Q 14: Ultracold atoms, ions, and BEC II / Ultracold plasmas and Rydberg systems (joint session A/Q)

Time: Thursday 10:45–12:15 Location: H1

Invited Talk Q 14.1 Thu 10:45 H1

BECCAL - Quantum Gases on the ISS — •Lisa Wörner[1,2], Christian Schubert[1,3], Jens Grosse[1,2], Claus Braxmaier[1,2], Ernst Rasel[1,2], Wolfgang Schleich[1,4], and the BECCAL collaboration[1,2,3,4,5,6,7] — [1]German Aerospace Center, DLR — [2]University of Bremen — [3]Leibniz University Hanover — [4]University Ulm — [5]Humboldt University Berlin — [6]Johannes Gutenberg University — [7]Ferdinand Braun Institute

BECCAL (Bose-Einstein Condensate and Cold Atom Laboratory) is a bilateral NASA-DLR mission dedicated to execute experiments with ultra-cold and condensed atoms in the microgravity environment of the international space station. It builds on the heritage of NASA's CAL and the DLR founded QUANTUS and MAIUS missions. BECCAL aims to enable a broad range of experiments, covering atom interferometry, coherent atom optics, scalar Bose-Einstein gases, spinor Bose-Einstein gases and gas mixtures, strongly interaction gases and molecules, and quantum information. This contribution gives an overview over the current status of BECCAL and its anticipated capabilities for scientific investigations.

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Invited Talk Q 14.2 Thu 11:15 H1

Ultracold polar ^{23}Na^{39}K ground-state molecules — •Kai Konrad Voges[1], Philipp Gersema[1], Mara Meyer zum Alten Borgloh[1], Torsten Hartmann[1], Torben Alexander Schulze[1], Leon Karpa[1], Alessandro Zenesini[1,2], and Silke Ospelkaus[1] — [1]Institut für Quantenoptik, Leibniz Universität Hannover, 30167 Hannover, Germany — [2]INO-CNR BEC Center and Dipartimento di Fisica, Universit 'a di Trento, 38123 Povo, Italy

Heteronuclear ground-state molecules, with their large electric dipole moments, are an excellent platform for the investigation of fascinating dipolar quantum phenomena.

In this talk we present the coherent creation of the light weight bosonic ^{23}Na^{39}K rovibrational ground state molecules by utilizing Feshbach molecule association and subsequent stimulated Raman adiabatic passage (STIRAP) to the ground state. We are able to create rovibrational ground-state ensembles in a single hyperfine state either as a pure ensemble or in a mixture with ultracold atoms. By applying external electric fields we induce electric molecular dipole moments of up to 1 Debye. We further present our investigations of collisional properties of the molecule-atom mixtures and the pure molecular ensemble. For the latter one we investigate the formation of long-lived sticky complexes and their light excitation by the optical dipole trap. Our measurements put a lower bound on the complex lifetime which is observed to be much larger than predicted by theoretical calculations base on RRKM theory.

Invited Talk Q 14.3 Thu 11:45 H1

Anderson localization in a Rydberg composite — •Matthew Eiles, Alexander Eisfeld, and Jan-Michael Rost — Max Planck Institute for the Physics of Complex Systems, 38 Noethnitzer Str. Dresden 01187

We demonstrate the localization of a Rydberg electron in a Rydberg composite, a system containing a Rydberg atom coupled to a structured environment of neutral ground state atoms. This localization is caused by weak disorder in the arrangement of the atoms and increases with the number of atoms M and principal quantum number ν. We develop a mapping between the electronic Hamiltonian in the basis of degenerate Rydberg states and a tight-binding Hamiltonian in the so-called "trilobite" basis, and then use this concept to pursue a rigorous limiting procedure to reach the thermodynamic limit in this system, taken as both M and ν become infinite, in order to show that Anderson localization takes place. This system provides avenues to study aspects of Anderson localization under a variety of conditions, e.g. for a wide range of interactions or with correlated/uncorrelated disorder.