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A Comprehensive Diffuse Neutrino Search Using the Full Askaryan Radio Array

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The Askaryan Radio Array (ARA) is a neutrino experiment at the South Pole, designed to detect radio-frequency emissions produced by interactions of ultra-high energy (UHE) neutrinos with the Antarctic ice. The array consists of five autonomous stations, each equipped with deep in-ice antennas sensitive to both vertically and horizontally polarized radio signals. With nearly 30 station-years of livetime accumulated, ARA is now conducting its first comprehensive array-wide search for diffuse UHE neutrinos. This analysis is expected to deliver the most stringent constraints from any in-ice radio-based detector up to 1000 EeV and is capable of probing flux levels suggested by KM3NeT around 220 PeV. The results from this analysis mark a critical step toward establishing scalable techniques for next-generation detectors.

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