

Measuring soil moisture level using cosmic rays neutron detectors

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Cosmic rays are high-energy subatomic particles that reach Earth from outer space. Interacting with the atmosphere forms Extensive Air Showers of particles (EAS), also called secondary cosmic rays, which can be detected with different techniques, among them are Water Cerenkov Detectors (WCD) such as those developed by the LAGO Collaboration.

The hadronic component of EAS contains neutrons that interact with hydrogen present in the soil and atmosphere creating epithermal neutrons with energy between 0.1 and 100keV s. The abundance of epithermal neutrons is inversely proportional to the amount of hydrogen and therefore to the moisture of the soil and the surrounding atmosphere. This phenomenon can be used to build Cosmic Rays Neutron detectors (CRND) that are used for monitoring soil moisture level, information that can be used to develop smart-irrigation systems in agriculture or monitoring wetlands and biomass among other applications.

Present work analyzes the principal cosmic rays neutron detection techniques for applications in agriculture and presents preliminary studies for the implementation of a neutron detection system based on a WCD detector modified for the effect in order to collect data on the total neutron flux from secondary cosmic rays that can be used as a reference for calibration and optimization of a CRND for soil moisture monitoring.

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Yes

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