

Quick Guide to Observing with LCOGT's BOS Telescope

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Basic Procedure

Accessing the Schedule

Scheduling observing runs at the Byrne Observatory at Sedgwick Reserve (BOS) is remarkably simple. You can either log in to the class g-mail account (ucsbphysics134@gmail.com, ask your TA for the password if you've forgotten it) and access the calendars along the top menu bar, or you can go directly to the calendar on the class website, <http://www.deepspace.ucsb.edu> → Classes → Physics 134. Coming from the course website, you'll have to click on the "+ Google Calendar" button on the lower right, and you'll be prompted to log in to an account. After logging in, you'll be able to edit the calendar.

Scheduling an Observation

DO NOT EDIT ANY EXISTING EVENTS ON THIS CALENDAR EVER, UNLESS YOU ARE CHANGING ONE OF YOUR OWN OBSERVATIONS. Many people access this calendar to schedule observations outside of this class for many purposes. Do not disturb their plans, and no one should be disturbing yours unless a very high priority observation is scheduled.

To schedule an observation, create a new event on the calendar. In "week" view, you can just click and drag on the calendar to schedule an observation of the appropriate length. Make sure that the duration of the event on the calendar matches how long you want to make your observations (i.e., if you want to observe a nebula for 30 seconds in four filters, twice per filter, make the event five minutes long or so). The duration of the event is not what determines what the telescope does for your observation, per se, but it *will* affect the scheduling for the night, so don't be making one hour observation events for 2 minute observations.

The name of the event (goes in the **What:** field when you've created the event) isn't all that important, but to make things easy for us, start each of your events with **PHYS134**, then put a dash, then put your first initial and last name. For instance, if I were making an observation, I'd call it **PHYS134-wwolf**. This is just so that we have a common nomenclature; it shouldn't really affect anything, though.

All of the robotic instructions for BOS to follow are to be put in the "Description" field in the calendar event. After naming your event, click on **Edit event** and enter your instructions there. The telescope is set up to read these events off of the calendar, schedule them according to where they are on the google calendar, then read off the observing instructions from each individual event. No one is copying information over from google calendar or anything, so what you put in for your observing directions will not be corrected by anyone if you make a mistake.

After you've entered in the commands for your observation, save the event, and you're almost done. BOS will make the observation at the proper time, and the next day, the data will be deposited on an LCOGT server, which your TA has access to. After scheduling your observation, go to the "PHYS 134 Observations" spreadsheet on Google Docs (obviously on the class account). Please

fill in the appropriate fields for your observations, in particular, the UT Date of the observation (essentially just the morning after the night of your observation; regular month/day/year format is good enough), your last name, the name of the observation, and fill in the status as “scheduled”. This will aid your TA in getting your data to you in a timely fashion.

Making Observing Plans

So we’ve covered how to set up an observation run, but we still don’t really know what to put in the **Description** field yet. BOS uses the ACP Observatory controls format to read in robotic instructions. What follows is a very brief description of the ACP format for observing plans, but you can find very good documentation at

<http://solo.dc3.com/ar/ACPRefGuide.html>

I encourage you to look especially at **Acquiring Images Automatically** and the subsequent fields for a more exhaustive look at how to tweak your observing plans.

General Format

An observing plan in ACP first begins with a series of **Directives**. These are essentially instructions that tell the telescope *how* to observe the objects that will be listed later. For instance, here you might be telling it to observe for 500 seconds, using a red filter, and with a binning of 2. There are many directives that can be selected, and they are well covered in the above-mentioned documentation. After the directives, you will put one or more **Target Specifications** (and possibly more directives if you want to specify different directives for different targets). Each target is denoted by a name, then the Right Ascension (RA) and Declination (Dec). Finally, you may add **Comments**. You do this by starting the line by a semi-colon. Comments are ignore by the telescope, but they are saved in log files, so you can use them if you want to leave some sort of explanation or questions in your plans.

Selected Directives

Directives always start with a pound sign (#). Depending on what directive you use, it may effect the entire observing plan, the next target and all subsequent targets, or only the next target. Here I show a few important directives and how they are used. *Many* others exist, and I encourage you to consult the online documentation to learn more about them.

FILTER Sets the filter(s) used on all subsequent targets. For instance,

```
#FILTER Blue
```

will cause all subsequent observations to be taken with a blue filter, whereas

```
#FILTER Red,Clear,Green,Blue
```

will cause each subsequent target to be observed in each of the respective filters, in that order. We can (and will need to) specify different exposure times for each filter as well.

The proper filter names are given in Table 1. They must be input exactly as they appear in the “Input” column.

Input	Filter
ADNP-PI-002	Clear or Luminosity
ADNP-BU-002	Bessel- B
ADNP-VX-002	Bessel- V
SDSS-GP-011	SDSS g'
SDSS-RP-011	SDSS r'
SDSS-IP-011	SDSS i'
SDSS-ZP-011	SDSS z'
NBND-HA-040	Narrowband $H\alpha$

Table 1: Acceptable filter inputs for LCOGT's BOS telescope.

INTERVAL Sets the exposure time (in seconds) for each filter. For example, if we just had the blue filter example given above, we would denote one exposure time, like 180 seconds, with:

```
#INTERVAL 180
```

On the other hand, if we had four filter settings, we would need to denote the exposure time in each, via

```
#INTERVAL 180,240,180,180
```

If we had used the above filter settings, this would cause each of the color filter images to have 180 second exposures and the luminance image would have a 240 second exposure.

BINNING Sets the binning factors for each filter (Assuming multi-filter exposures from now on). Example:

```
#BINNING 2,1,2,2
```

Due to poor seeing conditions at BOS, 1x1 binning is generally not used. Note that at 2x2 binning, the plate scale is approximately 0.59" per pixel.

COUNT Sets the number of exposures in each filter. Example:

```
#COUNT 5,10,5,15
```

This would cause there to be 5 exposures in both red and green, 10 in clear, and 15 in blue.

Target Specifications

After the directives for your observation have been selected, it's time to name the target. On the next line of your observing plan, do *not* start with a pound sign. Instead, they are composed of a name, the right ascension (in the J2000.0 epoch), and the declination (also in the J2000.0 epoch) of the target being observed. The format is

```
NAME      RA      DEC
```

Between the name and the RA, as well as between the RA and the Dec, there must be a tab. Some modern browsers will not format this correctly, so you can use five space. Note, it *must* be five spaces (no more, no less) in order to work. I would advise always using five spaces to ensure that your observations are done properly.

Extending Your Plan

If you wish to observe more than one target, for most directives you'll be using, you can simply add another target specification line. That is, you could have

```
#DIRECTIVES...
NAME1    RA1    DEC1 ;First target specification
NAME2    RA2    DEC2 ;Second target specification
...
```

Note here that I've used some comments to denote the targets. Some directives (like REPEAT or AUTOGUIDE) only work for the *very next* target, and *must* be restated in between each target unless they are no longer needed. Indeed, *any* directive can be reset after each target. For instance, you might want to use the same filters in a second observation in the same observing plan, but not the same exposure times. Then you'd need to use the INTERVAL directive inbetween the two targets. In general, it should look like

```
#FIRST DIRECTIVES
NAME1    RA1    DEC1
NAME2    RA2    DEC2
#NEW DIRECTIVES
NEWNAME1 NEWRA1  NEWDEC1
NEWNAME2 NEWRA2  NEWDEC2
```

and so on. Once the last target (or single-use directive) has been called and dealt with, the telescope will be done with your plan, and when the next event on the calendar is called, it will start reading that plan.

For more concrete examples, take a look at (but be careful not to alter in any way) the observing events that have already been scheduled. They will show some very typical setups, and you are free to copy an event as a template and just change the bits that you need to for your own purposes.

Getting Your Data

After performing a night of observations, the resulting FITS files are deposited onto one of LCOGT's servers. Your trusted TA has access to this server and will do his best to move the files daily from the server to the class dropbox account (same login information as the Google account). Be sure that you have reported your observation in the "PHYS 134 Observations" spreadsheet on Google Docs. Your TA will likely not notice that you've made an observation unless you do so. After they are moved, you can then download the files from the cloud at Dropbox.com.

If you think you are missing some files (i.e. your TA has not been working fast enough), let your TA know, and he'll check to see if your files are available. Indeed, if you have any questions on this process, don't hesitate to ask him.