Contribution ID: **37** Type: **Talk: in-person**

Unlocking high energy tau-neutrino astronomy with the TAMBO deep-valley detector array

Tuesday, 17 September 2024 13:45 (20 minutes)

High-energy astrophysical neutrinos, recently discovered by IceCube up to energies of several PeV, opened a new window to the high-energy Universe. Despite IceCube's excellent muon flavour identification, tau neutrinos have still not been unambiguously detected. To address this limitation, we present a concept for a large-scale observatory of astrophysical tau neutrinos in the 1 – 100 PeV range, where a flux is guaranteed to exist. The key innovation of TAMBO is its location on one of the faces of the 3 km deep Canyon of Colca (Peru). The mountain geometry is used as a natural background filter, allowing the detector array to observe Earth-skimming tau neutrinos. These enter the dense mountain volume, and if a charged-current interaction occurs, tau leptons are produced. These propagate further on a range between 50 m and 5 km. If the tau leptons exit the mountain volume and get into the valley, they decay, generating extensive air showers that can be detected. TAMBO aims to achieve an order of magnitude better acceptance of high-energy tau neutrinos than IceCube. However, at the same time, TAMBO is designed to overlap with Ice Cube in the 1 - 10 PeV range. This would allow an in-detail characterization of the neutrino sources observed by IceCube, the discovery of new ones, and the exploration of neutrino physics at high energies. The deep-valley air-shower array concept that we present provides highly background-suppressed neutrino detection with pointing resolution better than 1°, allowing us to begin the era of high-energy tau-neutrino astronomy. In this contribution, I am going to report on the progress of the detector design and the optimization studies foreseen in the near future.

Working Group

WG 5: Neutrinos Beyond PMNS

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Session Classification: Parallel: WG5

Track Classification: WG5: Neutrino Beyond PMNS