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PHOTOMETRIC ANALYSIS FOR TESTING STARLINK SOLUTIONS TO LIGHT REFLECTION MITIGATION

Abstract

The new space era we are living in is experiencing the large scale spread of the satellite mega-constellations. With the deep launch cost reduction occurred throughout the last two decades, space private companies are currently designing constellations made up by thousands of small, low-cost satellites which are going to be placed in a well-defined region of the Low Earth Orbit (LEO). Alongside the risks related to the heavy overcrowding of a region which is also exposed to the space debris problem, such satellites have a highly negative impact on astronomical research and space surveillance, both from the amatorial and professional point of view. Considering a long-time exposure image or a satellite tracking the probability to capture one of these satellites is increasing year after year. Such phenomena may compromise the observations, since other satellites could overlap to the targets of interest making difficult distinguishing two or more different objects. Moreover, astrophotography images could be ruined catching tens of undesired objects. In this context, the Sapienza Space Systems and Space Surveillance Laboratory (S5Lab) organized an intensive observation campaign concerned with the Starlink satellites, in order to investigate the effects of the solutions realized by SpaceX to face the problem of the light reflection mitigation. The observations were performed using Red, Green and Blue (RGB) filters and were focused on the comparison between satellite equipped or not equipped with the VisorSat system, an array developed by SpaceX to reduce the amount of sunlight reflected by the Starlinks. Details will be provided concerning the entire optical system used to carry out the observation campaign; then, a step-by-step description of the image analysis software will be shown. In a nutshell, the developed software permits to realize a complete photometric characterization of the satellites, obtaining their luminous intensity and

the associated magnitude. Such results will be used to find out the actual anti-reflection effect brought by VisorSat and correlated to the used filters and the geometry of the orbits. Therefore, the purpose of this paper is producing an accurate photometric analysis of the Starlinks in various colour bands and to prove the efficacy of VisorSat, in such a way to provide to the community an all-around characterization of the Starlinks reflection pattern, highlighting the increasingly significant problem connected to the light pollution of the near-Earth environment.