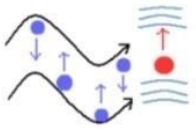
How Particle-Wave Duality Affect the Understanding of Quantum Physics?

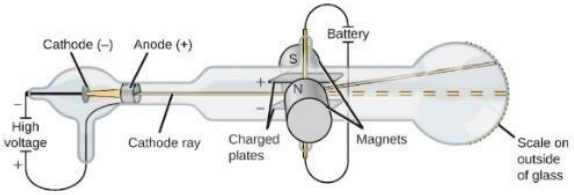
Alper Tağman, Ümit Şen, Murat Akın Çiçek, Mustafa Kasap, Ahmet Göktekin



Background

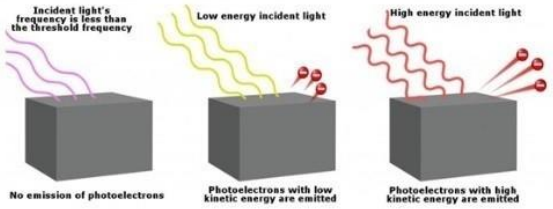
Late in 19th century, the atomic theory that been established explained the content of an atom.

J.J. Thomson showed that the Electricity consists of electrons by using cathode rays.



The Double Slit Experiment of Young consolidated the existance of light's wave form.

At the start of 20th century, Einstein told that light, which had been known as a wave, must be considered as a particle at the same time.

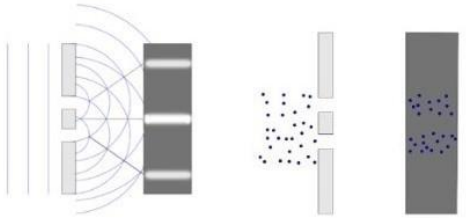


Then the Compton effect which been observed in 1922, pointed the wave-particle duality of light.

In 1924, De Broglie suggested that the electrons also show wave characteristics.

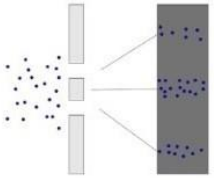
Later on, the experiments of Clinton Davission and Lester Germer confirmed the wave properties of electrons.

Double Slit Experiment



An interference pattern

The pattern from particles



Double slit experiment with electrons

Light's Behaviour

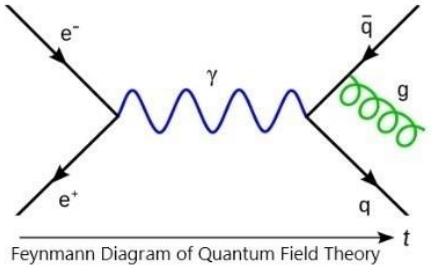
	●→	∿∿∿
Reflection	✓	✓
Refraction	✓	✓
Interference	✗	✓
Diffraction	✗	✓
Polarization	✗	✓
Photoelectric effect	✓	✗

Conclusion

The wave-particle duality of a particle, as a quantum mechanics concept, shows and proves the ineffectiveness of classical physics for explaining the characteristics of quantum-sized matter.

Niels Bohr, Arthur Compton, Louis De Broglie, Albert Einstein, Max Planck and other scientists showed that particles can also behave like waves with their studies. Also, this duality has been confirmed for atoms and molecules additional to elementary particles.

With the evidence of the existence of wave-particle duality, the explanation of classical physics about the fields have been changed. The magnetic and electric field concepts of Maxwell is removed and the unique quantum field theory is established.



Feynmann Diagram of Quantum Field Theory

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