



CRC 1227
Designed Quantum States of Matter



GUEST LECTURE

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(Guest of Prof. Klemens Hammerer and
Prof. Dr. Piet O. Schmidt)

Physikalisch Technische Bundesanstalt
Bundesallee 100, 38116 Braunschweig
Einstein-Building, Room 201
30 November, 2017, 3:30 pm

"Antimatter experiments and ultracold antiprotons"

The imbalance between matter and antimatter in the observable universe is one of the great unsolved questions in physics. Antimatter experiments, which can probe the fundamental matter-antimatter (CPT) symmetry and the weak equivalence principle (WEP) of general relativity, have the potential to shed light on this puzzle. After the first production of cold antihydrogen by ATHENA, second-generation experiments are being performed and/or being set up at CERN's Antiproton Decelerator with the aim of measuring its fundamental properties. The goal of our AEGIS experiment is to measure the gravitational interaction of antimatter in order to test the WEP. All experiments studying antihydrogen require ultracold anti-atoms in order to reach the highest possible precision. In Heidelberg, we are developing a cooling scheme for antiprotons that will enable the production of colder antihydrogen. A fast electronic transition in an atomic anion will be used to laser-cool it to microkelvin temperatures. By sympathetic cooling, ultracold ensembles of any other negative ions (including antiprotons) can be produced. In this talk, after an introduction to antimatter physics, the principle of the indirect laser cooling method and recent experimental results will be presented.

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