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Neutrino Mass Ordering with IceCube DeepCore

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The neutrino mass ordering (NMO) is one of the last unmeasured fundamental parameters in the neutrino sector of the Standard Model of Particle Physics. NMO studies aim to answer the question of whether the neutrino mass ordering is normal (m3>m2>m1) or inverted (m2>m1>m3). IceCube is an ice-Cherenkov neutrino detector deployed greater than 1.5 kilometers below the surface of the South Pole. Using the DeepCore subarray, the densely-instrumented region of IceCube, we conduct a study of the NMO using neutrino oscillations from atmospheric neutrinos. Matter effects distort the oscillation probabilities for neutrinos (normal ordering) and anti-neutrinos (inverted ordering) traversing the Earth's core with energies below about 15 GeV. Differences in the atmospheric flux and cross-section yield a higher rate of neutrinos than anti-neutrinos in DeepCore, resulting in differences between the normal and inverted orderings in the combined neutrino/anti-neutrino signal. In this talk, we show a study of the NMO sensitivity using nine years of IceCube DeepCore data where a new event selection, reconstruction method, particle identification, and systematic uncertainty modeling are used. The aim is to both provide a higher-energy complementary NMO study to those being conducted by long-baseline neutrino experiments as well as to serve as a preamble for an NMO study using the upcoming IceCube Upgrade, which should significantly improve IceCube's NMO sensitivity.

Attendance type

In-person presentation

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