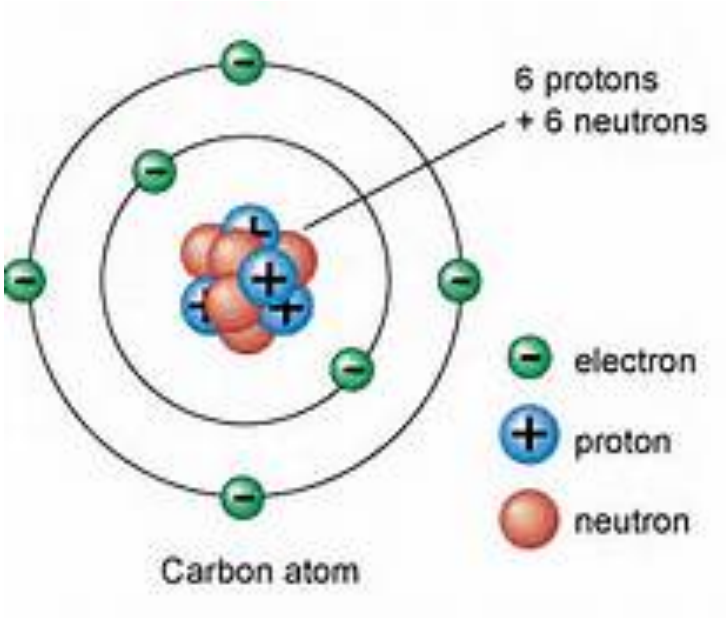
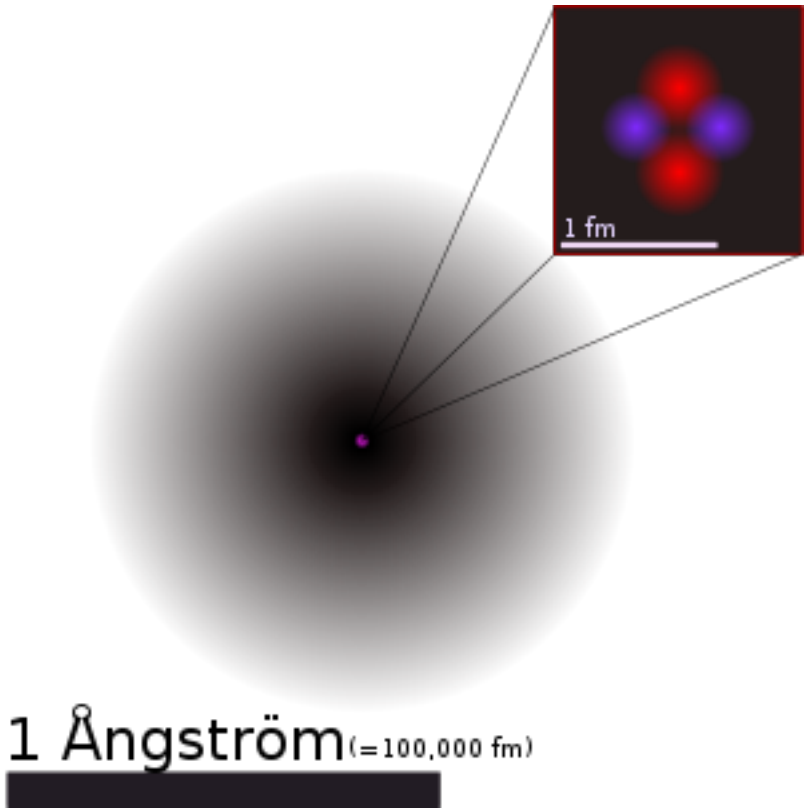
ATOMS
(*Atomos* = Greek → Unbreakable)

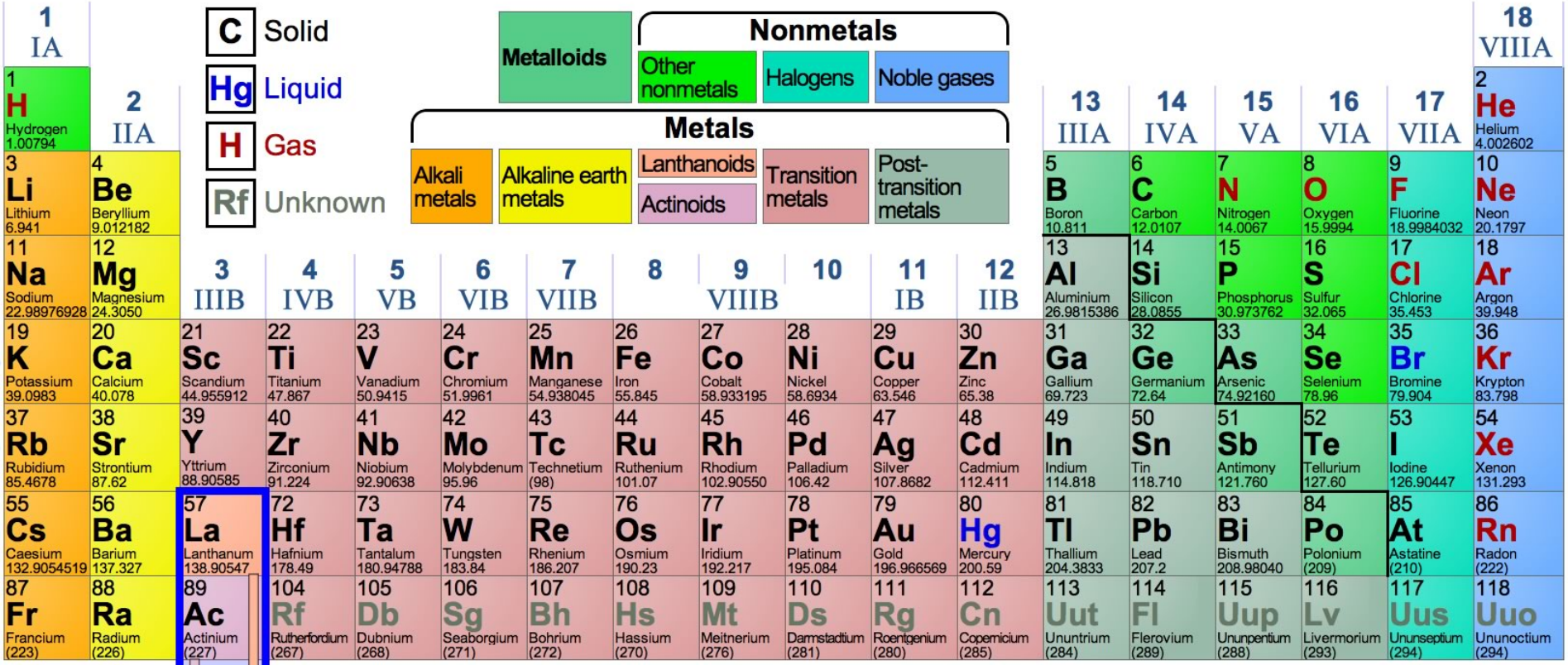


A carbon atom is 6th on the periodic chart. All carbon atoms have 6 protons…NEVER more NEVER less…Carbon can vary in its numbers of electrons and neutrons. If it has an imbalance of positive (protons) to negative (electrons) charged particles, it is called an ion. All atoms can have a variety of numbers of neutrons…atoms of the same element that differ in their numbers of neutrons are called isotopes. Atoms with odd numbers of electrons are very unhappy and are called free radicals.

The helium atom including its electrons is about 1 angstrom in diameter. Its nucleus is about a femtometer (10^{-15} meters)



Periodic Table of Elements



For elements with no stable isotopes, the mass number of the isotope with the longest half-life is in parentheses.

Key

Atomic #
Symbol
Name
Atomic Mass

*Edited by Dr. Casagrande

Some Isotopes of Carbon

Carbon
- 6 Protons
- 6 Neutrons

Nuclear number
= 6 + 6
= 12

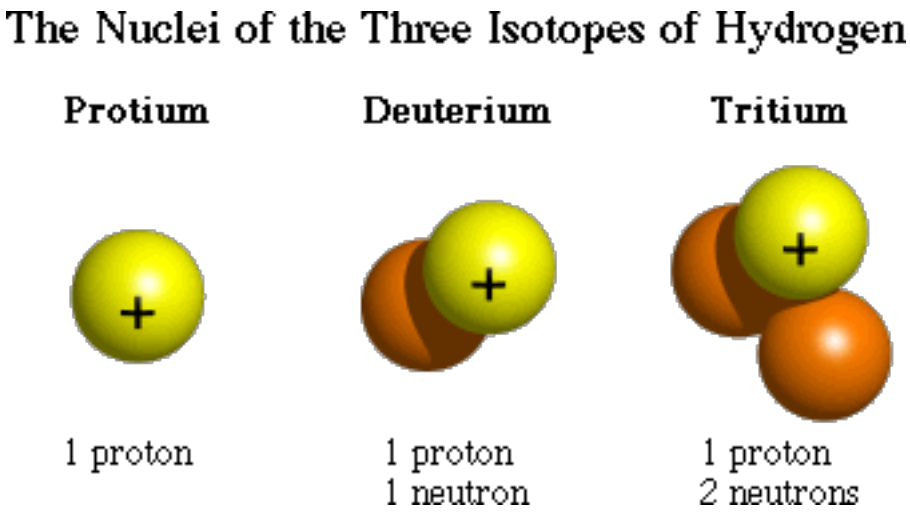
Carbon-13
- 6 Protons
- 7 Neutrons

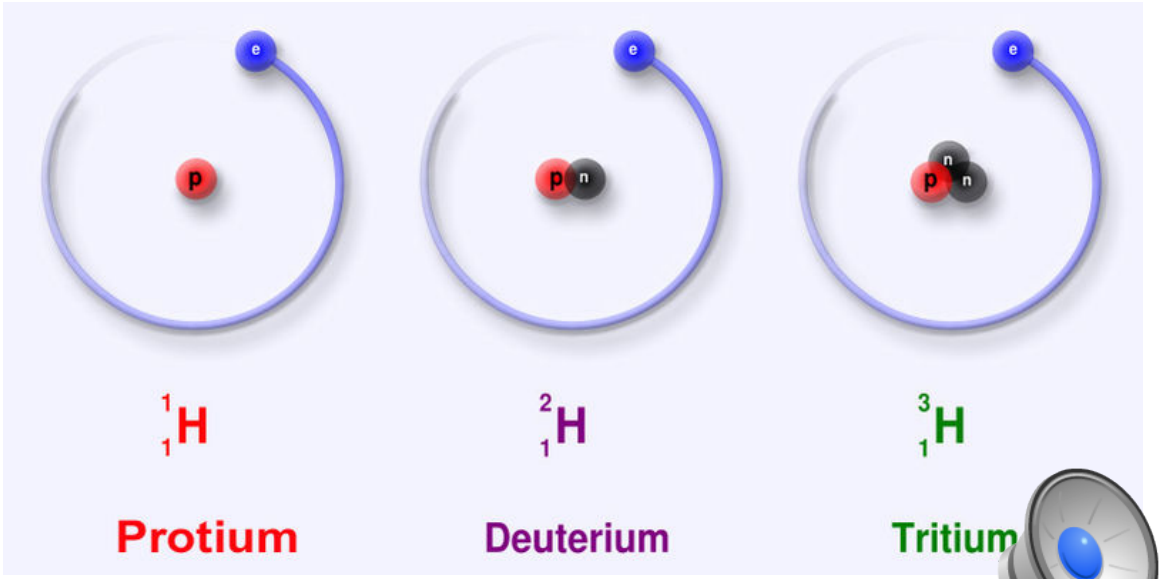
Nuclear number
= 6 + 7
= 13

Carbon-14
- 6 Protons
- 8 Neutrons

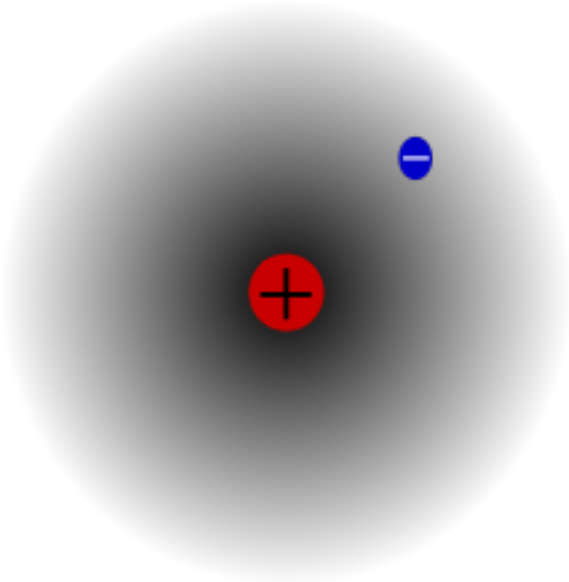
Nuclear number
= 6 + 8
= 14

The 3 most common isotopes of hydrogen





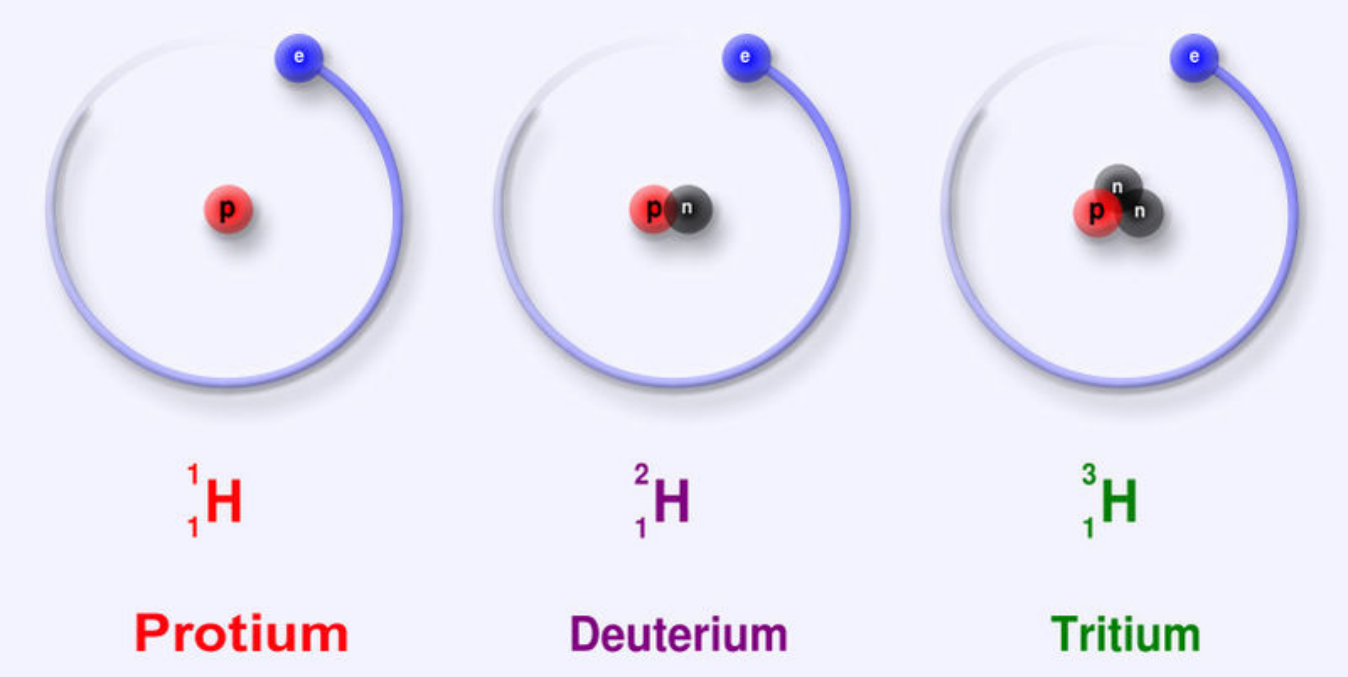
Hydrogen…the most common element in the Universe



Protium, the most common isotope of hydrogen, consists of one proton and one electron. Unique among all stable isotopes, it has no neutrons. (see diproton for a discussion of why others do not exist). 1H (atomic mass 1.00782504 amu) the most common hydrogen isotope with an abundance of more than 99.98%. Because the nucleus of this isotope consists of only a single proton, it is given the descriptive but rarely used formal name protium.

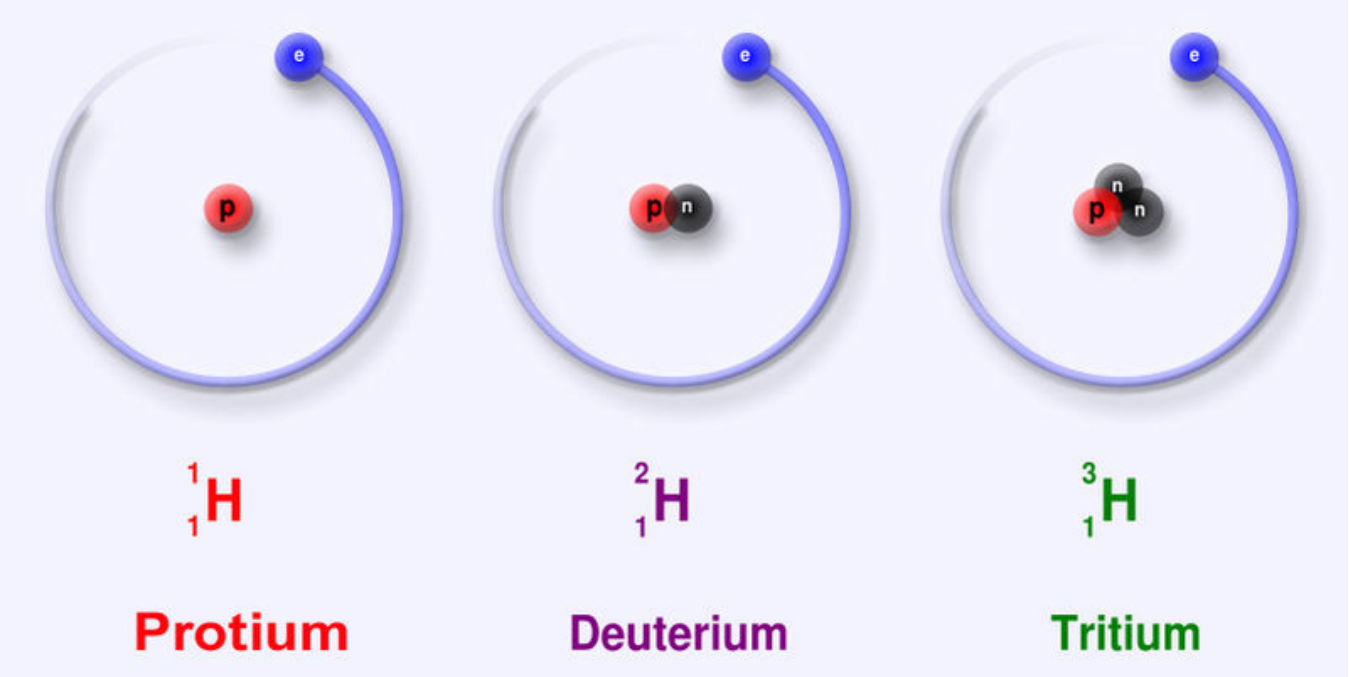
Deuterium

Deuterium comprises 0.0026 – 0.0184% (by population, not by mass) of hydrogen samples on Earth.

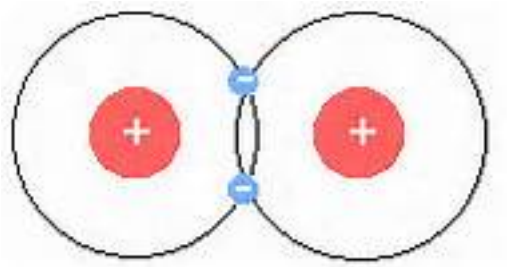


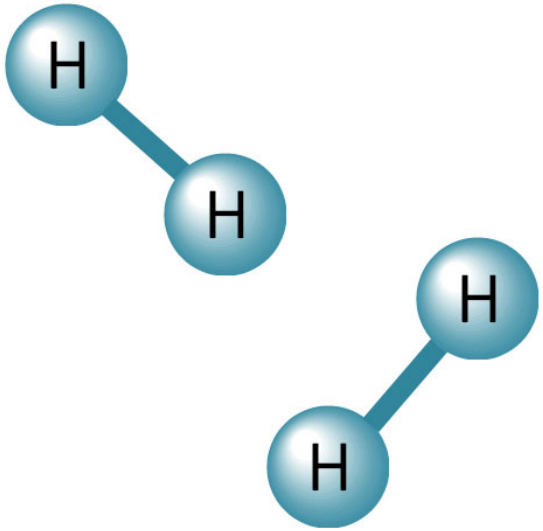
Tritium

3H is known as tritium and contains one proton and two neutrons in its nucleus. It is radioactive, decaying into helium-3 through β− decay with a half-life of 12.32 years.[3] Small amounts of tritium occur naturally because of the interaction of cosmic rays with atmospheric gases. Tritium has also been released during nuclear weapons tests. It is used in thermonuclear fusion weapons, as a tracer in isotope geochemistry, and specialized in self-powered lighting devices.



Hydrogen Molecule H_2

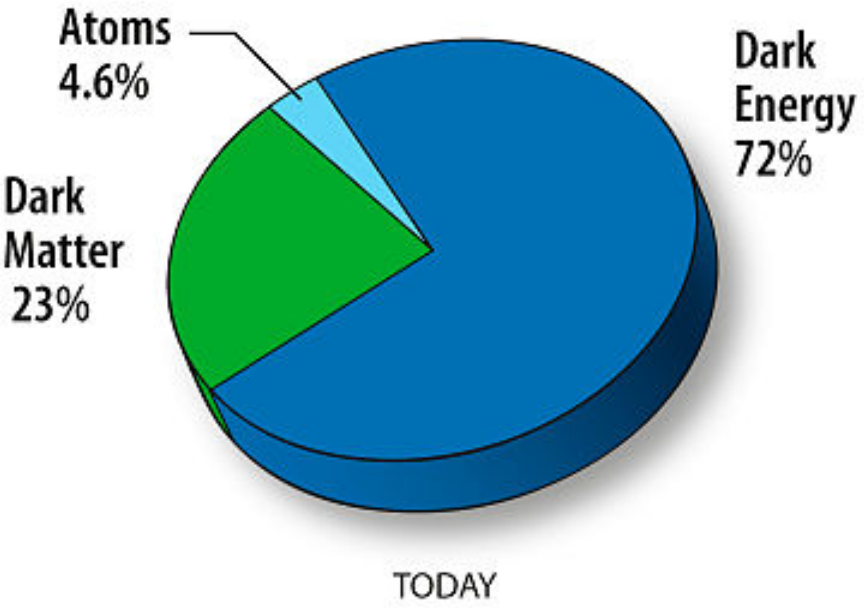


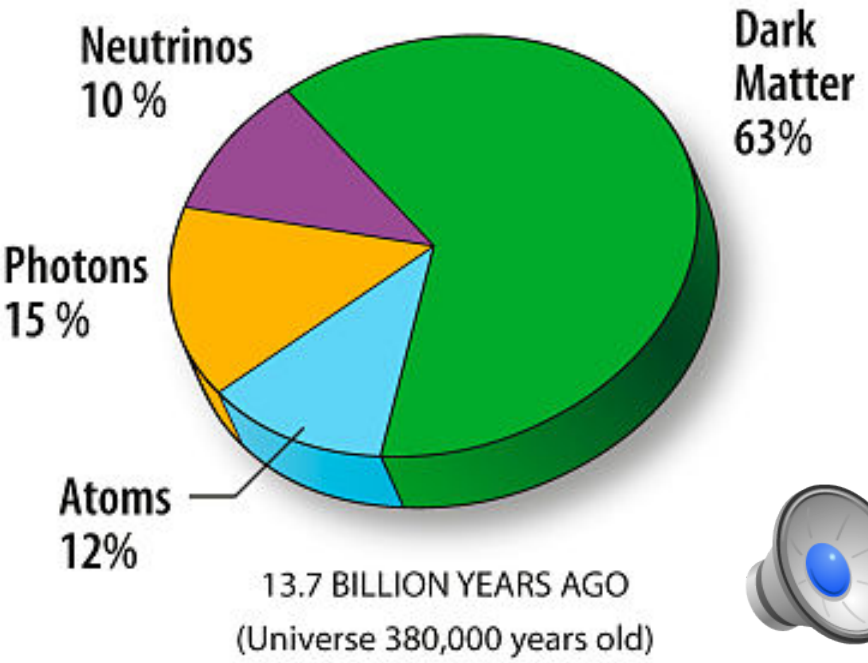


Hydrogen exists normally as a diatomic molecule…two hydrogen atoms sharing electrons are chemically bonded. A chemical bond is represented by a single solid line.

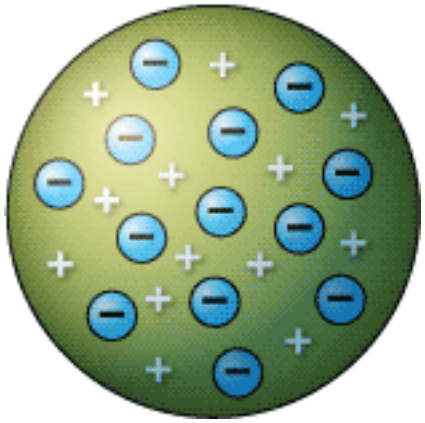
The matter we interact with on an everyday level only makes up about 4.6% of the universe. Most of the matter of the universe is called “dark matter”. Dark Matter’s existence was originall inferred from the motions of galaxies that shows that their orbital motions could only behave as they do if they had more mass. The rest of the Universe is made of a mysteries force called dark energy that is causing the universe to expand at ever increasing velocities.

Dark matter's existence is also inferred from gravitational effects on the light from stars and galaxies… Gravity can bend light.

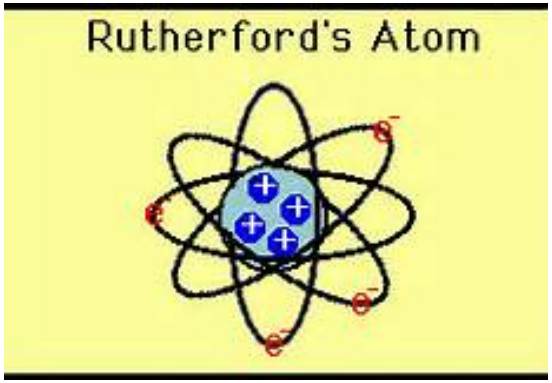


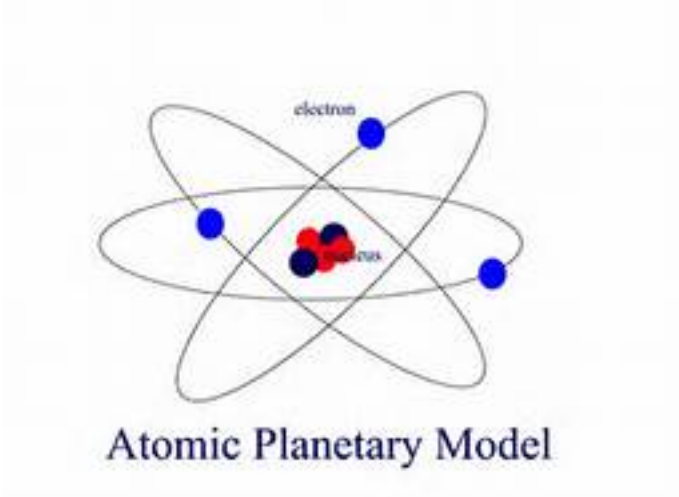


Atoms from an Historical Perspective



plum pudding model

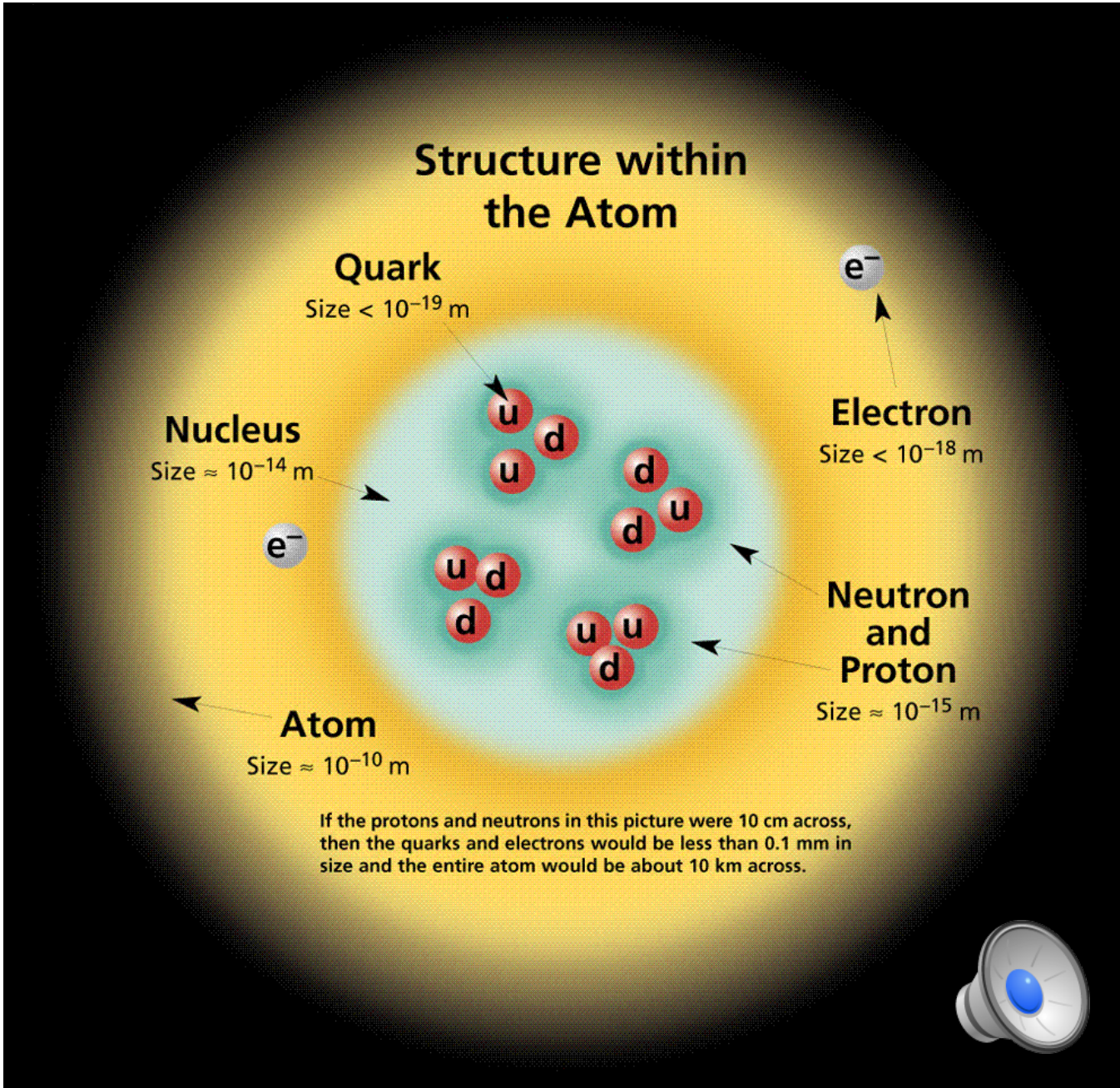




Evolution of the model of the atom from the electrons mixing in the same space as protons through the protons with no neutrons in the nucleus surrounded by electron and then the “planetary model” which is rather functional but somewhat inaccura

Current Model

We now believe that the nucleus is made of protons and neutrons that are in turn made of quarks.



The Bohr model of the atom, showing states of electron with energy quantized by the number n. Electrons have a probability of being found in different energy levels, shown as rings sometimes referred to as orbits in this model. The orbits farther away from the nucleus have higher energies. An electron dropping to a lower orbit emits a photon equal to the energy difference between the orbits. This emission of photon energy is a consequence of the conservation of energy.