EPSC Abstracts
Vol. 13, EPSC-DPS2019-1702-1, 2019
EPSC-DPS Joint Meeting 2019

EPSC
EPSC-DPS Joint Meeting 2019
15–20 September 2019 | Geneva, Switzerland

Faint asteroid observations by the UH NEO Follow-Up Program

Dora Föhring, Dave Tholen and Denise Hung
Institute for Astronomy, University of Hawai'i, 2680 Woodlawn Dr, Honolulu, HI 96822, USA (fohring@hawaii.edu)

Abstract

The number of Near-Earth Objects (NEOs) discovered is increasing each year. Follow-up of these objects is essential in order to improve their orbits and to prevent them from getting lost, particularly for Virtual Impactors (VIs), asteroids whose orbital solutions intersect that of the Earth. We present observations of faint asteroids that have been recovered using the University of Hawaii (UH) 2.2m telescope and the Canada-France-Hawaii Telescope, as part of the UH NEO Follow-Up Program. In the year 2018, we reported nearly 3000 observations, focussing on VIs and current and future 1-opposition asteroids fainter than V$\sim$21 mag. The median measured seeing at the UH 2.2m telescope was 1.0" and the mean apparent magnitude of our reported targets was V$\sim$22.0 mag. These results were obtained through non-sidereal tracking and stacking of faint images to reach a Signal-to-Noise $>\sim$ 5. We regularly achieved RMS residuals of the astrometric fit and of the orbital solution of 0.05 arcseconds using GAIA. Using the UH 2.2m telescope, we have reported objects as faint as V=25.3$\pm$0.3 with a Signal to Noise Ratio of $\sim$4.

1. Introduction

In 2006 Congress tasked NASA to discover 90% of NEOs larger than 140m. As a result of this directive, to date, over 20000 NEOs have been discovered, with a rate of discovery increasing almost every year. Additionally to the large asteroids capable of global impact, this has lead to an increasing number of smaller NEOs (currently over 10000) to being found. These are still capable of causing major disruption if they land in populated areas. With the coming online of LSST, it is predicted that the rate of discovery of NEOs will increase by a factor of ten. After discovery, the follow-up of an NEO is critical to ensure the object has a long enough arc to prevent it from getting lost. In order to deal with the increasing discovery rate of NEOs and the multitude of important but challenging small objects that are being discovered, there is a need for facilities capable of performing follow-up objects towards the fainter end of observability.

2. Observations

Using the UH-2.2m telescope, we have observed Virtual Impactors (VIs) as faint as V=25.5, thanks to the combination of excellent seeing on Maunakea, no filter and our photometric methods involving trailed long exposures and image stacking. Over the last 2 years, we spent around 30% of our observing time dedicated to observing NEOs fainter than V=23 and 30% of our time observing fainter than V=24. Our faintest observation recently has been 2012 QQ10, at V=25.3, requiring 6.25 hours of observation time over two nights. Recent highlights of our observing program have been:

- Observations of 99942 Apophis, the object that holds the record for highest Palermo value ever reached, which we observed at a very low altitude of 16 degrees, pushing the observing limit of our telescope.
- The second opposition recoveries of VIs 2017 RH16, 2002 EM7 and 2018 LR3. Compared to previous years, we have reduced our overheads by increasing the automation in the observing procedures and we are optimising our observations with the aid of in-house software to prioritize observations, which takes an object's future orbital uncertainty into account. These, together with recent upgrades to telescope hardware place us at the forefront of being able to respond to critical and challenging follow-up requirements.

3. Summary and Conclusions

With the increasing rate of NEO discovery due to new facilities coming online such as PS-2, ZTF, and future addition of LSST, follow-up of targets is crucial to prevent them from getting lost. There is an increasing

need for facilities capable of performing follow-up of objects towards the fainter end of observability. The UH NEO Follow-Up Program is at the forefront of being able to respond to critical and challenging follow-up requirements.

Acknowledgements

This work is supported by NASA grant NNX13AI64G.