A 30: Precision spectroscopy III

Zeit: Freitag 14:00–15:15 Raum: 3C

A 30.1 Fr 14:00 3C

Laser Spectroscopy on Trapped Highly-Charged Ions using Soft X-rays from FLASH — •Sascha Epp[1], José Crespo López-Urrutia[1], Günter Brenner[1], Volkhard Mäckel[1], Paul Mokler[1], Joachim Ullrich[1], Rolf Treusch[2], Marion Kuhlmann[2], Mikhail Yurkov[2], Josef Feldhaus[2], Jochen Schneider[2], Michael Wellhöfer[3], Michael Martins[3], and Wilfried Wurth[3] — [1]Max-Planck-Institut für Kernphysik, Heidelberg — [2]DESY, Hamburg — [3]Institut für Experimentalphysik Universität Hamburg

Resonance laser spectroscopy, the most sensitive tool for atomic structure studies, has been severely limited due to the lack of appropriate light sources beyond the UV and especially the VUV region. With FLASH, the free electron laser in Hamburg, the soft x-ray region is now accessible for laser spectroscopy. Therefore transitions in heavy, few-electron systems — i.e. highly charged ions (HCI) — become open to this precision method. Here we report the measurement of the ground state transition between the $1s^2 2s\ 2S_{1/2}$ and $1s^2 2p\ 2P_{1/2}$ levels for Li-like Fe^{23+} ions by matching soft x-rays from FLASH together with HCI provided in a transportable EBIT. The present statistical accuracy is already superior to the theoretical uncertainties of the most accurate two-loop QED calculations.

A 30.2 Fr 14:15 3C

Frequency Measurements on the 2S-3S Transition of Lithium-7 and Lithium-6 — •Sánchez A. Rodolfo M.[1], Noerterhaeuser Wilfried[1,2], Andjelkovic Zoran[2], Ewald Guido[1], Geppert Christopher[1], Kluge Juergen[1], Kraemer Joerg[2], Nothhelfer Matthias[2], Tiedemann Dirk[2], Winters Danyal[3], and Zakova Monika[2] — [1]GSI mbH, Planckstr. 1, 64291 Darmstadt — [2]Institut für Kernchemie, Universität Mainz, Fritz-Straßmann-Weg 2, 55128 Mainz — [3]Institut für Kernphysik, Universität Münster, Wilhelm-Klemm-Straße 9, 48149 Münster

We report on the absolute frequency measurement of the 2S - 3S two-photon transition of lithium-7 and -6 by employing a frequency comb. The values we obtained in this measurement are a factor ten times better than the last reported ones. We also discuss how a detailed description of the line profile is necessary in order improve the measured values.

A 30.3 Fr 14:30 3C

Absolute frequency measurements on Mg^+ cooling transitions — •Valentin Batteiger[1], Maximilian Herrmann[1], Sebastian Knünz[1], Birgitta Bernhardt[1], Feng Zhu[2], Hans Schüssler[2], Thomas Udem[1], and Theodor W. Hänsch[1] — [1]Max-Planck-Institut für Quantenoptik, Hans-Kopfermann-Str. 1, 85748 Garching — [2]Texas A&M University, College Station, Texas 77843

We present isotopically resolved absolute frequency measurements of both fine structure components of the 3s-3p transition in single, trapped magnesium ions. The transitions are observed in the limit of unresolved sidebands, which would lead to strongly asymmetric line shapes due to cooling and heating if only one laser were swept over the resonance. A novel spectroscopy scheme based on sympathetic cooling and spatially resolved detection allows to observe symmetric lines. The measurements contribute to astronomical searches for drifts of the fine structure constant in quasar absorption spectra and improve the accuracy over previous measurements by two orders of magnitude.

A 30.4 Fr 14:45 3C

Chemical Shift of K transitions in Manganese — Detlev Gotta, Thomas Strauch, and •Christian Weidemann — IKP, FZ Jülich

Precision measurements of X-ray energies in the few keV range must take into account chemical shifts of the Kα fluorescence radiation. In a recent measurement MnO_2 was used as calibration standard, which itself had to be calibrated against the precisely measured values of metallic Mn. For that, a systematic study of the shift in manganese compounds was performed by using a high precision Bragg-spectrometer. The energies of the K$\alpha_{1,2}$ transitions from Mn metal and Mn compounds were measured with a relative accuracy of 10 - 20 meV. According to the line shape model of [1] the Mn metal spectrum was fitted and the tabulated peak energy has been used for absolute calibration for the Kα_1 lines. The transition energies of the various Mn compounds, representing different valences of manganese, show significant chemical effects. Compared to previous measurements [2] the accuracy could be improved by factors 6 to 10. To check the spectrometer system for consistency the Kβ-spectra were measured for the same compounds. In agreement with previously obtained data, chemical shifts up to 1.6 eV were found for the K$\beta_{1,3}$ transition.

[1] Förster, E. et al., *Phys. Rev.* A 56 No. 6 (1997).
[2] Meisel, A.; Döring, E., *Über den Einfluss chemischer Bindung auf das Kα-Dublett von Mangan, Leipzig (1962).*

A 30.5 Fr 15:00 3C

Mg^+ - He^+ Mixed Crystals for High Precision Spectroscopy in the XUV — Sebastian Knünz[1], •Maximilian Hermann[1], Valentin Batteiger[1], Akira Ozawa[1], Feng Zhu[2], Thomas Udem[1], Hans Schüssler[2], and Theodor W. Hänsch[1] — [1]Max-Planck-Institut für Quantenoptik, Hans-Kopfermann-Strasse 1, 85748 Garching — [2]Department of Physics, Texas A&M University, College Station, Texas 77843, USA

The 1s-2s two photon transition of singly ionized hydrogen-like helium at 60 nm is an interesting candidate for precision tests of bound state QED. Rapid progress in the development of high-power XUV frequency combs lets high resolution spectroscopy of this transition come in sight for the first time. We report on important steps towards this goal. In our novel 6-rod RF trap, we generated and analyzed cold mixed crystals.