MO 22: Cold Molecules II

Time: Thursday 14:00–15:00 Location: F 142

MO 22.1 Th 14:00 F 142

Exploring the Rb_2 $^3\Sigma_u$ electronic ground state potential — •Christoph Strauss[1], Tetsu Takekoshi[2], Florian Lang[2], Eberhard Tiemann[3], Rudolf Grimm[2,4], and Johannes Hecker Denschlag[1,2] — [1]Institut für Quantenmaterie der Universität Ulm, D-89081 Ulm, Germany — [2]Institut für Experimentalphysik und Zentrum für Quantenphysik, Universität Innsbruck, A-6020 Innsbruck, Austria — [3]Gottfried Wilhelm Leibniz Universität Hannover, D-30167 Hannover, Germany — [4]Institut für Quantenoptik und Quanteninformation der Österreichischen Akademie der Wissenschaften, A-6020 Innsbruck, Austria

The production of ultracold molecules opens up new possibilities for precision spectroscopy. For alkali dimers, triplet states are of special interest, since they are not easily accessible in conventional setups. In our experiments we investigate the triplet $^3\Sigma_u(5S_{1/2}+5S_{1/2})$ electronic ground state potential, mapping out in detail the vibrational, rotational, hyperfine and Zeeman structure with an absolute accuracy of about 30 MHz. Starting with a sample of 3x10^4 ultracold Rb_2 Feshbach molecules in an optical lattice we use optical Raman transitions to couple to the unknown levels. Molecular properties like magnetic moments, rotational and vibrational constants are extracted. In addition, it was also possible to directly observe deeply bound states which consist of a singlet-triplet mixture. After adjusting a few model parameters, the measurements are in general in excellent agreement with calculations. These results will be relevant for future experiments with ultracold Rb_2 molecules, e.g. cold collisions and molecular BEC.

MO 22.2 Th 14:15 F 142

High resolution spectroscopy of excited Rb_2 molecules — •Christoph Strauss[1], Tetsu Takekoshi[2], Florian Lang[2], Marius Lysebo[3], Leif Veseth[3], Eberhard Tiemann[4], Rudolf Grimm[2,5], and Johannes Hecker Denschlag[1,2] — [1]Institut für Quantenmaterie der Universität Ulm, D-89081 Ulm, Germany — [2]Institut für Experimentalphysik und Zentrum für Quantenphysik, Universität Innsbruck, A-6020 Innsbruck, Austria — [3]AlbaNova University Center Atomic-Molecular Physics S-106 91 Stockholm Sweden — [4]Gottfried Wilhelm Leibniz Universität Hannover, D-30167 Hannover, Germany — [5]Institut für Quantenoptik und Quanteninformation der Österreichischen Akademie der Wissenschaften, A-6020 Innsbruck, Austria

Even today, understanding the hyperfine structure of excited alkali dimers can be quite a challenge. We carry out precision spectroscopy on excited ultracold Rb_2 molecules which are deeply bound in the $^3\Sigma_g(5S_{1/2}+5P_{1/2})$ triplet potential. By irradiating a sample of 3x10^4 Rb_2 Feshbach molecules in an optical lattice with a widely tunable laser we detect excited bound levels through molecular loss. We fully resolve vibrational, rotational, hyperfine, and Zeeman structure. Using a model calculation a large fraction of the observed lines can be attributed to specific states and quantum numbers. However, for higher rotational quantum numbers systematic deviations occur which cannot be explained yet. A good understanding of the molecular structure is important for an optimized population transfer in various deeply bound states. Our results call for further research in this direction.

MO 22.3 Th 14:30 F 142

Photoassociative creation of ^{6}Li-^{40}K molecules in a magneto-optical trap — •Armin Ridinger, Saptarishi Chaudhuri, Thomas Salez, Ulrich Eismann, Frédéric Chevy, and Christophe Salomon — Ecole Normale Supérieure, 24, rue Lhomond, 75005 Paris, France

The recent realization of gases of ultra-cold molecules in their vibrational ground state has opened a new frontier in atomic physics. However, efficient atom-molecule conversion by photoassociation (PA) requires a precise knowledge of the molecular potential under study. In this talk I will report on a preliminary study of photoassociation spectroscopy of ^{6}Li- ^{40}K in a magneto-optical trap. In particular we observed more than 40 clearly resolved rovibrational levels of the electronically excited LiK-molecule within 350 GHz below the $4^2P_{3/2}$ atomic limit of ^{40}K allowing for an accurate determination of the interatomic potential parameters.

MO 22.4 Th 14:45 F 142

Electric trapping of molecules in a microstructured trap — •Martin Zeppenfeld[1], Barbara G.U. Englert[1], Manuel Mielenz[1], Christian Sommer[1], Josef Bayerl[1], Michael Motsch[1], Pepijn W.H. Pinkse[1,2], and Gerhard Rempe[1] — [1]Max-Planck-Institut für Quantenoptik, Hans-Kopfermann-Str. 1, 85748 Garching, Germany — [2]Mesa+ Institute for Nanotechnology, University of Twente, PO Box 217, 7500 AE Enschede, The Netherlands

Optoelectrical cooling [1] is possibly the most promising method to produce sub-mK samples of a wide range of polar molecules. Here, we present the experimental realization of a key element of this scheme, a suitable electric trap for molecules. Such a trap must not only provide long lifetimes, but must also provide regions of variable homogeneous electric field to allow the required addressing of transitions between individual rotational M sublevels. In addition to cooling, such a trap might be used for precision Stark spectroscopy of trapped molecules as well as for investigation of cold collisions.

[1] M. Zeppenfeld et al., Phys. Rev. A **80**, 041401(R) (2009)