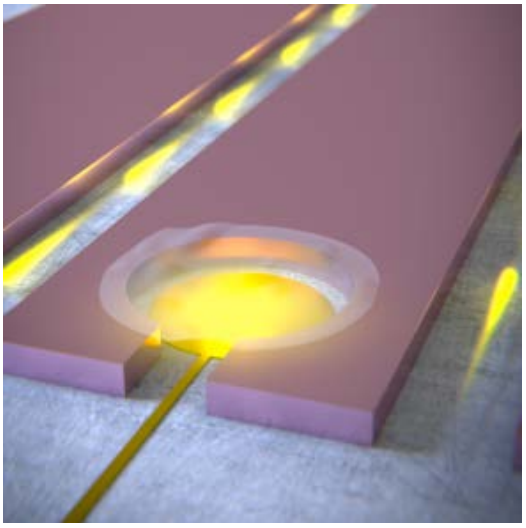
Allgemeines Physikalisches Kolloquium

Donnerstag, 07.05.2015 um 16 Uhr c.t.

Dr. Gary Steele
Delft University of Technology

Cavity Optomechanics: Detecting and controlling motion with microwave light

Optomechanics is a field that uses light confined in a cavity to detect and control the motion of a mechanical resonator, potentially even at the quantum level. In this talk, I will discuss experiments we have been doing in Delft to detect and control the motion of membranes made from multilayer graphene and high-stress silicon nitride using microwave photons confined in superconducting cavities.



In the first experiment, we use high-quality factor (Q-factor) coplanar waveguide cavities to study the motion of a multilayer graphene drum. We find that these “bottom up” crystalline 2D material membranes have high mechanical Q-factors of up to 220,000 at millikelvin temperatures. Using only microwave light, we drive the motion of the drum with radiation pressure forces, and observe strong backaction between photons and phonons, leading to amplification of microwave signals by the graphene drum and strong optical damping of the motion. Through these measurements, we observe a coupling of light and motion in the graphene device should be close to the quantum limit.

In a second experiment, we explore much bigger membranes made from high-stress silicon nitride, now a millimeter in size, and couple these to the microwave fields confined in a 3D superconducting cavity. Using a highly coherent coupling to the microwave fields, we perform laser cooling of the 100 kHz motion of the membrane down to a temperature of 35 microKelvin, close to its quantum ground state.

IG1 HS2, Wilhelm-Klemm-Straße 10
Kolloquiums-Kaffee ab 16.00 Uhr vor dem Hörsaal
Im Anschluss an den Vortrag findet ein geselliges Beisammensein mit Getränken und Knabbereien statt.

Kolloquiumsbeauftragter: Prof. Dr. Bratschitsch
Einladender: Prof. Dr. Bratschitsch