Laboratoire de physique subatomique et des technologies associées

Unité Mixte de Recherche 6457
École des Mines de Nantes - IN2P3/CNRS - Université de Nantes

Experimental Neutrino Physics

Postdoc opening at SUBATECH, Nantes on JUNO and Double Chooz

The Subatech laboratory is opening a 3-year postdoctoral position in low energy neutrino physics on the JUNO (based in China) and the Double Chooz (based in France) experiments - further details provided below. The group is also involved in the Nucifer and SoLid experiments.

The postdoc fellow is expected to play an important role in these two experiments, whose detectors are based on liquid scintillator read out by large PMTs. It is expected from the successful candidate to assume key responsibilities in the analysis of the Double Chooz experiment and the conception/realisation of the JUNO detector design. The postdoc will actively engage in the leading national activities of DC and JUNO with other laboratories in France, Europe and Asia.

The Jiangmen Underground Neutrino Observatory (JUNO) is a multipurpose neutrino experiment relying on the largest liquid scintillator detector in the world (20ktons at ~700m deep underground), designed mainly for high precision neutrino oscillations physics. JUNO is the only experiment in the world able to be sensitive to both the so called “solar” and “atmospheric” oscillations simultaneously but using reactor neutrinos at a baseline of ~50km in the South cost of China. This allows its unique ability to determine the atmospheric-mass-hierarchy using vacuum oscillations (unlike most other experiments relying on matter effect enhanced oscillations) and the precise measurement of both solar and atmospheric oscillation parameters to the unprecedented precision of $\lesssim$1%. The detector being so large becomes one of the best core-collapse supernova neutrinos observatories in the world. In addition, the study geo-neutrino as well as atmospheric and solar neutrinos appears possible, as well as other exotic physics searches. The main challenge of the experiment lies on the detector design to yield the unprecedented $\lesssim$3% energy resolution at 1MeV, thus needing the largest photo-coverage and tightest control of calorimetry systematics ever built in the land. In fact, the postdoc fellow will get involved in leading activities of a new proposal called “multi-calorimetry” (officially approved by the collaboration) thus modifying the present JUNO design by adding small PMTs reading the target volume. This proposal has been led mainly by French collaborators, in tight collaboration with Brazil, China, Chile and Italy. This task is strongly related to the improvements in calorimetry for the Double Chooz experiment, effectively used as prototype for JUNO, since the similar readout systematics, such as FADC electronics reconstruction are expected. The successful candidate will also have the possibility to work on the design of electronics and DAQ systems of JUNO in tight inter-European collaboration. Optimisation of the system for the demanding detection of supernova high rates is also expected.

The postdoc fellow will take part of the Double Chooz (DC) experiment, expecting to play leading role during the second data taking phase with the Near Detector in order to increase the sensitivity on the θ_{13} measurement. Direct involvement in the rate+shape fit analysis with the two-detector configuration is

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likely. The near detector data will also provide the opportunity for novel studies on the non-oscillated spectrum in order to understand the distortion around 5MeV seen by all reactor experiments today. Moreover, the DC results will be able to provide very useful experimental data (energy calibration, flux normalisation systematics, new calorimetry method, etc) to extrapolate for the next generation reactor antineutrino experiments like JUNO. Eventually, a precise measurement with the DC Near Detector of the neutrino flux coming from a Pressurised Water Reactor might also improve the measurement of the geo-neutrinos with JUNO, where reactor neutrinos are their main background. All the near detector spectral studies quoted above will also benefit from the expertise developed by Subatech on the simulations of the Chooz reactors and of reactor antineutrino spectra.

Applicants must have a PhD (or a fixed date of defence) in experimental particle Physics and demonstrate the ability to work in a research environment, prepare research results for publication and for presentation at scientific meetings. Experience in C++ programming, in particular with ROOT and Geant4, is required.

Interested candidates should contact Dr Frederic Yermia and Dr. Muriel Fallot for more information about the position. The candidate should send a CV, a brief description of research experience and interests, a list of publications, and three letters of recommendation.

The deadline for the application is September 20, 2015; late applications will be accepted until the position is filled.

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