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Ground-based Verification Experiment of Ultra-High-Energy Neutrino Detection on the Moon Using Radio Waves

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In the construction of future lunar scientific stations, radio arrays can be deployed on the lunar surface and around subsurface lava tubes to detect high-energy neutrinos. The Askaryan effect, generated by the interaction between high-energy neutrinos and lunar regolith, produces radio emissions. On Earth, detecting radio signals from this effect is subject to significant radio frequency interference, resulting in a low signal-to-noise ratio for neutrino-related signals. This report presents the observation of radio signals within mountain rock caves of a certain thickness. The implementation of detection technologies related to this method will significantly enhance the likelihood of detecting neutrinos. As a prospective project proposal, this report addresses the identification, directional localization, and energy reconstruction of neutrino-associated radio signals from three aspects: the antenna array system, the ultra-low-noise nanosecond-scale pulse signal acquisition system, and the online signal identification and storage system.

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