Physics 4D
Modern Physics

History

At the end of the 19th century scientists pretty much believed that they knew everything there was to know about physics- with the exception of some "minor" discrepancies.

1. Classical Mechanics
    A. Newton's Laws of Motion
    B. Law of Gravitation

2. Classical Electromagnetism (Maxwell's Equations)

A. $\oint \vec{E} \bullet d\vec{A} = \frac{q_{enc}}{\varepsilon_o}$

B. $\oint \vec{B} \bullet d\vec{A} = o$

C. $\oint \vec{E} \bullet d\vec{l} = -\frac{d\Phi_B}{dt}$

D. $\oint \vec{B} \bullet d\vec{l} = \mu_o I + \mu_o \varepsilon_o \frac{d\Phi_E}{dt}$

3. Laws of Thermodynamics and Kinetic Theory of Gas

These theories/Laws were very successful in describing and explaining our physical world. However, in each of these areas of physics you were always able to find an experiment in which the results did **NOT** agree with the theory! That is, there was a discrepancy between theory and experiment.

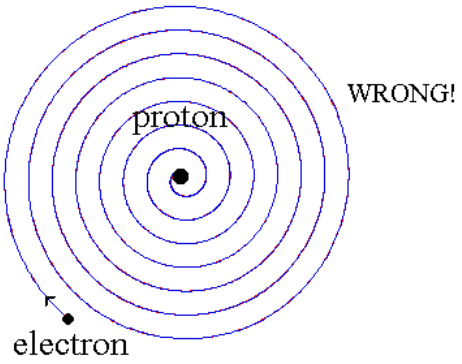
Failure of Classical Physics:

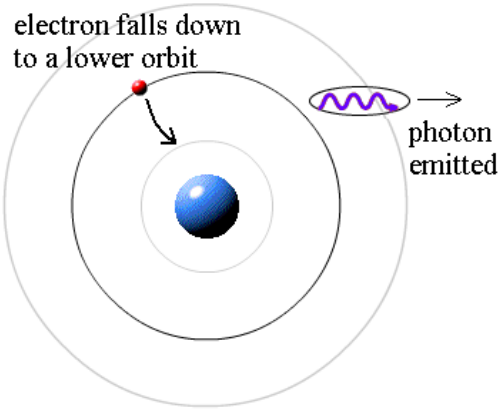
1. **Newton's Laws** failed when applied to objects moving near the speed of light and when applied to particles at the atomic scale. (Special Theory of Relativity)

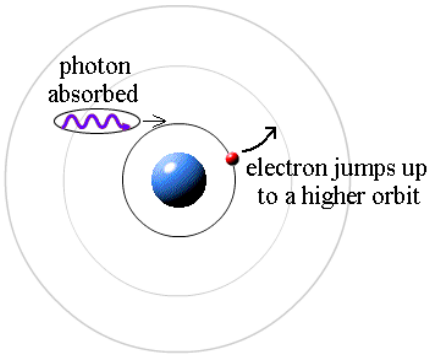
2. **The Photoelectric Effect** - Maxwell's Equations could not explain the quantization of light (Quantum Mechanics)

3. **The Speed of Light** in a vacuum is always $c = \frac{1}{\sqrt{\mu_o \varepsilon_o}}$ = 3.0 x10^8 m/s regardless of the motion of the observer or emitter. (Special Theory of Relativity)

4. **Hydrogen Emission Spectrum** – To explain the emission spectrum of the hydrogen atom.(Quantum Mechanics).







5. **<u>Black Radiation Problem</u>** – To determine the intensity at a given wavelength of the radiation emitted by a blackbody. (Quantum Mechanics)