section5_Ex.3

2024/07/19

M1 Kensho Tanaka

3. Consider the design of a diffraction grating spectrometer for a 10m telescope.

- The 2-pixel resolution element is 0.5”
- R = 20000
- the configuration is Littrow.
- Two grating is available.
  - a first-order grating blazed at 17.5°
  - an echelle grating blazed at 63.5°
- Determine the D_{coll} in both cases
- which is more practical?
- assuming f/ratio : 15, what is the focal length of these two collimators?

- using Littorw condition

$$R = \frac{2D_{coll} \tan \theta_B}{p\theta_{pix} D_{tel}}$$

$$D_{coll} = \frac{R}{2tan\theta_B} p\theta_{pix} D_{tel}$$

  - blazed at 17.5°（a first-order grating) : D_coll = 77cm
  - blazed at 63.5°（an echelle grating)：D_coll = 12cm
  - echelle grating is more practical.
- Focal length (f/ratio = 15) : $f_{focal} = D_{coll} \times f/ratio$
  - blazed at 17.5 : f = 15 * 77cm = 11.55m
  - blazed at 63.5：f = 15 * 12cm = 1.8m