Physics Lab →

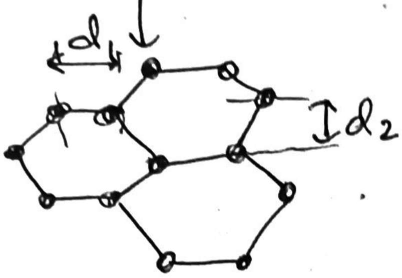
9th January 2024

(1) Electron diffraction →

$$\lambda = \frac{h}{p}$$ → particles have ~~wa~~ wave nature in addition to their particle properties.

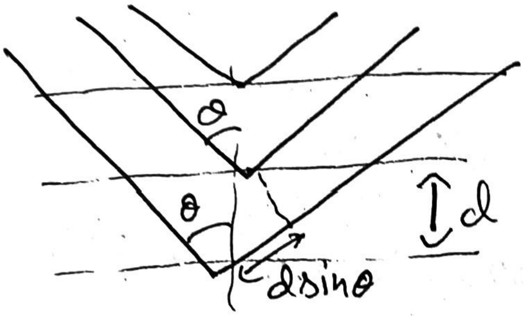
Experimentally demonstrated by Davison-Germer. using nickel crystal

We use ~~gr~~ polycrystalline graphite.



When electrons hit the atoms, they diffract.

We allow monoenergetic electrons.



Bragg's Condition:

$$n\lambda = 2d\sin\theta$$

What we measure as the interference pattern is the probability density.

We use transmission method.

for $n=1$, we see a dot.

for higher n, we see circular fringes.

The sample is polycrystalline — there are all possible orientations of the crystal — not uniform.

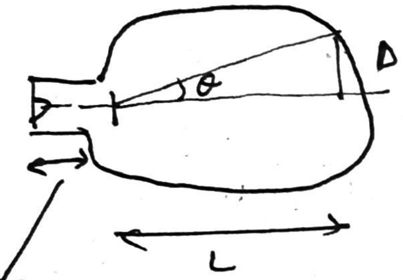
That is the reason why we see the fringes.

for media that have more than 2 different ds, there are more circles.

$$\lambda = \frac{h}{p}$$

$$\Rightarrow 2d\sin\theta = \frac{h}{p}$$

$$\Rightarrow d = \frac{h}{p(2\sin\theta)}$$



$\tan\theta = \frac{D}{2L}$

potential difference (why is this the case when the accelerated electrons radiate energy?)

Imparts KE to electron.

$$\frac{1}{2}mv^2 = eu$$

$$\Rightarrow \frac{p^2}{2m} = eu \Rightarrow p = \sqrt{2meu}$$

$$\Rightarrow \lambda = \frac{h}{\sqrt{2meu}}$$

$$\boxed{d = \frac{2hL}{\sqrt{meu}\,D}}$$

$$\boxed{d = k\frac{1}{D}}, \quad \boxed{D = k'\frac{1}{\sqrt{u}}}$$

We have to determine planck's constant from the slope.

(2) Photoelectric effect →

$$E = h\nu$$

- ⊛ Tells us that energy is quantised
- ⊛ That metals have a work function.

$$E_w = e\phi$$

$$h\nu > e\phi$$

$$h\nu = \underbrace{\frac{1}{2}mv^2}_{\text{KE of electron.}} + e\phi$$

Usual photocurrent graphs.

(3) Frank Hertz ⟶

Atoms emit radiation at discrete frequencies.

(4) Velocity of light → Next week