MASTER-PHD STUDENT PROJECT

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JUNO is a large liquid scintillator detector in construction phase in China, whose purpose is the detection of anti-neutrinos emitted by nuclear reactors situated at a distance of 53 km. The detector is located ~700 m below the rock and consists of 20 kilotons of liquid scintillator contained in a 35.7 m diameter acrylic sphere, instrumented by more than ~18000 20-inch photomultipliers tubes (PMTs). The main objective of the experiment is to determine the mass hierarchy of neutrinos, but it has also other physical goals. JUNO will also be useful for the detection of other natural sources of neutrinos, including the measurement of oscillations of atmospheric neutrinos produced during interactions of cosmic rays, or of neutrinos from supernova explosions. The international JUNO collaboration was established in 2014, construction of the site started in 2015 and the R&D and production phase for the detector is underway. The exciting moment of the start of physics data collection is expected at the end of 2024, but commissioning data will be available during the filling, already from the start of 2024. These commissioning events will be extremely useful to test the detector response for the very first time with real data.

Two work subjects are proposed:

- Study of the energy spectrum of atmospheric muons and neutrinos measured by the JUNO detector. The work will consist more particularly in defining the selection criteria of the physical events of interest for the analysis. The student will work on evaluating the tagging efficiency and reconstruction performance for muons and neutrinos with the available algorithms. In a second part, the selection will be tested on the first commissioning data. Even few weeks of data will be enough to test the algorithms on muon, for which a high rate (4 Hz) is expected.

- Study of the effect of the JUNO triggers on its capabilities for Core Collapse Super Novae (CCSN) physics, especially on the efficiency to separate the various interaction channels and the remaining background. The student will work with the JUNO simulation detector response to a CCSN with the different triggers. The model dependency of the performance will be evaluated. In a second time, the commissioning data will used to compare the different triggers at data acquisition (DAQ) level on real data to the simulations.