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Ongoing and Upcoming Mission Highlights
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Deflection / Disruption Modeling & Testing
Space Mission & Campaign Design
Impact Effects & Consequences
Disaster Management & Impact Response
Public Education and Communication
The Decision to Act: Political, Legal, Social, and Economic Aspects

THE COLOR ANALYSIS OF DIMORPHOS PLUME PRODUCED BY DART IMPACT USING LICIACUBE-LUKE DATA: RESULTS ON PHYSICAL PROPERTIES AND COMPOSITION TO BETTER CONSTRAIN PLANETARY DEFENCE EFFICENCY

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ABSTRACT

NASA's DART mission successfully demonstrated the first test of planetary defense through the kinetic impactor technique. The ASI cubesat LICIACube, separated from the DART spacecraft 15 days before the impact, acquired more than 400 images before and after the moment of impact. One of the LICIACube payloads, the LUKE (LICIACube Unit Key Explorer) camera was equipped with an RGB Bayer filter for acquiring color data. The primary target of the mission was Dimorphos, which is the 150 meters wide satellite in the binary system (65803) Didymos. As a result of the impact, the secondary asteroid decreased its orbital period around the primary by about 32 minutes with a large amount of ejected material observed by both LICIACube and ground- and space-based telescopes.
Analyses of the colors of the plume are critical to constrain the physical properties of the material ejected from Dimorphos, such as grain size, composition and a possible contribution from the degree of alteration by space weathering although lower than the other contributions. We evaluated the relationship between different RGB filters of LUKE to investigate possible color differences. The ratio of red to blue filter shows that the center of the plume has a prominence of bluer material with respect to the outer part of the plume, likely related to the presence of material with different grain size and probably less altered by space weathering excavated from the Dimorphos subsurface. Intensity profiles on the various channels along the streamers of the plume reveal its inhomogeneity and allow us to assess color differences within the dust filament of the ejecta by tying these results to patterns of plume evolution.
Color variations can be used to constrain the surface properties such as composition and grain size as well as alteration from space weathering, these studies are of primary importance in planetary defense to predict the efficiency of future deflection strategies.

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