

PHYS234 Notes

Minyang Jiang

January 9, 2017

1 History

A conservative revolutionary In about 1908, Planck convert to the view that the quantum of action represents an irreducible phenomenon beyond the understanding of classical physics

Einstein in 1905

1. photoelectric effect
2. dissertation, proving the existence of atoms
3. Brownian motion
4. special relativity
5. $E = mc^2$

Johann Jakob Balmer's formula

$$v = R \left(\frac{1}{n_f^2} - \frac{1}{n_i^2} \right)$$

Rutherford atom model was unstable in classical physics

Niels Bohr - grandfather of quantum physics

1. solve the stability problem of Rutherford's model
2. classical physics could not apply inside the atom
3. orbits have something to do with the Planck - Einstein quantum relation of the light photon ($E = hv$).

Bohr derived Balmer's formula

Bohr's model of atom

1. Electrons in atoms orbit the nucleus
2. Electrons can only gain and lose energy by jumping from one allowed orbit to another, absorbing or emitting EM radiation with a frequency ν given by the energy gap of the levels according to the Planck relation:

$$\Delta E = E_2 - E_1 = h\nu$$

angular momentum L is restricted to be an integer multiple of a fixed unit

$$L = mvr = \frac{nh}{2\pi} = nh$$

where $n = 1, 2, 3, \dots$ is called the principal quantum number.
He mixed classical and quantum physics to get

$$\frac{1}{\lambda} = R \left(\frac{1}{n_f^2} - \frac{1}{n_i^2} \right)$$

Important applications of QT in 20th century

1. Invention of transistors
2. Invention of lasers
3. Invention of STM
4. ...