N E L I O T A

ESA's new NEO lunar impact monitoring project with the 1.2m telescope at the National Observatory of Athens

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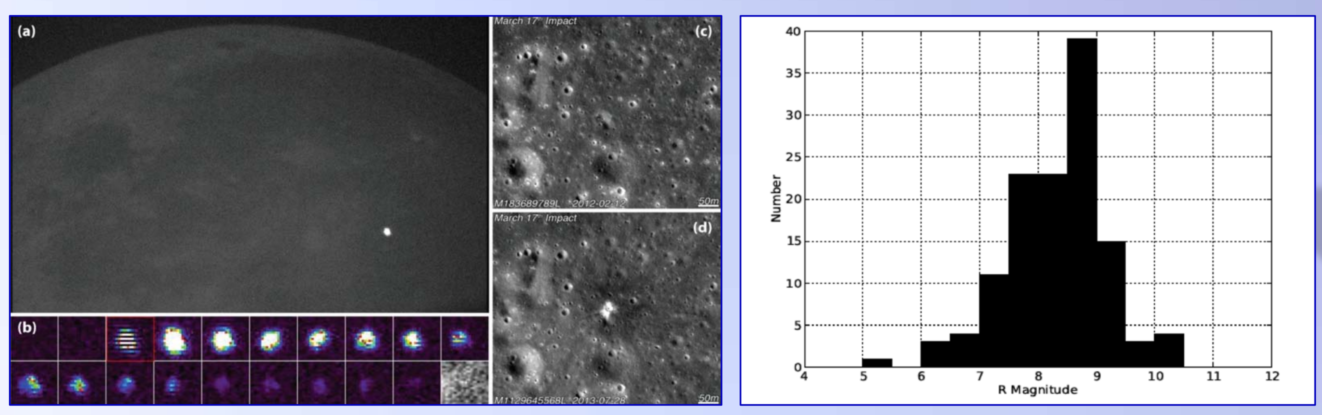
Introduction

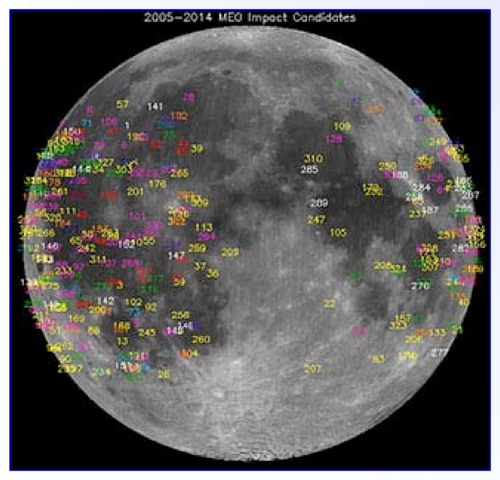
NELIOTA is a new activity initiated by ESA and launched at the National Observatory of Athens, aiming to establish an operational system, which will conduct a lunar impact monitoring campaign to help determine the distribution and frequency of small near-earth Objects (NEOs) in the vicinity of the Earth. The project will use the 1.2 m telescope at Kryoneri Observatory, located in the northern Peloponnese, just 120 km west of Athens, Greece.

The goal is to increase the number of detected faint lunar impacts, and therefore increase the statistics to obtain their size distribution, speeds, frequency, and characterize the impact ejecta. By employing a dedicated telescope larger than those used in existing monitoring programs, we aim to push the detection limit for the first time to R=12 mag. These data will be valuable to NASA's Marshall Space Flight Center, which is responsible for characterizing the meteor environment and providing guidelines to spacecraft manufacturers for protection of their vehicles, as well as to ESA future space mission planning.

Lunar Impact Flashes



Left: A lunar impact flash detection example (panel a) showing the individual images taken at a 30 fps rate (panel b) and the crater detection by the *Lunar Reconnaissance Orbiter* (panels c and d). *Right*: Histogram of peak magnitudes of 126 impact flashes observed in 5 years, during 267 hrs of monitoring (Suggs et al. 2014).

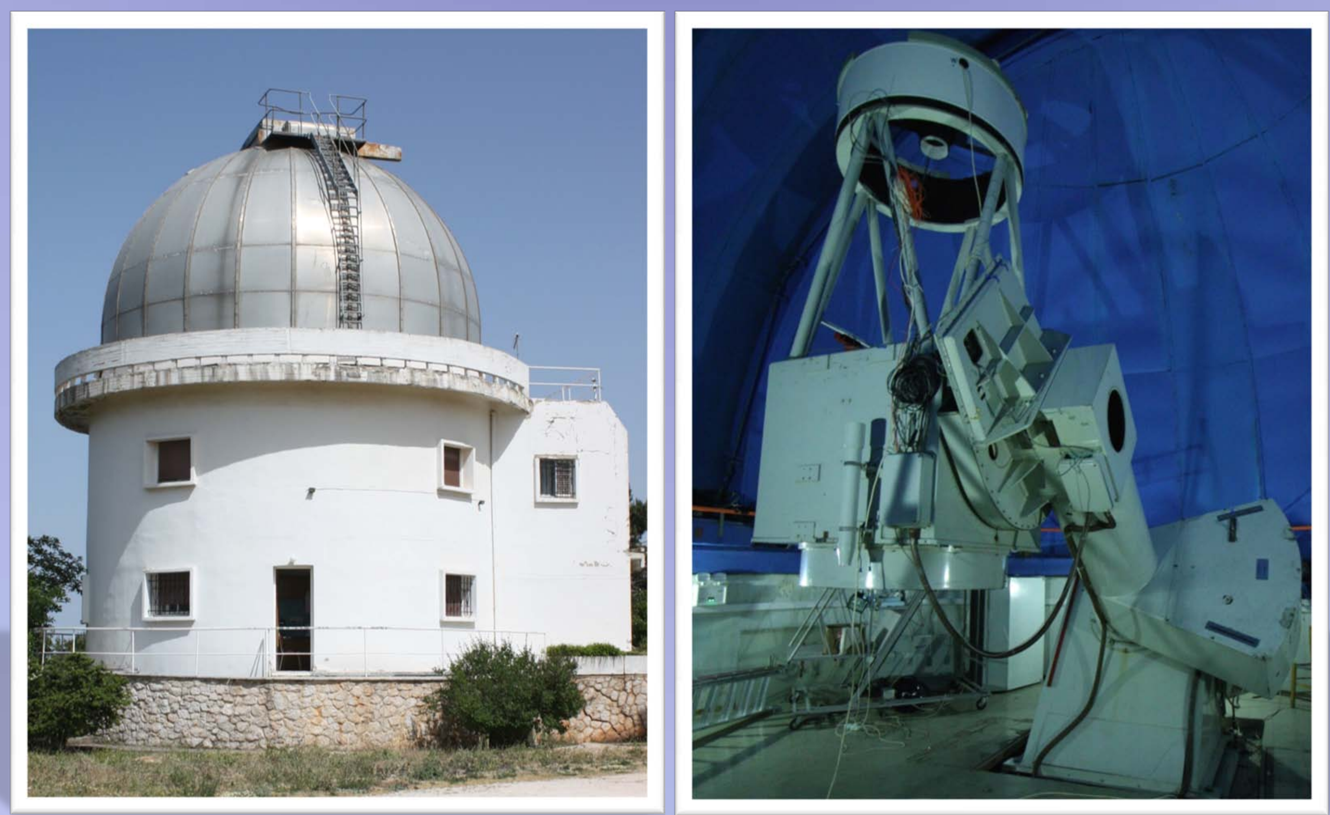


Location of impact flashes detected by the group at NASA Marshall Space Flight Center.

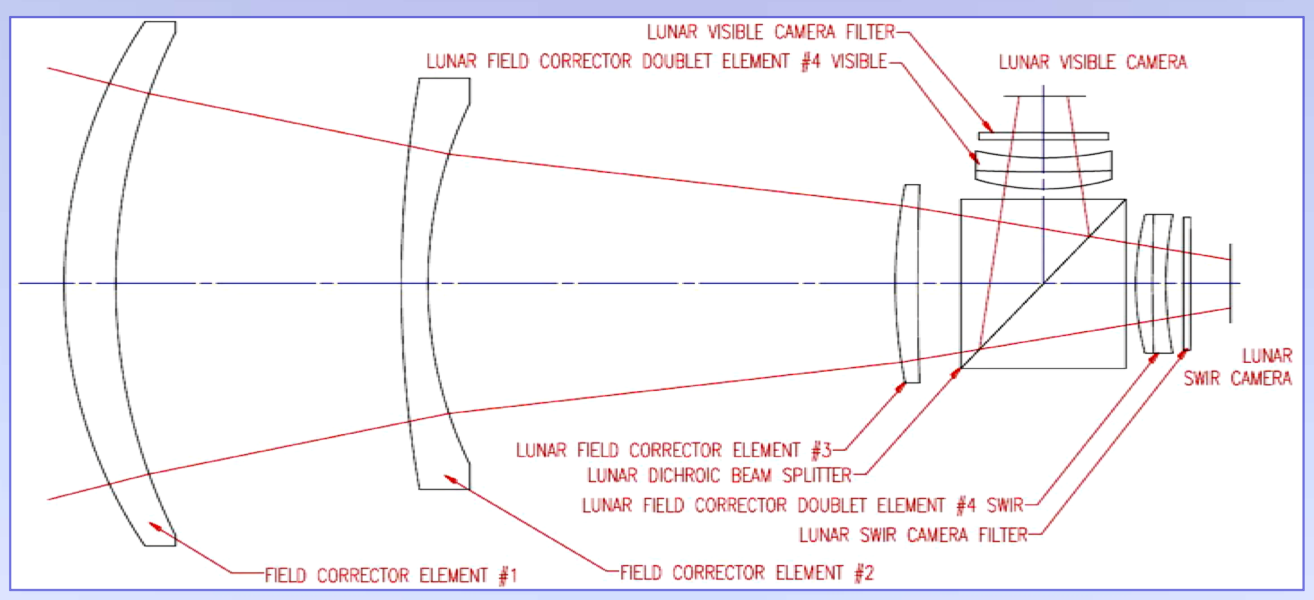
Telescope upgrade and Instrumentation

The 1.2 m reflector telescope at Kryoneri Observatory was manufactured and installed in 1975 by the British company Grubb Parsons Co., Newcastle. In June 2016, DFM Engineering, Inc. completed the full upgrade the telescope, which involved: a) replacement of all electronics by a completely modern telescope control system, b) installation of new servomotors and encoders in both motion axes, c) automatization of the dome, and d) replacement of the secondary mirror by a new optical-mechanical system with a dichroic beam splitter that will host two cameras and allow for imaging at the telescope's prime focus.

The project will use two ANDOR Zyla 5.5 sCMOS cameras, which will simultaneously record the Moon in the R and I passbands, respectively, at a frame rate of 30 fps.



The Kryoneri Observatory building (left) and the 1.2 m telescope (right).

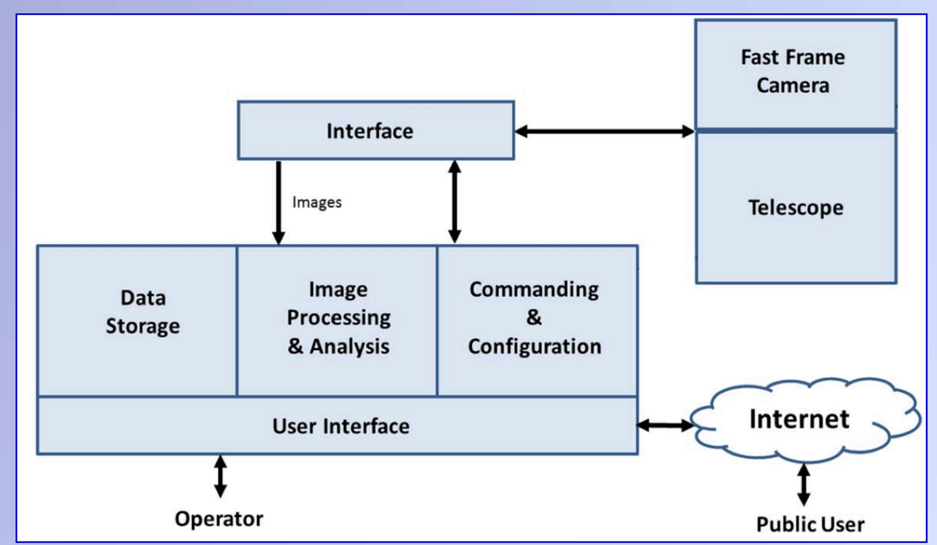


The prime focus optical design by DFM Engineering, Inc.

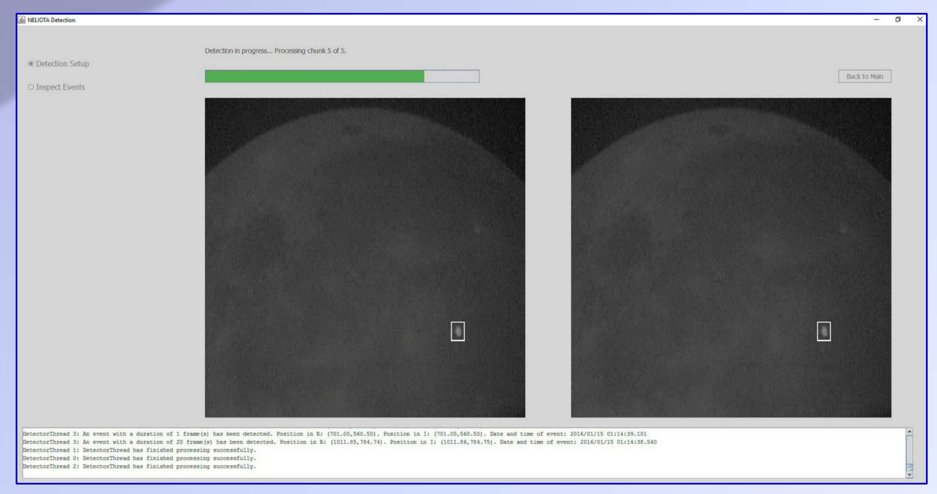
System Design

The components of the NELIOTA system comprise of the telescope, two fast frame cameras, a data storage and a specialized software installed on a powerful processing system, which outputs detected and validated events to the public. An expert user will confirm validated events detected by the software. These will be published to our online, interactive web-based system and be made available to public and registered users.

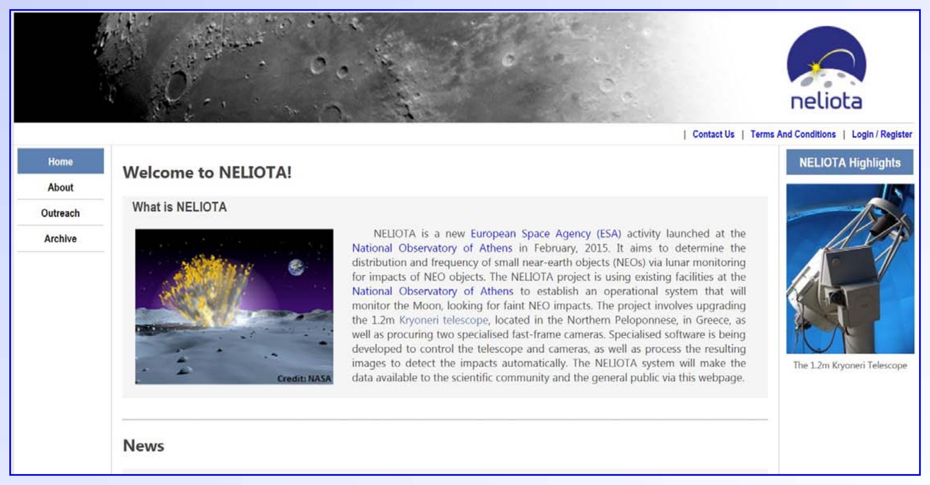
The NELIOTA software will be installed on a Windows Server and will be capable of: a) creating the observing plan of the night, b) commanding both the telescope and the cameras, c) calibrating the data using the technical frames, d) analyzing the data and detecting flashes, d) calculating the magnitudes and the selenographic coordinates of the flashes, and f) data archiving.



NELIOTA data acquisition, analysis, and distribution system design.



The flash detection algorithm running in the NELIOTA software.



The Home Page of the NELIOTA website.

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http://neliota.astro.noa.gr