

The QUEST Institute for Experimental Quantum Metrology is a joint institution of Leibniz Universität Hannover and PTB Braunschweig. The institute was founded within the scope of the Cluster of Excellence QUEST on PTB's campus. The Physikalisch-Technische Bundesanstalt (PTB) is the National Metrology Institute of the Federal Republic of Germany. It furthers progress and reliability in metrology for society, the economy and science.

PhD Student Position (TVöD 85%) In⁺/Yb⁺ Ion Coulomb Crystal Optical Clock

Background

Coulomb crystals are an interesting system for scaling trapped-ion precision spectroscopy to multiple particles. They are the basis for a new generation of ion optical clocks with improved stability and thus higher time resolution in **fundamental physics tests** and applications such as **relativistic geodesy**. At the same time, the highly controlled environment in state-of-the-art ion traps allows for 10⁻¹⁹-level systematic uncertainties in such many-body spectroscopic references [Keller *et al.*, PRA **99**, 013405 (2019)].

Description of work

We use linear ¹¹⁵In⁺/¹⁷²Yb⁺ ion chains for precision spectroscopy. Yb⁺ is used in searches for physics beyond the Standard Model and tests of the Einstein Equivalence Principle [Dreissen *et al.*, Nat. Commun. **13**, 7314 (2022)]. Our In⁺/Yb⁺ optical clock has demonstrated operation with multiple clock ions and participated in local and international frequency comparisons with an evaluated systematic uncertainty in the low 10⁻¹⁸ range [t.b.p.].

By cooling crystals close to their motional ground state, time dilation in clock ions can be explored with a relative precision of 1 x 10⁻¹⁹. Such a clock is ideally suited to explore and test physics at the intersection of quantum mechanics and general relativity. In addition, we are investigating novel quantum-enhanced interrogation protocols for multi-ion clocks pushing the bounds of today's best atomic clocks with an atomically resolved and highly controlled quantum system.

Skills and Requirements

We are looking for an ambitious and highly motivated experimentalist with very good analytic thinking. Experience in one or more of the following fields is advantageous: spectroscopy of trapped ions or atoms, lasers and laser stabilization, time & frequency metrology, opto-electronic controls and systems. We expect the candidate to have finished their university degree in physics or a comparable field with a very good degree. They should have good command of spoken and written English, excellent communication skills and the integrate well into an international team.

Position

The position is initially limited to three years; an extension of the contract is possible. The salary will be paid in accordance with remuneration **group 13 TVöD Bund (85%)**. Applicants should send their CV and application to Prof. Dr. Tanja Mehlstäubler (tanja.mehlstaebler@ptb.de).

Contact

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