Schumacher quantum mechanics

Teaching Company: Quantum Mechanics: The Physics of the Microscopic World

Lecture 3:

At end of 19th century, scientists tried using classical physics to explain black body radiation. Classical physics predicts way too much high energy radiation from a light bulb. Max Plank solved the problem by assuming light was not emitted continuously, but only in discrete quanta. That means a quanta of high energy is hard to get together, because it takes so much energy, so there are relatively few higher energy photons.

Energy of the electrons emitted when light falls on metal does not depend on the intensity of the light. If increase intensity of light, get more electrons emitted. The greater the frequency of light, (the higher the energy of the photons), the higher the energy of the emitted electrons.

Einstein was aware of plank's hypothesis. Says every photoelectron gets its energy from a single photon. So energy of single electron depends on energy of single photon.

Lecture 4:

Light travels like a wave, interacts like a particle

Two connections between energy and momentum of particle and wave length/frequency of wave:

1: Planks constant

2: Born's Rule

Planks constant

The Plank DeBroglio relations connect particle properties (energy, momentum) with wave properties (wavelength/frequency)

plank's equation:

The Plank relation: particle energy= planks constant times wavelength frequency E=hf

Debroglio proposed: particle momentum= planks constant divided by wavelength= h/ lambda

Electrons and photons are very small. The Wavelength for electron or photons is very small

As mass increases, wavelength gets even smaller, so not possible to do interference experiments with macro sized objects.

Particle located at a point in space; a wave is spread out.

Borns rule:

The intensity of the wave at a point tells us the probability of finding the particle at that point. Intensity of wave is square of amplitude of the wave; energy of wave.

One electron or photon at a time thru a double slit will resolve, through many thousands of particles, into an interference pattern.

This is an example of Born's rule.