

## Ongoing and Upcoming Mission Highlights

### LOW-SPEED EJECTION MECHANISMS IN THE DART EXPERIMENT

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### ABSTRACT

Following the impact of the NASA-DART space probe against the asteroid Dimorphos, several thousand tons of material were ejected at a wide range of velocities. Several groups have used close observations of LICIACube minutes after impact, as well as long-range long-range tracking from HST and the ground, to infer the spatial and velocity distribution of ejecta (Li et al. 2022). From images taken by LICIACube's camera LUKE during the fly-by with a wide range of viewing angles, it was concluded that the ejecta cone had a wide angle of ~140 deg. In addition, the tip of the ejecta cone does not appear to have been located at the surface, as would be expected from a point source cratering event. The ejecta was released from a wide area covering almost the entire impacted hemisphere (half of the Dimorphos surface centered on the impact point). The ejected material can be broadly classified into three different regimes: the very-high-speed ejecta (with speeds tens m/s); the high-speed ejecta (a few m/s); and the low-speed ejecta (below 1 m/s). The radial extension of the cone and the darkened ring just above the surface observed in a side view are in correspondence with the fact that most of the material was ejected at very low velocities. Moreno et al. (2022) and Tancredi et al. (2022) presented models similar to those used to study the evolution of Active Asteroids to predict coma brightness and the formation of a long-lived tail after impact, and dubbed the DART experiment as the creation of the first artificial Active Asteroid. The inversion of this model is used by Moreno et al. (this conference) to infer the ejecta distribution in mass and velocities, concluding that most of the material was released at velocities comparable to the escape velocity from Dimorphos' surface (i.e. 0.09 m/s). What are the physical mechanisms that could explain the large ejection zone and low velocities of the material? Tancredi et al. (2022) predicted that the seismic shaking generated by the impact, and the so-called "cocoa effect" (lofting of small particles from the top of a dust layer when shaking it off), are the mechanism behind these observations. Other groups have been working on other interpretations.

In the present work, we present new simulations of the above mechanism in the light of observations. We critically discuss the different alternatives that has been proposed.

Finally, we analyze the relative contribution of low-speed ejecta to linear momentum transfer.

References:

- Moreno et al. (2022), "Ground-based observability of Dimorphos DART impact ejecta: Photometric predictions"; MNRAS, 515, 2, 2178–2187; <https://doi.org/10.1093/mnras/stac1849>
- Li et al. (2022), "Ejecta from the DART-produced active asteroid Dimorphos"; submitted to Nature
- Tancredi et al. (2022), "Lofting of low speed ejecta produced in the DART experiment and production of a dust cloud" (2022) ; MNRAS, in press; <https://doi.org/10.1093/mnras/stac3258>

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**Comments:**

*Alternative session:* **Deflection / Disruption Modeling & Testing**

**Oral**