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**DART time of impact observations and long-term photometry of Didymos from the LCOGT Network**

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**ABSTRACT**

The LCO NEO Follow-up Network is using the telescopes of the Las Cumbres Observatory (LCO) Global Telescope (LCOGT) Network and a web-based target selection, scheduling and data reduction system to confirm Near Earth Object (NEO) candidates and characterize targets of special interest such as radar-targeted known NEOs, close passing NEOs, potential and actual mission destinations. The impact of NASA's Double Asteroid Redirection Test (DART) spacecraft into Dimorphos, the secondary of the binary asteroid 65803 Didymos, occurred on 2022 Sep. 26 23:14 UTC during the night for LCO's South Africa site. We used three of LCO's 1-meter telescopes and the fast readout guider cameras to obtain quasi-simultaneous

multicolor data covering the time of DART's impact and for several hours after. The images and photometry from the time of impact allow study of the initial impact and resulting effects.

During the month after the impact, Didymos was in the Southern Hemisphere where LCO has most of its telescopes. The LCOGT Network comprises twelve 1-meter telescopes, with eight located in the Southern Hemisphere at Cerro Tololo (Chile), SAAO (South Africa) and Siding Spring Observatory (Australia). In addition, there are four additional 1-meter telescopes, two each at McDonald Observatory (Texas) and Tenerife (Canary Islands), ten 0.4-meter telescopes at the above sites and at Haleakala (Hawaii), where one of the two 2-meter telescopes is also located.

In addition to using the network of 1-meter telescopes to obtain high-precision light curves of Didymos to determine the new binary period after the DART impact (Thomas et al. 2022; Scheirich et al., Naidu et al., Moskovitz et al. this meeting), we used the LCOGT Network for nightly cadence observations. This utilized our cloud-based observing portal (NEOexchange; Lister et al. 2021) to schedule each telescope site. The combination of a distributed global network of robotic telescopes, with flexible queue-based scheduling, has allowed regular monitoring of the evolving brightness of Didymos and the ejecta tail every ~8 hours over a period of three months. We supplement these single filter observations and cadence with data in other filters and with the 4-channel MuSCAT3 (Narita et al. 2020) imager on Faulkes Telescope North on Haleakala through collaboration with schools and other groups in the United Kingdom who are making use of the educational interfaces to the LCOGT observing system to obtain additional data which is used in a combined analysis.

We present both immediate impact results and long-term photometric data of the evolution of the Didymos ejecta cloud and tail. These observations were obtained with LCO NEO Follow-up Network starting at the time of impact of the DART spacecraft and continuing for hours to months after the event. In addition, we will describe our current developments and future plans, including incorporating 0.4-meter to 8-meter diameter telescopes through AEON, the Astrophysical Events Observing Network. This will allow a network of robotic and part-robotic telescopes including LCO, the SOAR 4-meter and the Gemini 8-meter telescopes to operate together and respond rapidly for NEO characterization observations on targets of interest, including new and close-passing NEOs.

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