Atomic Theory: Modern Theories

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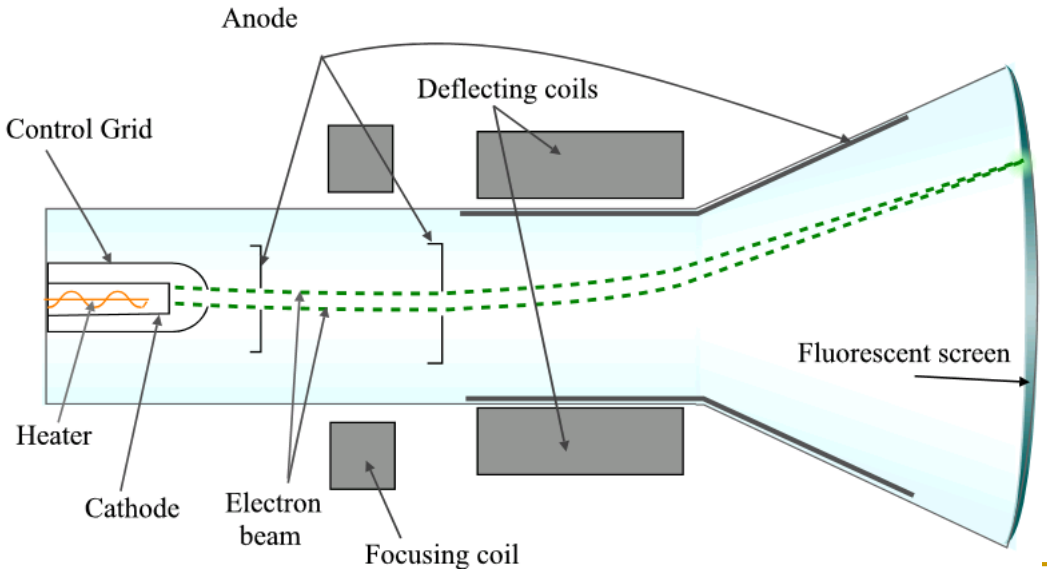
Discovery of the electron

- IN 1897, J.J Thompson performed experiments with a sealed glass tube called a cathode ray.



Electron observations

- When performing the experiment, he noticed several important observations.
  - The “beam of light” in the cathode ray projected a straight line
  - The beam started to bend when a magnet was brought close to the cathode ray
  - When the beam was aimed at a propeller, it caused the propeller to spin (p.11 Fig.1.9)
  - The beam was always attracted towards the positive end of an electric field (p.11 Fig.1.8)

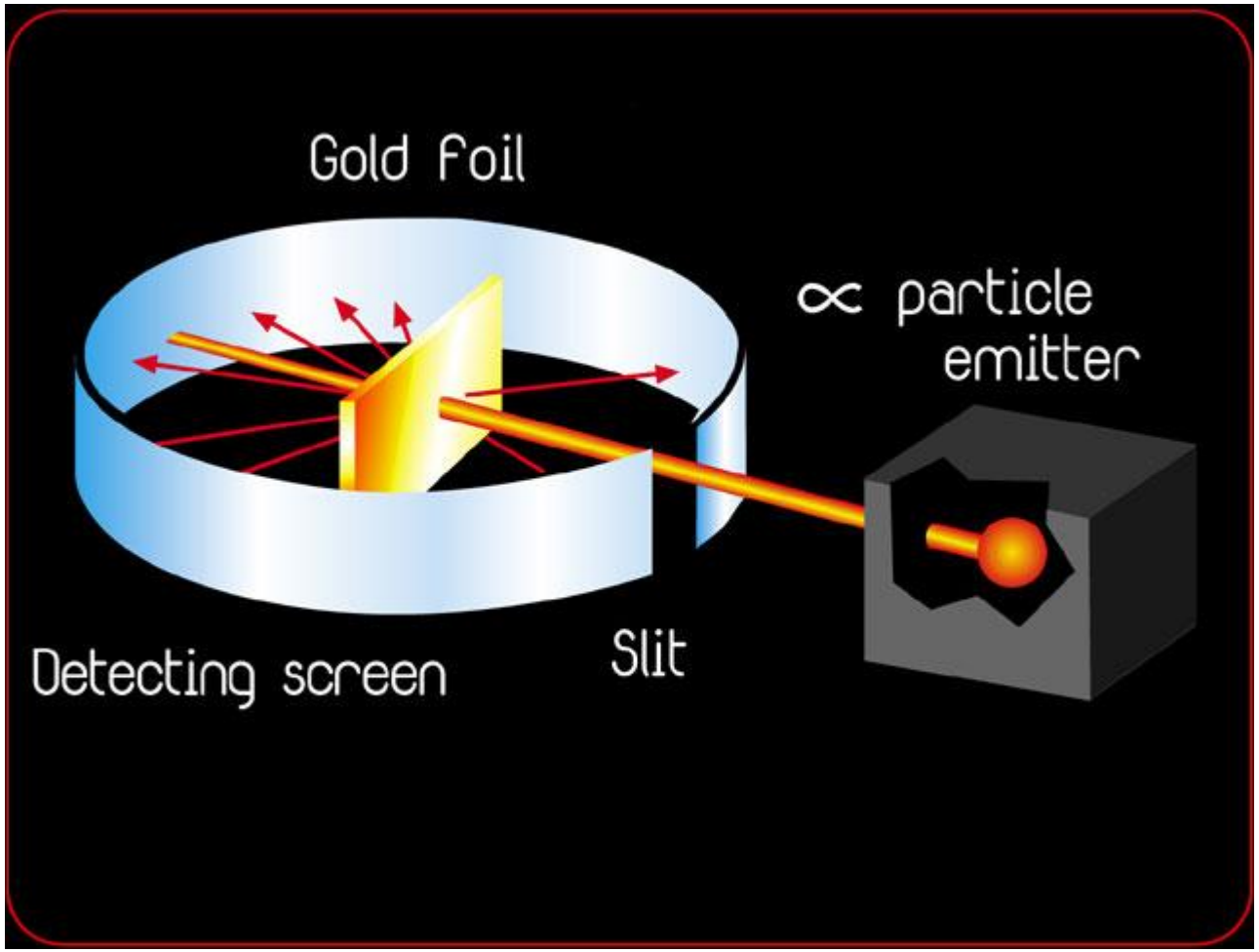
Thomson's conclusion

- The electron is a sub particle of the atom and it is made up of negative charges
- His model is called the "plum pudding" or "chocolate chip cookie" because the electrons are lying on the surface of the atom
- The electrons would be "stuck" to the surface because it is positive and the electrons are negative

Rutherford's Atomic Model

- In 1911, a New Zealand physicist named Ernest Rutherford made advances to the effect of radiation on matter
- He then decided to bombard a thin sheet of gold foil to see how the electrons would react when subjected to radiation
- He made a discovery that completely revolutionized the way we perceive atoms

Rutherford's Atomic Model



Rutherford's Atomic Model

- He saw that most of the alpha particles went through the sheet of gold foil.
- Some were deflected and very few bounced straight back towards the source

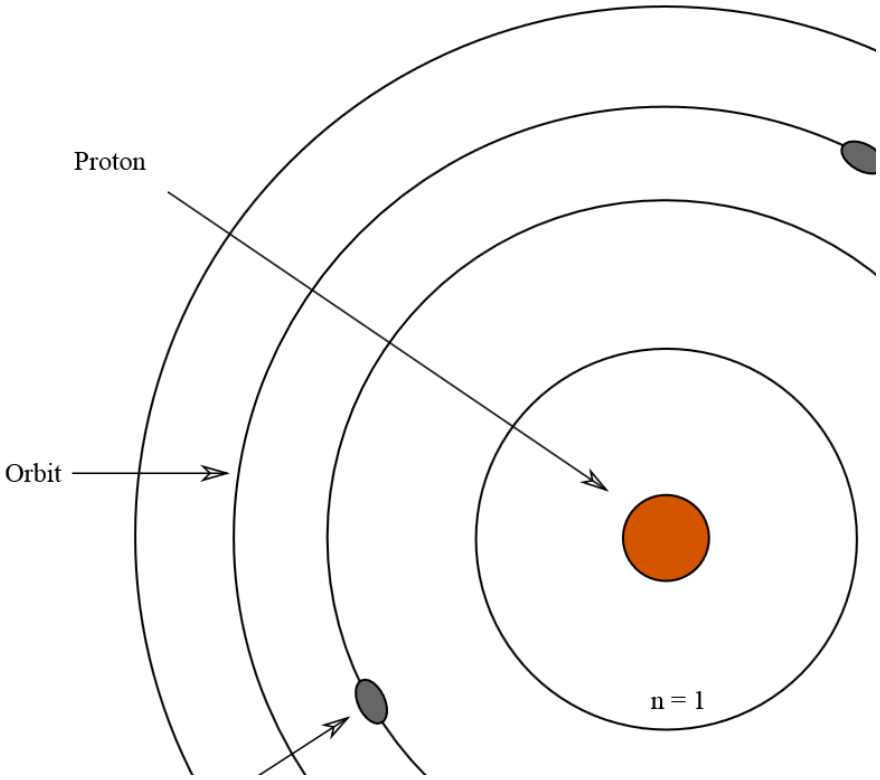
His conclusions

- Since most of the alpha particles went through without being deflected, an atom is made up mostly of empty space.
- Some of the alpha particles are strongly deflected and therefore the nucleus has to be small and very dense. The charge of the particle has to be positive

Bohr's Model

- He noticed that if you leave the electrons moving randomly around the nucleus, the electrons might get too close to the postive center and fall in.
- He proposed a solution to make sure that electrons never fall into the protons in the center.

Bohr's Model



Bohr's Model

- He proposed that electrons move around the nucleus in "orbits", just like planets would move around the Sun.
- When given energy, the electrons would get excited and "jump" to a higher orbit.
- When they came back down, they would release their extra energy as light that we can observe.

Energy levels

- Each level can contain a limited number of electrons
- The first level : 2 electrons maximum
- The second level: 8 electrons maximum
- The third level: 8 electrons maximum
- The fourth level: 2 electrons
- You must fill out the lower levels before you can start on the high levels

Number of protons and electrons

- If you look on the periodic table, in each of the elements, you will find a whole number.
- This number tells you the number of protons and electrons.
- For example, Helium has 2 as a whole number. It therefore has 2 protons and 2 electrons.