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Spectroscopy: Data Acquisition

1. Equipment to bring to the telescope

- DADOS spectrograph of your choice
- ST402ME CCD camera (NOT the big STL1001 camera)
- Orion StarShooter AutoGuider
- same laptop as for imaging lab
- finding charts of your targets (the FOV of the pick-up mirror is $\sim 5'$)

2. Strategy

For each wavelength setting, we want to record both the spectrum of our target, as well as the wavelength-specific calibration exposures (arc lamps and flat-fields). In addition, we might need to acquire the spectrum of a spectrophotometric standard star with the same wavelength range. Dark frames are independent of what wavelength range is set on the spectrograph, but need to be taken with the same exposure time and CCD temperature.

1. Assemble the spectrograph with the CCD camera. Before attaching the camera, it is a good idea to use the eyepiece and the Neon arc lamp to set the initial central wavelength to a known position (the bright yellow Neon line at 5852.48Å).
2. Focus the camera on the arc lines. Adjust the camera so that the spectrum runs along the long axis of the CCD (i.e. horizontally). The arc lines should run exactly parallel to the short axis of the CCD.
3. After focusing, change the binning to bin in the spatial direction by a factor of 2. Do not bin in the spectral dimension.
4. Slew the telescope to a bright star (this can be your spectrophotometric standard star).
5. Attach the spectrograph.
6. Adjust the telescope pointing so that the bright star is close to the center slit (use the eyepiece as slit viewer).
7. Check and if necessary, adjust, the finderscope pointing.
8. Sync the telescope to the position of the star.
9. Assemble the Autoguider camera as a slitviewer. To do so, remove the two black extension tubes of the slit-viewing assembly from the lens. Screw the remaining piece holding the lens into the black extension tube of the Autoguider camera.
10. Attach the Autoguider to the slitviewing port and focus it on the slits (turn on the slit illuminating lamp). Rotate it so that the slits are horizontal - this provides the largest field of view.
11. Focus the telescope. Use the Autoguider to monitor the shape of the star. If the telescope is very out-of-focus, focus with the primary mirror's focusing knob first; then do a fine focus with the hand panel.
12. Shine an arclamp into the telescope to change the grating angle to your desired wavelength setting. Do NOT refocus the camera on these lines, even if they look more blurry than before!

13. Take an exposure of your arc lamp spectrum, making sure that no line is saturated. This is one of your calibration exposures!
14. If the star is one of your targets, or your spectrophotometric standard star, record the spectrum. Use PhDGuide, (or the Autoguider display and the hand display) to keep the star on the desired slit. Try to get 5000-20000 counts in the brightest individual pixels.
15. Take a flat-field at the same grating setting: move the dome in front of the telescope; turn on the dome lights, record a spectrum. Try to get > 2000 counts per pixel.
16. Go to your (next) target.
17. If your target is a faint nebula: move your target onto the desired slit; take a 2 min exposure. Use PhDGuide to keep your target at the same position on the slit. About half of the slit should be on your object, and the other half on empty sky. Can you see all the emission lines you are targeting with this wavelength bracket in the 2-minute exposure? If not, increase the exposure time. Take (at least) 5 exposures where you can see all targeted lines.
18. If you want to acquire a different wavelength range, shine the arc lamp into the primary mirror, and (slowly) change the grating angle to the other wavelength setting.
19. Finally, take a series of dark frames of the same exposure time(s) as used in your science images.