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Neutrino Mass Ordering using Atmospheric Neutrino Oscillations with IceCube DeepCore

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Neutrino Mass Ordering (NMO) studies explore the unresolved fundamental question of whether the neutrino masses follow a normal ordering (m3>m2>m1) or an inverted ordering (m2>m1>m3). IceCube is an ice-Cherenkov neutrino detector deployed about 1.5 kilometers below the surface of the South Pole. Using DeepCore, a more densely instrumented volume of ice near the bottom of the detector, we study the ordering by a measurement of the oscillation patterns of a 9.28-year sample of atmospheric neutrinos. The main goals of this work include analyzing the NMO at higher neutrino energies relative to Super-Kamiokande and long-baseline experiments as well as observing neutrino-Earth matter effects, both of which will play a distinctive role in NMO global fit studies. Another goal includes preparing for a measurement of the ordering using the superior IceCube Upgrade instrumentation, a fully-funded extension of DeepCore that is estimated to be deployed in the 2025-2026 Antarctic summer.

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