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Ultra-high Energy Neutrinos, Antarctica, Greenland, and the Askaryan Effect: A Summary

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The observation of EeV astrophysical neutrinos will be a significant scientific achievement, and the radio-frequency Antarctic neutrino observatories represent the cutting edge in the field of high-energy neutrino science. Being electrically neutral, astrophysical neutrinos propagate directly from the highest-energy objects in the cosmos, and could reveal the source of the highest energy cosmic-ray hadrons. Further, astrophysical neutrinos scattering in ice are predicted to have center of mass energies currently inaccessible on Earth, implying that tests of fundamental physics could be performed. The ice sheets and ice shelves of Antarctica and Greenland have become the largest, most technically convenient media for high-energy neutrino detection. The Askaryan effect provides a detection mechanism whereby radio frequency pulses are radiated from the particle cascades initiated by the neutrinos, and the cold temperatures of the natural ice formations in polar regions allow the radio pulses to propagate to detectors. The recent achievements and future plans of detectors like ANITA, ARIANNA, ARA, and EVA will be described, along with a brief review of the Askaryan effect, and the accompanying particle physics.

Summary

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