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Progress in Development of High Energy Neutrino Detectors in Antarctica using Coherent Radio Techniques

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Evidence is growing for the existence of a diffuse flux of astrophysical neutrinos with energies up to a few x 10^{15} eV. This has spurred considerable interest in developing new techniques that can extend the search to even higher neutrino energies. Promising new efforts over the past half-decade focus on the radio-Cherenkov technique in polar regions with cold, highly transparent ice. I will describe the broad, complementary physics goals of these telescopes with design sensitivities as least a factor 10 better than current limits for energies >$10^{17.5}$ eV. One important goal centers on a measurement of the cosmological neutrino flux, whose existence is relatively secure but also expected to be quite small even under the best of circumstances. The inherent cost efficiencies of radio-Cherenkov techniques suggest far greater boosts in sensitivity are possible. After briefly reviewing the progress by ANITA, ARA, and GNO collaborations, I will report on the new results from the Hexagonal Radio Array, a pilot array of the ARIANNA project. It was completed in December 2014 and located on surface of the Ross Ice Shelf at a site about 110 km from McMurdo Station, Antarctica. ARIANNA is designed to measure astrophysical neutrinos with energies greater than 10^{16} eV, with sufficient sensitivity to overlap with high energy tail of neutrino events detected by IceCube. The technique relies on the detection of nanosecond radio pulses produced by the particle cascade induced by the neutrino interaction in Antarctic ice. The RF emission was first observed during beam tests at SLAC about a decade ago. Interestingly, the air showers induced by cosmic rays generate a similar RF signal - though the dominant generation mechanism is distinct- which are used to validate the sensitivity of the neutrino detector expected from simulation studies. In this talk, I will discuss the first observation of cosmic rays by HRA and discuss the implications for neutrino detectors.

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