A 27: Ultra-Cold Atoms, Ions and BEC IV / Interaction with VUV and X-Ray Light II (with Q)

Time: Friday 14:00–15:45 Location: F 303

A 27.1 Fr 14:00 F 303

Hunting for Efimov trimers in a three-component Fermi gas — •Thomas Lompe[1,2], Timo Ottenstein[1,2], Martin Ries[1,2], Friedhelm Serwane[1,2], Philipp Simon[1,2], Gerhard Zürn[1,2], and Selim Jochim[1,2] — [1]MPI für Kernphysik, Heidelberg — [2]Physikalisches Institut, Universität Heidelberg

In the past years Efimov states have been observed in a multitude of bosonic systems. In contrast, we study Efimov physics in a system of three distinguishable fermions with broad, overlapping Feshbach resonances. For each of these Feshbach resonances there exists a shallow dimer state, which creates a much richer system than a single resonance. So far we have found one loss resonance in three-atom- and two resonances in atom-dimer-scattering, which are caused by two Efimov trimers. This should allow for accurate predictions for the binding energies of these trimers. Additionally the fermionic nature of the atoms greatly enhances the stability of the Feshbach molecules, which makes the preparation of atom-dimer mixtures much easier than in bosonic gases. These properties make our system a promising candidate to attempt spectroscopy of Efimov states by RF-association of Efimov trimers.

A 27.2 Fr 14:15 F 303

Rydberg atoms in Bose-Einstein condensates and optical lattices — Matthieu Viteau[1], Jagoda Radogostowicz[1], Mark Bason[1], Nicola Malossi[1], Amodsen Chotia[2], Donatella Ciampini[1], •Oliver Morsch[2], and Ennio Arimondo[1,2] — [1]CNISM UdR Pisa, Dipartimento di Fisica, Largo Pontecorvo 3, 56127 Pisa, Italy — [2]CNR-INFM, Largo Pontecorvo 3, 56127 Pisa, Italy

We report on progress in exciting Rydberg states of Rubidium atoms in the Bose condensed phase and inside optical lattices. The high densities achievable in Bose-Einstein condensates give us access to a regime where dipole-dipole interactions between Rydberg atoms are strong, and the spatial order in optical lattices fixes a length scale for the interatomic distance. Both ingredients are essential for implementing controlled Rydberg-Rydberg interactions for quantum gates.

A 27.3 Fr 14:30 F 303

Optical Trapping of Magnesium — •Matthias Riedmann, Jan Friebe, Temmo Wübbena, André Kulosa, Hrishikesh Kelkar, Sana Amairi, André Pape, Sina Malobabic, Steffen Rühmann, Wolfgang Ertmer, and Ernst-Maria Rasel — Institut für Quantenoptik, Hannover, Germany

Magnesium is an interesting candidate for a future high performance neutral atom optical frequency standard. Long spectroscopy time and therefore high resolution can be reached by confining the atoms in the Lamb-Dicke regime in an optical lattice. Magnesium is challenging because cooling on the strong singlet transition is limited to the Doppler limit of 2 mK. Cooling on narrow lines, a standard technique to reach ultralow temperatures for other alkaline-earth atoms, is not promising for Mg because of a too narrow intercombination line (31 Hz).

Mg atoms are pre-cooled in a two-stage MOT. Atoms are first trapped on the strong singlet cooling transition and then pumped to the triplet system. There, another MOT operating between the ^3P and ^3D states is used to further cool and compress the atomic cloud. Atoms that decay to the $^3P_1$ state are repumped while those that decay to the $^3P_0$ are not and can be optically trapped by a 1064 nm dipole trap, which is superimposed with the second MOT. All cooling stages are running coutinously and atoms are accumulated in the dipole trap. The loss chnannel in the second MOT avoids a density limitation and therefore increases the loading to the dipole trap. With this technique, we are able to load up to $9 \cdot 10^4$ atoms to the dipole trap.

A 27.4 Fr 14:45 F 303

One-dimensional Anderson localization in correlated random potentials — •Pierre Lugan[1], Alain Aspect[1], Laurent Sanchez-Palencia[1], Dominique Delande[2], Benoit Grémaud[2,3], Cord A. Müller[2,4], and Christian Miniatura[3,5] — [1]Laboratoire Charles Fabry de l'Institut d'Optique, CNRS and Univ. Paris-Sud, Campus Polytechnique, RD 128, F-91127 Palaiseau Cedex, France — [2]Laboratoire Kastler-Brossel, UPMC, ENS, CNRS, 4 Place Jussieu, F-75005 Paris, France — [3]Centre for Quantum Technologies, National University of Singapore, 3 Science Drive 2, Singapore 117543, Singapore — [4]Physikalisches Institut, Universität Bayreuth, D-95440 Bayreuth, Germany — [5]Institut Non Linéaire de Nice, UNS, CNRS, 1361 Route des Lucioles, F-06560 Valbonne, France

The study of disorder with ultracold atomic gases has recently attracted much attention due to the possibility of controlling disorder, interactions, and dimensionality in these systems. In this contribution, we study the Anderson localization of ultracold atoms in weak, correlated one-dimensional potentials, and we discuss how the special long-range correlations present in the speckle potentials used in current experiments affect the localization properties of single particles and non-interacting wave packets. It is known that in one dimension generally all single-particle states are localized. For weak speckle potentials, we show the existence of a series of sharp cross-overs (effective mobility edges) between regions of the single-particle energy spectrum where the localization lengths differ by orders of magnitude [1].

[1] P. Lugan et al., Phys. Rev. A 80, 023605 (2009).

A 27.5 Fr 15:00 F 303

Aufbau zur Untersuchung freier nanoskopischer Partikel mit Synchrotronstrahlung — •Markus Eritt[1,2], Jan Meinen[1,2], Svetlana Khasminskaya[1,2], Egill Antonsson[3], Burkhard Langer[3], Eckart Rühl[3] und Thomas Leisner[1,2] — [1]Universität Heidelberg, Institut für Umweltphysik — [2]Karlsruher Institut für Technologie, Institute for Meteorology and Climate Research Atmospheric Aerosol Research (IMK-AAF) — [3]Freie Universität Berlin, Institut für Chemie und Biochemie

Es wir eine Apparatur zur Untersuchung freier, funktioneller Nanopartikel im Größenbereich von 3-300nm mit Synchrotronstrahlung vorgestellt. Die zu untersuchenden Partikel werden unter Atmosphärendruck erzeugt und durch ein Einlasssystem aus durchstimmbarer aerodynamischer Linse und RF-Ionenführung ins Vakuum transferiert. Um die zur Untersuchung freier Teilchen mit VUV-Strahlung nötigen hohen Targetdichten zu erreichen, werden die geladenen Nanopartikel in einer linearen Ionenfalle akkumuliert dort moderiert und dann und in dichten Pulsen in den VUV-Wechselwirkungsbereich eingeschossen. In einem ersten Experiment am BESSY II wurden die Photoelektronenspektren von 10nm Siliziumoxid Partikeln mit einem Elektronen-Flugzeitspektrometer aufgenommen. Vorgestellt werden die apparativen Möglichkeiten sowie erste Ergebnisse.

A 27.6 Fr 15:15 F 303

Collectivity and interference in x-ray scattering on nuclei — •Adriana Pálffy, Christoph H. Keitel, and Jörg Evers — Max-Planck-Institut für Kernphysik, Heidelberg, Germany

Resonant scattering of monochromatized synchrotron radiation or light from upcoming x-ray laser sources can lead to coherent photoexcitation of nuclei. Such an excitation in a nuclear ensemble is of excitonic nature, and the underlying collective effects determine the coherent nuclear reemission in the forward direction or at the Bragg angle. The coherent decay of the collective nuclear excitation is considerably speeded up with respect to the incoherent decay channels and thus to the natural lifetime. It has been shown experimentally [1] that switching abruptly the direction of the magnetic hyperfine fields can control and even completely suppress the coherent decay channel due to destructive interference. With a proper choice of switching parameters, specific transitions between hyperfine levels can be restored thus controlling the polarization of the emitted x-ray light [2].

Based on the results of [1,2], we study here advanced coherent control schemes aimed at the selective population of nuclear states. We show that suppression of the coherent decay in resonant x-ray scattering can be used to control the effective branching ratio in nuclear systems, and thus the population of nuclear states. Prospects for the population of metastable nuclear states are discussed.

[1] Y. V. Shvyd'ko *et al.*, Phys. Rev. Lett. 77, 3232 (1995)
[2] A. Pálffy, C. H. Keitel and J. Evers, Phys. Rev. Lett. 103, 017401 (2009)

A 27.7 Fr 15:30 F 303

X-ray scattering and ionization of rare gas clusters by superintense pulses from the LCLS FEL — •Tais Gorkhover[1], Marcus Adolph[1], Daniela Rupp[1], Sebastian Schorb[1], Thomas