**2018 Helmholtz – OCPC – Program**

**for the involvement of postdocs in bilateral collaboration projects**

**DESY\_OCPC\_2018-10**

**PART A**

**Title of the project:** Real time observation of electron dynamics on surfaces using attosecond XUV-XUV pumb-probe techniques

**Helmholtz Centre and Research Group: DESY**

**Project leader:** Prof. Dr. Franz Kärtner

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**Description of the project** (max. 1 page)**:**

Investigation on ultrafast electron dynamics is very important for understanding the key physical and chemical processes in many cutting-edge technologies such as solid-state solar cells, molecular electronics, single-electron devices and chemical reactions in general. So far, such processes have been studied using synchrotron-based core-hole spectroscopy in the frequency domain, or via attosecond transient absorption measurements in the time domain. The former method can only be applied to a specific class of charge-transfer systems where core-hole lifetimes are comparable to the time scale on which the electron-transfer process takes place; while the latter can cause strong perturbation to charge-transfer systems by strong streaking electric fields as well as large background signals. For these reasons, an ideal method to study such processes is to use the attosecond pump-probe spectroscopy, although its realization is for a long time hindered from attainable bright and well-characterized attosecond XUV light sources.

A newly built setup in our group based on a mJ-level sub-cycle optical waveform synthesizer, we have the ability to deliver bright enough table-top attosecond XUV pulses in the range 20 – 250 eV with precisely controlled delays, making it promising for XUV-XUV pump-probe studies. The goal of the present project is to employ this newly built setup to measure sub-femtosecond charge transfer on surfaces. Initially well characterized attosecond pulses at 40 eV and 160 eV will be generated and characterized. An attosecond beamline using these two energy bands in a pump-probe configuration has to be constructed and combined with a surface science station provided by another CFEL group specialized in surface science and XUV spectroscopy. The experimental setup will be first applied to the already understood problem of charge transfer from an adsorbed sulfur atoms to c(4×2)S/Ru(0001) surface. The corresponding transfer time has been determined in earlier experiments using core-hole spectroscopy (A. Föhlisch et al., Nature 436, 373 (2005)).

After the successful testing of the XUV-XUV attosecond pump-probe setup at this example, we will use it to investigate not yet understood catalytic processes. Towards this goal, further developments on the attosecond source and its temporal characterization as well as improvements in its automatization will be needed.

**Description of existing or sought Chinese collaboration partner institute** (max. half page)**:**

Our group has very strong ties with Peking University and the Chinese Academy of Sciences, especially the Institute of Optics, where our former Helmholtz Young Investigator group member Dr. Guoqing Chang just started a full professor position. Our group has a Sino-German Research Project funded via DFG and joint NSFC Professor Zhigang Zhang from PKU. Recently we learned about a postdoc Guangjin Ma from PKU-HKUST Shenzhen-Hong Kong Institution/Peking University a joint venture of the Shenzhen Municipal Government, Peking University (PKU) and the Hong Kong University of Science and Technology (HKUST) we believe he would be a very appropriate candidate for the proposed project and we prefer to receive an application from him. However, we also encourage applications from other partner institutes as we continuously have open positions in similar directions including ultrafast lasers and attosecond timing and synchronization of large scale facilities like Free-Electron Lasers.

**Required qualification of the post-doc:**

* PhD in physics, electrical Engineering or related field.
* Experience with high field laser physics, high-order harmonic generation and isolated attosecond pulse generation if possible.
* Strong skills in algorithm development, numerical simulations and experimental data analysis is a plus.

**PART B**

**Documents to be provided by the post-doc, necessary for an application to OCPC via a postdoc-station:**

* + Detailed description of the interest in joining the project (motivation letter)
  + Curriculum vitae, copies of degrees
  + List of publications
  + 2 letters of recommendation
  + Proof of command of English language

**PART C**

**Additional requirements to be fulfilled by the post-doc:**

* Max. age of 35 years
* PhD degree not older than 5 years
* Very good command of the English language
* Strong ability to work independently and in a team