Physical Properties of NEAs are Scrutinized via EURONEAR

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ABSTRACT : Lightcurves and spectra of a few PHAs and NEAs have been observed in 2011, 2013 and 2014, part of the European Near Earth Asteroids Research project (EURONEAR, euronear.imcce.fr). We brief our results. In 2011 we used the WHT-ACAM in service mode to observe for 8 hours during 3 nights the lightcurve of the VI (101955) Bennu (NASA target of OSIRIS-ReX). Due to the difficult observing circumstances, PSF fitting technique was used to derive accurate magnitudes needed to check the rotation period. Part of an international effort lead by NASA, in 2013 we used the INT for 5 hours to observe the photometry of the PHA (163249) 2002 GT (possible target of the former Deep Impact mission). Accurate data was obtained by a few telescopes, and the INT and TMO lightcurves (the Southernmost observing sites involved in this campaign) show a small growing trend (compared to the other sites) suggesting maybe a possible satellite or very distorted shape for this object. In 2014A we were awarded 7 nights with the INT for photometry of NEAs (using the WFC) and visible spectroscopy (using the IDS). Part of this program, visible spectra of 9 NEAs were acquired and lightcurves of 6 NEAs were observed during 7 nights, and the run continues. In a complementary work we used the 0.6m Modra telescope to observe lightcurves of 4 more NEAs, part of the same EURONEAR project to contribute to NEA characterization. We plan to continue these efforts in 2014B and beyond, using the INT and other facilities accessible by the EURONEAR network, carefully planning for the best NEA visibility circumstances and complementing other data available in the literature.

NEA PHOTOMETRY (LIGHT-CURVES)

Institutional and smaller national 1-2m facilities, educational/amateur telescopes and coordinated network could bring a great contribution to the NEA research! Two papers to be submitted soon based on first such observations of about 25 NEAs.

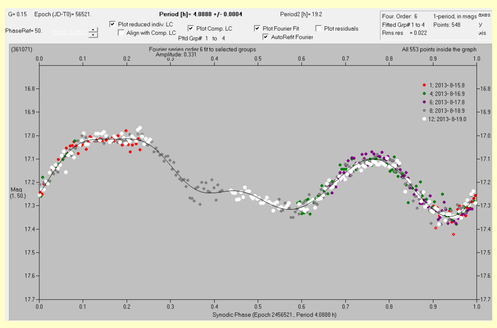

Fig. 1 : Smaller 1m class facilities are easiest to secure for many nights but require good weather. Lightcurve of NEA (361071) observed in Aug 2013 during 4 nights using Modra 0.6m telescope allowed accurate period determination (thanks to Petr Pravec for his ALC software).

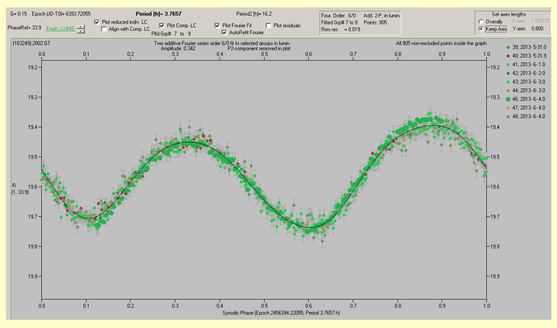

Fig. 2 : Coordinated simultaneous network observations using 1-2m facilities allow determination of accurate periods. April 2013 INT data (solid green symbols) of the VI (163249) 2002GT (former NASA Deep Impact target) evidences some curious residual trend compared with other Nothern stations, suggesting binarity?

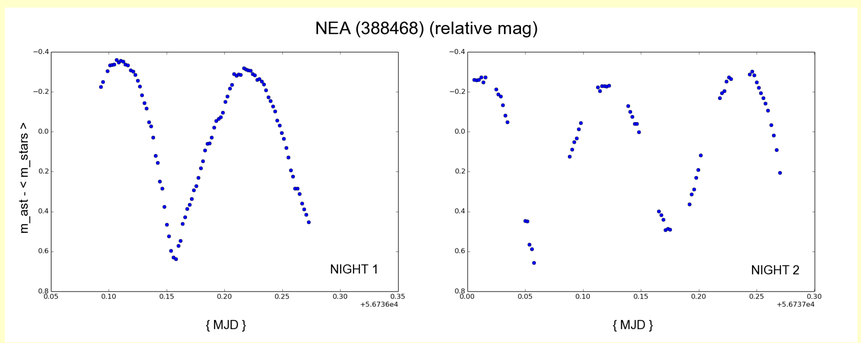

Fig. 3 : Medium size 2m facilities are more difficult to obtain for many nights (less friendly TACs, limmited number of nights available). Onsite pipeline data reduction allow better planning for observations of more objects in the available time. Lightcurve of NEA (388468) observed in Mar 2014 during two nights using the INT. First night limited time was available (left plot), thus data was reduced rapidly, allowing better planning during second night (20+20 min alternating series to observe another object during the little time 3n available – right plot).

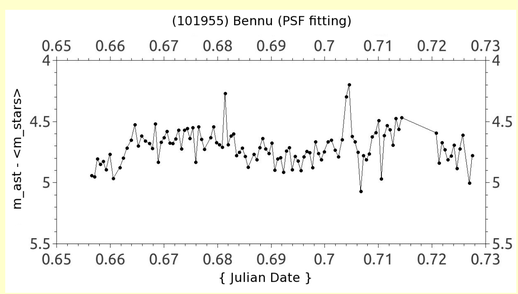

Fig. 4 : VI (101955) Bennu, NASA OSIRIS-REx target WHT 5 Nov 2011. PSF mag lightcurve was derived by amateur student Oana Suciu due to low S/N (V=21.8 plus low altitude). About 2h window sampled half period.

RAPID PHOTOMETRY DATA REDUCTION

The ING student Vlad Tudor developed recently a new Python and IRAF pipeline for the INT WFC rapid data reduction (~1hr). Input : original images, flats, biases, two NEA measured X,Y positions (first and last in the series). Output : NEA lightcurve and other plots including relative calibration stars.

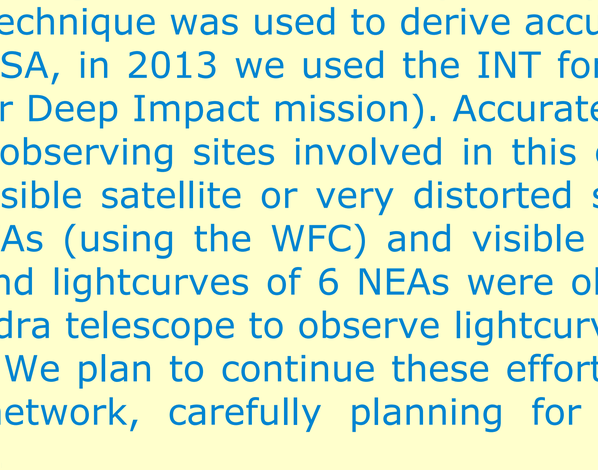

Fig. 5 : NEA (68031) INT one night plot output (derived with our new pipeline) revealing very small amplitude with some rotational pattern which could suggest a fast rotator. The two peaks are due to faint nearby stars.

NEA SPECTROSCOPY (VIS and NIR)

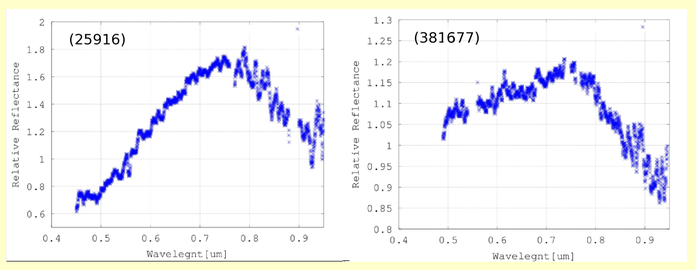

Fig. 6 : INT IDS visible spectroscopy of NEAs (25916) and (381677)(Feb 2014, spectra of 9 NEAs were observed in 2014A, probably pioneering NEA spectral work on the INT).

SEMESTRAL PLANNING THE TARGETS

For all known NEAs to date, we use the IMCCE MIRIADE and VISION services and some local pipeline to plan NEA targets observable for an observing site during a specific date interval or one entire semester. In the future, we plan to integrate this planning pipeline as an online interface in our EURONEAR website.

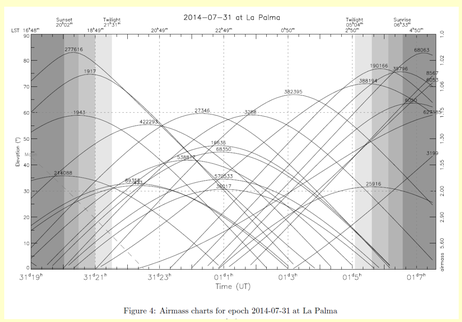

Figure 4: Airmass charts for epoch 2014-07-31 at La Palma

Fig. 7 : IMCCE VISION output showing observable NEAs from La Palma for the 31 July 2014 night. Lists of objects covering one entire semester can be also produced using our pipeline.

* Thinking to join EURONEAR? Email: euronear@imcce.fr