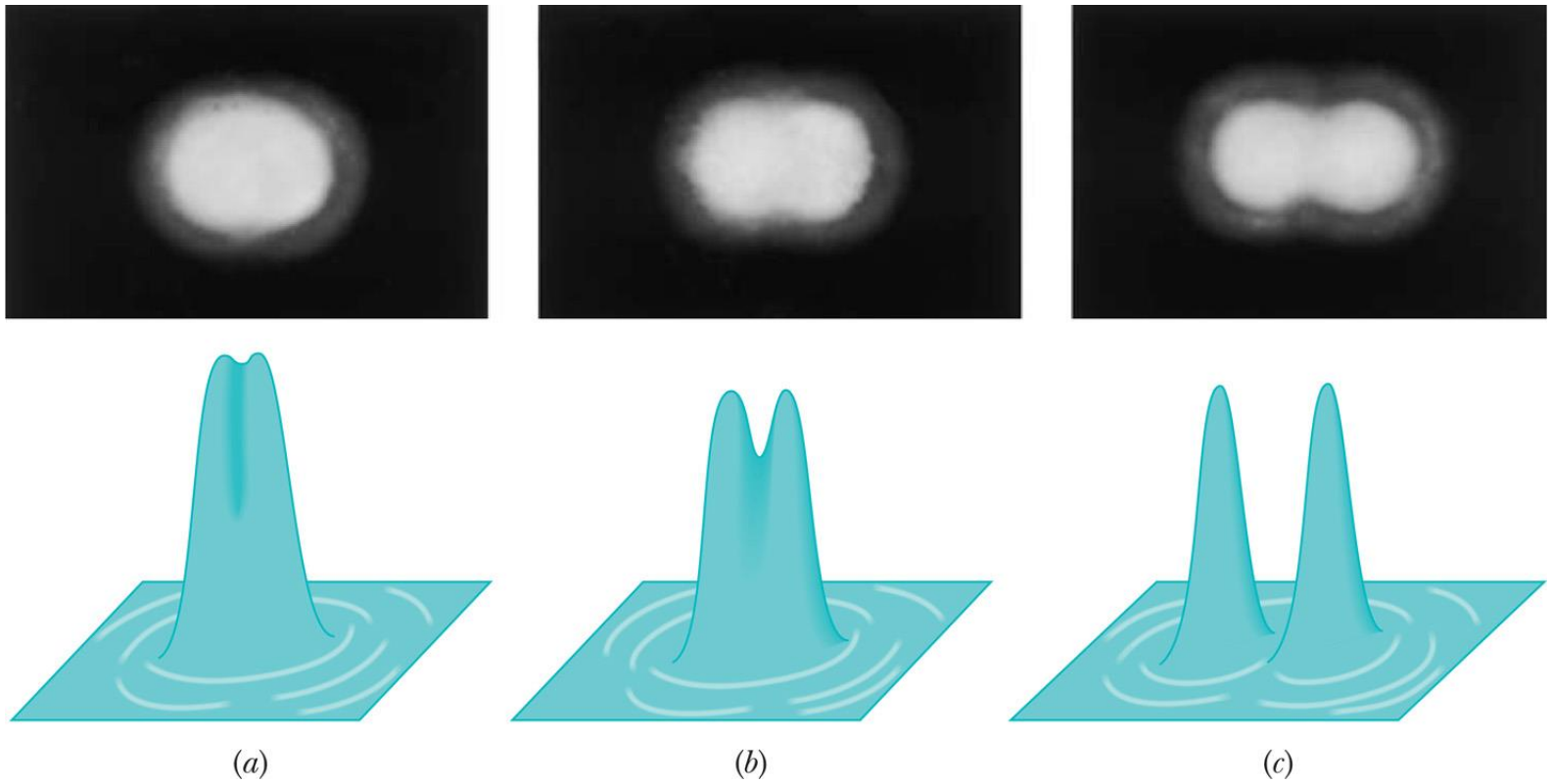
Copyright statement

- The images and the pictures in this lecture are provided by the CDs accompanied by the books

  1. University Physics, Bauer and Westfall, McGraw-Hill, 2011.
  2. Principles of Physics, Halliday, Resnick, and Walker, Wiley, 8th and 9th Ed.

- The rest is made by me.

Rayleigh's criterion for a telescope



분해능 (resolution)

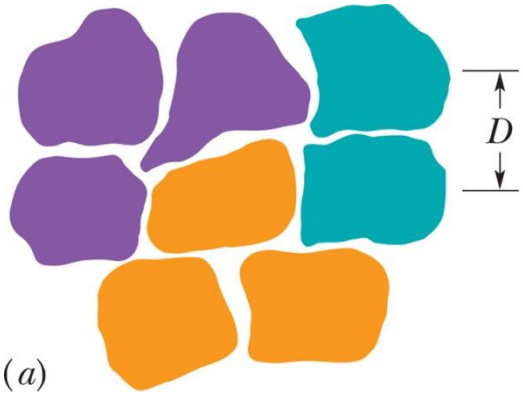
$$\theta_R = \sin^{-1} \frac{1.22\lambda}{d}$$

Rayleigh's criterion: $\theta_R = 1.22\frac{\lambda}{d}$

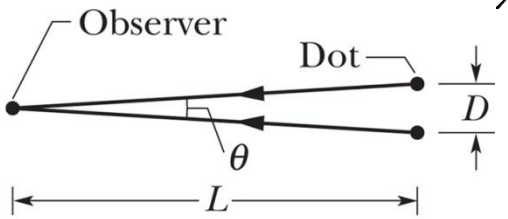
Example

$$D = 2.0 \text{ mm}, \quad d = 1.5 \text{ mm}$$

$$\theta = \frac{D}{L}, \quad L = \frac{Dd}{1.22\lambda}$$



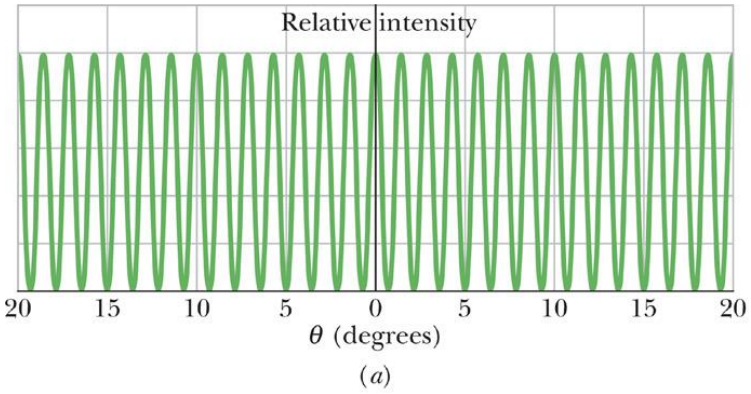
(a)

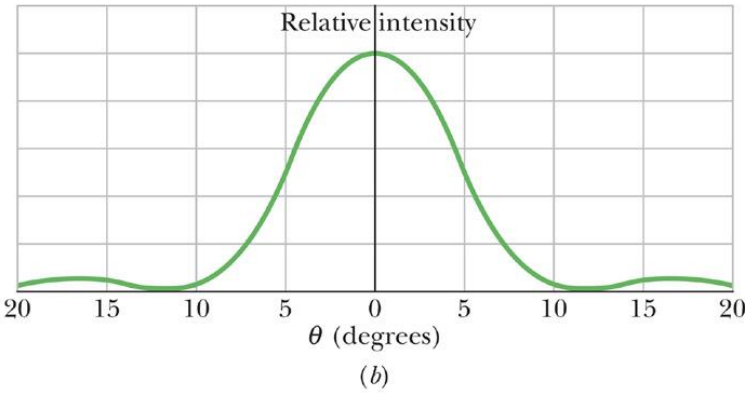


(b)

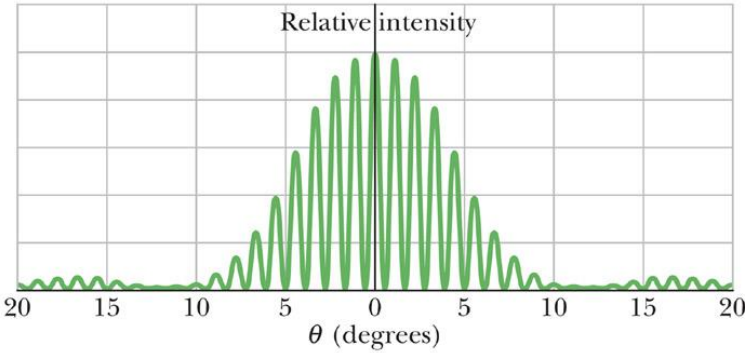
$$\lambda = 400 \text{ nm} \rightarrow L = 6.1 \text{ m}$$

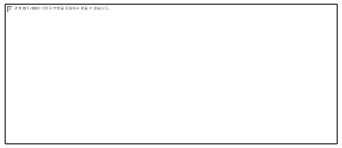
Double slit diffraction





$$I = I_m \cos^2 \beta \left(\frac{\sin \alpha}{\alpha} \right)^2$$

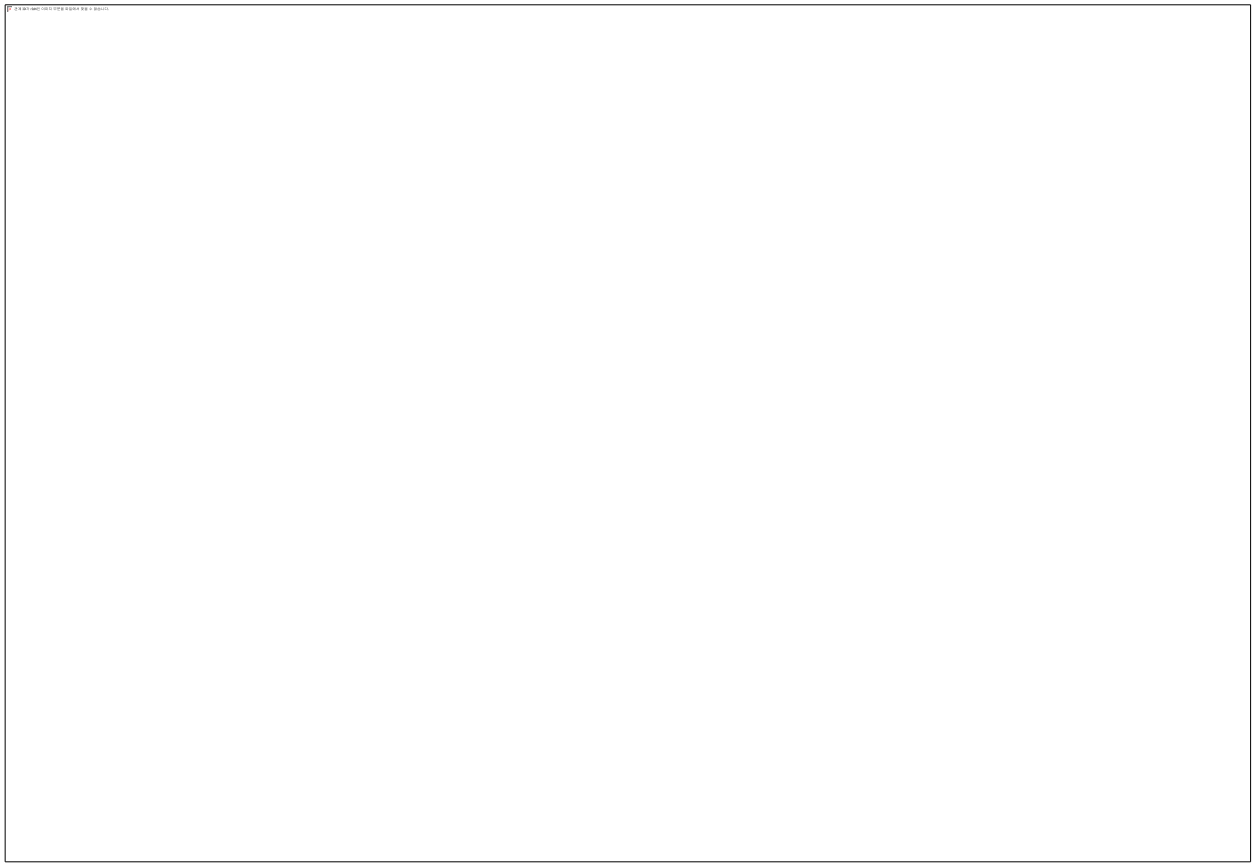




Double slit (a)

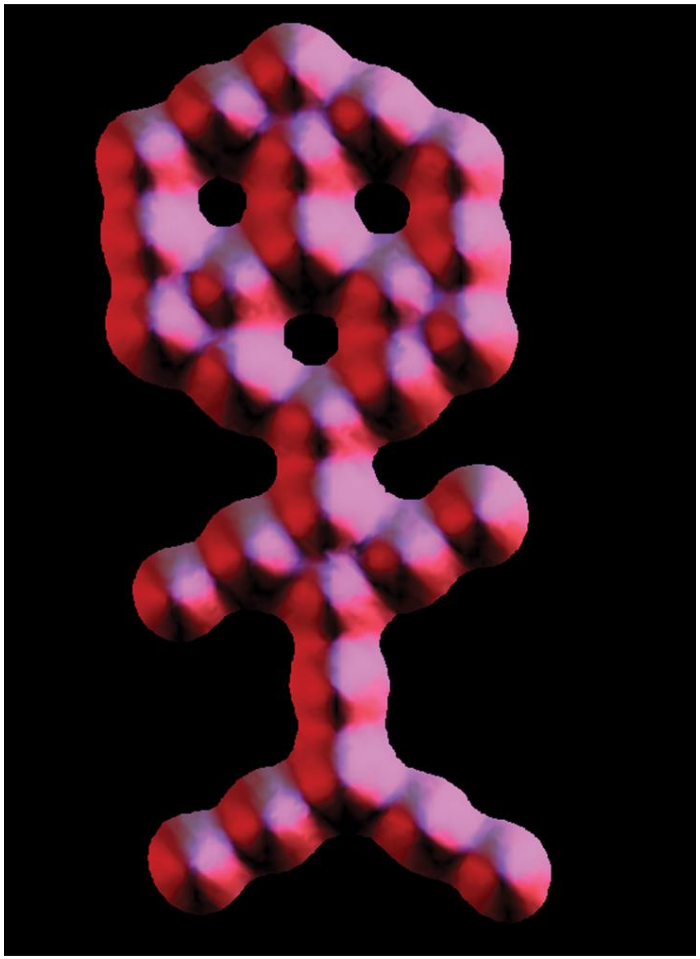
Single slit (b)

Problem



$a, d, \lambda?$

Chap. 36 Quantum Physics



양자물리에서 배울 내용

1) 양자물리학 소개

2) 빛의 입자성

※ photoelectric effect, Compton 산란, blackbody radiation

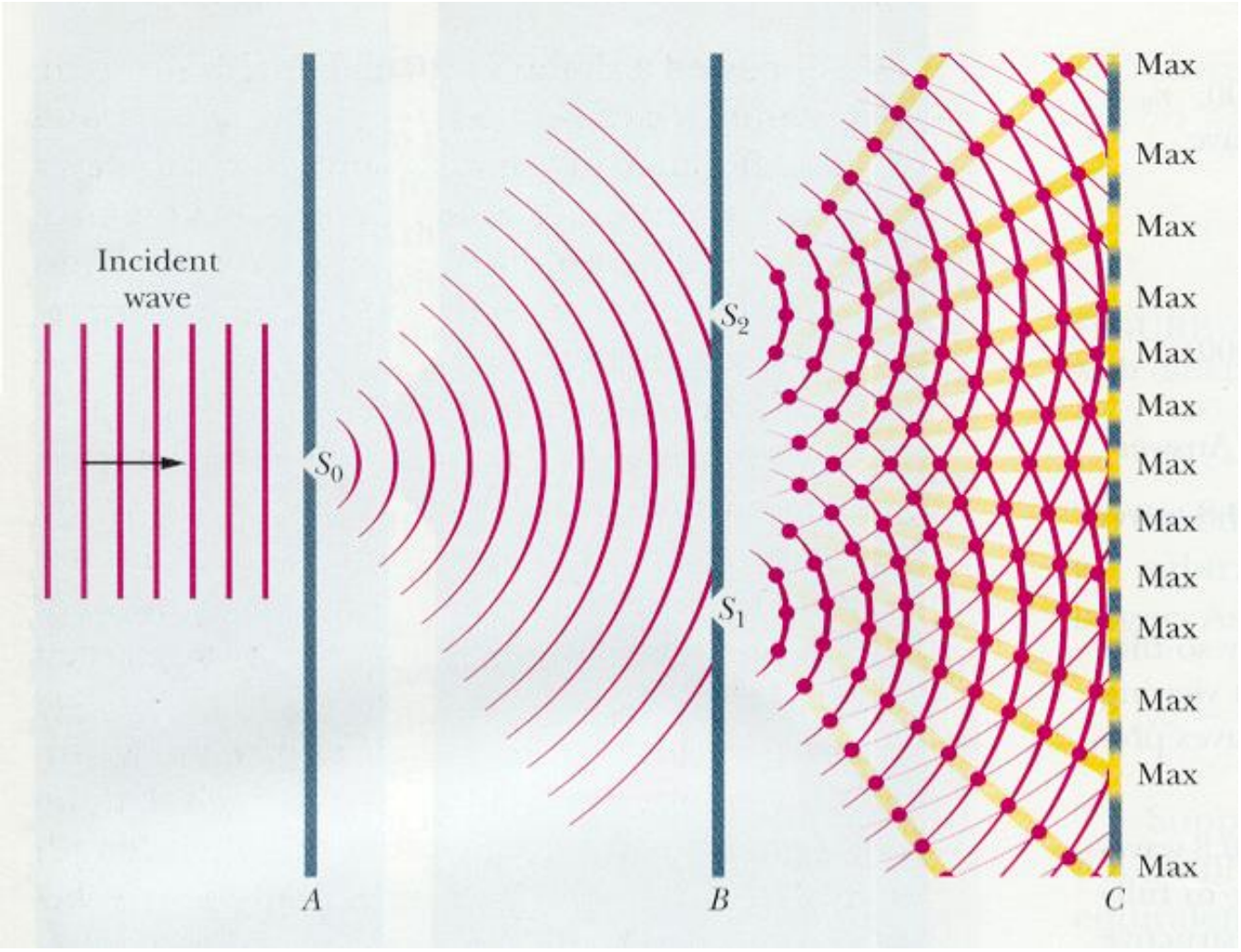
3) 입자의 파동성

※ de Broglie's hypothesis, Davisson-Germer experiment

Bohr의 수소원자 모델

4) Uncertainty principle, complementary principle, correspondence principle..

Young's experiment



빛은 파동이다.

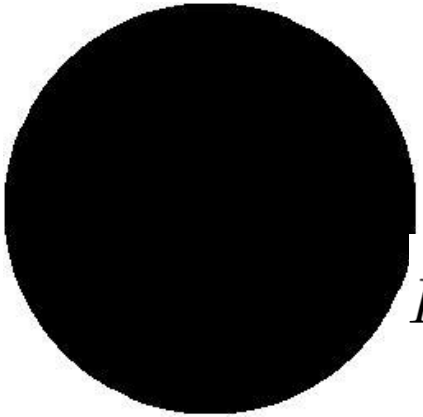
1) 빛, 혹은 전자기파는 Maxwell 방정식으로부터의 파동방정식을 만족한다.
2) 빛은 회절과 간섭을 한다.

빛은 입자의 성질을 가지고 있다.

$$E = hf$$

$h = 6.63 \times 10^{-34}\ \mathrm{J \cdot s}$ Planck 상수

Blackbody radiation



Classically known facts

(1) Stefan-Boltzmann law

$$I = \int_0^\infty \epsilon(\lambda) d\lambda = \sigma T^4, \quad \sigma = 5.67 \cdot 10^{-8} \mathrm{Wm}^{-2}\mathrm{K}^{-4}$$

(2) Wien's law

$$\epsilon_{\mathrm{Wien}} = \frac{a}{\lambda} e^{-b/\lambda T} \qquad \lambda_m T = \text{constant}$$

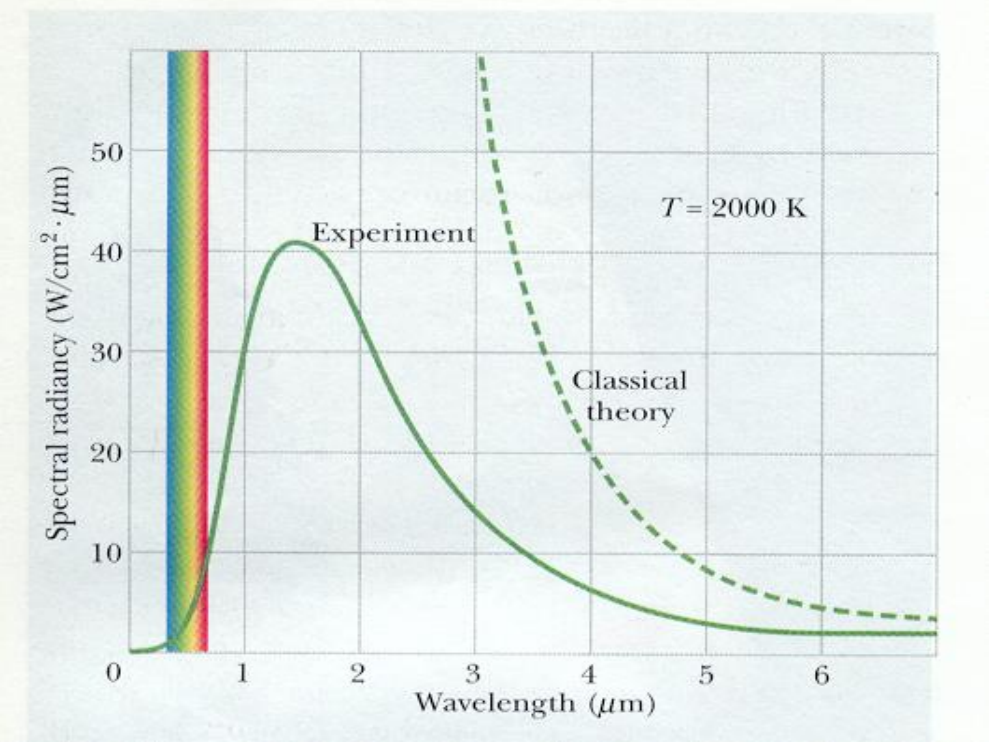
(3) Rayleigh-Jeans law

$$\epsilon_{\mathrm{RJ}} = \frac{2\pi c k_B T}{\lambda^4}$$

Planck got the result

$$\epsilon_T(\lambda) = \frac{2\pi hc^2}{\lambda^5\left(e^{hc/\lambda k_B T} - 1\right)}$$

빛은 파동이다. 아니다.



편광, 간섭, 회절

↓

전자기파동 이론

빛의 양자화 에너지

$$E = hf$$

$$yellow : \lambda = 589\text{nm} \Rightarrow E = hf = \frac{hc}{\lambda} = 2.11\text{eV}$$

$$\gamma - ray : E = 1.35\text{Mev} \Rightarrow \lambda = \frac{c}{f} = \frac{hc}{hf} = \frac{hc}{E} = 920\text{fm}$$