The 1.2m Kryoneri Telescope:

An ideal facility for science requiring high-cadence multicolor observations

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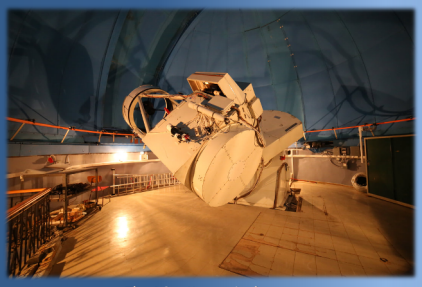
Abstract

The 1.2 m telescope at Kryoneri Observatory joined the Europlanet Telescope Network (EPN-TN) in mid-2020. The facility is equipped with a wide-field twin imaging system, consisting of two fast-frame, sCMOS Andor Zyla 5.5 cameras at the prime focus. This system was developed in 2016, in the framework of the ESA-funded, lunar impact flash monitoring program "NELIOTA", and has been performing lunar monitoring observations since 2017, resulting in over 130 NEO impact flash detections to date. The novelty of the system is the use of a large aperture telescope and the high-cadence achieved by two detectors observing simultaneously at a rate of 30 frames per second in two optical bands. The system provides a field of view of 17.0'×14.4' and reaches limiting magnitudes of 18.7 mag in 10 s in both bands at a 2.5 signal-to-noise ratio level. The above characteristics make it a unique instrument that can be used not only for the detection of NEO impact flashes on the Moon, but also for any astronomy projects that demand high-cadence multicolor observations, such as asteroid occultations, variable source follow-up (e.g. microlensing events, contact binaries), and satellite tracking (e.g. the BepiColombo flyby).

About the Observatory

Established in 1972, Kryoneri Observatory (37˚58'19" N, 22˚37'07" E) is located in the northern Peloponnese at the top of mount Kyllini, at an altitude of 930m. The telescope has a diameter of 1.2 m. It was upgraded and converted to a prime focus instrument in 2016, with an effective focal ratio f/2.8, to support observations of the NELIOTA project. Its IAU Minor Planet Center code is L10. It is operated by the IAASARS of the National Observatory of Athens.



The 1.2m Kryoneri telescope

- A fast frame twin camera system (sCMOS Andor Zyla 5.5) allows for simultaneous observations in the R and I bands with a frame rate of 30 fps and FoV of 17'×14.4' (Xilouris et al. 2018).
- A CCD Apogee Aspen CG47 camera is also attached to the prime focus, allows for observations in the UBVRI Bessell system and provides a FoV of 12'×12'.

Kryoneri telescope prime focus instruments

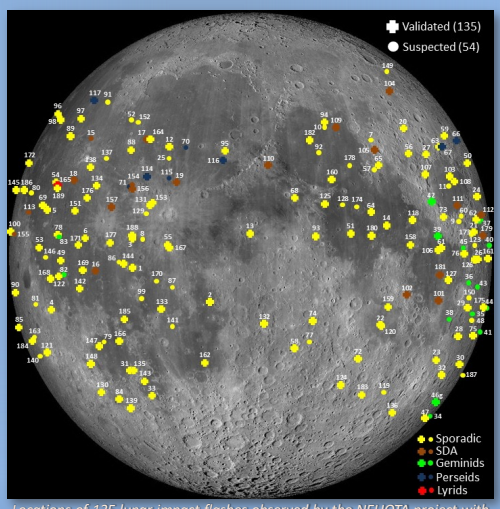
The observatory has a high storage capacity (~36 TB) and is equipped with an autonomous positioning system providing a timing accuracy of less than 10 ms. Accommodation for the observers and staff is provided in the main observatory building.

Panoramic view of Kryoneri Observatory

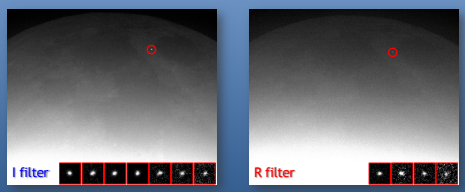
Research Projects

The 1.2 m Kryoneri telescope is used for various astronomical projects, primarily for lunar monitoring for impact flashes with the ESA-funded NELIOTA system. Kryoneri has also passed the tests to join the EU-SST optical network. A list of the main current projects underway at Kryoneri follows:

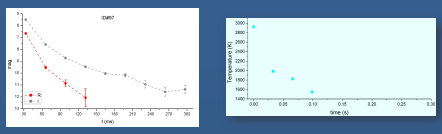
- Lunar monitoring (NELIOTA) *neliota.astro.noa.gr*
- Transients and variable stars (i.e. microlensing, supernovae, eclipsing binaries, pulsating stars)
- NEO and planetary satellite occultations
- Astrometry of planetary objects
- Satellite tracking



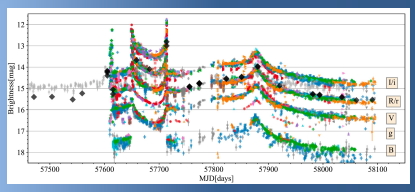
Locations of 135 lunar impact flashes observed by the NELIOTA project with the 1.2 m Kryoneri telescope (2/2017-1/2022). Detected flashes are uploaded to our website within 24 hours of observation.



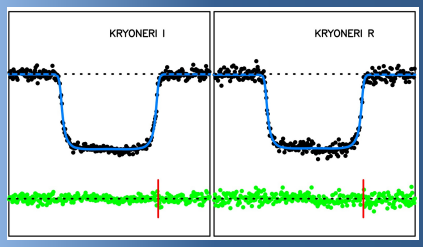
Multi-frame lunar impact flash observed by NELIOTA on 5/9/2018 01:51:37.399 UT. Internal panels show the brightness decrease in each filter over time with a step of 33 ms.



R and I light curves (left) and cooling curve (right) of a multi-frame lunar impact flash (Liakos et al. 2020). The NELIOTA system enabled the first temperature measurement of impact flashes (Bonanos et al. 2018).



The light curve of the microlensing event Gaia16aye, including several R & I datapoints from Kryoneri (Wyrzykowski et al. 2020).



The light curves in I and R filters of the stellar occultation of Triton in 2017 as observed with the Kryoneri telescope (Marques Oliveira et al. 2022).

The Earth flyby of BepiColombo (circled point source) on 10/4/21. Our observations were combined with other data to simulate the trajectory of the spacecraft as a potential NEO threat (Micheli et al. 2021). The stars appear trailed.

Europlanet Telescope Network

Starting in mid-2020, the National Observatory of Athens has committed up to 120 nights annually to the Europlanet TN, and up to 24 nights annually for collaborating projects until early 2024. We invite you to use the Kryoneri telescope for your research!

EUROPLANET TELESCOPE NETWORK

References

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