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OBSERVATIONS OF SATELLITES IN DECAM IMAGES: A MITIGATIVE PROPOSAL FOR SATELLITE INTRUSIONS

Abstract

This paper contributes to the substantial evidence that satellites can adversely affect astronomy. Further, it analyzes satellite "photobombs" for distinctive metrics and their ability to mitigate visual interference. Finally, it proposes additional efforts to mitigate the impact of satellites on astronomy and other space sciences.

For more than two years, numerous parties invested a significant amount of work in addressing the harmful effects of satellites on astronomy. These efforts began soon after the first set of 60 Starlink satellites launched in May 2019 and appeared in the Dark Sky. Indeed, astronomers awakened to the impending impact on their observations as astronomical images emerged with intruding satellite trails. One of the most widely known images occurred in November 2019 when satellites crossed the field of view of the Dark Energy Camera (DECam) in Chile.

With access to the observation logs for DECam, we developed Python code to calculate whether Starlink orbits would have crossed the field of view of any DECam images captured from May 2019 to present. After running the code and obtaining suspect image times, comparisons occurred with actual images to confirm the accuracy of the calculations. The corroborated calculations then provide information about the temporal increase in frequency of satellite intrusions as the number of Starlink satellites increased over time. The overall anticipated outcome will demonstrate that, as the number of Starlink satellites increased, there existed a correlative increase in the number of images adversely affected by satellite intrusions.

Beyond the facial evidence, the affected DECam images contain additional data that allow for analysis of the Starlink streaks. Employing these analytics, the hope will be to provide astronomers with metrics that mitigate the impact of intrusions on specific images. At the same time, the presentation will address measures to mitigate satellite-astronomical impacts through software telemetry awareness and other technical innovations.

Though predominantly technical, the presentation will conclude with specific proposals that build upon the conclusions articulated in the reports that arose from the SATCON 1 2 and Dark Quiet Skies 12 workshops. Rather than merely reiterate, specific initiatives will be proposed for astronomers, industry, regulators, and state parties driven by the technical analysis from the DECam images.