



Contribution ID: 120

Type: Oral

A Cubesat mission concept for multifrequency observation of Terrestrial Gamma-ray Flashes

Terrestrial Gamma-ray Flashes (TGFs) are intense bursts of gamma rays that originate from the mid to upper levels of thunderstorms on Earth's atmosphere. Gamma-Flash is an Italian project supported by ASI devoted to the detection of such events and to the study of their correlation with lightning and with the emission of pulses of neutrons produced by photonuclear reactions in the atmosphere with typical kinetic energies of several MeV. To this end, a detector system for gamma-rays and neutrons has been installed at the CNR-ISAC Italian Climate Observatory "Ottavio Vittori" located on the peak of Monte Cimone (2165 a.s.l.). A similar detection system is being installed on an aircraft that will be flown over the same ground-based detector at an altitude of 10-12 km with the aim of detecting the same phenomenon from two different observation points. Within the same program a new mission concept for the detection of TGFs from space has been designed. The mission consists of an array of 5 Cubesats, each consisting of a 12U bus (2U x 2U cross section, x 3U in depth). A 4U gamma-ray detector based on scintillator crystal bars readout by SiPM is included inside each Cubesat. In order to reduce background noise, peripheral bars behave as anti-coincidence detectors. A VHF antenna is proposed within each Cubesat to exploit interferometry and enable the localisation and identification of lightning types (cloud-to-ground or intra-cloud) based on VHF power profiles. A 2.5U high resolution multispectral optical camera is also planned for stereoscopic space-based observation of transient light events (TLE), in order to investigate the relation between optical and gamma-ray emission.

Eligibility for "Best presentation for young researcher" prize

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Session Classification: Direct hard-X-ray and γ -ray measurements

Track Classification: Instrumentation and missions for hard X-ray and γ -ray direct measurements in space