Operating the Schommer Observatory 0.5-m Telescope

Weather

The telescope must not be exposed to inclement weather; it is an expensive precision instrument that can be damaged by thoughtless use. In the following conditions the dome may not be opened, or must be closed immediately if it is open:

- Rain, snow, fog, or threat of precipitation
- High humidity, above 95% relative humidity on the electronic hygrometer
- High winds, indicated by vibration of the dome
- Blowing sand, dust, or grit

Before Observing

If the air in the dome is at a temperature different from the outside, convection currents will arise that significantly degrade the seeing. The exhaust fan on the dome can quickly exchange the air in the dome with the outside air and help minimize this problem. Plug the fan in and turn it on high. Be careful to keep hands, hair, clothing, *etc*. out of the fan blades! Also make sure that there are no loose papers or other articles that can be blown around inside the dome. Make sure that you turn the fan off, unplug it, and store the cable inside the fan enclosure before you attempt to rotate the dome.

Starting Up

1. Power up: Turn on the Bisque TCS controller on the side of the telescope; after a brief initialization you should hear two beep tones (one for each axis) and the two blue LEDs should light. Turn on the focus encoder readout on the observing desk. Start up the computer if necessary. Log into the PC as user "**ph344**" (password "orion").
2. Open the dome: Raise the dome slit cover with the left lever on the control box. There is a sliding plate below the lever that only allows it to be turned one way at a time – if you cannot make the motor run, slide this plate to the other side. Let the cover open all the way, until it shuts off automatically, then return the control lever to the vertical position. Unplug the cable for the dome slit motor and hang it through the cable tie on the dome. The dome rotation is interlocked with this cable, so the dome will not rotate until the cable is unplugged. If you have not yet done so, unplug the exhaust fan power cable and store it in the fan enclosure. The lower dome slit drop-out may be opened with the manual crank; this is only essential if you are observing objects near the horizon, but opening it may help move more air through the dome to equilibrate temperatures. (On the other hand, if it is moderately windy, you may want to keep the lower slit closed for comfort or to avoid the wind shaking the telescope.)
3. Uncover the telescope: Be careful when moving the telescope with the cover on – it is unbalanced (top-heavy) and will fall (slowly) toward the horizontal. Hold on to the telescope tube until the cover is removed. The telescope is balanced with the cover removed. Bring the telescope horizontal and remove the cover (carefully). You will need to release the two clips holding the cover on. Store the cover along the dome wall or under the table. While the telescope is horizontal, remove the cover from the finder telescope also. Tip the telescope back to the vertical and, if necessary, move it to the *east* side of the pier (this is the side closest to the stairs). This is the normal storage location for the telescope and where you should have found it.
4. Select the desired observing mode: There is a rotating bar on the side of the red box attached to the

back of the mirror cell, with a black screw head that indicates either "visual" or "CCD" mode. Make sure that the instrument selector is in "visual" mode for looking through the telescope or in "CCD" mode for taking pictures or spectra with the CCD cameras. To change the mode:

a. Remove the two thumb screws on either end of the rotating bar.

b. Slide and rotate the bar to the desired position.

c. Re-install the thumb screws. (Tighten snugly, but do not over-tighten.)

5. Home the telescope mount: Set the mount (and telescope) to the home position by double-clicking the button on the end of the joystick. When you hear two sets of two beeps, the telescope is at the home position. (If *The Sky* program is linked to the telescope – see step 6 below, this can also be done with *Find Home* on the *Telescope* → *Options* pull-down menu.) If necessary, by hand return the telescope to the *east* side of the mount. It should have remained on that side if the telescope was returned to the home position at the end of the last observing session. Then, again by hand, point the telescope to the zenith, as indicated by the two bubble levels attached to the telescope support saddle. It is important to have the telescope pointing vertically when it is in the home position, so that the computer can control it accurately.

6. Start the telescope control program: Double click on *The Sky* icon on the Windows desktop. From the *Telescope* pull-down menu, issue the command *Establish Link* (or click on the green telescope button on the toolbar.) A circle with cross-hairs will appear on the display indicating where on the sky the computer thinks the telescope is pointing.

Observing

1. Dome rotation: The rotation motor is interlocked and will not operate while the dome slit cable is plugged in. The dome rotation control is the right-hand lever on the control box, and it works backwards: push the lever right to rotate the dome left, *etc*.. Be very careful when rotating the dome not to injure people or hit the observing ladder with the protruding crank handle or fan enclosure! Also keep hands, hair, and clothing away from the dome rotation motor.

2. Computer synchronization: You have to synchronize where the computer thinks the telescope is pointing with where it is pointing (once) to allow automatic pointing. This is a two-step process that starts with using the zenith and then refines the synchronization with a bright star. With the telescope pointing at the zenith in the home position, zoom in on the display of *The Sky* to see the region around the zenith. The telescope-pointing indicator should be near the zenith – if it is not, click on a star near the zenith, select the *Telescope* tab in the object pop-up window and press the *Sync Scope* button (the pointing indicator will jump to that star). This is necessary because the zoom function will change the field of view of *The Sky* to keep the telescope location in it – normally a good thing, but only after the computer and telescope have been synchronized. Continue zooming in until you see faint stars very close to the zenith. Click on those stars *to the right of the meridian line* (assuming that the display has east to the left and west to the right as usual) and find the one with an altitude closest to 90°. With this star selected, press the *Sync Scope* button on the object pop-up window. The telescope should then be aligned well enough to point to a star and have it appear in the finder telescope. Zoom out in *The Sky* to see the whole sky (pushing the toolbar button that is a Z with a circle around it does this). Click on a bright star in the computer display that you can identify in the real sky and slew to it by clicking on the green telescope icon in the object pop-up window. The telescope should slew to put this star in the finder. If it did not, you probably selected

a star on the wrong side of the meridian (particularly if the telescope moved north when it should have moved south or vice versa). If the telescope did not point correctly, return to the home position (double-tap the button on the joystick) and repeat the zenith initialization. If the star did appear in the finder, use *the joystick control* to center the star in the finder, then in the main telescope eyepiece. When the telescope is pointing accurately at the star, select the *Telescope* tab in the object pop-up window and press the *Sync Scope* button. Thereafter, do not move the telescope by hand, or you will have to re-initialize the coordinates. It is a good idea to immediately slew (see the Pointing section below) to another bright nearby star to check that everything is working properly.

3. Pointing: Once the computer and telescope are synchronized, it is easiest to point the telescope to new objects by using the computer. Click on the desired object on the display (or use the "Find" menu). When the window for that object pops up, click on the green telescope (slew) button at the bottom and the computer will move the telescope to the object. Wait for the slew to finish before trying to move the telescope with the joystick. When slewing over large distances or looking for a faint object, it is wise to first set on a nearby bright star and re-sync the coordinates. To stop a slew in progress, click on the stop button in the slew pop-up window.
4. Hand Controller: The telescope pointing is adjusted with a joystick hand controller. The further you push the joystick in a particular direction, the faster the telescope moves. Beware of the button on the end of the joystick – double clicking it will send the telescope to the home position! The switch on the hand controller turns on a red LED that can be useful for reading notes, *etc*..
5. Eyepieces: The eyepieces are stored in the drawer in the observing desk. Take care when handling the eyepieces not to drop them or to put fingerprints on the optical surfaces. The 55 mm eyepiece should always be used with the extender tube, making it approximately parfocal with the other eyepieces. The 38 mm and 26 mm eyepieces need no extenders or adapters. The smaller-diameter 20 mm, 15 mm, and 10 mm eyepieces use the 2.0-inch to 1.25-inch adapter.
6. Focusing: The telescope is focused by moving the secondary mirror. The focus is controlled with switches on the observing console. Turn on the focuser power with the on-off switch and select the direction of motion and speed with the other two switches. Press and hold the push button to run the focuser motor. The green numeric readout shows the secondary position. For visual observing, set the secondary focus to about 0.000 mm, and use the manual focus adjustments on the eyepiece tube. For the CCD camera and spectrograph all focusing is done with the secondary; an approximate focus value is 1.000 mm.
7. Software: *The Sky* program has a large number of options, settings, and display modes. Most are relatively obvious in their operation. If all else fails, read the on-line help files!

Shutting Down

1. Home the telescope, then tip it to the horizontal position and put the covers back on the telescope and finder. Point the telescope back to the zenith.
2. Close the lower dome slit drop-out if it is open.
3. Rotate the dome until the slit motor cable is near the control box. Plug in the slit motor and close the dome slit. Make sure that the outer lip of the cover comes down over the drop-out. It may be necessary to use the hand crank to keep the drop-out snugged up as the cover finishes closing. If you cannot turn the lever in the correct direction to close the dome, remember to slide the metal locking plate below the lever to the other side.

4. Disconnect *The Sky* from the telescope (the red telescope icon) and shut down all running programs on the control computer. Turn off the Bisque TCS controller and the focus encoder display. (If you were using the CCDs, turn off their power.) We leave the computer running if the weather is cold (winter) and shut it down if the weather is hot (summer). If you do shut it down, be sure to do so correctly – don't just turn off the power!
5. Fill out the observing logbook, and note any problems that you have had with the equipment.
6. Please be sure that the dome lights are out and the door is locked when you leave.