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On the feasibility of RADAR detection of high-energy cosmic neutrinos in ice

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We discuss the radar detection technique for the detection of high-energy neutrino-induced particle cascades in ice. A high-energy neutrino interacting in ice will induce a particle cascade. When propagating through the ice, this cascade will ionize the medium producing a plasma. The different properties of this ionization plasma, such as its size and lifetime, will be discussed to determine an energy threshold for the over-dense scattering of the ionization plasma. This energy threshold is found to be at a few PeV. To determine the feasibility of the radar detection technique, we modeled the radar return power for a radio wave scattered off of the ionization plasma for a bi-static radar configuration. It follows that the radar detection technique, if successful, will be able to cover the currently existing energy gap between several PeV where IceCube runs out of events and a few EeV where the Askaryan radio detectors start to become sensitive.

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