

# IPID4all Doctorate Research Exchange with Carl von Ossietzky University Oldenburg

## Feedback report

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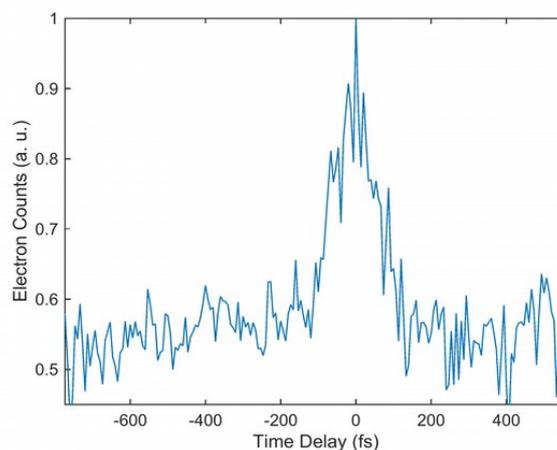
### Introduction

The aim of the research exchange was to perform carrier envelope phases (CEP) dependent measurements and detect the photoelectron dynamics regarding to the CEO of the laser. Therefore ultrafast photoemission of plasmonic nanoparticles was examined. For various reasons this measurements could not be carried out properly, and we changed subject to pump-probe measurements started at the group earlier.

### Research Undertaken

As this was the my first visit at the Ultrafast Nanooptics Group in Oldenburg, I had to get experienced with the labor equipment. So I was involved in an ongoing project, and besides learning all the needed skills a paper was born from the undertaken research (“Ultrafast Electron Emission from a Sharp Metal Nanotaper Driven by Adiabatic Nanofocusing of Surface Plasmons”, J. Vogelsang, J. Robin, B. J. Nagy et al., *Nano Letters* **2015** 15 (7), 4685-4691).

The group performed pump-probe measurements on gold nanotapers, and they found an interesting structure in the spectra at zero time delay leading to a new phenomena connected to the dynamics of Rydberg states localized to the sharp nanotaper. In the last few weeks my task was to carry out measurements on gold nanorods to give a confirm of these results and give a background. After setting up a new laser beam path according to my samples I run some routine measurements such as measuring electron autocorrelation and power dependency of the electron emission to calculate the nonlinearity factor of the photoelectric process. After aligning the spatial and temporal overlap with the two beams I started the pumb-probe measurements on the gold nanorods. The measurements need to be done with special care due to the low damage threshold of the samples. After the appearance of a signal



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(shown in the figure) many measurements were done with different intensity ratios of the pump and probe beam. The structure is different as gained from the nanotapers and the same theory cannot be applied either. As the results differ strongly from the results gained with nanotapers, the paper submitted to Nature Photonics (still under revision) does not include any of these results.

## **Personal Experience**

I was in Oldenburg at the beginning of my Ph.D. studies. Therefore I gained the necessary skills in this field during my internship. I learned a higher level of photoelectron detecting and data processing.

## **Conclusions**

With this visit we started a fruitful collaboration. We tried to measure CEP dependence of photoelectrons of gold nanoparticles, but we turned the scope to pump-probe measurements later.

## **Outlook**

We hope, that the measurements carried out with the gold nanostructures can be improved in the future and will give a strong basis for the current paper in review as a follow up.



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