

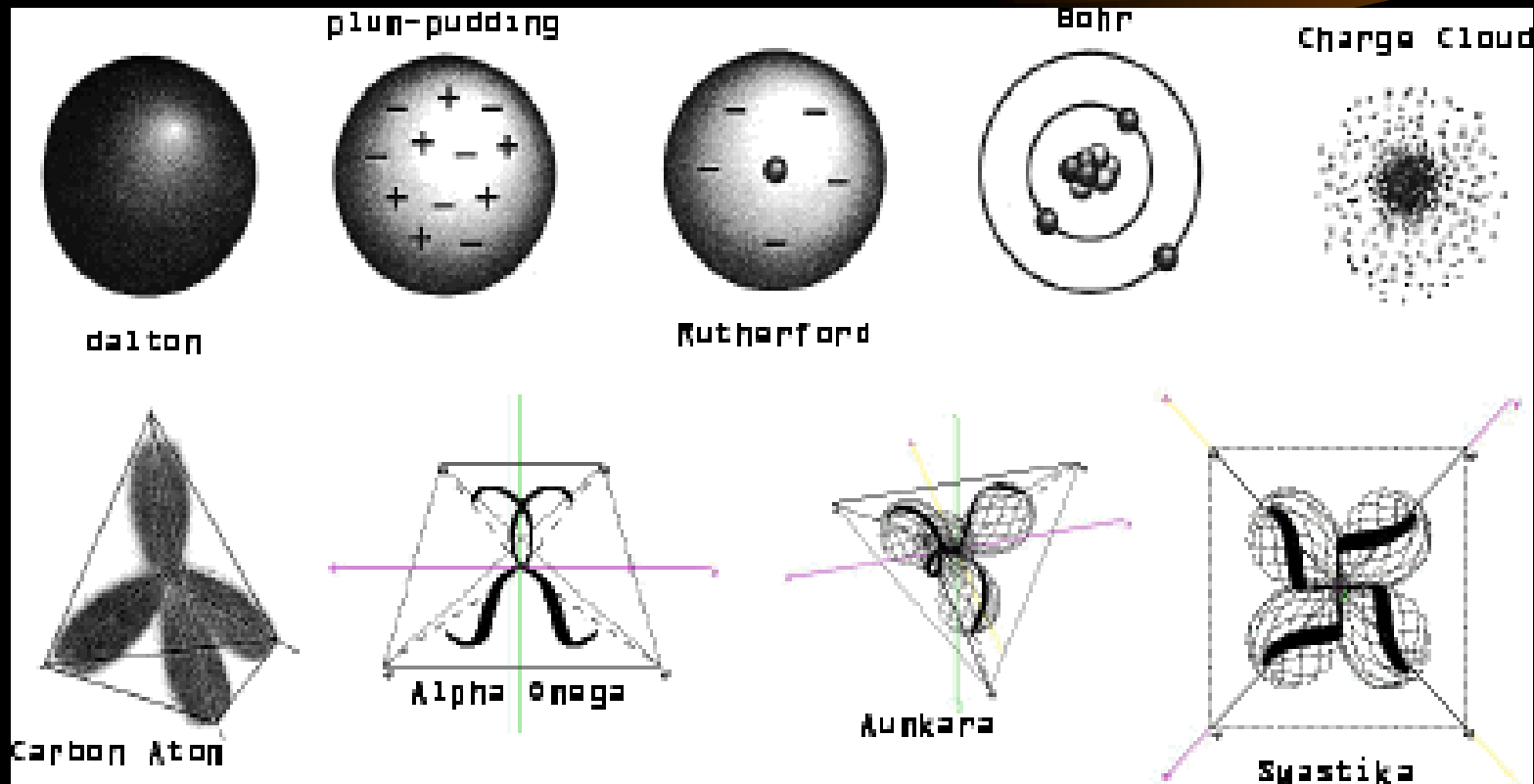
ATOMIC STRUCTURE AND PROPERTIES

Ch. 3 – Atoms, Electrons & Periodic Trends



- I. Nuclear Atomic Model
(p.119+)

Overview of Atomic Models



Dalton's Atomic Theory

- ◆ Democritus first suggested the existence of the atom but it took almost two millennia before the atom was placed on a solid foothold as a fundamental chemical object by John Dalton (1766-1844). Although two centuries old, Dalton's atomic theory remains valid in modern chemical thought.

Dalton's Atomic Theory

- ◆ 1) All matter is made of atoms. Atoms are indivisible and indestructible.
- ◆ 2) All atoms of a given element are identical in mass and properties
- ◆ 3) Compounds are formed by a combination of two or more different kinds of atoms.
- ◆ 4) A chemical reaction is a *rearrangement* of atoms in definite proportions.

Dalton's Biography:



John Dalton

John Dalton Biography

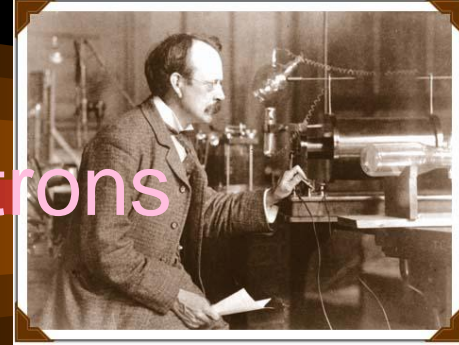
John Dalton (1766-1844) was an English chemist with a Quaker background. His religious beliefs, and perhaps his modesty, prevented him from accepting much of his deserved fame and recognition. Today Dalton is known primarily for his atomic theory, although his inquisitive nature and diligent research led him to make many important discoveries in fields other than chemistry. He made a careful study of color-blindness, a condition from which he suffered. Dalton was also a pioneer meteorologist, keeping daily records of the weather for 57 years. His fascination with weather and the atmosphere led to his research into the nature of gases, which in turn became the foundation on which he built his atomic theory.

Dalton's Model Explains:

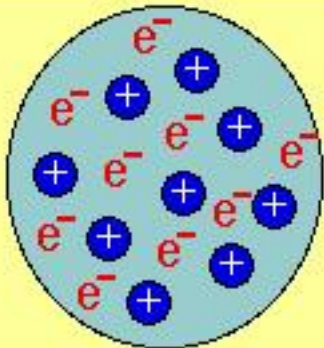
- ◆ Laws of Chemical Change and how atoms combine to form molecules
- ◆ BUT it does not explain the existence of isotopes, the nucleus or any subatomic particles



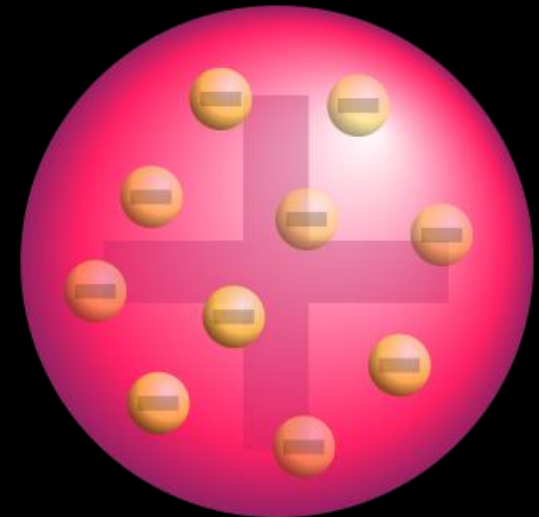
Thomson's Plum Pudding Model



- ◆ An atom is a sphere of uniformly distributed positive charge with electrons embedded throughout
- ◆ Explains existence and location of protons and electrons
- ◆ Does NOT explain the existence of electrons outside the nucleus, neutrons or isotopes



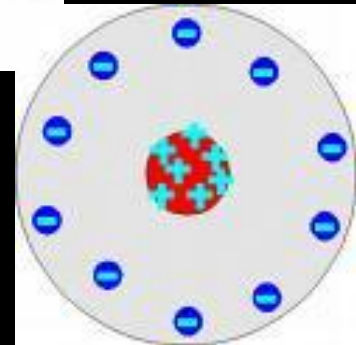
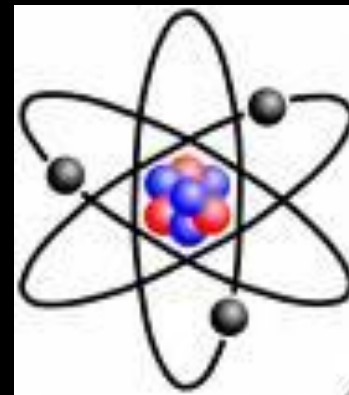
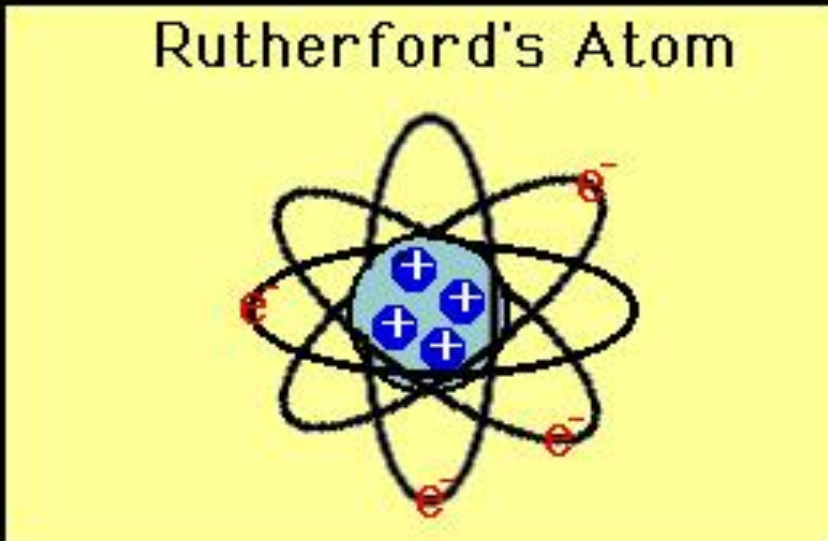
J.J. Thomson's
"Plum Pudding" Model



Rutherford's Nuclear Model

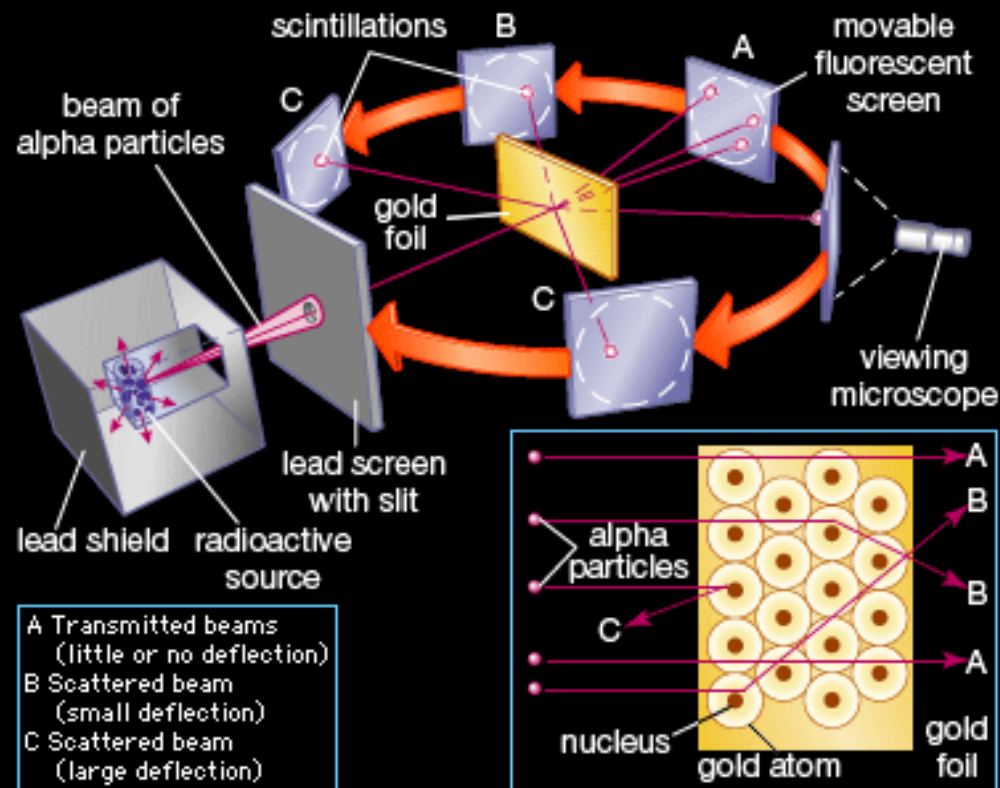
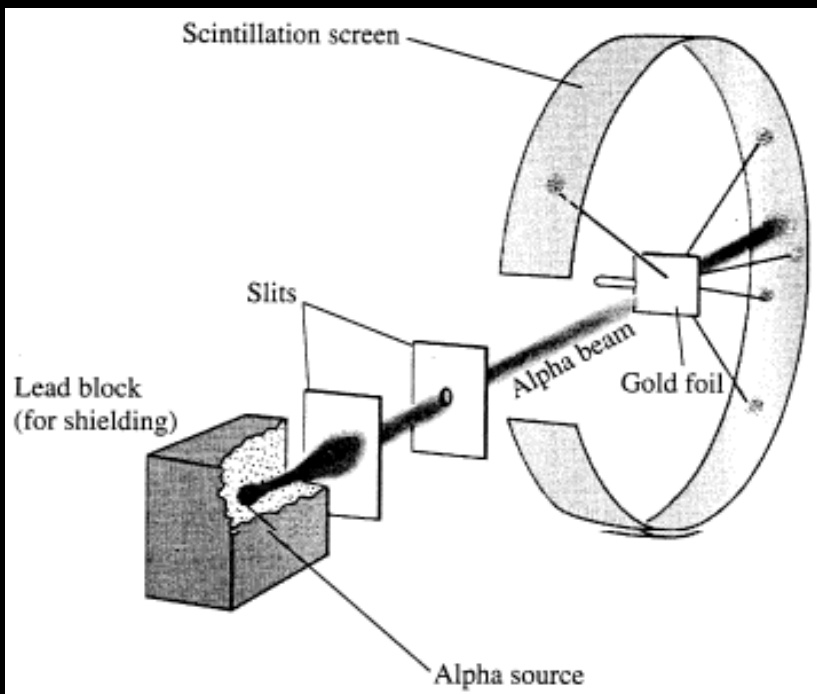


- ◆ An atom is mostly empty space with all of the positive charge and most of the mass located in a central part called a nucleus



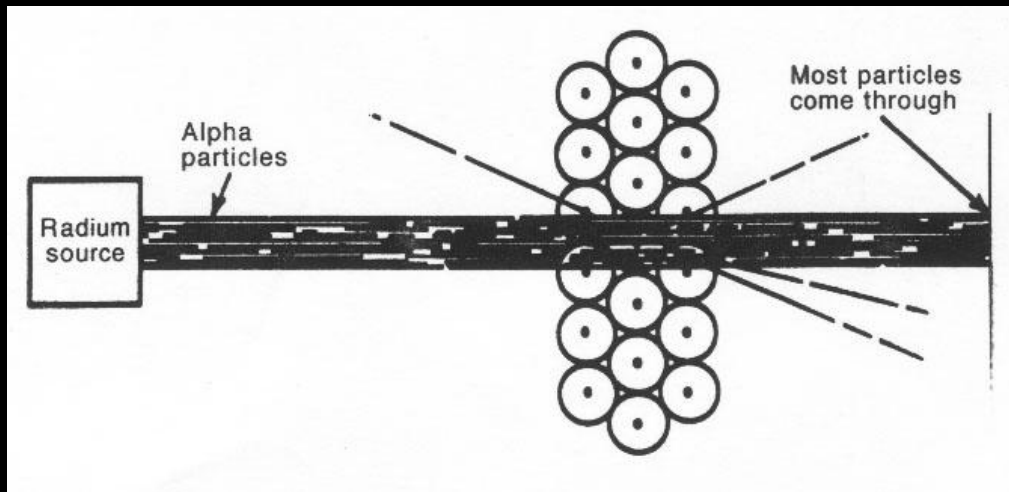
Rutherford's Model Explains:

- ◆ Scattering of alpha particles by metal (gold) foils
- ◆ The atom is mostly empty space
- ◆ The nucleus is positively charged
- ◆ The electrons are outside the nucleus



Rutherford's Model does NOT explain:

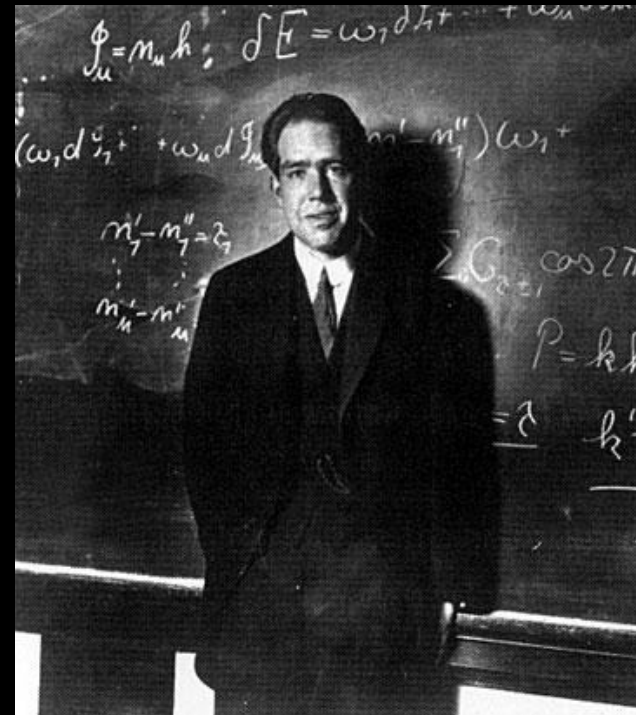
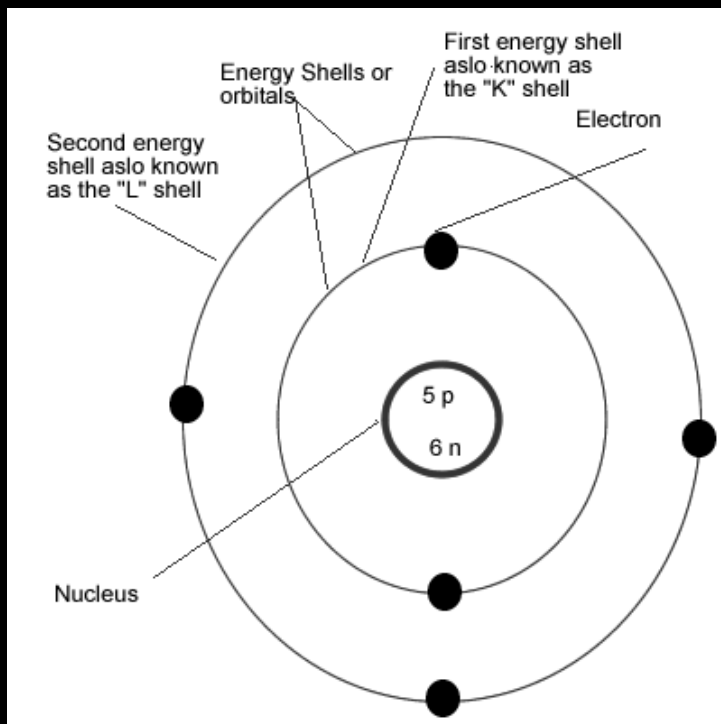
- ◆ Neutrons in the nucleus
- ◆ How electrons are in definite energy levels around the nucleus



Bohr Model

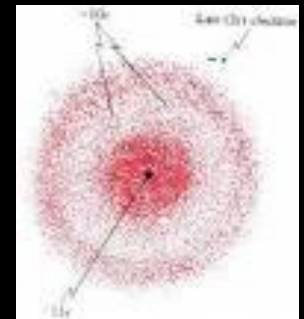
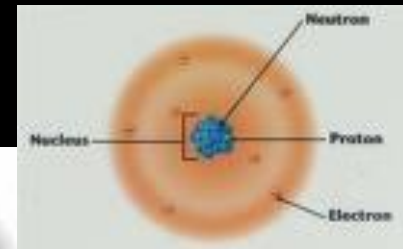
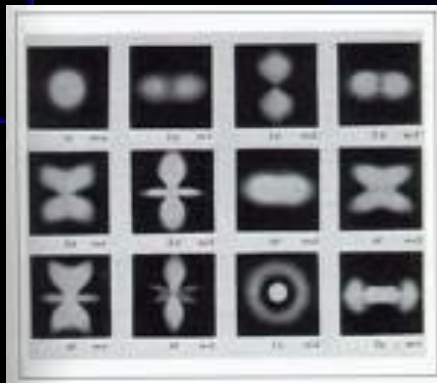
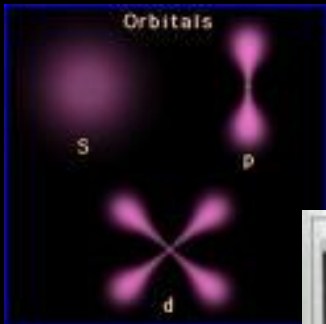


- ◆ The energy of an electron is quantized. Electrons travel around the nucleus in definite circular paths called orbitals or shells
- ◆ Explains atomic line spectrum of hydrogen plus ionic and covalent bonding

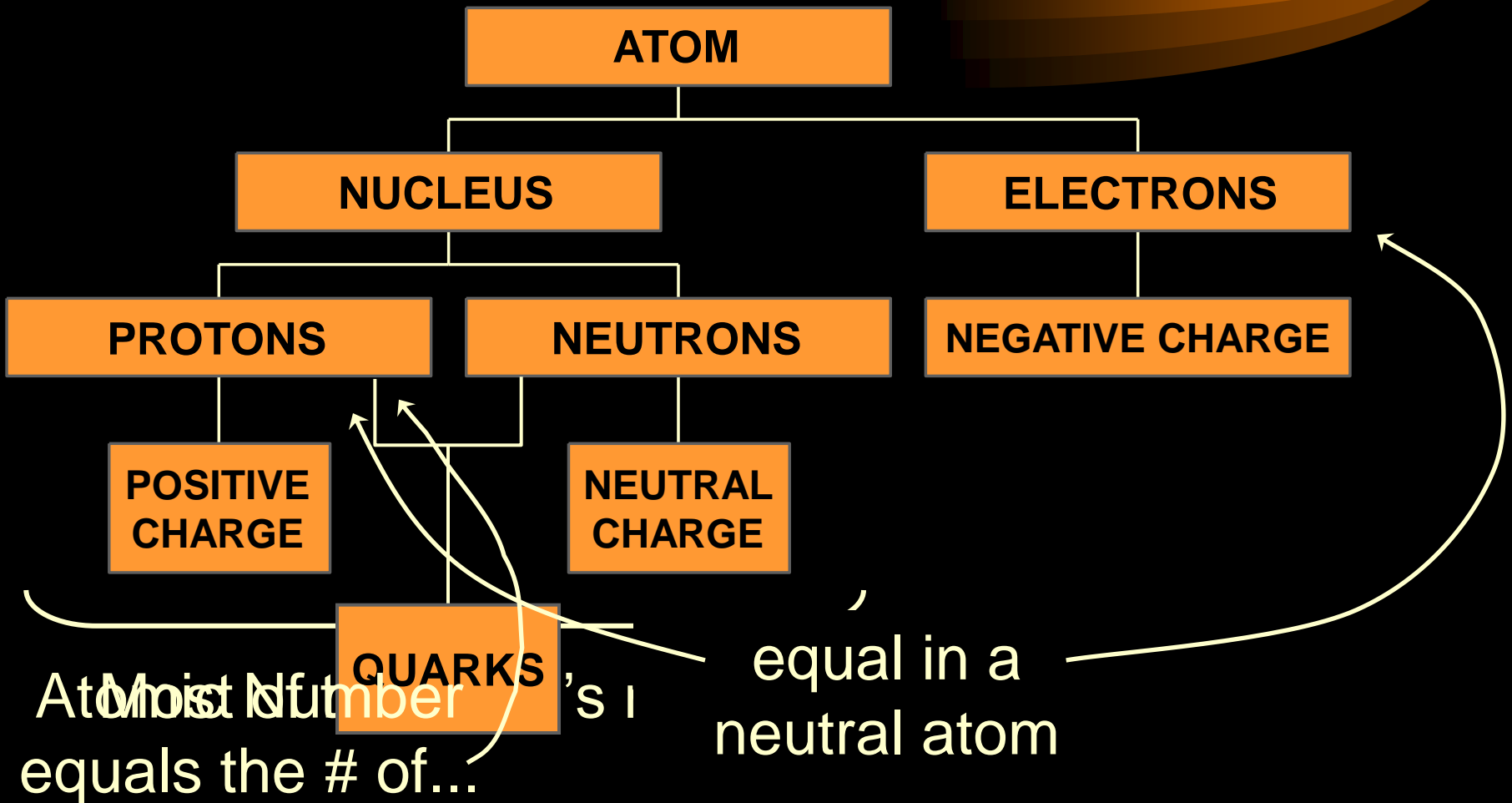


Modern Theory: Quantum Mechanical Model or Electron Cloud Model

- ◆ An electron has properties of both a particle and a wave and its location cannot be determined exactly
- ◆ Refer to region in which it is most likely to be found
- ◆ Analogy is that of a beehive where the bees are the electrons moving around the nucleus in a “cloud” of energy levels



Subatomic Particles



Subatomic Particles

◆ Quarks

- component of protons & neutrons
- 6 types
- 3 quarks = 1 proton or 1 neutron



He