The LCOGT near-Earth-object follow-up network

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[1]Las Cumbres Observatory Global Telescope Network (LCOGT)

Las Cumbres Observatory Global Telescope (LCOGT) network is a planned homogeneous network that will eventually consist of over 35 telescopes at 6 locations in the northern and southern hemispheres [1]. This network is versatile and designed to respond rapidly to target of opportunity events and also to do long term monitoring of slowly changing astronomical phenomena. The global coverage of the network and the apertures of telescope available make the LCOGT network ideal for follow-up and characterization of a wide range of solar-system objects (e.g. asteroids, Kuiper-belt objects, comets) and in particular near-Earth objects (NEOs). There are 3 classes to the telescope resources: 2-meter aperture, 1-meter aperture and 0.4-meter aperture.

We have been operating our two 2-meter telescopes since 2005 and began a specific program of NEO follow-up for the Pan-STARRS survey in October 2010. The combination of all-sky access, large aperture, rapid response, robotic operation and good site conditions allows us to provide time-critical follow-up astrometry and photometry on newly discovered objects and faint objects as they recede from the Earth, allowing the orbital arc to be extended and preventing loss of objects.

These telescope resources have greatly increased as LCOGT has completed the first phase of the deployment, designated as "Version 1.0", with the installation, commissioning and ongoing operation of nine 1-meter telescopes. These are distributed among four sites with one 1-meter at McDonald Observatory (Texas), three telescopes at Cerro Tololo (Chile), three telescopes at SAAO (South Africa) and the final two telescope at Siding Spring Observatory (Australia). In addition to the 1-meter network, the scheduling and control system for the two 2-meter telescopes have been upgraded and unified with that of the 1-meter network to provide a coherent robotic telescopic network. The telescope network is now operating and observations are being executed remotely and robotically.

I am using the LCOGT network to confirm newly detected NEO candidates produced by the major sky surveys such as Catalina Sky Survey (CSS) and Pan-STARRS (PS1) with additional targets coming from the NEOWISE satellite and the Palomar Transient Factory (PTF). Robotic observations of NEOs and other solar-system objects have been routinely carried out for several years on the 2-m and 1-m telescopes, with over 20,000 positional and magnitude measurements reported to the Minor Planet Center (MPC) in the last two years. We have developed software to automatically fetch candidates from Pan-STARRS and the MPC Confirmation Page, compute orbits and ephemerides, plan and schedule observations on the telescopes and retrieve the processed data [2]. The program is being expanded which will allow us to greatly increase the amount of survey discoveries that are followed-up, obtain accurate astrometry and provide important characterization data in the form of colors, lightcurves, rotation rates and spectra for NEOs. An increasing amount of time is being spent to obtain follow-up astrometry and photometry for radar-targeted objects in order to improve the orbits and determine the rotation periods. Priority for follow-up is now given to the fainter and most southern targets on the Confirmation Page, objects that are scheduled for Goldstone/Arecibo radar targeting and those objects which could become potential mission destinations for spacecraft. This will be extended to obtain more light curves of other NEOs which could be Near-Earth Object Human Space Flight Accessible Targets Study (NHATS) or Asteroid Retrieval Mission (ARM) targets.

With the increase in time available from the LCOGT 1-meter network and commissioning of low-resolution spectrographs on the 2-meter telescopes for moving objects, this will produce a large advance in capabilities for NEO follow-up and characterization. This will produce an unprecedented network for NEO follow-up, particularly in the Southern Hemisphere where there is currently a shortage of suitable facilities. We will continue to develop our software to take advantage of the increased resources and capabilities of the LCOGT Network.

References: [1] Brown, T. M et al. (2013). "Las Cumbres Observatory Global Telescope Network". PASP 125, 1031. [2] Lister, T. A. (2012). "Solar System Science with Robotic Telescopes". IAU Symposium 285, 352.