



Finding moving objects with Heavens Above

Instructions

STEP 1. Finding known comets to observe

A useful website which many astronomers use to work out what is visible in the sky is:

www.heavens-above.com

This website lists all sorts of different objects which are visible from your location.

Setting up Heavens Above

1. **Set the location of the telescopes:** From the Heavens Above homepage, click on the link, **Change your observing location (under Configuration)**, and set the location of

Summary

Short Description: This document explains how to find known comets to observe with the LCO telescopes, but similar steps can be taken to find known asteroids to observe.

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Suitable for age: 14-18 years

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Format: .doc

Link: www.heavens-above.com

your observing site (one of the sites of the LCO telescopes). These can be saved as defaults for future use. **Hint: If you set up a user account, you can set up multiple observing sites.**



Finding asteroids/comets

1. From the Heavens Above homepage, scroll down to **Astronomy > Asteroids** or **Astronomy > Comets** and click on the link to find a list of the brightest currently available asteroids or comets. Clicking on their names gives further details including finder charts. However, these won't all be visible to you at the time your observing session is planned. **Set the date/time option at the top of the screen to the time of your session.**

STEP 2: Checking the observability of comets with the Minor Planet Centre

Although the comets listed in Heavens Above may well be up in the sky at the time/date that you set, the LCO Telescopes may not be able to observe them if they are too low in the sky. These telescopes have an altitude limit of 25 degrees - any objects less than this altitude in the sky cannot be observed by the telescopes. To check the observability of any comet found in Heavens Above, you must query the [Minor Planet Centre \(MPC\) website](#).

Getting the observing data:

1. Go to the [Minor Planet & Comet Ephemeris Services webpage](#).
2. Enter the name of the object you wish to observe in the first box, e.g. **C/2012 S1 (ISON)**
3. Enter the date and the **START** time of your observing slot into the next box titled '**Ephemeris start date**', in the format "**2013 11 05 1000**" (this would be 10:00 UT on 5th November 2013)
4. Enter "**30**" in the box on the right titled '**Number of dates to output**'
5. On the next line, select the option '**minutes**'
6. In the box labelled '**Observatory Code**', enter "**F65**" if you are using Faulkes North (Haleakala), or "**E10**" if you are using Faulkes South (Siding Spring). You can find the codes for the other LCO telescope sites here on their [MPC codes webpage](#).
7. Then click on the upper or lower bar labelled '**Get ephemerides/HTML page**'

You will then see 30 lines of data starting with the date/time you selected and showing (amongst other things) the coordinate information for the object every minute for the following 30 minutes.

Checking everything is ok:

1. Check that the column headed '**Object Alt.**' (the object's altitude) has values **>25** (degrees) in it. If not, this object will **not be visible** from the telescope on that time and date.
2. If the object is visible during the time of your observing slot, you should make a note of the two positions under the heading '**R.A. (J2000) Decl.**'. These are the values for the Right Ascension and the Declination which need to be entered as the coordinates for pointing the telescope.
3. Check the **moon phase and distance parameters**. When the moon is brighter (full or close to full) it can be more difficult to image faint, diffuse objects like comets. Also the distance from your object (measured in degrees) can seriously impact how good the images are. So if your lunar distance for example is **<30** degrees and the phase is bright (say 0.7 or higher), your images may not be very clear.



4. Finally, check the column headed '**Sky motion "/min**'. This shows how fast the object will move across the camera. Make a note of the value given in the column, and read the next section for information on how to decide on the best exposure time for your objects.

For the above time, the first position shown is: R.A. 11h 36m 59.5s and Decl. +03d 07' 43" but the object alt is -60 from E10 so this would not be a suitable object to observe from Siding Spring on the given time and date.

STEP 3: Observing criteria - Exposure times and filters

Exposure times

Asteroids and comets move in the sky, so to make sure that any images that you take don't have trailed objects, you must choose an exposure time based on the pixel scale of the camera on the telescopes.

You can find the sky motion/min from the MPC Ephemeris results. If the value listed is given as 0.92"/min this is 0.92 arcseconds in a minute. So how do we use this information to estimate an exposure time?

If we want to take a picture of an asteroid/comet we **divide the pixel size of the camera by the sky motion value** - this gives a time in minutes that we can take the image for, before the object's movement will start to trail on the images, and make doing any real science more difficult (or even impossible).

e.g. the 2metre FT cameras have pixel sizes of 0.27" x 0.27" so for the above example:

$$0.27/0.92 = 0.34 \text{ minutes} = \text{approx. } \mathbf{20 \text{ seconds.}}$$

The pixel sizes of each camera on the LCO telescopes can be found on the [LCO website](#).

We have developed a quick look-up table for moving objects below:

Sky motion "/min	Exposure Time in Seconds
1.2"/min	15 s
0.6"/min	30 s
0.3"/min	60 s
0.15"/min	120 s

Note: If the object is brighter than magnitude 12, we recommend quite short exposures even if the object's movement allows you to take longer ones. Ideally **10 seconds at maximum** would be enough, as greater than this may also over expose the object and make doing any science difficult.



Filters

The temptation may be to take colour images, but this is not ideal for the science, as the filters (Red, Green and Blue) which make up a colour image, all have different characteristics. Astronomers usually use specialist filters with comets so that they can study the gas and dust components.

The astronomers working with FT recommend using the red filters, **so select either the 'Bessel R' or 'SDSS r' filter (unless you are using the 2m FTN in which case you can only use the 3 colour MusCat camera).**

How many images should I take?

For comets and asteroids, scientists usually take a good number of images. The RTI observing interface will add about 50 seconds at the end of each image to do its processing and show you an image, but here, time is critical, so we'd recommend that you only check that the object is in the first image, and then don't look at the images for the rest of the session, as the more good quality images you get, the better.

So, if you're aiming to take 10 images of an object, with each image of 20 seconds in duration, and adding in the overhead of the processing, this will probably come close to taking up your 30 minutes of time for an RTI session.

If you have other objects which you'd like to image, you should think about decreasing the number of images taken of the asteroid/comet.



ADDITIONAL INFO: What's in a name?

To access the minor planet centre ephemeris service properly, you need to **input the name of the object correctly**. So whilst you may know Comet Halley for example, its proper name is **1P Halley** or **1P**. Your list of comets may also include names like **C/XXXX YY** or **P/XXXX YY**. The X's refer to the date usually (e.g. C/2012 P1 - the 2012 being the year the comet was first discovered). The last two digits refer to a date within that year when the comet was found.

So how is a comet named?

The IAU designate names for comets in the following way:

1). They assign the comet a prefix, alluding to the type of comet, that can be any of the following

- **P/** for a **periodic** comet (the orbit is less than 200 years).
- **C/** for a comet that is **not periodic** (so the orbit is over 200 years, these may include comets which will only ever be seen once)

So, in our example 1P Halley is a periodic comet (the period is about 76 years). In some rare cases different prefixes can be used:

- **X/** for a comet for which a meaningful orbit cannot be computed.
- **D/** for a periodic comet that no longer exists or is deemed to have disappeared.

2). The year of discovery, including:

- An upper case letter identifying the half-month of observation during that year (A for first half of January, B for second half and so on).
- A number representing the order of discovery within that half month.

3). To complete the designation, a comet is given the name of its two first discoverers (last name for an individual or one word or acronym for a team of astronomers). The names appear in chronological order and are separated by a hyphen. In very rare cases the title can consist of three discoverers, or even be generic. An example of this is comet **C/2012 S1 ISON**, which was discovered by two people, but was assigned the ISON name after the network of telescopes with which it was discovered.

