

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.

## Postdoctoral Researcher Position at PTB

### In<sup>+</sup>/Yb<sup>+</sup> 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<sup>-19</sup>-level systematic uncertainties in such many-body spectroscopic references [Keller *et al.*, PRA **99**, 013405 (2019)].

#### Description of work

We use linear <sup>115</sup>In<sup>+</sup>/<sup>172</sup>Yb<sup>+</sup> ion chains for precision spectroscopy. Yb<sup>+</sup> 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<sup>+</sup>/Yb<sup>+</sup> optical clock has recently demonstrated operation with multiple clock ions and participated in local and international frequency comparisons with an evaluated systematic uncertainty in the low 10<sup>-18</sup> range [t.b.p.].

By cooling crystals close to their motional ground state, time dilation uncertainties in ensembles of clock ions can be reduced to below 1 x 10<sup>-19</sup>. At this level of uncertainty, our system will be ideally suited to explore physics at the intersection of quantum mechanics and relativity. In addition, we are investigating novel interrogation protocols for multi-ion clocks.

#### Skills and Requirements

We are looking for an ambitious and highly motivated experimental researcher with good analytic thinking and experience in at least one of the following fields: spectroscopy of trapped ions or atoms, lasers and laser stabilization, time & frequency metrology, opto-electronic controls and systems. We expect the applicant to be fluent in English and interested in leading a team of PhD and Master students. The applicant should have completed a PhD in physics before starting the position.

#### Position

The position is initially limited to **two years**. Long-term options of **up to six years** are available. Starting date is as soon as possible. The salary will be paid in accordance with remuneration **group 13 TVöD Bund**. Applicants should send their CV, list of publications and references to Prof. Dr. Tanja Mehlstäubler ([tanja.mehlstaebler@ptb.de](mailto:tanja.mehlstaebler@ptb.de)).

#### Contact

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