PDC2023
Vienna, Austria

Please submit your abstract at https://atpi.eventsair.com/23a01---8th-planetary-defense-conference/abstractsubmission

You may visit https://iaaspace.org/pdc for more information

(please select the topic that best fits your abstract from the list below)
(you may also add a general comment - see end of this document)

Impact Effects & Consequences

Reconstructing the Dimorphos ejecta plume by means of non-spherical dust simulations, DART and LICIACube data, and laboratory experiments

Ivanovski, S. L.[(1)], Zanotti, G. [(2)], Bertini, I.[(3,4)], Hasselmann, P.[(5),] Deshapriya J.D.P.[(5)] Lucchetti, A.[(6)], Pajola, M.[(6)], Perna, D.[(5)] , Poggiali G.[(7,8)], Dotto, E. [(5)],Herreros, M. I. [(9)], Ormo, J. [(9)], Li, J-Y.[(10)], Amoroso, M. [(11)], Brucato, J.R. [(7)], Capannolo, A. [(2)], Caporali, S. [(6)], Ceresoli, M. [(2)], Cremonese, G. [(6)], Dall'Ora, M. [(12)], Della Corte, V. [(4)], Gai, I. [(13)], Gomez Casajus, L.[(13)], Gramigna, E. [(13)], Ieva, S. [(5)], Impresario, G. [(11)], Lasagni Manghi, R. [(13)], Lavagna, M. [(2)], Lombardo, M. [(13)], Marzari, F. [(14)], Mazzotta Epifani, E. [(5)], Modenini, D. [(13)], Palumbo, P. [(3,4)], Pirrotta, S. [(11)], Rossi, A.[(15)], Tortora, P.[(13)], Tusberti, F. [(6)], Zannoni, M.[(13)], Zinzi, A.[(11)] Fahnestock, E.G.[(16)], Farnham, T. L.[(17)], Hirabayashi M.[(18)], Raducan S. D.[(19)], Ferarri, F.[(2)], Soldini S.[(20)], and Luther R.[(21)]

(1) INAF Osservatorio Astronomico di Trieste, Italy stavro.ivanovski@inaf.it
(2) Politecnico di Milano, Italy
(3) Università degli Studi di Napoli "Parthenope", Napoli, Italy
(4) INAF Istituto di Astrofisica e Planetologia Spaziali, Roma, Italy
(5) INAF Osservatorio Astronomico di Roma, Italy
(6) INAF Osservatorio Astronomico di Padova, Italy
(7) INAF Osservatorio Astrofisico di Arcetri, Firenze, Italy
(8) Observatory of Paris, France
(9) Centro de Astrobiología (CAB), CSIC-INTA
(10) Planetary Science Institute, Tucson, AZ, USA
(11) Agenzia Spaziale Italiana, Roma, Italy
(12) INAF Osservatorio Astronomico di Capodimonte, Napoli, Italy
(13) Università di Bologna, Bologna, Italy
(14) Università di Padova, Italy
(15) CNR Istituto di Fisica Applicata "Nello Carrara"
(16) Jet Propulsion Laboratory, California Institute of Technology, USA
(17) University of Maryland, College Park, Maryland, USA
(18) Auburn University, Auburn, AL, USA

(19) Space Research and Planetary Sciences, University of Bern
(20) University of Liverpool, UK
(21) Museum für Naturkunde - Leibniz Institute for Evolution and Biodiversity Science, Berlin, Germany

Keywords**:** *dust dynamics, asteroids, Dimorphos, kinetic impact, NEO*

ABSTRACT

On the 26th of September 2022, NASA's Double Asteroid Redirection Test (DART) mission [1] was the first space mission demonstrating the kinetic impactor method for planetary defence. ASI's Light Italian Cubesat for Imaging of Asteroids (LICIACube) [2] was the first to image it.

To reconstruct the ejecta plume, we apply a 3D+t model – LIMARDE [3, 4] - constrained with laboratory observations [5], impact simulations and near- and far- field observations such the LICIACube [6] images and HST [7] dust observations, respectively. The main tasks that have been pursuing are the following: to compute the dust velocity distribution based on the physical properties (size, mass and shape) derived from the LICIACube observations; to reconstruct the dust distribution of the plume with its filaments, spikes and large aperture; to determine the contribution of the rotation of the dust in the optical thickness of the plume; to check what is the role of the fragmentation of the particles; to constrain the dust density and shape based on the dynamical properties of the ejected dust in the near- mid- and far-environment.

LIMARDE can compute single trajectories and obtain time dependently the rotational frequency and velocity as well as the particle orientation at any time and distance. The latter will be used not only to calculate the deviation of different shapes in the ejecta evolution but also to provide insights on the optical thickness of the plume and the collision enhancement factor β. This can be addressed by estimating how much momentum the ejected particles had to form the observed filamentary-like ejecta.

References: [1] Rivkin et al. 2021, PSJ; [2] Dotto et al. 2021, PSS;[3] Ivanovski et al. 2023, PSJ; [4] Fahnestock et al. 2022, PSJ; [5] Ormo et al. 2022, *E&PSL* [6] Dotto et al. Submitted [7] Li et al. 2023, Nature

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

****

Comments: *Oral presentation preferred, will be attending in person*