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SYMPOSIUM ON TECHNOLOGICAL REQUIREMENTS FOR FUTURE SPACE ASTRONOMY AND SOLAR-SYSTEM SCIENCE MISSIONS (A7)
Technology Needs for Future Missions, Platforms (3)

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EARTH ATMOSPHERE UV BACKGROUND MEASUREMENT AND SIPM CHARACTERIZATION USING NANO-SATELLITES

Abstract

Despite their intrinsic limitations, nano-satellites are playing an increasing role in space applications by dramatically reducing costs and development time. Thus, they can be an important tool for assessing new technologies and measuring basic performance parameters valuable for the design of space science and astrophysics missions. As an example of such an application, we detail here the cubesat Nano-SiPM, a satellite and payload fully developed at the Institute of Nuclear Sciences of the UNAM (ICN-UNAM), Mexico, in order to perform two important engineer and science tasks related to future astro-particle physics and ultra-high energy cosmic ray (UHECR) observations from space. The first objective is to assess the utilization of Silicon photo multipliers (SiPM) in space particle detectors, as an alternative to the usually employed and well-tested multi-anode photo-multiplier tubes. The advantages of SiPM are several, ranging from increased quantum efficiency to mechanical robustness, lower power consumption, space compactness smaller mass and reduced costs. Nevertheless, radiation resilience and thermal noise among others are potential counterbalancing issues, which require experimental verification under realistic conditions. This validation will be performed by the instrumentation of a small volume of scintillator with SiPM and electronics in counting mode, which will measure the response of the system to the ambient cosmic ray flux at LEO. The second objective is the measurement of the night atmospheric UV background at wavelengths shorter than 400 nm, over a variety of ground features (oceans, deserts, forests, etc.). This is the dominant background for the observation of extensive airshowers produced by UHECR in the atmosphere by future space observatories, like the proposed Extreme Universe Space Observatory (EUSO). The measuring instrument is a small UV camera with Fresnell lenses, UV filter and a SiPM focal surface. The science/engineering payload, on-board computer, telemetry system, power supply system, ADC system and mechanical structure are all developed at ICN-UNAM.