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Neutron spectrometry with HENSA in underground facilities and neutrons induced by cosmic-rays

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Neutrons are produced in underground facilities from nuclear reactions induced by the intrinsic radioactivity of the materials in the rock and cavity walls. These radiogenic neutrons constitute a background which is a limiting factor for underground physics, in particular low counting rate experiments in nuclear astrophysics, dark matter and neutrino searches. On the other hand, neutrons are continuously produced as a secondary radiation from cosmic-ray interactions in the upper atmosphere of our planet. This component is the main contribution to the ambient neutron background observed at ground level or high altitudes. Cosmic-ray induced neutrons are connected with different fields such as environmental radioactivity, single event upsets (SEUs) in microelectronics, and space weather.
The High Efficiency Neutron Spectrometry Array (HENSA) is a state-of-the-art detection system for neutron spectrometry in low radioactivity facilities, such as underground laboratories, and for the measurement of secondary neutrons produced by cosmic-rays. HENSA has a spectral sensitivity 5-15 times larger than conventional neutron spectrometers in the energy range spanning from thermal up to several GeV.
In this contribution the HENSA project (www.hensaproject.org) will be introduced. The experimental activities in underground laboratories will be outlined, including a recent background measurement at the Dresden Felsenkeller underground facility and the long-term characterization of the neutron background at the Canfranc Underground Laboratory (LSC). The use of HENSA for measurements of cosmic-ray neutrons will be also presented, in particular, preliminary results from a mapping of the cosmic-ray neutron background along the spanish territory, during quiet solar conditions, just at the beginning of the solar cycle #25. Prospects with HENSA in astroparticle physics and space weather will be also discussed.

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