LICIACube observation capabilities of dust plume evolution after DART impact

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The NASA Double Asteroid Redirection Test (DART) mission will be the first test to check an asteroid deflection by a kinetic impactor. The target of DART mission is the secondary element of the (65803) Didymos binary asteroid system and the impact is expected in late September – early October, 2022. The DART S/C will carry a 6U cubesat called LICIACube (Light Italian Cubesat for Imaging of Asteroid), provided by the Italian Space Agency, with the aim to collect pictures of the impact’s effects. The impact of the 610 kg DART spacecraft at 6.58 km/s on the 163 m Didymos B will result in a change of the binary orbital period of about 10 minutes assuming momentum transfer efficiency $\beta = 1$. Values of $\beta > 1$ are expected because the produced ejecta carries momentum, primarily in the direction opposite the DART speed direction. The LICIACube mission profile consists in a flyby of Didymos system with closest approach about 3 minutes after the DART impact. LICIACube will be able to acquire the structure and evolution of the DART impact ejecta plume and will obtain high-resolution images and also in 3 colour of the surfaces of both bodies. The nominal mission foresees also imaging of the Didymos B non-impact hemisphere. The contributions of LICIACube observations to the DART investigations are important for determination of the momentum transfer efficiency $\beta$, that is a crucial result of the planetary defence test. Moreover, captured images can enable scientific investigations about the main features of the asteroid system.

In order to check the imaging capability and to optimize the fast scientific phase of LICIAcube, the LICIA team performed several simulations of pictures’ acquisition. In these simulations, considering the specifications of the 2 optical payloads and the foreseen mission design, we reconstructed synthetic images mainly of the plume. As the plume evolution remains the most important uncertainty, since it depends on a very high number of impacting phase parameters, we simulated imaging of different expected evolution behaviours, to obtain instrument operative parameters and to prepare the data analysis.
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