Stuttgarter Physikalisches Kolloquium

Fachbereich Physik, Universität Stuttgart

Max-Planck-Institute für Festkörper- und Metallforschung

Ansprechpartner: Prof. Harald Giessen

E-Mail: g.feurle@physik.uni-stuttgart.de

Telefon: 0711-685-65111 / 65110

Dienstag, 5. Juni 2007	17.15 Uhr	Hörsaal V 57.01

Universität Stuttgart, Pfaffenwaldring 57, 70569 Stuttgart-Vaihingen

Gastgeber: Prof. Tilman Pfau, Universität Stuttgart, Telefon: 0711-685-68025

Ion Coulomb Crystals: Properties and Applications

Prof. Michael Drewsen, University of Aarhus/Denmark

Abstract

When a confined ensemble of particles with the same sign of charge is cooled below a certain critical temperature, a spatially ordered state of matter, often named a Coulomb cluster/crystal, is created. Such ordered systems can today be studied in the laboratory by laser cooling trapped ions to a temperature of a few milli-Kelvin where the ions form very sparse and fragile crystals with densities of only 10^8-10^9 cm^{-3} (about 10^{14} times lower than normal solids). The ordered structures depend critically on the trapping potential as well as on the numbers of the trapped ion species.

Since 1995, where the first proposal for implementation of a quantum computer using an ion Coulomb cluster in a string configuration was published, the numbers of quantum information processing (QIP) related applications and research groups working with QIP aspects based on cold Coulomb systems have steadily increased.

Cold molecular ion research is another new steadily developing field where ion Coulomb clusters/crystals are applied. This is not at least due to the fact that the translational motion of molecular ions can be sympathetically cooled so effectively through the Coulomb interaction with laser cooled atomic ions that they become part of Coulomb crystalline structures where the individual molecules can be localized within a few μm^3. The ultimate situation of having only a single laser-cooled atomic ion interacting with a single molecular ion is extremely interesting for investigations of single molecules.

After a general introduction to the properties of ion Coulomb clusters/crystals, I will discuss some of the interesting applications of such objects in QIP experiments as well as in cold molecular ion research. Regarding the latter aspect, I will focus on two recent single molecule studies of photofragmentation of singly changed Aniline ions ($C_6H_7N^+$) and isotope effects in the reaction of $^{26}Mg^+$ atomic ions with HD molecules.

(Kolloquiums-Tee gibt es um 16.45 Uhr im Seminarraum des 4. Physikalischen Instituts, Raum 4.319. Studenten sind herzlich eingeladen)