Lutz Telescope and CCD Camera
Start Up and Shut Down Procedure
April 14, 2010

Telescope Start Up Information:
1. Turn exterior lights off (light in parking lot as well as lights on ROTC building)
2. Turn off exterior observatory ring lights (first light switch after coming up stairs in observatory)
3. Open slit
4. Carefully remove telescope cover, taking care to avoid putting any torque on the secondary motor, and place the cover in its protective container.
5. Remove primary mirror cover; do not bump the secondary or primary mirrors. Place primary mirror cover somewhere safe, such as near the telescope cover container.
6. Go downstairs and turn on power to mount and telescope (switch #6, named "BLT," in the circuit breaker box on the right)
7. Go back upstairs and turn on power to mount (O/I switch on mount base)
8. Plug in filter wheel power and listen for a series of clicking noises
9. If you do not hear clicking noises, disconnect the filter wheel power, wait a few seconds, and plug in filter wheel power again

On The Upstairs Computer Screen:
1. Turn on screen and click on "Observer"
2. Click on "Dome Control" icon; settings should be "com 6" and "+ProXR" – these will not need to be changed
3. Click "OK"
4. After windows pop up, wait for the green "RUN MODE" symbol
5. Close "A/D Enhancements" and "Firmware Selected" windows
6. Move dome to face slit to the east; Clicking "Relay 1" moves the dome right, and clicking "Relay 2" moves the dome left. Click the button to start movement, and click it again to stop. **Do NOT have "Relay 1" and "Relay 2" clicked on at the same time!**
7. Once dome is in position, click on "Launch T-Point" icon on the desktop. This starts up the telescope's pointing system, but only a very small window will pop up in the upper left hand corner of the screen
8. Click "The Sky6" icon on the desktop
9. In "The Sky6", Go to "Telescope" → "Link" → "Establish"
10. When the dialog box pops up, click "yes" to home the telescope.
11. Once the telescope has stopped moving, wait and listen for two sets of three beeps.
12. Click the small red goggles icon in The Sky to turn off night mode.

Set-up for Twilight Flatfields (evening):

1. In TheSky, use the E button to look due East
2. Select a point that is due east and at an altitude of 60-65° (each red line signifies ten degrees) with very few stars (zoom in if necessary.) Click on that point, and slew the telescope to that point (click the small green telescope icon to slew)
3. Check that the telescope is pointed out the slit; move dome if necessary
4. Turn off the upstairs computer screen, ensure that no lights remain on in the dome, and go downstairs

Software Set up in Control Room:

1. Click on the RCOS TCC (Telescope Command Center) icon
2. Go to the "Temperature" tab, and under "Fan," select "Auto"
3. Click on the "CCDSoft" icon and a "Camera Control" window should open. If not, open it using Camera → Set Up; close any previously open images
4. Under "Set Up" tab in "Camera Control" window, select "Imager" radio button, and click "Connect"
5. Click on "Temperature" and when the window pops up, select Temperature Regulation "On", then set to roughly -25°C, depending on ambient temperature (check with ambient temperature under RCOS TCC - may be set colder during winter months.) Click "OK"
6. Go back to "Set Up" tab, select "Autoguider" radio button and "Connect"
7. Click on "Temperature" and select Temperature Regulation "On", then set temperature to roughly -8°C, again depending on ambient temperature (autoguider does not need to be cooled as much.) Click "OK." **In the "Set Up" tab, make sure that neither the camera nor autoguider are working at more than 85-90%!**
8. Ideally, we want the fans to cool the telescope and autoguider as cold as possible to minimize the effects from dark current. **Be sure to have it cooled appropriately before taking data – changing the temperature settings (and thus dark current) while taking data will affect your results.**
9. Under "Camera Control", click the "Autosave" tab, and click "Choose Folder" to make a new folder in which to write your images (with UT date, e.g., 20090605). You will have to create a new folder under "Images" in "My Documents". Check to make sure your new folder is selected and that the image prefix is correct
10. **Important: Change the starting number to zero!**
11. Under the "Take Image" tab in Camera Control, select a bias frame under "Image" and take a bias image (~1200 counts) to make sure you're writing into the appropriate directory.
12. Take a bias image with the autoguider (will NOT save to directory – make sure under the "Autosave" tab that it is ON for Images and OFF for Autoguider.)
13. Check the time written into the image header by opening a web browser and navigating to time.gov. When a minute rolls around, take a one second exposure bias image at :59. In CCDSoft, go to "View" → "File Info" and check the timestamp on the image.
14. In TheSky, go to "Telescope" → "Motion Controls" to open up the paddle. Now you're ready for flatfields!

Twilight Flatfield Procedure:

1. On the web, check the sunset time (NOAA/Google).
2. In RCOS TCC, check to make sure that the focus is at roughly 6900 for imaging (it may be set around 17000 if the eyepiece was on last.)
3. Take a one second test image, and check the counts. Counts will probably be over 60,000 or so. If so, you will need to wait a few minutes for the sky to darken more.
4. Once the counts in the test images are under 40,000, you may begin to take real data
5. If you plan on taking data in more than one filter, be sure to take flats in each filter (cycling through B, then V, then R, etc.) before changing the exposure time
6. After each B, V, and R sequence, be sure to jog the telescope! As the telescope is pointed due East, we want to move up the slit, so in TheSky under Motion Controls, jog about 1 minute West each time.
7. Changing the exposure time will depend on the numbers of pixel counts. As the sky gets darker, we'll want longer exposures (with the 8 second – 1 minute exposures being prime flatfields.)
8. Be sure to look at the **background counts**, not the peak counts, to determine exposure times, and avoid extremely bright stars in your frame. Ideally, we want the background counts from 20,000-40,000.
9. When you begin to see lots of stars, and exposure times are over 1 minute, the flatfield window of opportunity will be over.

Focusing the Telescope and Calibrating the Autoguider:

1. Make sure you have RCOS TCC and CCDSoft both open. Using TheSky, slew to a 6th magnitude star high in the sky and on the side of the meridian of your first target. Check the dome to make sure the dome is not occulting the telescope field of view.
2. Under "Camera Control" in CCDSoft, click the "Focus Tools" tab, and click @focus (with 0.5 sec exposures.)
3. While @focus runs, carefully watch the peak on the graph and the images of the stars, and compare it to the actual focus value in the RCOS TCC window. Determine which focus value appears to give the best focus, and write that down.
4. After @focus finishes, if you prefer your value over the @focus value, you can go back to RCOS TCC and set the best focus value in the box next to the "GoTo" button. The telescope should now be focused.
5. Next, you will need to calibrate the autoguider. On the desktop, launch "Shortcut to RCOS", and when the window pops up, choose "Channel 2", and click "Communications" → "Connect"
6. Under "Focus Tools" back in CCDSoft Camera Control, select the Autoguider, check the "Continuous" box, and take a series of images, looking for a good guide star.
7. You may need to jog the telescope minimally and/or adjust the guide angle in "RCOS OAG" to find and position the appropriate guide star. **Make sure that your star is the brightest in the field and close to the center of the image; otherwise the calibration procedure may fail.**
8. Under the "Autoguide" tab, click "Auto". The program should choose the appropriate star in the autoguider image.
9. Click "Calibrate", and leave all settings (x, y coordinates) the same. Once the autoguider calibrates successfully, you are ready to autoguide. Next, you need to slew to your target.

Slew To Target, Find Guide Star, Guide, and Begin Exposures

1. Slew to your object. You can enter coordinates in The Sky via Orientation→ Move To. Enter the objects coordinates in the appropriate boxes. Be sure to use the correct epoch.
2. Once you are at the object, move the dome to the appropriate position.
3. In the Camera Control window and under the "Focus Tools" tab, take continuous images with the autoguider.
4. Either jog the telescope by 1 to 2 arcminutes or change the guider angle in the ROCS OAG window by steps of 25 until you obtain a guider star near the center of the guider imager.
5. Abort the continuous images in "Focus Tools."
6. Take an image with the autoguider under the "Autoguide" tab in the Camera Control window
7. Click "Auto" to select the guide star or click on the guide star to select it
8. Click on the "Autoguide" button. You should see the autoguider status (blue bar) constantly updating.
9. If you have trouble with the guide star, make sure the max counts on the autoguider is over 500 *after* the AutoDark reduction – if it is under 500, you will probably lose the image ("Guide star lost brightness.")
10. Change to the "Take Image" tab in the Camera Control window.
11. Set your exposure time and filter.
12. Click on "Take Image." You may choose to take a series of images if you so desire.
13. Remember, if you move to the opposite side of the meridian to acquire a new target (or if your target transits), you must recalibrate the autoguider before guiding and taking data.

Shutdown Procedure

1. Under the CCDSoft Camera Controls Setup tab, disconnect the autoguider.
2. Disconnect the imager.

3. Close CCDSoft, RCOS TCC, and any web browsers, but leave everything else open
4. Head upstairs, making sure the front doors are closed and locked if the control room is unattended.
5. Once upstairs, make sure the ladder is out of the way of the telescope.
6. On the computer, open TheSky, and go to "Telescope" → "Options" → "Park".
7. Click "OK."
8. Once the telescope finishes parking, use the joystick to ensure that the counterweights are aligned with the mount.
9. In TheSky, click "Telescope" to check if it is possible to "Establish". Do NOT establish.
10. In Dome Control, move the dome back to its home position (with the slit facing due South.)
11. You may now plug in the interior dome lights in order to see better.
12. Close out TheSky, do not save changes, then close TPoint.
13. Close Dome Control
14. Hit CTRL-ALT-DEL to open Windows Task Manager, and close/end "Project1"
15. Click "End Now" and "Don't Send"
16. Turn off the telescope mount.
17. Unplug the filter wheel.
18. Go downstairs and turn off power to the mount (switch #6 "BLT" in the breaker box.)
19. Go back upstairs, and replace the primary mirror cover, being careful to avoid hitting the secondary and primary mirrors.
20. Replace the telescope bag.
21. Close the slit, and make sure it is secure.
22. Turn off the upstairs computer screen.
23. Ensure that small dome door to balcony is closed and locked.
24. Turn on the exterior observatory ring lights (first lightswitch after coming up stairs in observatory.)
25. Unplug interior dome light.
26. Go back downstairs, close any remaining open programs on the computer, and log off "Observer". **Be sure to leave the computer on.**
27. Make sure no one's things are still inside, lock all interior doors, turn off all interior lights, make sure the coffee pot, etc are all turned off; turn on observatory porch light.
28. Lock the front door and turn streetlights back on. ☺
29. Go home, go to sleep or to class