

The first Laser Retroreflector deployed on the lunar far side onboard China's Chang'e-6 mission

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Abstract: With the support of Queqiao-2 relay satellite, the lander-ascender combination of the Chang'e-6 probe softly touched down at the designated landing area in the Apollo crater inside the South Pole-Aitken (SPA) basin on June 2, 2024. The precise location of the Chang'e-6 landing point is 153.9856°W, 41.6383°S. The INstrument for landing-Roving Laser Retroreflector Investigations (INRRI), one of the four international payloads piggybacked on Chang'e-6, was mounted on the lander top panel. INRRI is the Italian instrument that was originally developed by INFN and ASI for, and deployed on Mars surface missions: ExoMars (ESA), InSight (NASA) and Perseverance (NASA). The successful landing of Chang'e-6 on the lunar surface marks the first precise reference point at the farside of the Moon. In fact, the goal of INRRI is to support positioning metrology for reference frames, geodesy and (in the long term) accurate seleno-location of Chang'e-6. As part of the expanding global laser

retroreflector network on the Moon, INRRI will contribute to the study of gravitational physics and geophysics (the more and the better in the long term). The piggybacking of this instrument was proposed and facilitated by the scientific collaboration team composed of Italian and Chinese scientists in reply to an international Announcement of Opportunity (AO) issued by CNSA in 2018. In order to adapt to the mounting position on Chang'e-6 lander, we conducted adaptive design of INRRI and completed environmental qualification tests according to the conditions at the faside of the Moon. The laser retroreflector INRRI can be observed with the laser altimetry observation instrument onboard LRO and the future lunar orbiter missions. For the subsequent Chang'e-7 and Chang'e-8 lunar polar exploration missions which belong to the Phase IV of China's Lunar Exploration Program (CLEP) in near future, the Sino-Italian bilateral team submitted proposals and will actively promote the deployment of both small retroreflector arrays similar to INRRI and large ones for Earth-Moon Lunar Laser Ranging (LLR) observations.