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Ultra High Energy Atmospheric Muons Measurement at INO-ICAL Detector Using Pair Meter Techniques.

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Cosmic rays primarily composed of high energy protons and atomic nuclei interact with the earth's atmospheric nuclei and produce pions and kaons, these particles further decay to muons, which carries bundel of information as they travel in the atmosphere such as (i) pi/k hadronic production ratio (ii) Composition of cosmic ray primaries (iii)Contribution of charmed hadrons (iv) Neutrino flux at very high energies etc.
The proposed ICAL detector at INO is a large underground magnetized iron detector. This detector is shielded by 1.2km of rock(aprox). When the muons produced in the atmosphere pass through the rock, low energy muons gets stopped in the rock but the high energy muons will reach the detector. ICAL being a magnetized detector can reconstruct muon energy for a limited energy range using magnetic spectrometry techniques but for higher energy range we can not use this techniques because the tracks will be straight. We can use an alternative techniques to reconstruct energy of muons in higher energy range which is called as Pair-Meter techniques. This techniques is well tested at NuTeV/CCFR experiment.
In this work we have done the preliminary analysis for iron plates and demonstrate the observational feasibility of very high energy muons (1 TeV- 1000 TeV) in a large mass underground detector operating as a pair-meter. This energy range corresponds to surface muon energy of (5 TeV- 5000 TeV) and primary cosmic ray energy of (50 TeV- 50000TeV). That much wide range of energy spectrum will be helpful for studing the cosmic ray in the Knee range and understanding of atmospheric neutrino flux for the future and present ultra high-energy neutrino experiment.

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