

**MARCH 2021** 

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## LARA: INFN'S CONTRIBUTION TO MARS EXPLORATION

As part of NASA's Mars 2020 mission, the rover Perseverance, that in the coming years will have the task of searching for traces of present or past life on the surface of the Red Planet, landed on Friday 19<sup>th</sup> February. Among the instruments that Perseverance will use during its stay on Mars is the Italian Laser Retroreflector Array (LaRA), developed and built by the SCF\_Lab group at INFN Frascati National Laboratories. LaRA, a device facilitating the identification of the rover by reflecting the light of the laser that will equip the probes expected to reach the Martian orbit in the near future, will perform various tasks, such as measuring the position of the vehicle on the planet's surface, geophysics and geodesy measurements and the verification of Einstein's theory of General Relativity.

Created as part of a collaboration between INFN-LNF and ASI, LaRA is one of the Italian contributions to the Mars Sample Return programme, with which NASA and the European Space Agency (ESA) aim to return samples of Martian soil to Earth by 2030. Consisting of a dome with a diameter of about 5 cm, above which are eight quartz prisms made from the edge of a cube of fused silicon, the micro-reflector is able to reflect light in the same direction as the light itself. LaRA is just the latest in a series of similar instruments made in recent years by LNF, already on Mars or ready to reach the Red Planet in the near future, thanks to which it will be possible to have a sufficient number of devices for the triangulation of the positions of Martian vehicles, thus making a laser navigation system operational in Martian orbit.

LaRA will allow scientists to perform laser-ranging distance measurements to accurately pinpoint Perseverance's position on the Martian surface, test Einstein's theory of General Relativity and make future landings on the Red Planet safer and more precise. However, this will have to wait for the arrival of a future Martian orbiter equipped with a laser system, as laser ranging cannot be performed directly from stations on Earth.



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The micro-reflector was conceived, designed, assembled and tested by the SCF\_Lab, the LNF group specialising in space research. Set up in 2006, the lab is dedicated to the design, definition and modelling of space laser telemetry, the technique that allows distances in space to be measured by measuring the time-of-flight of laser pulses sent from a source to devices equipped with retroreflectors, such as LaRA. This technology will play an important role in the near future of space missions dedicated to exploring the Moon, asteroids and the Red Planet itself.