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Space Debris Detection, Tracking and Characterization - SST (1)

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OBSERVATION STRATEGY TO CATALOGUING, MONITORING AND CLASSIFYING OBJECTS IN MOLNIYA ORBIT THROUGH OPTICAL OBSERVATION

Abstract

The population of space debris in the geostationary (GEO) ring and in Low Earth Orbit (LEO) has been widely studied given the importance of these two regions, which are the most used and consequently the most saturated with debris. But a further knowledge of the population in other regions and orbital regimes should be achieved to have a complete knowledge of the space around the Earth. In this complex framework the Molniya orbits represents an interesting orbital regime to be monitored. It is fundamental to be aware of the operative objects and debris present in Molniya because these orbits have their perigee in LEO, and apogee in GEO sweeping regions densely populated. The objects in Molniya-like orbits haven't been largely observed in the past years because of the high apogee altitude, which made observations with the available optical instruments extremely difficult, but thanks to the last generation cameras and mounts, it became easier to observe these orbits. The researchers of the Sapienza Space System and Space Surveillance Laboratory (S5Lab) with their wide network of telescopes and their large experience in Space Surveillance and Tracking (SST), performed an observation campaign to investigate the objects in these orbits to get a further knowledge of the trackable and the unknown population. It is evident how not having precise information on Molniya debris increases the probability of collisions. In this paper will be described the observation campaign designed to carry out an optical survey in Molniya-like orbital regimes, from the implementation of an optimal observation strategy to the achieved results. First of all, a region of interest (ROI) in terms of Right Ascension (RA) and Declination (Dec) has been found considering all the catalogued objects with values in inclination, eccentricity and mean motion near to the typical ones of a Molniya. This ROI contains the maximum density of objects observable from a telescope of the S5Lab network for each observation evening. Once this region has been found, a strategy to scan the ROI and perform the survey with a last generation camera has been implemented based on an optimization with respect to the best visibility conditions from the observation site. In the paper the definition of the ROI and the strategy are described in detail and the results of the observation campaign are shown and explained, demonstrating the importance of the used strategy and the selected one.