Hello students.

Welcome to this presentation.

My name is Pradeep Morajkar

I'm an associate professor.

This presentation is on the paper

quantum mechanics, Semester V.

And the unit is “waves and particles”.

The name of the model is

Davisson and Germer experiment.

The outline of this presentation

is Davisson and Germer experiment.

In which.

We will also understand the variation

of intensity of scattered light

for various accelerating potential.

And demonstration of wave

nature of particles.

The learning outcomes.

The learner will be able to understand

that electrons can undergo diffraction.

The wave nature of electrons or particles.

And hence it will confirm the De-Broglie’s

hypothesis for matter waves.

The Davisson and Germer experiment.

It is the main presentation over here.

This is a proof of the De-Broglie’s hypothesis.

Which was postulated by the scientists

Louis de-Broglie in the year 1924.

In 1927 two physicist by the name

Davisson and Germer were able to

demonstrate in the form of experiment,

the diffraction of electrons.

The experimental setup consists of

a electron gun which is connected

to a high tension battery.

Nickel crystal on which the light.

Falls is connected to low tension battery

A mobile detector for which

a galvanometer is connected

to record the current.

The filament , nickel

crystal and the detector.

It is concealed in a vacuum chamber.

When it comes to electron gun it consists of.

A filament like tungsten?

When the voltage is applied

across the tungsten filament.

The electrons are given out and this physical

process is called thermionic emission.

These emitted electrons pass through the cylinder,

with a high voltage and their

accelerated towards the crystal.

When the light beam ie. the electron beam,

falls on the crystal,

it is scattered in all directions.

This scattering of electron beam is

observed with the help of a movable detector.

What was amazing to see in this case when

it comes to scattering phenomena that

each scattering shows the minima and

maxima corresponding to a particular voltage.

It was founded.

The intensity of scattered beam .

depends upon the angle of scattering.

That is, we denote here as Φ̂

In each curve we find the minimum and

maximum and Maxima is in the form of a bump.

Or the kink

And which always occurs in the curve.

At 54 Volts this Bump is maximum, it decreases on further

with the increase of potential difference,

so we can see one of the graph

shows the maximum intensity. At a voltage of 54 degrees

an Atom scattering angle of 50 degrees.

So we find that and it was noticed

by both Davisson and Germer.

The strong peak in the intensity of

the scattered beam cannot happen

unless the scattered beam undergoes

constructive interference,

so the scattering of the electron beam

by the crystal produces an interference.

And this proves that electrons suffer

scattering

And the interference takes place when

the electron behaves like waves.

In this experiment,

the voltage was varied from 44

volts 268 volts.

When we try to quantitatively understand.

Davidson and Germer observations.

We make use of the de-Broglie equations

so desperately problems hypothesis.

Lambda is equal to h/ p

where h corresponds to Planck’s

constant whose value is given as 6.63* 10 raise to minus 34 joules.

p refers to momentum associated with the particle.

Now we make use of this expression to

calculate the wavelength associated with

the electron using the de-Broglie's hypothesis.

When it comes to the kinetic energy

of the electron in this case.

At 50 degree angle it was found to be

54 electron volts and the rest energy

comparatively is much much higher.

So we ignore here the

relativistic consideration.

In the expression of the Broglie's equation,

we substitute the values of

all the constants,

like playing constant mass

associated with the electron.

That is 9.1 10* raise to -- 31 kg

the charge

1.610 * 10 raise to minus 19 Coulomb and

the value was calculated and was

found to be 1.65 Angstrom unit.

Considering the scattering which takes place

in analogous to the Bragg’s diffraction

we try to observe the similar pattern.

The same pattern was observed

but Davidson in Germer.

Compared with the Bragg’s diffraction

considering the incident wave front

and the scattered wave front.

when we use the Bragg's equation,

the Bragg's equation is 2D Sin Ø are.

Is equal to an Lambda and in this

case we consider the 1st order.

Now for the nickel crystal,

the interatomic distance is .191 angstrom

unit and hence the scattering angle.

In this case is calculated to be 65

degrees and when it is substituted in

Bragg's equation we obtain the value

of Lambda to be 1.65 and strong unit.

This is the similar value,

the same value which is obtained

using the de-Broglie's hypothesis.

So our claim.

To prove that the particles of matter

and in this case the electrons that they

behave as a wave is justified

The interference takes place

and hence this supports the de-Broglie's

hypothesis

Which says that the particles of the

matter like electrons behave as a wave.

Thank you very much for your kind attention.