2016 Jülich – OCPC – Programme
for the involvement of postdocs in bilateral collaboration projects

PART A

Title of the project: Neutrino physics with JUNO (Jiangmen Underground Neutrino Observatory)

Jülich's institute: Institute for Nuclear Physics 2 - Experimental Hadron Dynamics (IKP-2)

Project leader: Prof. Dr. Livia Ludhova

Web-address: http://www.fz-juelich.de/ikp/ikp-2/EN/Home/home_node.html

Description of the project (max. 1 page)[1]**:** see overleaf

Description of existing or sought Chinese collaboration partner institute (max. half page)**:** Chinese neutrino physics has provided to the physics community a breakthrough precision measurement of the θ_{13} mixing angle in 2012 (Daya Bay project). The experience and the number of institutes involved in the neutrino physics (mostly Daya Bay and JUNO experiments) is constantly growing. We search for a candidate from a research group, which has already an experience in experimental neutrino physics.

Required qualification of the post-doc:

- PhD in physics
- Experience in experimental neutrino physics
- Both hardware and software expertise is appreciated.

PART B

Documents to be provided by the post-doc:

- Detailed description of the interest in joining the project (motivation letter)
- Curriculum vitae, copies of degrees
- List of publications
- 2 letters of recommendation

[1] Please add overleaf

PART C

Additional requirements to be fulfilled by the post-doc:

- Max. age of 33 years
- PhD degree not older than 5 years
- Very good command of the English language
- Strong ability to work independently and in a team

Description of the project:

Neutrino physics continues to be a very active research field, full of opened fundamental questions reaching even beyond the Standard Model of elementary particles and towards a possible new physics. The importance of the progress in this field was recognized by awarding the 2015 Nobel Prize in Physics for the discovery of the phenomenon of neutrino oscillations. In spite of this achievement, there are still some fundamental quantities related to neutrinos, which are completely unknown. The determination of one of these, that is, the determination of the ordering of neutrino mass eigenstates (normal versus inverted neutrino mass hierarchy), is the main goal of the JUNO experiment in Jiangmen in China. The mass hierarchy (MH) is a prerequisite for the detection of CP-violation with any neutrino experiment, another currently unknown fundamental neutrino-related quantity.

JUNO with its 20 kton will be the biggest liquid scintillator detector ever built, with unprecedented energy resolution of 3% at 1 MeV. It is currently under construction and development, having ahead a challenging goal of starting the data taking in 2020. JUNO will measure reactor antineutrinos from the nuclear cores built at 53 km distance. The expected sensitivity on MH-determination is of 3σ in about 6 years. JUNO, thanks to its large target mass, has also challenging aims in measuring (anti)neutrinos from other sources, as for example geo-neutrinos, solar or supernovae neutrinos.

Forschungzentrum Jülich is already involved in the JUNO project. Jülich's Central Institute for Engineering, Electronics and Analytics 2 Electronic Systems, in close collaboration with RWTH Aachen University, is leading the effort of developing the smart sensor, the core element of the read-out electronics chain for each of about 20.000 photomultipliers mounted around the JUNO detector. The IKP-2 neutrino group started its activities in November 2015 by Livia Ludhova, having a 10-years long experience in neutrino physics with liquid scintillators in Borexino project. IKP-2 has recently become a new member of the JUNO collaboration and the number of group members dedicated to JUNO started and will continue to grow. The group will specialize in the low-level data analysis in a close synergy with the electronics development. It will also focus on the development of software, monte carlo, and data analysis tools. A special attention will be dedicated to the topic of JUNO potential in geo-neutrino and solar neutrino measurements. The candidate will have an opportunity to take part in the challenge of setting up a new neutrino group with a clear aim of having JUNO as its main long-term project. Involvement both in the software and hardware development is expected.