

The Institute of Quantum Optics of Leibniz University Hannover, in cooperation with the Physikalisch-Technische Bundesanstalt (PTB) - the national metrology institute of the Federal Republic of Germany - in Braunschweig, invites applications for the position of a

Doctoral researcher (m/f/d) on multi-ion clocks at PTB

starting at the earliest possible date. The position is initially limited to 3 years.

Background:

Scalable quantum systems based on trapped ions have wide applications in quantum computing, optical clocks, and tests of fundamental physics. Our approach to scale the number of trapped ions for clock spectroscopy has been very successful in the past years and is implemented in our clock experiments based on In^+ and Yb^+ ions. The Yb^+ ion spectroscopy is at the forefront in searches for physics beyond the Standard Model and tests of General Relativity [[Dreissen et al, Nat Commun 13, 7314 \(2022\)](#)]. The multi-ion optical clock recently achieved a world-record stability and accuracy of 2.5×10^{-18} [[Hausser et al, arXiv:2402.16807 \(2024\)](#)]. Our group is part of the Cluster of Excellence “[Quantum Frontiers](#)” and the SFB [DQ-mat](#) and a [Joint Research Lab](#) with Osaka and Tokyo labs (Japan).

Task description:

You will be part of a diverse team, embedded in national and international collaborations and close exchange with theory groups at LUH. Our future work will concentrate on the following key aspects of multi-ion clocks and you will participate in one of the following tasks:

- Investigating new clock spectroscopy methods such as:
 - Dead-time free clock operation with many clock ensembles in one ion trap
 - Cascading the laser stabilization over multiple ions for ultra-compact and portable clocks
 - Using quantum entanglement and squeezing to enhance the sensitivity
- Utilizing precision spectroscopy for tests of General Relativity with precisely controlled quantum systems

In detail, the tasks include:

- Working on scalable ion traps and ultra-high vacuum chambers
- Laser-cooling and precision spectroscopy on trapped ion crystals
- Quantum optical simulations
- Participating in international clock comparisons
- Work with ultra-stable lasers and laser optics
- Presenting research findings at national and international conferences

Employment conditions

- A degree in physics (MSc) with very good grades
- Hands-on experience in at least one of the following fields:
 - Work with laser-optics and vacuum setups
 - Programming opto-electronic control systems
 - Laser-cooling and spectroscopy of trapped ions or atoms
 - Quantum optics
- Fluent English skills
- We search for candidates who enjoy active participation in scientific discussions
- Strong analytical thinking abilities
- Good communication and teamwork skills

- Curiosity and high motivation to develop quantum optics experiments

In return for your contributions, we offer:

- Competitive Tarif [TVL](#) compensation, E13 75%
- The opportunity to work in an international and highly motivated team in a state-of-the-art equipped research lab and embedded in a world-class infrastructure

The university aims to promote equality between women and men. For this purpose, the university strives to reduce under-representation in areas where a certain gender is under-represented. Women are under-represented in the salary scale of the advertised position. Therefore, qualified Women are encouraged to apply. Moreover, we welcome applications from qualified Men. Preference will be given to equally-qualified applicants with disabilities.

For further information, see <https://www.quantummetrology.de/quaccs/> or contact Prof. Dr. Tanja Mehlstäubler (Tel.: 0531 592-4710, Email: tanja.mehlstaebler@quantummetrology.de).

Please submit your application with supporting documents in electronic form to

Email: tanja.mehlstaebler@quantummetrology.de