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INCA - NANOSAT FOR DETECTING ATMOSPHERIC NEUTRON DENSITIES AND SOURCES

Abstract

New Mexico State University is developing a low-cost research 6U satellite called INCA (Ionospheric Neutron Content Analyzer) to detect neutrons in the Ionosphere and determine their origins. The project is a collaboration with the University of New Hampshire, who will be providing the state-of-the-art SiPM based neutron detector for the satellite, and NASA's Goddard Space Flight Center who will both help with the instrument and mentor the spacecraft's development. The project is part of the Air Force Research Lab's University Nanosat Program (UNP-8).

The INCA design effort will serve as the platform for numerous innovations for small spacecraft. The satellite will measure, for the first time ever, the time and latitude dependence of the neutron spectrum in the energy range from 1-20 MeV in the atmosphere. Neutrons play a prominent role in several space weather phenomena, and so these measurements will expand our understanding of space weather. This, in turn, will advance our scientific knowledge as well as directly support the goals of the Air Force Research Laboratory. The particle analyzer is a modified version of the Scintillator-Based Neutron/Gamma/Particle Instrument developed specifically to be compact, low-mass, and low-power for use in a small spacecraft. The instrumentation onboard is also sensitive to gamma rays and low energy charged particles, and, due to the orientation of the sensor arrays, the particles' sources can be determined.

This project provides rich research opportunities for undergraduate and graduate students, including RF design, digital signal processing, power reduction techniques, antenna design, data analysis, networking, communications, and interfacing with cutting-edge technology.