

Abstract

Autonomous illumination payloads on-board small satellites, i.e. LED (Light-Emitting Diode) boards on CubeSats, can be tracked by ground-based telescopes for optical identification, orbit determination and attitude determination. The concept has been explored through the LEDSAT 1-Unit CubeSat project, conceived by Sapienza University of Rome and University of Michigan, and generalized for implementation on all the satellite form factors and classes. The first CubeSat that was launched with LED-based payloads on-board is WildTrackCube-SIMBA (International Designator code 2021-022 K, NORAD identifier 47 941), conceived by Sapienza University of Rome, Machakos University and University of Nairobi. The spacecraft was launched on March 22, 2021, while LEDSAT has been launched on August 17, 2021. This paper describes the proof of concept of LED boards tracking performed with blue LEDs (449–453 nm) installed on-board the WildTrackCube-SIMBA 1-Unit CubeSat. The observations results provide the identification of the object among the numerous satellites released by the same launcher and the recognition of the flashing pattern and satellite face. The results validate the concept of the usefulness of such payloads on-board small satellite platforms, while the upcoming mission LEDSAT will extend the investigation significance by performing extended operations with an enhanced LED-based payload.