

## Astro 500 Problem Set #4

1. For a spectrograph fed with an  $f/3.32$  beam, and with an  $f/1.33$  camera, what is the magnification factor of the entrance slit at the detector focal plane (larger or smaller)?
2. For the above spectrograph, how big is a 300 micron entrance-slit (in width) at the detector? Give your answer in units of microns and 15-micron pixels.
3. If the above spectrograph has a 115 mm diameter collimated beam (for each field-point) what are the focal lengths,  $f_1$  and  $f_2$  of the collimator and camera, respectively?

The following questions all assume the above spectrograph and detector.

4. If the spectrograph has a camera-collimator angle  $\theta_{cc}=100$  deg, and is used with a Littrow transmission grating (e.g., a VPHg), how many l/mm are needed to make the central wavelength 653 nm? In the context of this problem, the camera-collimator angle is defined such that  $\theta_{cc}=0$  corresponds to a straight-through reimaging system.
5. What is the angular dispersion of the grating in the configuration defined in (4)? Identify the units of your answer.
6. What is the linear dispersion at the detector (A/pix) for this configuration defined in (4)?
7. What is the anamorphic demagnification of the system defined in (4)?
8. What is the spectral resolution of the system (defined in 4)?
9. (a) How many pixels sample the resolution element? (b) Does this number have an impact on the delivered instrumental spectral resolution? (c) How much (if at all) would you bin your CCD?