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DESIGN AND TESTING OF A 3U CUBESAT TO TEST THE IN-SITU VETOING FOR THE NUSOL SOLAR NEUTRINO DETECTOR

Abstract

For years, earth-based neutrino detectors have been run and operated to detect the elusive neutrino. These have historically been enormous underground detectors. The νSol project is working to design a technical demonstration to show that a much smaller neutrino detector can be operated in near-solar environments for a future spaceflight mission. At a closest approach of 3 solar radii, there is a ten thousand-fold increase in the neutrino flux. This would allow a 100 kg payload to be the equivalent of a 1 kTon earth-based payload, larger than the first neutrino experiment in the Homestake mine. As a continuing step towards this goal, the νSol project will fly a 3U CubeSat for testing the detector's passive shielding design, active vetoing system in a space environment, and the rate of false double-pulse signals in a space environment.

I go into technical detail about the characterization of the central detector in simuo and in the lab. The first test is a characterization of energy resolution and calibration through the use of radioactive sources. We will continue testing by measuring the veto success rate with ground-level cosmic rays. For the final ground testing, we will use the FermiLab test beam to characterize the central detector and veto performance at specific particle energies.

Veto performance on the previous detector design has been promising, and we were able to veto a high percentage of all particles that can penetrate the passive shielding of the satellite. These laboratory results and simulations of the cubesat detector design will raise the technological readiness level of the planned technological demonstrator flight to the sun, and the current level of shielding performance is promising for a successful cubesat test flight.