

Case Study: Global Relay for Asteroid Light Curve and Parallax

Design a simple observing campaign for observing a newly discovered asteroid from PTF. A list of newly discovered asteroids with well-determined orbits is available at:

http://www.astro.caltech.edu/~waszczak/ptf_small_body_discoveries.html

You can click on any of these entries to get the page at the minor planet center (MPC) that contains more information on the orbit for the planets.

The listing also include orbital elements for the object. Note how for 2015 AH44 the orbital elements appear in the first line of the target.

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Comets discovered/co-discovered by PTF (3 total)
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CR139030 2014 11 23.6022 8.646291 1.001232 177.1711 177.3758 93.9148 20150601 5.5 4.0 C/2013 P3 (Palomar) MPC 92272
CR13226P 2015 08 16.4470 6.536950 0.999087 145.1591 153.9877 25.3797 20150601 6.5 4.0 C/2012 LP26 (Palomar) MPC 2015-J41
PR11042B 2018 06 23.8196 2.523441 0.280357 173.2749 58.7253 8.4827 20150601 13.0 2.0 P/2011 CM42 (Catalina) MPC 86639
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Near-Earth asteroids discovered by PTF (20 total)
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K15A44E 24.4 0.15 K156R 84.02911 4.97607 114.42120 16.03421 0.4479945 0.40283358 1.8154338 5 MPO331371 40 1 8 days 0.46 M-v 3Ea MPCALB 0894
K14V99P 23.3 0.15 K156R 113.88865 288.01482 89.82533 24.06547 0.5239760 0.48461545 1.6008309 4 MPO318047 121 1 8 days 0.39 M-v 3Ea MPCW 0893
K14W07B 27.3 0.15 K156R 78.15791 194.24164 238.23825 8.68444 0.4763718 0.37904658 1.8709251 6 MPO318756 24 1 1 days 0.39 M-v 3Ea MPCALB 0892
K14W07K 22.4 0.15 K156R 111.35711 188.83384 233.78876 23.91054 0.3687359 0.50564447 1.5404113 6 MPO318755 53 1 15 days 0.48 M-v 3Ea MPCALB 0891
K14071L 24.4 0.15 K156R 122.44742 74.18535 232.55743 2.06881 0.6500435 0.42374426 1.7554873 7 MPO313410 96 1 4 days 0.44 M-v 3Ea MPCALB 2893
K148M7P 27.6 0.15 K156R 319.73455 273.55227 359.93775 5.87526 0.1783853 0.51181724 1.8532485 6 MPO322349 41 1 22 days 0.58 M-v 3Ea MPCALB 2892
K148R5C 25.7 0.15 K156R 170.71060 225.26164 183.92934 20.16794 0.2045224 0.32895508 1.2216279 6 MPO339129 42 1 6 days 0.38 M-v 3Ea MPCALB 2891
K148R5D 28.5 0.15 K156R 182.12882 25.81888 181.12888 28.82188 0.3183329 0.51133332 1.3183333 7 MPO339130 51 1 7 days 0.38 M-v 3Ea MPCALB 2890
    
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IAU The International Astronomical Union
Minor Planet Center
The nerve center of asteroid detection in the Solar System

OBSERVERS PUBLIC IAWN

2015 AH44

First observed at Palomar Mountain--PTF on 2015-01-15.

(Discoverer will be defined when the object is numbered. See [this note](#) on how discoverers are determined.)

Orbit

Orbit type: Amor

Near-Earth Object

[Interactive Orbit Sketch](#) Note: WebGL enabled browser required.

epoch	2014-12-09.0	semimajor axis (AU)	1.8168809	uncertainty	5
epoch JD	2457000.5	mean anomaly (°)	343.49925	reference	MPO 331371
perihelion date	2015-01-19.00054	mean daily motion (°/day)	0.40245210	observations used	40
perihelion JD	2457041.50054	aphelion distance (AU)	2.632	oppositions	1
argument of perihelion (°)	4.83905	period (years)	2.45	arc length (days)	8
ascending node (°)	114.44127	P-vector [x]	-0.48609551	first opposition used	2015
inclination (°)	16.03341	P-vector [y]	0.79223988	last opposition used	2015
eccentricity	0.4484115	P-vector [z]	0.36887277	residual rms (arc-secs)	0.46
perihelion distance (AU)	1.0021706	Q-vector [x]	-0.83695025	perturbers.coarse.indicator	M-v
Tisserand w.r.t. Jupiter	3.9	Q-vector [y]	-0.54348418	perturbers.precise.indicator	003Eh
ΔV w.r.t. Earth (km/sec)	7.0	Q-vector [z]	0.06433677	first observation date used	2015-01-15.0
		absolute magnitude	24.4	last observation date used	2015-01-23.0
		phase coefficient	0.15	computer name	MPCALB

Now let's examine one or more of the asteroids - try to get coordinates for the objects - then design a global observing campaign!

To get coordinates for an object you can enter the orbital elements into a planetarium program such as SkySafari, TheSky, etc. OR you can use the JPL Horizons database, and look up the coordinates for the object tonight!

The JPL Horizons database is at: <http://ssd.jpl.nasa.gov/horizons.cgi>

You will want to change the "target body" to your selected solar system object - this will then generate an ephemeris (with coordinates) and also give approximate magnitudes of the objects.

For your observing campaign:

1). Choose a set of 3-4 global observatories you would like to use, and provide coordinates for these observatories and a sample observing program that will give you a 24 hour light curve for the asteroid. This sort of light curve is very useful for determining the shape of the asteroid.

2). Determine how accurately can you measure parallax for this asteroid, given a pair of observatories and an accuracy of centroiding within CCD images for the two observatories of 0.2 arc seconds. For your object, provide an estimate of its parallax, and the precision of a distance determination using the pair of observatories with the best baseline.

3). Comment on whether the chosen objects are observable - are they the right magnitudes, and coordinates for visibility?

Note too how many of the near-earth objects that are discovered at PTF move away from earth and become too faint to observe - this is one good reason for a rapid global followup - sometimes it will take many years for them to become "near-earth" objects again!