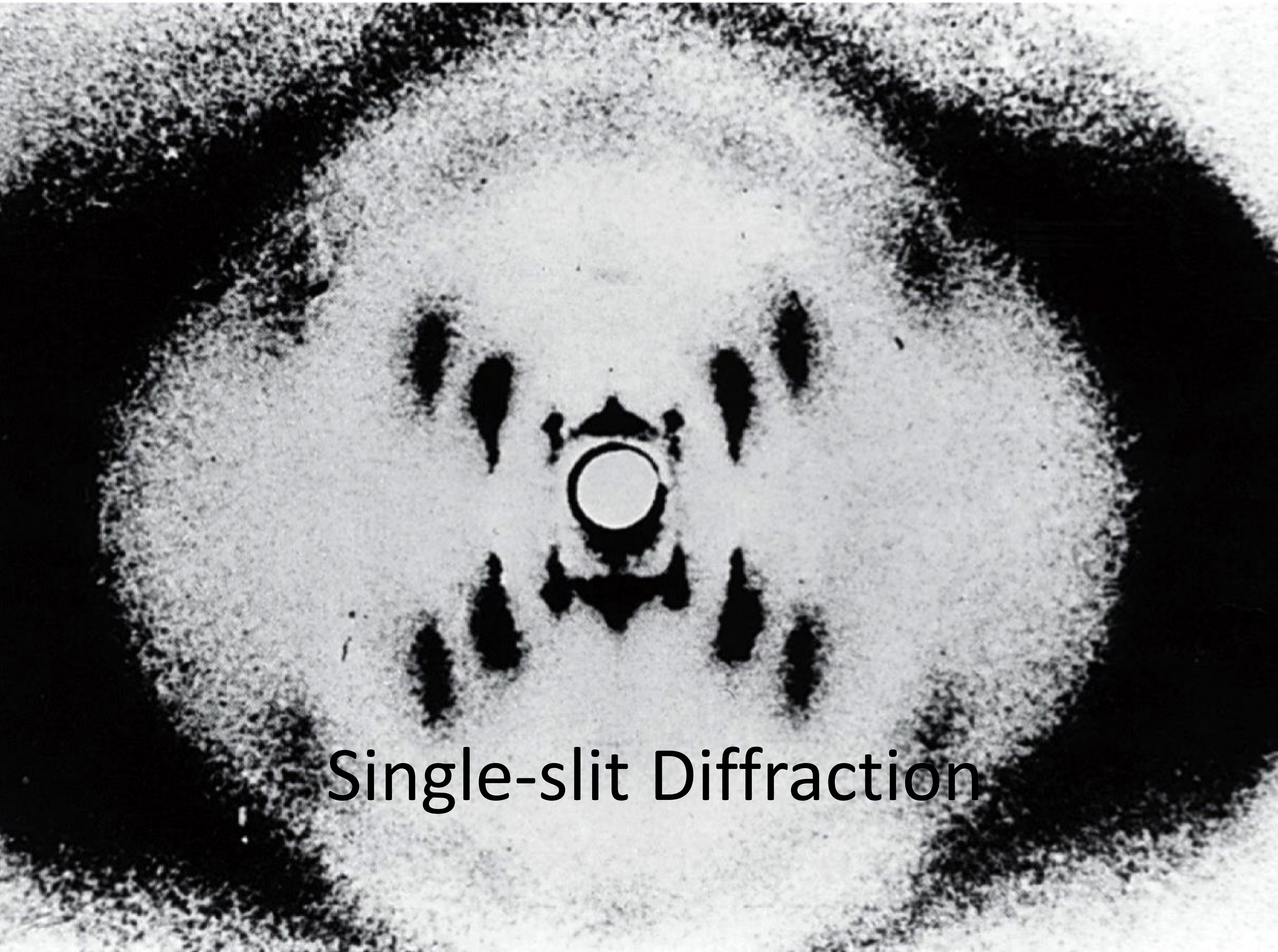


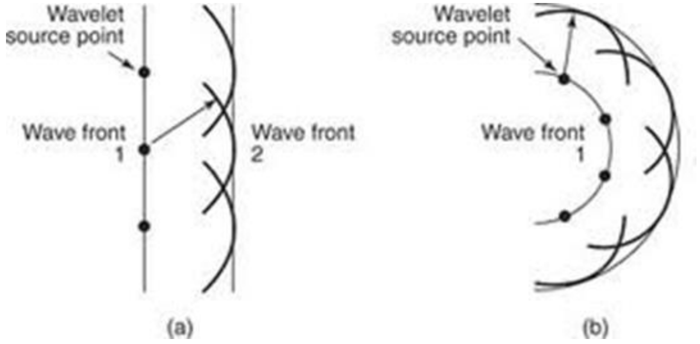
Single-slit Diffraction

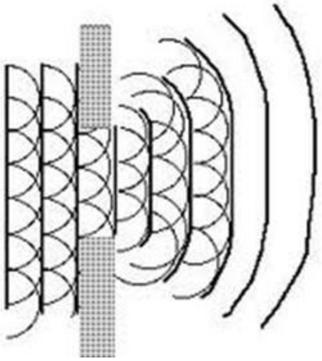
Diffraction by a single slit and Huygens' principle

$w > \lambda$

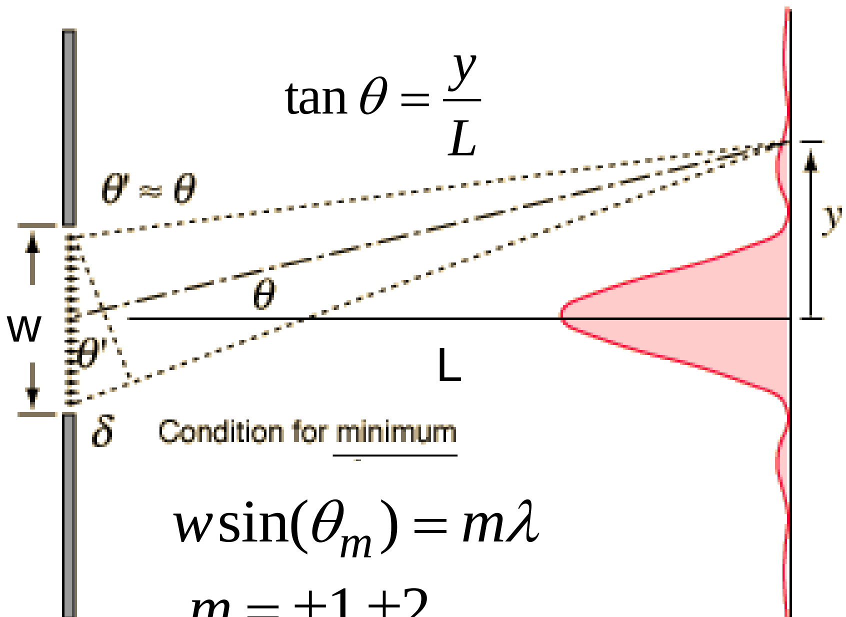
$w \leq \lambda$

Huygens' principle for propagation of waves:



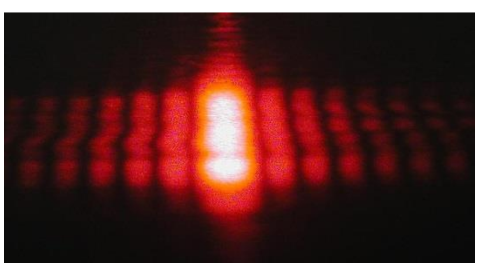


Mathematical analysis of single-slit diffraction



$$w\sin(\theta_m) = m\lambda$$

$$m = \pm 1, \pm 2, \ldots$$



Notice that the condition for a <u>minimum</u> here has the same form as condition for a <u>maximum</u> in a double-slit case

Quickuiz

In a single-slit diffraction experiment, with a slit of a given width w, which type of EM radiation (light) will produce the widest central bright fringe in the diffraction pattern?

A. X rays ($\lambda \sim 10^{-11}$ m)

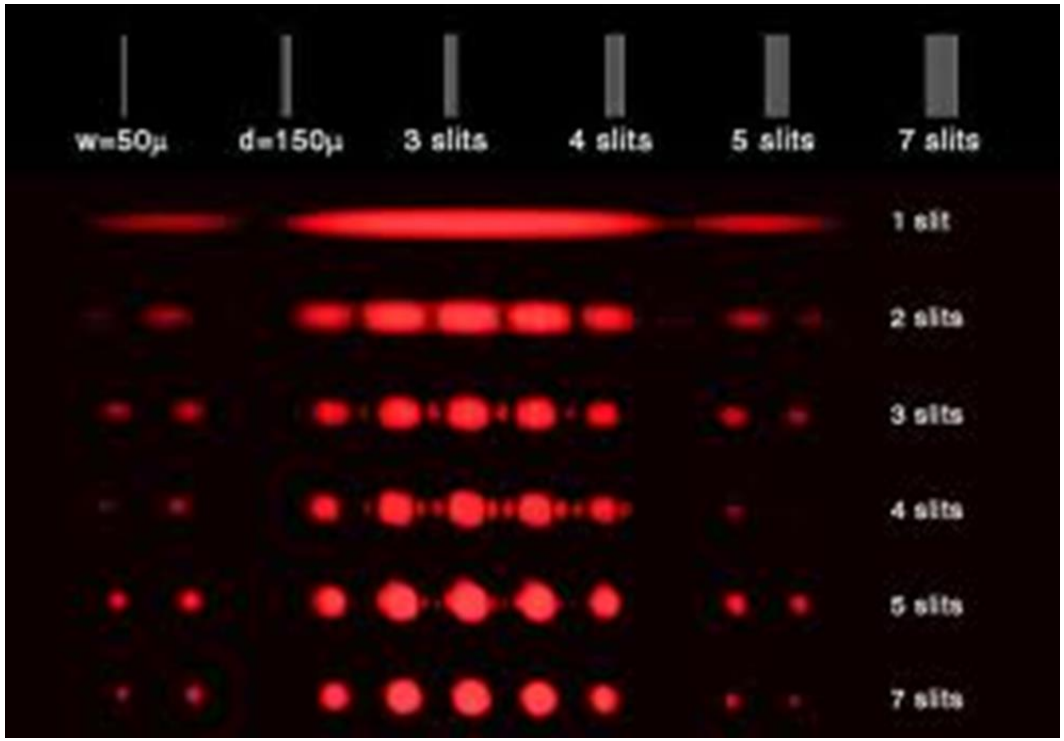
B. Ultraviolet light ($\lambda \sim 10^{-9}$ m)

C. Visible light ($\lambda \sim 10^{-7}$ m)

D. Microwaves ($\lambda \sim 10^{-2}$ m)

$$w \sin \theta_m = m\lambda$$

Diffraction by multiple slits (and diffraction grating)



Condition for maxima for multiple slits (and diffraction grating) is same as for two-slits:

$$d \sin \theta_m = m\lambda$$

Quickuiz

Suppose that in a diffraction grating (with many slits), the **spacing between the slits** is increased by a factor of 4. The effect of this change will be to:

A. Increase the spacing between the maxima (bright fringes)
B. Decrease the spacing between the maxima
C. Change the relative intensity of the different maxima

$$d \sin \theta_m = m\lambda$$

$$d = \frac{m\lambda}{\sin \theta_m}$$

d inversely proportional with angle

Atomic structure determination with X-ray diffraction