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DESIGN OF A 3U CUBESAT FOR METEOR DETECTION AND CHARACTERIZATION

Abstract

Meteoroids are small, unaffected, rocky bodies in Space (10μm $\sim$ 10m) that carry the primitive matter produced at the formation of the Solar System. Depending on their parent body, and thus their origin, they can be of asteroid or comet nature and are true witnesses of the formation of planets. It is believed that some are composed of elements such as carbon (C), iron (Fe) and hydroxide (OH^-), which are a trace to the fundamental properties of the primitive Solar nebula. Furthermore, the detection of these elements is precious to studies of the origin of prebiotic molecules found on Earth, which could provide information about the basic building blocks of life.

Nonetheless, their exact composition is still a mystery to the scientific community since ultraviolet spectrometry cannot be performed from ground stations, due to the absorption of wavelengths below 310nm by the atmosphere. To characterize them, only the meteors need to be sampled which are the ablating process of meteoroids burning through the Earth's atmosphere ($\sim$100km). Only three spectrums have been performed from Space in the past, which does not give enough input data to validate current models. The advantage of a Space mission is to scan a large volume of the atmosphere in order to make a statistic on the entry of meteoroids, as well as to detect ultraviolet wavelengths whilst avoiding bad weather conditions.

To tackle these primordial questions, the Université Pierre et Marie Curie (UPMC, Paris) is developping a 3U Cubesat with two main mission objectives: To conduct a statistic count of the entry of meteores and to capture tens of UV Spectrums to detect volatile elements such as OH, C, C2, CH, NO, SiO, AlO, CN. To achieve all goals, a visible camera and an ultraviolet spectrometre need to be embarked on-board the Cubesat. This technological quest will be developed solely by students within a 5 year time span.

The results of the feasibility study of Phase 0/A are presented here, taking into account mass and power budgets from Off-The-Shelf Components (COTS) to reduce risks and development costs. As a hard point in the design, the integration of two separate payloads had to be tackled. These include the miniaturization of the ultraviolet spectrometre capable of providing a high resolution ($\leq$0.8nm) whilst coping with the high frame rate requirement of the visible camera (20$\sim$30fps). The main design features together with preliminary results are presented in this paper.