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Determining the Hierarchy of Neutrino Masses Using Discrete Fourier Analysis[1] DAINE DANIELSON, University of California, Davis — Neutrinos are among the least understood elementary particles, with theorized properties capable of addressing major open problems in modern physics such as the disparity between matter and antimatter present in the observed universe. Determining the hierarchy of the three observed neutrino mass states would mark a major milestone in unlocking these particles' secrets. The sign of $\Delta m^2{}_{32}$–the ordering of the second and third squared neutrino masses–is unknown; a positive value defines the "normal," and negative the "inverted," mass hierarchy. Analyzing simulated neutrino detector outputs, we implement a discrete Fourier transform of detection rate as a function of neutrino flight distance over neutrino energy. Employing the discrete Fourier transform, we compare the transformed frequency domain spectrum to the predicted normal and inverted hierarchy spectra to determine the hierarchy present in the detected data. Using this technique, an experimental determination of the sign of $\Delta m^2{}_{32}$ may be possible, which would bring resolution to the neutrino mass hierarchy problem.

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