The moon as a detector of Ultra-High-Energy neutrinos

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Cosmogenic particles at ultra-high energies (UHE, $E > 10^{20}$ eV, about 1 Joule) are the messengers of the most energetic processes in the universe. Their energy is orders of magnitude higher than reachable at CERN. The quest is to find their origin. Neutrinos are especially suited for this as they fly unobstructed in straight lines. The expected flux of UHE neutrinos is about 1 particle per square kilometer per year, steeply falling with energy, making it necessary to work with large detectors.

When an UHE particle hits the lunar surface a very strong electromagnetic pulse is generated through a process known as the Askaryan effect. This mechanism will be explained and it is argued that in an observing window around 150 MHz there is a maximum chance for detecting this radiation on Earth with radio telescopes commonly used in astronomy. Using this principle we have set a new limit on the flux of neutrinos with energies in excess of 4×10^{22} eV in 50 hours of observation time with the Westerbork Synthesis Radio Telescope array. In the near future, the digital radio array LOFAR will be used to perform a more sensitive observation. The status of this project, the NuMoon project, will be presented.

Reference:
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