

2020 Helmholtz – OCPC – Program for the involvement of postdocs in bilateral collaboration projects

PART A

Title of the project: Design and Installation of an VIS/IR diagnostic to study plasma-wall interaction in low temperature plasmas with high spatial resolution

Helmholtz Centre and institute: Forschungszentrum Jülich
Institut für Energie und Klimaforschung – Plasmaphysik (IEK-4)

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Description of the project (max. 1 page):

Passive optical spectroscopy in the VIS-IR range provides in-situ access to the most relevant plasmas-surface processes like e.g. material erosion without any plasma perturbation and with relative easy access. Therefore, the use of passive spectroscopy for in-situ process control in complex environments like controlled areas (radiation, hazardous, etc.) is often applied as base level or routine diagnostic. The application of modern detection technics with advanced, ultra-sensitive intensified cameras in combination with 2D imaging processing technics opens new possibilities in the in-situ analysis. High spatial resolution (μm -range) with respect to the characteristic plasma dimension (cms) can be achieved at once with simultaneous spectral coverage from VIS-IR by applying hyperspectral cameras with spectral channel separation in the nm range. Thus, simultaneously all relevant plasma species can be recorded at once with 2D resolution and provide input to erosion-deposition modelling performed in IEK-4.

Within this project an optical set-up for such an advanced detector shall be developed for the linear plasma devices PSI-2 as well as for the JULE-PSI facility located in the Hot Material Lab in FZJ. The system shall be complemented with single-fibre spectrometers with high temporal resolution to maximize the scientific output regarding plasma-wall interaction (erosion fluxes, concentrations, composition) in a single exposure. The interaction of plasma species like H, D, He as well as process plasmas relevant species like Ar, Ne, N with different type of sample materials such as W, Ta, Mo, C, stainless steel etc. The knowledge and experience with these novel type of spectroscopic systems shall then be transferred to toroidal plasma devices like EAST and Wendelstein 7-X in Greifswald. The novel spectral systems would permit access to the main plasma and impurity species in both devices with a reduced number of detectors. The simultaneous observation of different ionization stages at the same time will give unique access to transport studies.

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

A cooperation between the ASIPP (Academy of Science - Institute of Plasma Physics) Hefei and IEK-4 exists for more than a decade and is focused on plasma-wall interaction (PWI) studies in tokamaks and associated diagnostic developments within different frameworks (e.g. SINO-GERMAN HGF and DFG projects). The tokamak EAST (ASIPP), a full metallic device, aims to reach steady-state plasma conditions in long pulses like the proposed Chinese fusion reactor CFETR. ASIPP is the leading institute in plasma physics in China and worldwide record holder in long-pulse tokamak operation. Understanding of PWI, thus in particular erosion and fuel retention in the novel W divertor is key issue for a successful and controlled plasma operation. The ASIPP is most interested in the advanced spectroscopic diagnostics, developed and tested in IEK-4, in order to predict in-situ the lifetime of W PFCs under low temperature divertor conditions with high temporal and spatial resolution.

Required qualification of the post-doc:

- The candidate needs to be qualified in plasma physics and plasma-wall interaction
- Experience in electrical engineering and design of optical/IR diagnostics is of advantage
The candidate shall be experience in VIS /IR analysis
- The candidate shall be communicative and able to work in a team
- As the work is also related to the EAST tokamak in ASIPP, the applicant shall be part of the EAST team and potentially ASIPP

PART B

Documents to be provided by the post-doc, necessary for an application to OCPC via a postdoc-station in China, which is affiliated to a research institution like a university:

- 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