

TOPIC: Ongoing and Upcoming Mission Highlights

**MILANI LASER RETROREFLECTORS FOR HERA, ESA'S MISSION TO A
DOUBLE ASTEROID**

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Keywords: *Hera, Milani Cubsat, Laser Retroreflectors, Lidar, Georeferentiation*

ABSTRACT

INFN-LNF delivered through ASI the microreflectors dubbed INRRI (INstrument for landing-Roving laser Retroreflector Investigations) for the ExoMars Schiaparelli Lander in 2015 and for the ExoMars Rover mission in 2018 to ESA. INFN-LNF also delivered through ASI the two identical microreflectors flown on the InSight Lander (LaRRI, Laser RetroReflector for InSight) in 2018 and on the Perseverance Rover (LaRA, Laser Retroreflector Array) in 2020 to NASA. These four microreflectors are small spherical domes with eight 1/2 inch reflectors with a total mass of 25 gr and a 2D size of 56 mm. Exploiting this consolidated Mars heritage INFN started developing custom, miniaturized reflector models for other solar system destinations and for missions equipped with laser devices capable of laser altimetry and ranging. These mission of opportunities have been pursued through ASI. One of these mission is Hera by ESA, which will be launched in 2024 to the double asteroid Didymos. Hera hosts several instruments to study and characterize the double asteroids and their orbits, especially after the impact of NASA's DART. The mothership Hera will also carry two cubesat, one of which, named "Milani", will have onboard two Italian picoreflectors, named MLRH (Milani Laser Retroreflectors for Hera). The MLRH inherit directly from the very same Martial microreflector technology (figure attached). Milani is built as Prime Contractor by Tyvak International for ESA. The two MLRH are installed on two sides of Milani to be released in Didymos orbits by the Hera mothership equipped with a LIDAR instrument (LIght Detection And Ranging). The LIDAR will perform laser altimetry/topography of the asteroids and observe the MLRHs on Milani. Thus, asteroid metric observations by Milani will be metrically tied (georeferenced) by the LIDAR to the mothership and to the asteroids' topography. All Hera metric measurements will then have a highly accurate common georeference system thanks to the LIDAR and the MLRHs. Since the LIDAR observation distance will be shorter than for the heritage Mars missions, the MLRHs are more compact and light: they are built with 7 reflectors of 7.16 mm diameter for a total mass of ~5.1 gr each and a total 2D size of 36 mm.

This research work is carried out and supported under the Agreement between ASI and U. of Bologna n. 2022-8-HH.0 “Scientific Activities for the Hera Mission”, WP 3100 led by INFN-LNF (Italian National Institute for Nuclear Physics – Frascati National Labs).



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