# Helmholtz - OCPC - Programme 2017-2021

## for the Involvement of Postdocs in Bilateral Collaboration Projects with China

**PART A**

**Title of the project**

Hydrogen safety issues in future fusion power plants

**Helmholtz Centre and Institute**

Karlsruhe Institute of Technology (KIT) - Institute für Neutronenphysik und Reaktortechnik (INR)

**Project leader**

Dr. Frederic Arbeiter

**Web-address**

https://www.inr.kit.edu/english/index.php



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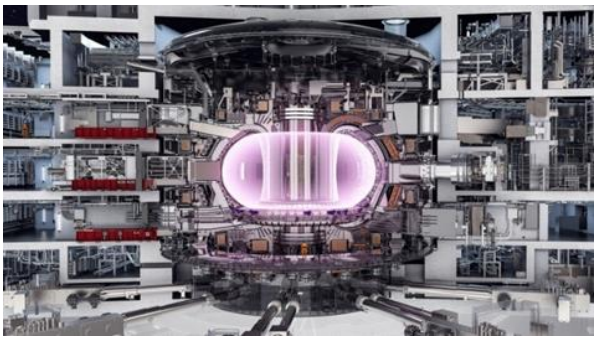
**Description of the project:**



(https://www.golem.de/news/fusionsreaktor-iter-das-eine-million-teile-puzzle-in-der-entscheidenden-phase-2001-146107.html?utm_source=pocket-newtab)

Future fusion power plants are based on hydrogen. For this reason, the knowledge of hydrogen permeation through materials is of great importance in this context. H2 permeation phenomena are described by the Sievert's law and are based on two main parameters, storage capacity and diffusion constant, which have to be evaluated from experiments and are characterised by Ficks´ second law. The solution of the differential equation system does not provide the desired explicit constants, which need to be computed with the Branch and Bound (B&B) algorithm, which is described in [1]. The possible solutions available at the moment are based on the Ficks´ mathematics:

- Analytical solution
- Numerical FDM solution
- "Combined" matrix solver (to be presented at the DSL Conference2020 in Malta)

In the present project, we will work at the improvements of the aforementioned solutions while basing our experimental knowledge on the Q-PETE (Hydrogen Permeation and Transport Experiment) facility at the INR-KIT [1], which is a membrane experiment. The evaluation of the transport parameters is currently based on FDM and analytical solution, but should extended to the matrix solver solution.

Further work should be carried out on:

1. Thermal desorption [2]
2. Exothermic material modelling

[1] A. von der Weth et al., Permeation Data Analysis Considering a Nonzero Hydrogen Concentration on the Low-Pressure Detector Side for a Purged Permeation Experiment, Defect and Diffusion Forum, 2019, 18-19, Vol 391, https://doi.org/10.4028/www.scientific.net/DDF.391.18.
[2] von der Weth, A. et al., Numerical analysis of an isovolumetric thermal desorption experiment, DOI: 10.5445/IR/1000096449



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**Project will be co-supervised by Dr. Daniela Piccioni Koch (SCC-KIT), Daniela.piccioni@kit.edu and Dr. Axel von der Weth (INR-KIT), axel.vonderweth@kit.edu**

**Description of existing or sought Chinese collaboration partner institute:**
None

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

- PhD in Physics/Chemistry/Mathematics/Informatics.
- Experience with source code development, mainly FDM.
- Ability to develop new algorithms.
- Extended knowledge about differential equation.
- Knowledge in analytical and numerical solution (cylindrical, spherical) of heat or diffusion equation.
- Unix/Linux/Fortran required, some Python, Matlab, Origin, xmgrace
- Basic knowledge of German language would be appreciated

**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



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