



CRC 1227  
Designed Quantum States of Matter



## GUEST LECTURE

**Associate Prof. Dr. Shimon Kolkowitz**

University of California, Berkeley, USA

### **DQ-mat Colloquium**

Physikalisch Technische Bundesanstalt  
Bundesallee 100, 38116 Braunschweig

**Thursday, 12 December 2024, 4.00 pm**

### **"Enhancing the Performance of an Optical Lattice Clock with Multiple Atomic Ensembles"**

The remarkable precision of optical atomic clocks enables new applications and offers sensitivity to novel and exotic physics. In this talk I will explain the motivation and operating principles of a multiplexed strontium optical lattice clock, which consists of two or more atomic ensembles of trapped, ultra-cold strontium in one vacuum chamber. This miniature clock network enables us to bypass the primary limitations to typical atomic clock comparisons and achieve new levels of precision.

I will present recent experimental results in which we make use of multiple atomic ensembles to perform enhanced phase estimation and demonstrate a reduced absolute instability of an optical lattice clock. I will also briefly present the results of a blinded, laboratory-based precision test of the gravitational redshift at the millimeter to centimeter scale. And finally, I will discuss recent measurements of the radiative decay rate of the  $3P_0 - 1S_0$  optical clock transition in strontium-87, and prospects for leveraging the level structure of strontium to convert depolarization errors into erasure errors and thereby enhance the performance of differential clock comparisons.

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