**LICIACube: THE CLOSE-UP OBSERVATION OF THE DART IMPACT.** Dotto, E.[1], Zinzi, A.[2,3], Amoroso, M.[3], Bertini, I.[4,5], Brucato, J.R.[6], Capannolo, A.[7], Caporali, S.[6], Ceresoli, M.[7], Cremonese, G.[8], Dall'Ora, M.[9], Della Corte, V.[5], Deshapriya J.D.P.[1], Gai, I.[10], Gomez Casajus L.[10], Gramigna E.[10], Hasselmann, P.[1], Ieva, S.[1], Impresario G.[3], Ivanovski, S.L.[11], Lasagni Manghi R.[10], Lavagna, M.[7], Lombardo M.[10], Lucchetti, A.[8], Mazzotta Epifani, E.[1], Modenini, D.[10], Pajola, M.[8], Palumbo, P.[5,4], Perna, D.[1], Pirrotta, S.[3], Poggiali, G.[6], Rossi, A.[12], Tortora, P.[10], Tusberti F.[8], Zannoni, M.[10], Zanotti, G.[7], Chabot, N.L.[13], Cheng, A.F[13], Rivkin, A.S.[13] and the DART Investigation Team, [1]INAF Osservatorio Astronomico di Roma, via Frascati 33, 00078 Monte Porzio Catone (Roma), Italy, +39 06 94286430 elisabetta.dotto@inaf.it, [2]Space Science Data Center-ASI, Roma, Italy, [3]Agenzia Spaziale Italiana, Roma, Italy, [4]Università degli Studi di Napoli "Parthenope", Napoli, Italy, [5]INAF Istituto di Astrofisica e Planetologia Spaziali, Roma, Italy, [6]INAF Osservatorio Astrofisico di Arcetri, Firenze, Italy, [7]Politecnico di Milano, Italy, [8]INAF Osservatorio Astronomico di Padova, Italy, [9]INAF Osservatorio Astronomico di Capodimonte, Napoli, Italy, [10]Università di Bologna, Bologna, Italy, [11]INAF Osservatorio Astronomico di Trieste, Italy, [12]CNR Istituto di Fisica Applicata "Nello Carrara", Sesto Fiorentino (Firenze), Italy, [13]Johns Hopkins Applied Physics Lab, Laurel, MD, USA

**Introduction:** "LICIACube – the Light Italian Cubesat for Imaging of Asteroids" [1,2] is a 6U CubeSat, managed by the Italian Space Agency (ASI), that witnessed in situ the DART [3] impact on Dimorphos. LICIACube was hosted as a piggyback during the interplanetary cruise and was released 15 days before the DART impact, on its autonomous path towards the target. After commissioning phase and braking and correction maneuvers LICIACube approached the target and performed its scientific phase during the asteroid's fly-by. After that, LICIACube downloaded the obtained images to Earth: the Ground Segment was based on the Argotec Mission Control Centre, antennas of the NASA Deep Space Network and data archiving and processing, managed at the ASI Space Science Data Center.

**Images acquisition:** LICIACube witnessed the DART impact on Dimorphos as an increase of the target luminosity and observed the plume developed after the impact and its global expansion. It also observed the non-impact hemisphere of Dimorphos and the plume evolution in forward scattering.

**Obtained results**: LICIACube achieved the goal to observe the plume evolution in different observation condition. The DART impact on Dimorphos produced an ejecta cone from the asteroid with a very large aperture and a complex and inhomogeneous structure, characterized by non-radial filaments, dust grains, and boulders (Fig. 1). Taking advantage of the RGB filters of LUKE camera the plume ejected by Dimorphos was analyzed in order to investigate any color variation within the plume itself or between it and the unaltered surface of the asteroids. From the RGB filters of the LUKE camera it is possible to obtain the flow ratios, that show color differences in all the acquired images (Fig. 2A). Color analysis reveals how the plume ejected by Dimorphos upon impact with DART has a blue color in the central part, with a transition to red in the outer parts (Fig. 2B). These color differences may be related to multiple factors: different grain sizes in the plume [4], excavation of subsurface material from Dimorphos that is less altered by space weathering and consequently bluer as demonstrated by laboratory experiments [5].

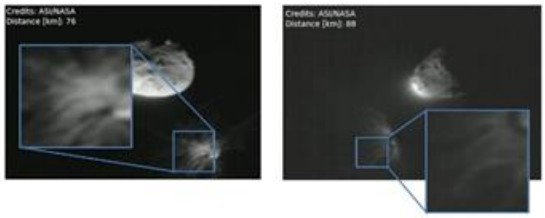

Figure 1. The structure of the ejecta plume produced by the DART impact, as seen by LICIACube.

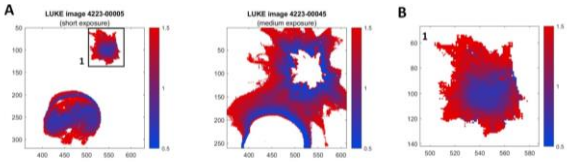


Figure 2. Didymos-Dimorphos maps of red over blue ratio in LUKE colour filter data.

In the framework of the AIDA (Asteroid Impact & Deflection Assessment) collaboration, the data obtained by DART and LICIACube will be combined with those obtained by the ESA Hera mission, that will be launched in 2024 and will rendez-vous with Didymos in 2027 for a deeper characterization of the binary system and of the effects of the DART impact.

**Acknowledgments:** Acknowledgements: The LICIACube team acknowledges financial support from Agenzia Spaziale Italiana (ASI, contract No. 2019-31-HH.0 CUP F84I190012600).

**References:** [1] Dotto E., et al. (2021) PSS 199, id. 105185. [2] Dotto E. et al. (2022) Nature, in preparation. [3] Rivkin A.S. et al. (2021) PSJ 2(5), id.173. [4] Lara L.M. et al (2007) A&A 465, 1061. [5] Marchi S. et al (2005) A&A 443, 769.