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Avenues for unveiling the mysteries in neutrino physics - From Daya Bay Reactor Neutrino Experiment to Jiangmen Underground Neutrino Observatory

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Venue: S4-625
Time: 11:00-12:30

Abstract:

Neutrinos play an important role in unveiling the mysteries of the universe. In standard model, neutrinos are massless. However, the discovery of neutrino oscillations tells that neutrinos are massive. This is experimental evidence for the existence of new physics beyond the Standard Model. The mixing matrix of neutrino oscillation was not completed until 2012, when Daya Bay Reactor Neutrino Experiment discovered a non-zero value for the neutrino mixing angle θ_{13}. The Daya Bay experiment received the 2016 Breakthrough Prize in Fundamental Physics for investigating neutrino oscillation.

Daya Bay experiment consists of eight functionally identical detectors placed underground at different baselines from six 2.9 GW reactor cores. After a total of about nine years of operation, it acquired world's largest sample of reactor antineutrinos to date, 5.6 million inverse beta decay (IBD) candidates with neutron captured on gadolinium obtained from the full data set, and the world's most precise determination of $sin^2 2\theta_{13}$ with more than 5σ significance. It is crucial to have a precise measurement on θ_{13}! The result of θ_{13} measurement tells us that it is possible to determine the neutrino mass ordering by using reactor antineutrinos and to measure CP phase.

The Jiangmen Underground Neutrino Observatory (JUNO) is located in Jiangmen, Guangdong, China, with an overburden of about 700 meters, and is expected to be completed in 2023.

The primary goal of JUNO experiment is determining the neutrino mass hierarchy by measuring the fine structure of the oscillation spectrum with a significance of 3~4 σ in 6 years of data taking at the 53 km baseline of the two power plants, and to precisely measure the mixing parameters, θ_{12}, Δm_{12} and Δm^2_{ee}. An unprecedentedly high energy resolution of 3% at 1 MeV is required for this purpose. The experiment will also look for geo-neutrinos, solar-neutrinos, atmospheric neutrinos, supernova neutrinos and neutrinos from dark matter annihilations.

This talk will present details of Daya Bay and JUNO experiments, which include the latest results from Daya Bay, the current status of JUNO, and the expected physics reach.