Lect. 18 ; Apr. 6, 2010

Part 4 — Diffraction

App: Diffraction grating ⇒ spectroscopy

Diffraction : ~~interference~~ superposition from an area source, equivalent to numerous point sources.

Interference : superposition from two point sources, or limited number

Fraunhofer Diffraction (CH 18)

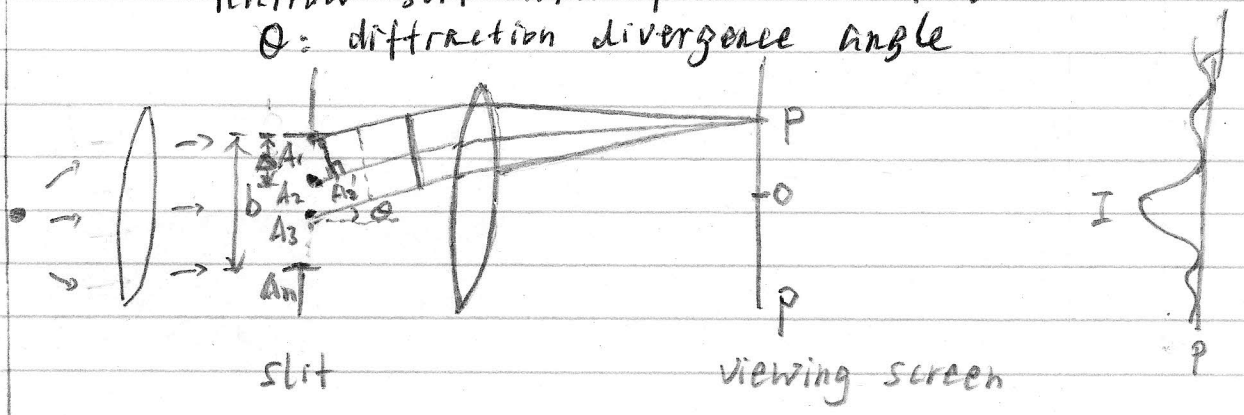
Both sources and viewing screen are at infinity

Fresnel diffraction, either source or screen at finite distance.

Single-slit Diffraction Pattern (CH 18-2)

narrow slit with finite width b

θ : diffraction divergence angle



Each point, e.g. A_1, A_2, A_3, is a source of Huygen's secondary wavelet

Let $\Delta = \overline{A_1A_2} = \overline{A_2A_3}$, and n points in the slit

$$b = (n-1)\Delta$$

Consider the optical path difference between A_1P and A_2P, τ

$$\tau = \tau_{A_1P} - \tau_{A_2P} = A_2A_2' = \Delta \sin\theta$$

The corresponding phase difference

$$\phi = \frac{2\pi}{\lambda} \Delta \sin\theta \qquad \text{---- (2)}$$

At the slit, all points are in phase.