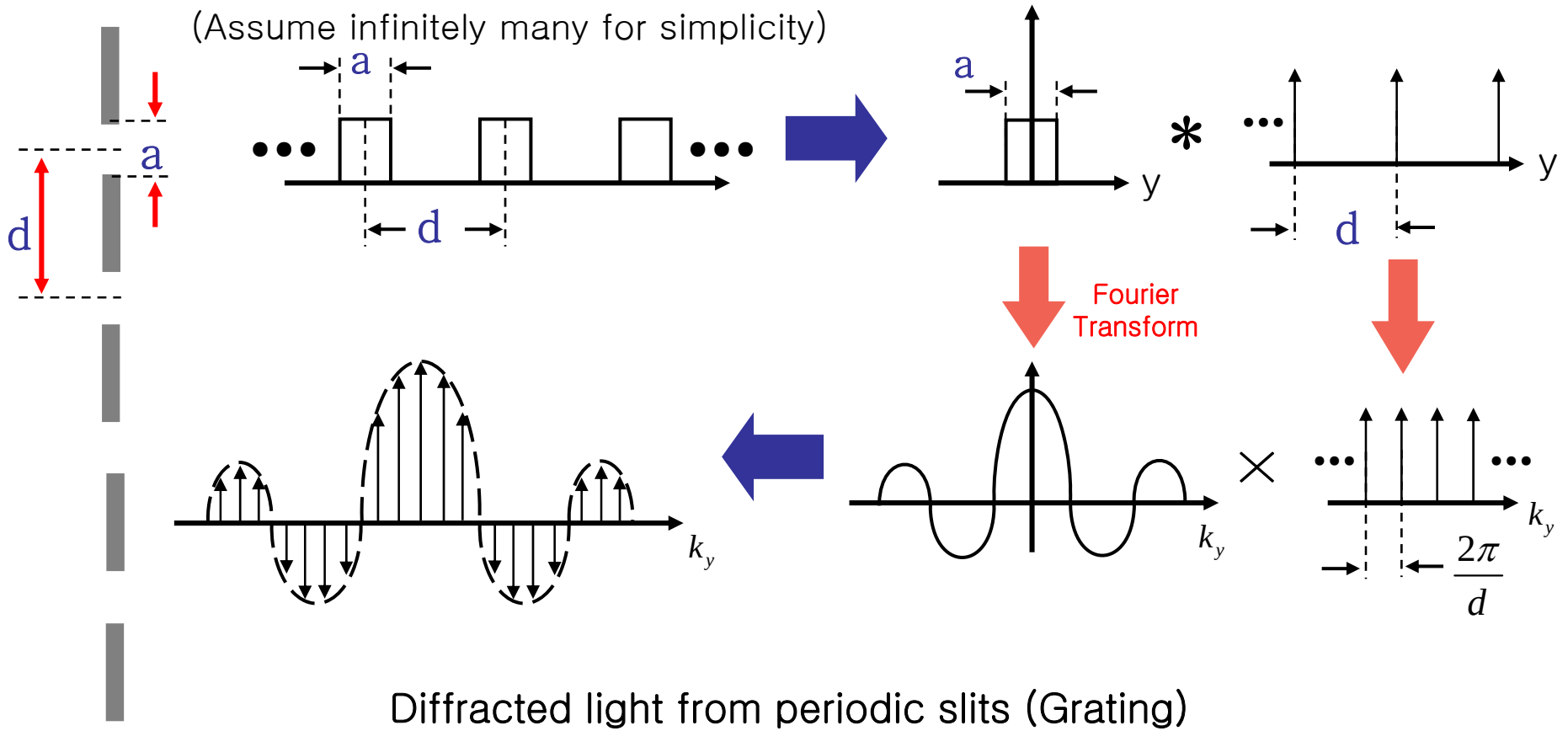
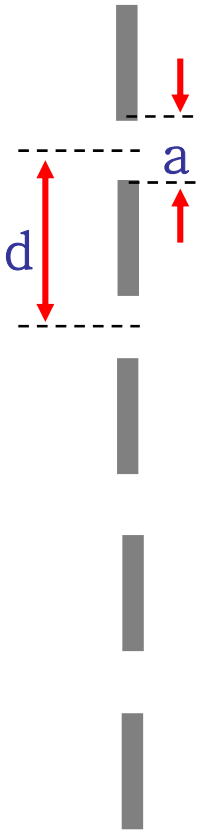
Lect. 10: Diffraction Gratings

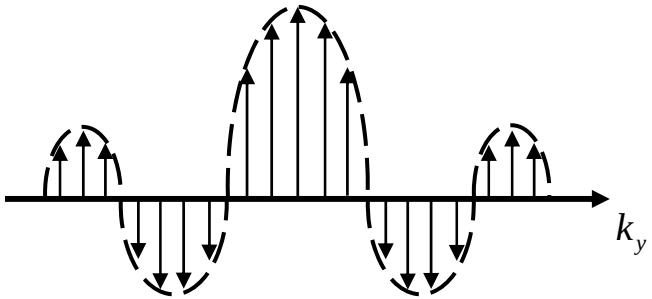


Diffracted light from periodic slits (Grating)

==> Far-field with only discrete k_y's

Lect. 10: Diffraction Gratings





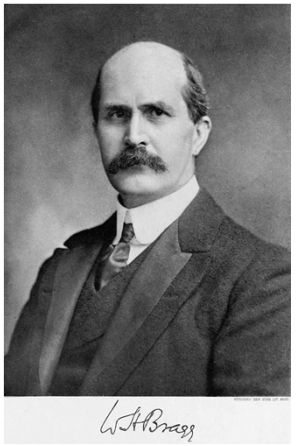
$$k_y = m\frac{2\pi}{d}$$

$$\frac{\sin\theta}{\lambda} = m\cdot\frac{1}{d}$$

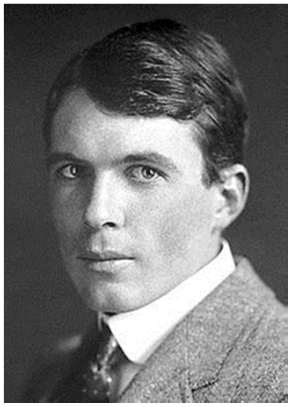
$$d\sin\theta = m\lambda$$

Grating equation

Bragg Condition



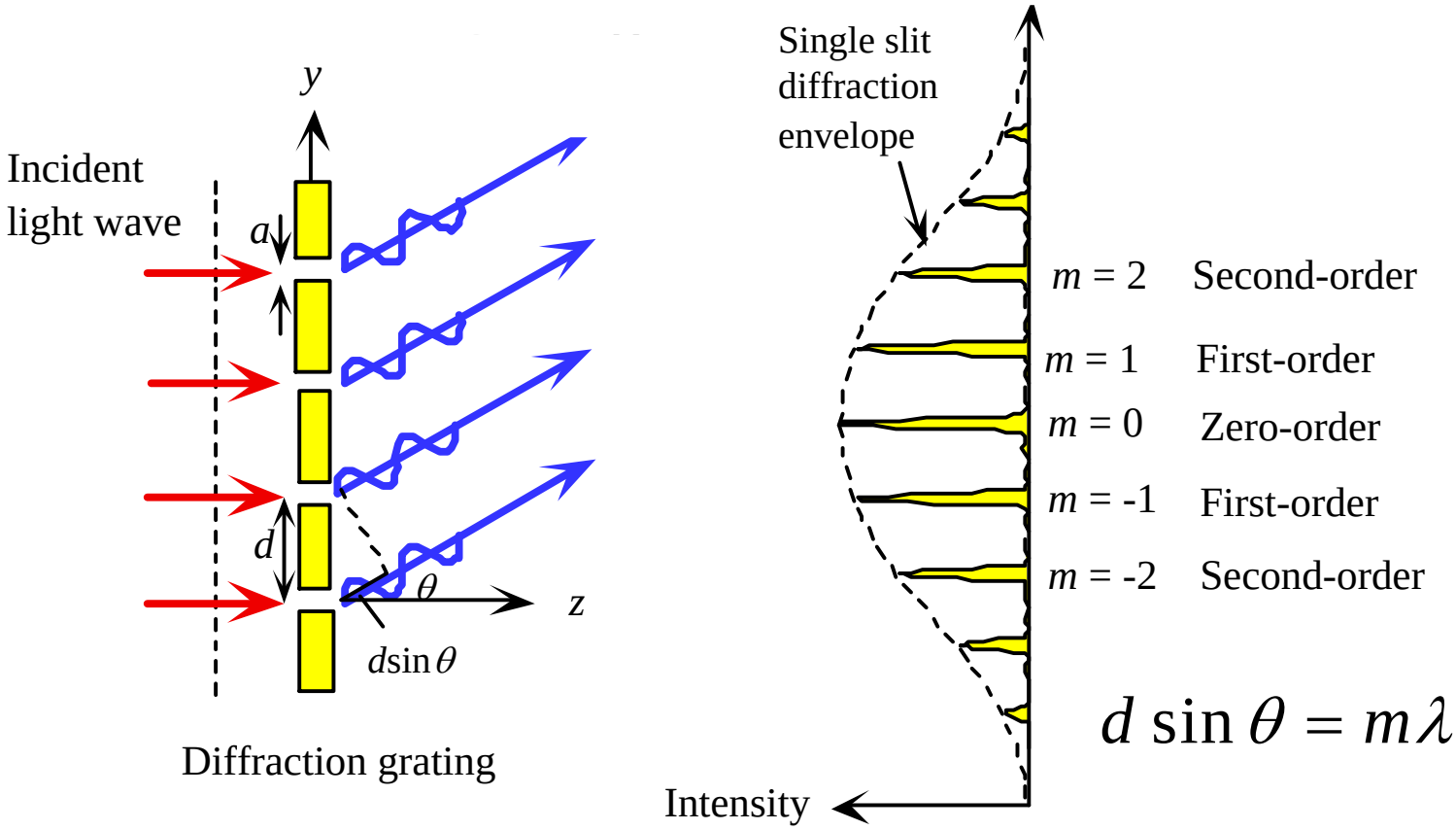
William Henry Bragg
(1862-1942)



William Lawrence Bragg
(1890-1971)

Nobel Prize in Physics (1915)

Lect. 10: Diffraction Gratings

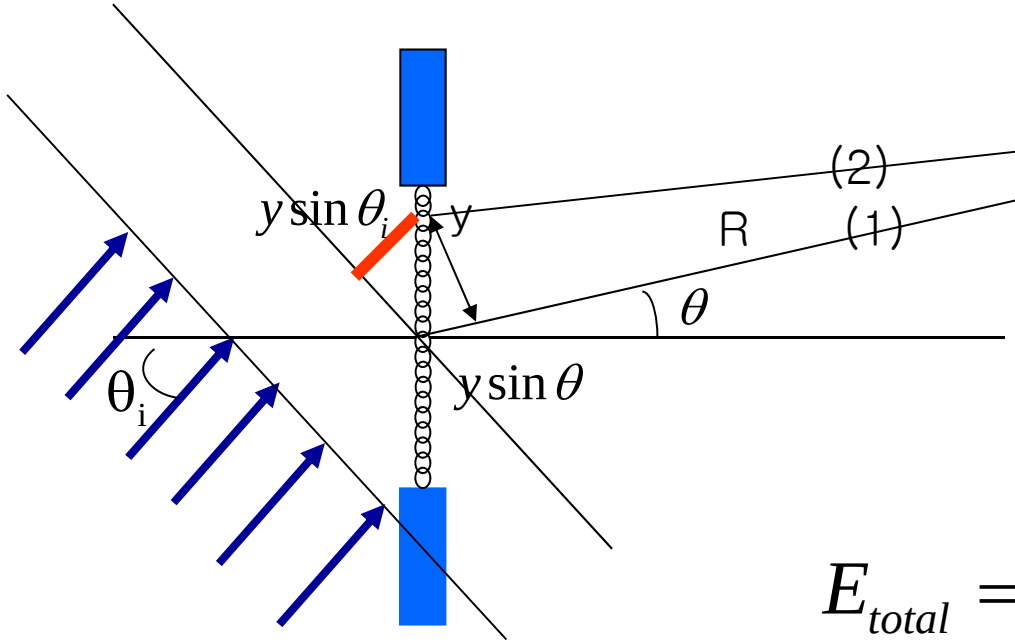


$$d \sin\theta = m\lambda$$

Width for each diffracted beam?

Lect. 10: Diffraction Gratings

Input with tilted angle



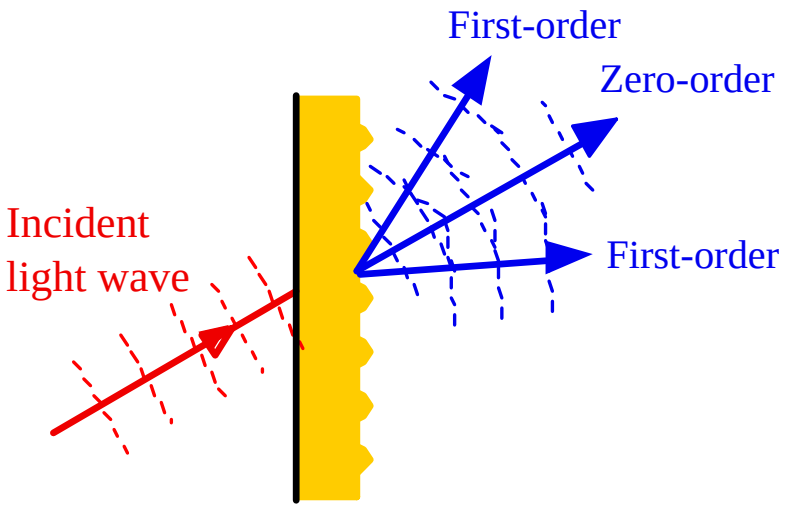
$$\frac{A}{R}e^{jky\sin\theta}$$

$$\Longrightarrow \frac{A}{R}e^{jky(\sin\theta-\sin\theta_i)}$$

$$E_{total}=\int_{-\infty}^{\infty}\frac{A}{R}e^{jky(\sin\theta-\sin\theta_i)}dy$$

Lect. 10: Diffraction Gratings

Tilted incidence on grating

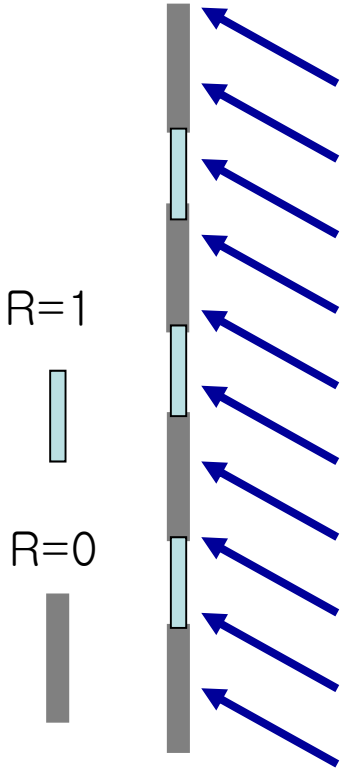


$$d \sin\theta = m\lambda$$

$$\rightarrow \quad d\left(\sin\theta - \sin\theta_i\right) = m \cdot \lambda$$

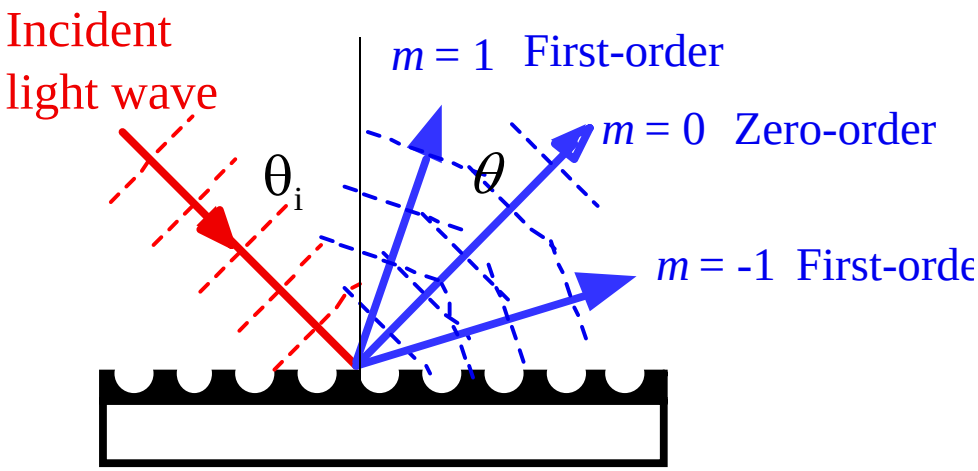
Lect. 10: Diffraction Gratings

Reflection-type grating



Same diffraction equation applies

$$d(\sin\theta - \sin\theta_i) = m \cdot \lambda$$



Reflection grating

Grating can be realized as long as reflection surface is periodic

Gratings are widely used as λ demultiplexer