A 14: Atomic Clusters II

Time: Wednesday 16:30–18:15 Location: F 303

Invited Talk A 14.1 We 16:30 F 303

Stochastic Resonance Effects in open Bose-Einstein condensates — •Dirk Witthaut[1], Friederike Trimborn[2], and Sandro Wimberger[3] — [1]Max-Planck-Institut für Dynamik und Selbstorganisation, Göttingen, Germany — [2]Institut für theoretische Physik, Universität Hannover, Germany — [3]Institut für theoretische Physik, Universität Heidelberg, Germany

In our naive understanding noise and dissipation are distracting, hindering measurements and degrading coherences in quantum mechanics. A paradigmatic counterexample to this assertion is the effect of stochastic resonance in nonlinear dynamics, where the response of a system to an external driving assumes its maximum in the presence of an appropriate amount of thermal noise.

In this talk I will discuss stochastic resonance effects for an interacting Bose-Einstein condensate subject to dissipation. For instance, particle loss can restore the phase coherence of a two-mode BEC and repurify a strongly interacting condensate almost completely. Moreover, even the decay induced by a localized perturbation in an optical lattice shows a stochastic resonance effect: If the loss rate becomes too large, dark solitons form which effectively suppress decay.

Invited Talk A 14.2 We 17:00 F 303

CRASY: Correlated Rotational Alignment Spectroscopy — •Thomas Schultz — Max Born Institut Berlin, Max Born Str. 2A, 12489 Berlin

The field of multidimensional nuclear magnetic resonance spectroscopy can teach us how to correlate the information of multiple measurements, thereby multipliying the information content of specific measurements. In optical spectroscopy, such experiments are rare. Here we demonstrate such an experiment with the correlation of rotational and electronic structure through the combination of nonadiabatic alignment techniques and femtosecond pump-probe ionization spectroscopy. The resulting mass resolved rotational spectra (mass-CRASY) allows the assignment of rotational spectra for rare natural isotopes and the state-selective investigation of fragmentation channels. The correlation of photoelectron spectroscopy with rotational structure (electron CRASY) can resolve electronic structure in an isomer selective fashion. We present first data and discuss how the combination of CRASY with (almost) all types of optical spectroscopy will transform the field of gas phase spectroscopy.

A 14.3 We 17:30 F 303

Collective Modes of Laser Excited Electrons in Clusters — •Thomas Raitza[1], Igor Morozov[2], Heidi Reinholz[3,1], and Gerd Röpke[1] — [1]Institut für Physik, Universität Rostock; Universitätsplatz 3, 18055 Rostock, Germany — [2]Joint Institute for High Temperature of RAS; Izhorskaya, 13, build. 2, Moscow 125412, Russia — [3]Institut für Theoretische Physik, Johannes-Kepler-Universität Linz; 4040 Linz, Austria

Clusters of solid state densities can form nano plasmas after laser irradiation with intensities of $10^{13} - 10^{16}$ Wcm^{-2}. Optical properties of plasmas are related to correlation functions, see [1]. A *restricted MD simulations* scheme for finite systems is introduced in [2], answering the question of local thermal equilibrium of electrons inside a cluster after laser irradiation. Plasma properties like temperature and density are discussed, see [3]. Investigations of dynamical correlations for finite systems via *restricted MD simulations* are presented. Collective electron excitation modes are analysed using spherical harmonics. The spatially resolved momentum auto-correlation spectrum is interpreted in terms of collective electron excitation modes. Resonance frequencies are calculated and damping rates are discussed. Size effects of dynamical properties are investigated.

[1] H. Reinholz; *Ann. Phys. Fr.* **30**, N° 4 - 5 (2006).

[2] T. Raitza, H. Reinholz, G. Röpke, and I. Morozov; *J. Phys. A* **42**, 214048 (2009).

[3] T. Raitza, H. Reinholz, G. Röpke, I. Morozov, and E. Suraud; *Contrib. Plasma Phys.* **49**, 498 (2009).

A 14.4 We 17:45 F 303

Elektron-Ion-Stoßfrequenz in Edelgas-Clustern — •Max Moll[1], Paul Hilse[1], Manfred Schlanges[1], Thomas Bornath[2] und Vladimir P. Krainov[3] — [1]Institut für Physik, Ernst-Moritz-Arndt-Universität Greifswald, 17487 Greifswald — [2]Institut für Physik, Universität Rostock, 18051 Rostock — [3]Moscow Institute for Physics and Technology, 141700 Dolgoprudny, Moscow Region, Russia

Bei der Wechselwirkung von Edelgas-Clustern mit Femtosekunden-Laserpulsen werden Plasmen mit hoher Dichte und hoher Temperatur erzeugt. Die Aufheizung der Cluster wird maßgeblich durch inverse Bremsstrahlung der Elektronen, d.h. durch Elektron-Ion-Stöße bestimmt. Eine wesentliche Größe in diesem Zusammenhang ist die Elektron-Ion-Stoßfrequenz. Im Beitrag wird gezeigt, dass es wichtig ist, die elektronische Struktur der Edelgas-Ionen zu berücksichtigen, was mit Modellpotentialen gelingt. Abschirmeffekte durch das umgebende Plasmamedium werden ebenfalls in die Beschreibung einbezogen.

In weiten Parameterbereichen entsprechender Experimente kann die oftmals benutzte Bornsche Näherung nicht verwendet werden. Zur Beschreibung der Elektron-Ion-Streuung untersuchen wir die Elektron-Ion-Stoßfrequenz auf der Basis klassischer Transportquerschnitte für die Streuung von Elektronen an Edelgas-Ionen verschiedener Ladungszustände. Neben Xenon-Plasmen werden auch die Edelgase Argon und Krypton untersucht. Die Abhängigkeit der Ergebnisse von der kinetischen Energie der Elektronen und vom Ladungszustand der Ionen wird diskutiert. Die Resultate für das Modellpotential werden mit Rechnungen für die Streuung an Coulomb-Teilchen verglichen.

A 14.5 We 18:00 F 303

Krypton clusters in the focus of the LCLS X-ray laser — •Marcus Adolph[1], Tais Gorkhover[1], Sebastian Schorb[1], Christoph Bostedt[2], Thomas Möller[1], and team CAMP[3] — [1]IOAP TU-Berlin, Hardenbergstrasse 36, 10623 Berlin — [2]LCLS, Stanford — [3]see ref [1]

With the development of short wavelength Free-Electron-Lasers (FEL) a new tool for the analysis of matter-light interaction is available. Very recently, at the SLAC National Accelerator Laboratory, the Linac Coherent Light-Source (LCLS) came into operation. LCLS produces 5 fs to 400 fs, super-intense X-Ray pulses in the regime from 800 eV up to 2 keV.

During our first experiments at LCLS we studied the interaction of LCLS pulses with rare gas clusters. With large pnCCD detectors [1] single shot scattering patterns of single clusters were recorded and combined with time of flight data of highly charged cluster fragments. This contribution will present first results for krypton clusters. The ionisation dynamics of krypton clusters irradiated above and below the L1 edge will be compared.

[1] L. Strüder *et al.* Nucl. Instr. Meth., accepted for publication