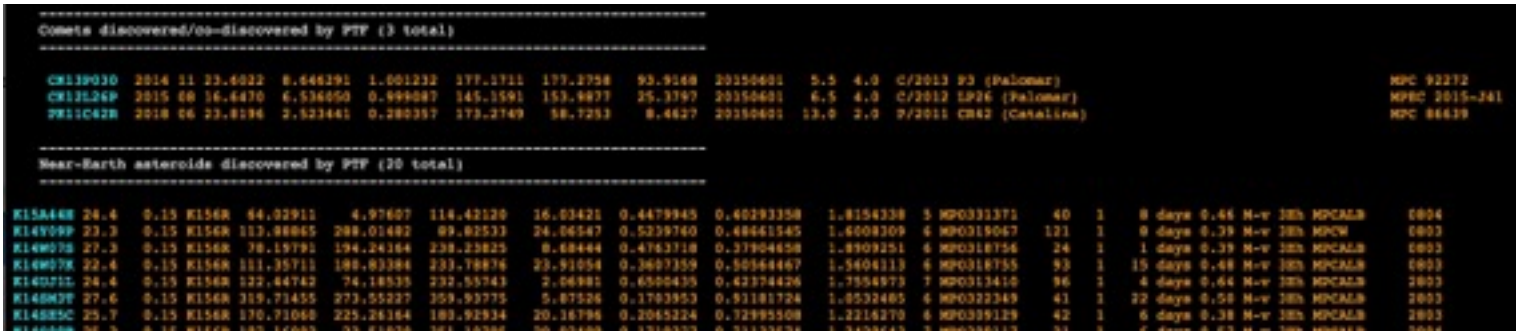
Case Study: Global Relay for Asteroid Light Curve and Parallax

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.



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 (°)	16.03541	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	005Eh
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
			0.15	computer name	MPCALB

minorplanetcenter.net

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!