

**HELMHOLTZ** RESEARCH FOR  
GRAND CHALLENGES

**Helmholtz - OCPC - Programme 2017-2021**  
**for the Involvement of Postdocs in Bilateral Collaboration**  
**Projects with China**

**PART A**

**Title of the project**

Neutrino phenomenology — from the lab to the cosmos

**Helmholtz Centre and institute**

Karlsruhe Institute of Technology (KIT), Institute for Nuclear Physics (IKP)

**Project leader**

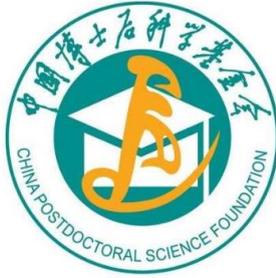
Prof. Dr. Thomas Schwetz-Mangold

**Web-address**

[http://www.ikp.kit.edu/astroparticle\\_theory/english/index.php](http://www.ikp.kit.edu/astroparticle_theory/english/index.php)

<http://www.ikp.kit.edu/english/index.php>

<http://www.kceta.kit.edu/english/index.php>

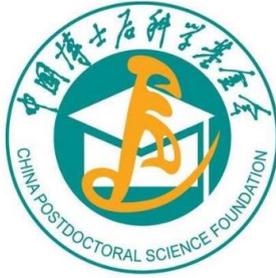


## Description of the project:

We work on the phenomenology of neutrinos, exploring the information from neutrino oscillation experiments, absolute neutrino mass experiments, neutrino less double-beta decay, as well as implications of neutrinos in astrophysics and cosmology. We use the available data to investigate properties of neutrinos and search for non-standard properties, such as sterile neutrinos, exotic neutrino interactions or using neutrinos as a portal to the “dark sector”. The origin of neutrino mass is unknown. Due to its feeble interactions, neutrinos can be a portal to new physics beyond the Standard Model of particle physics. Therefore, exploring their properties may reveal important hints on new fundamental laws of Nature.

The postdoc will join our working group on neutrino phenomenology and contribute to its activity in the context of determining neutrino properties and searches for new phenomena. This includes the analysis of existing data from laboratory experiments as well as astrophysical and cosmological observations. Links to Dark Matter physics can be explored. We will use current data as well as perform sensitivity estimates of future projects. Our investigations include implications of the KATRIN experiment at KIT as well as the JUNO project in China, which will be considered in the context of world-wide activities in neutrino physics. Combination with cosmological data (e.g., from observations of the cosmic microwave background, Big Bang nucleosynthesis, or large-scale structure) will offer increased sensitivity to standard and non-standard neutrino properties. We are part of the NuFit collaboration ([www.nu-fit.org](http://www.nu-fit.org)), one of the leading groups in global analyses of neutrino oscillation data.

The project includes numerical simulations, statistical analysis, as well as theoretical modelling (depending on the specific skills of the applicant). The project offers collaboration in an active field of research, at the international forefront of neutrino phenomenology, with strong links to the experimental activities at KIT as well as in China. The research will be performed within the group of Theoretical Astroparticle Physics at KIT, part of the KIT Centre for Elementary Particle and Astroparticle Physics (KCETA), which provides a lively research environment including active groups in theoretical high energy physics (LHC phenomenology, flavor physics, Higgs physics, QCD) as well as several groups in experimental particle and Astroparticle physics (CMS, Belle-2, KATRIN, Edelweiss, DARWIN, Pierre Auger, AMS-II).



**Description of existing or sought Chinese collaboration partner institute:**

Preliminary contacts exist with:

Prof. Zhi-zhong Xing and Shun Zhou (Institute of High Energy Physics, Beijing)

Prof. Wei Wang and Jian Tang (Sun Yat-Sen University, Guangzhou)

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

- PhD in theoretical particle physics or astroparticle physics/cosmology
- Experience with neutrino phenomenology, neutrino oscillations, neutrinos in cosmology, CMB/LSS and astrophysics
- Additional skills in numerical calculations, statistical data analysis, simulations of neutrino experiments, cosmological analyses

**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