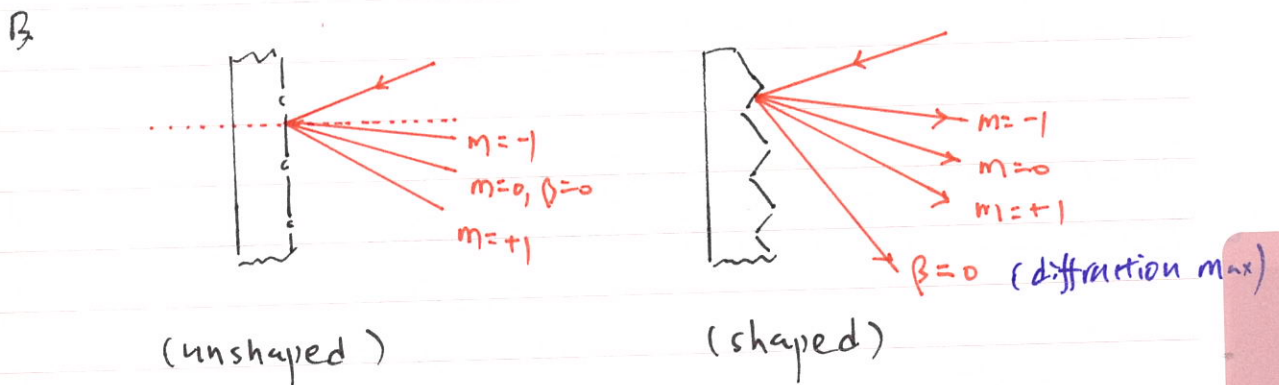
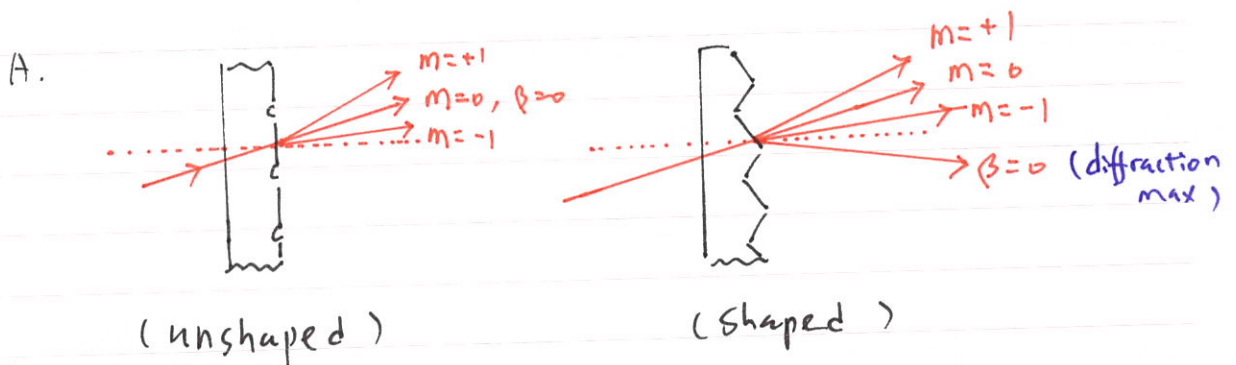


12-6 Blazed Gratings

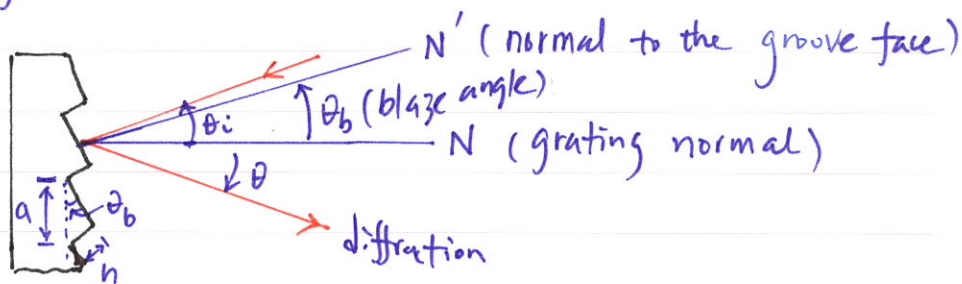
- grating efficiency = $\frac{\text{diffracted light energy}}{\text{incident "}}$
- zeroth-order diffraction: no dispersion \rightarrow waste of energy
 \rightarrow reducing grating efficiency
- The more N (groove #), the more energy throughput.
- Blazing: groove shaping tech so that the diffraction max shifts into another order.



* The grating max \rightarrow principal max
($m > 1$)

(Blazing)

< Blaze angle, θ_b >



shaping: diffraction max \rightarrow principal max
(redirect)

$\theta = \theta_m$: grating diffraction to the principal max

(i) Condition 1: < mirror reflection = principal max >

$$\rightarrow \theta_i - \theta_b = \theta_m + \theta_b \quad \text{: mirror reflection}$$

$$(i) \rightarrow \theta_b = \frac{\theta_i - \theta_m}{2}$$

(ii) Condition 2: grating eq for principal max

$$\star (ii) \rightarrow m\lambda = a (\sin\theta_i + \sin\theta_m) \quad (12-14)$$

$\therefore (i) = (ii)$

$$\rightarrow m\lambda = a [\sin\theta_i + \sin(2\theta_b - \theta_i)] \quad (12-15)$$

A. Littrow : incident light direction // groove face normal N'

$$\rightarrow \theta_b = \theta_i$$

$$\rightarrow \theta_m = -\theta_i$$

$$\therefore m\lambda = 2a \sin\theta_b \quad \text{or} \quad \theta_b = \sin^{-1}\left(\frac{m\lambda}{2a}\right)$$

$= 2h$

B. $\theta_i = 0$ (along grating normal N)

$$\rightarrow \theta_b = -\frac{1}{2}\theta_m \quad \text{or} \quad \theta_b = \frac{1}{2}\sin^{-1}\left(\frac{m\lambda}{a}\right)$$

ex) a. 1200 groove/mm

$$\lambda = 600 \text{ nm}$$

Blazing to the 1st principal max.

Q. what is θ_b ?

Sol). $a = \frac{1}{1200} \text{ (mm)}$

(i) Using Littrow mount eq., along N'

$$\theta_b = \sin^{-1} \left(\frac{m\lambda}{2a} \right) = \sin^{-1} \left(\frac{(1)(6 \times 10^{-4})}{2(1/1200)} \right) = \underline{21.1^\circ}$$

(ii) For incident light along the grating normal N ,

$$\theta_b = \frac{1}{2} \sin^{-1} \left(\frac{m\lambda}{a} \right) = \frac{1}{2} \sin^{-1} \left(\frac{(1)(6 \times 10^{-4})}{1/1200} \right) = \underline{23.0^\circ}$$