Physikalisches Institut
Fakultät für Mathematik und Physik
Albert-Ludwigs-Universität Freiburg

IRTG-Seminar

Marcel Binz

The University of Freiburg

“Phase-modulated nonlinear spectroscopy of doped helium nanodroplets”

Time-resolved nonlinear spectroscopy is a powerful tool to study complex dynamics in real time. Among these, 2D electronic spectroscopy (2DES) has gained particular high interest in recent years [1-4]. However, due to a lack of sensitivity, 2D spectroscopy has been almost exclusively applied to the condensed phase. Yet, an extension to the gas phase would provide valuable complementary information about the influence of environmental parameters (e.g. solvent molecules). Recently, we have built a 2DES setup based on quasi-continuous phase modulation combined with sensitive lock-in detection to facilitate 2DES of dilute molecular and cluster beams in the gas phase. I will give an introduction to our 2DES setup and present first results of dilute gas-phase systems combined with fluorescence and photoelectron detection.

Furthermore, an intriguing aspect of coherent nonlinear spectroscopy is its sensitivity to quantum coherences. In a coherent pump probe experiment, we exploit this feature to follow the time evolution of electronic coherences in a dissociation process. To this end, we prepare a pseudo diatomic molecule consisting of a rubidium atom and a helium nanodroplet. We study its dissociation by inducing an electronic coherence in the rubidium atom and follow its desorption in real time.

[1] T. Brixner, J. Stenger, H. M. Vaswani, M. Cho, R. E. Blankenship, and G. R. Fleming, Nature 434, 625 (2005)
[2] M. L. Cowan, B. D. Bruner, N. Huse, J. R. Dwyer, B. Chugh, E. T. J. Nibbering, T. Elsaesser, and R. J. D. Miller, Nature 434, 199 (2005).
[3] D. M. Jonas, Annu. Rev. Phys. Chem. 54, 425 (2003).
[4] M. Cho, Chem. Rev. 108, 1331 (2008).

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Contact:
Zofia Malachowska
IRTG / Cold Controlled Ensembles in Physics and Chemistry
Phone: +49 761 203 97666
E-mail: irtg-coco-coordination@physik.uni-freiburg.de