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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 the 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.

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# Postdoctoral position

## In<sup>+</sup>/Yb<sup>+</sup> Ion Optical Clock

### Background

Using a many-body ion system for precision spectroscopy is an exciting new way to realize an optical ion clock with increased stability and lowest accessible inaccuracies. With this approach we want to open up new technical applications for atomic ion clocks such as **relativistic geodesy**. The objective of our work is to study the dynamics of laser cooled crystals of mixed species In<sup>+</sup> and Yb<sup>+</sup> ions and implement clock spectroscopy with a relative frequency uncertainty below 10<sup>-18</sup>. Ytterbium ions are also interesting candidates for **fundamental physics tests** owing to a high sensitivity to a possible violation of the Local Lorentz Invariance [Dzuba et al., Nature Phys. (2016), doi:10.1038/nphys3610].

### Description of work

In our experiment we have recently developed a new scalable ion trap platform and demonstrated good control of many-body ion systems [Pyka et al., Nat. Commun. 4, 2291 (2013)]. It shall be utilized now for precision spectroscopy. Clock spectroscopy on In<sup>+</sup> ions doped into Yb<sup>+</sup> Coulomb crystals shall be implemented and systematic shifts evaluated. Motional shifts pose the largest contribution in today's ion clocks. Our project will tackle this challenge for a coupled many-body system. We will investigate the dynamics of mixed species ion crystals and the preparation of ground-state cooled Coulomb crystals. Engineering correlated states that are robust to external field fluctuations will allow performing high precision spectroscopy in pairs of Yb<sup>+</sup> ions for tests of fundamental physics.

The work will take place in a young and dynamical team in an international environment and with strong connections to many other institutes worldwide active in metrology and trapped ion physics. The project is part of a collaboration with NICT (Tokyo), Tel Aviv University and University of Berkeley.

### Skills and requirements

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

### Position

The position is at first limited to **one year**, an **extension to six years is possible**. 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 Dr. Tanja Mehlstäubler ([tanja.mehlstaebler@ptb.de](mailto:tanja.mehlstaebler@ptb.de)).

### Contact

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