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Cosmic Rays and Neutrinos above 10^{21} eV - the NuMoon experiment with WSRT and LOFAR

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Ultra-High Energy Cosmic Ray particles (UHECR) are known to reach energies at least up to 10^{20} eV, providing potential insight into physics that cannot be studied by current or upcoming particle accelerators. However, those particles are extremely rare and large natural detector volumes are needed to detect them. Here radio detection techniques provide interesting possibilities. Geosychrotron radiation in the Earth's atmosphere or radio Cherenkov (Askaryan) emission in solid media make it possible to observe radio waves from showers induced by UHECRs and neutrinos. In the NuMoon project we have used the Westerbork Synthesis Radio Telescope (WSRT) to monitor the lunar surface for an aggregate observing time of 46 hours at a frequency around 150 MHz. This has allowed us to improve current limits for the cosmic neutrino flux above 4×10^{22} eV by almost an order of magnitude, bringing it into an astrophysically interesting regime. In the future we will be using the new LOFAR interferometer to lower this neutrino limit further by at least one to two orders of magnitude. In addition we will place further constraints on UHECR beyond the Greisen-Zatsepin-Kuzmin (GZK) cut-off ($>10^{20}$ eV) and detect air showers from cosmic rays at lower energies around 10^{18} eV.