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Radio Phased Arrays for the Detection of High Energy Neutrinos

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Ground-based radio arrays offer a promising future for the detection of high energy neutrinos, including the prospect of reducing the energy threshold of the radio detection technique to a level necessary to overlap with the high-energy range probed by IceCube (∼10-100~PeV). Contemporary ground-based radio arrays, such as ARIANNA and ARA, are designed primarily to detect coherent radio Cherenkov emission from cosmogenic ultra-high energy neutrino interactions in the Antarctic ice. Here we describe the implementation of a radio phased array in a ground-based neutrino detector that would both lower the energy threshold and provide a more efficient coverage of the instrumented volume of ice. The phased arrays are made of a compact assembly of antennas and electronically steered into multiple beams covering a wide solid-angle of the ice, searching for coherent, transient nanosecond-scale power signatures. A proof-of-principle dual-polarization phased array detector is currently being constructed as an interferometric trigger system for an ARA station and will be deployed at the South Pole later this year. The array design, sensitivity, and outlook for future scaling up will be discussed.

Primary author: OBERLA, Eric (KICP University of Chicago)

Co-author: VIEREGG, Abigail (KICP University of Chicago)

Presenter: OBERLA, Eric (KICP University of Chicago)

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