CRC 1227
Designed Quantum States of Matter

GUEST LECTURE

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(Guest of Prof. K. Hammerer)

Leibniz Universität Hannover
DQ-mat Colloquium
Thursday, 20 June 2024, 4.00 pm
Room D326, Welfengarten 1, building 1101

"Precision measurements unraveling gravitational waves and dark matter"

In this talk I will talk about a new network of tabletop detectors to look for higher frequency gravitational waves (GWs). I will also summarize projects looking for dark matter signals in GW-detectors in multiple frequency bands. Gravitational waves (GWs) at frequencies higher than the LIGO band can bring us completely new information about the universe. Besides being the interesting frequency region for looking at cosmological phenomena, they can also convey signatures of dark matter candidates like ultralight bosons through blackhole super-radiance and light primordial blackholes (PBHs). I will introduce a new global initiative to study GW sources and detectors at ultra-high-frequencies, as well as a new precision measurement experiment to look for GWs in the radio frequency band (10 kHz to 300 kHz) using levitated optomechanical sensors. I will summarize the conceptual design of this radio-frequency levitated sensor detector (LSD) and the current experimental progress.

In the second part of the talk, I will describe an experiment searching for the QCD axion mediating new forces in the laboratory. The axion is a novel particle proposed to solve the strong-CP problem in QCD and is also one of the top candidates for dark matter. The ARIADNE experiment will search for spin-dependent forces mediated by the QCD axion in the mass range 10^-6 - 10^-2 eV. This is a precision measurement experiment that requires isolating a force equivalent to a magnetic field of 10^-20 T between golf-ball sized, moving objects, placed 50 microns away from each other. I will describe the experiment concept, engineering challenges associated with it, and current experimental progress, including a new method to isolate magnetic dipoles as small as 10^-9 Am^2.

All DQ-mat members and all interested are cordially invited to attend.