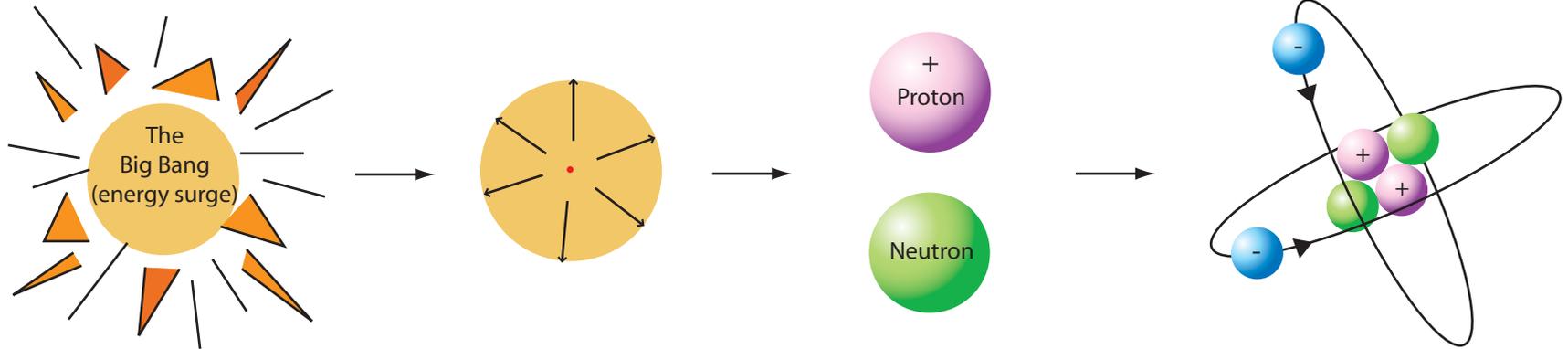


## Formation of Matter: The “Big Bang” Theory



There are different theories about how our Universe began. The most popular theory is called the “Big Bang”, which may have taken place between 10 - 20 billion years ago. Prior to the Big Bang, all that existed was a very tiny, tiny, tiny, infinitesimally small and extremely dense, very hot “point” of energy. Everything that would eventually become our Universe was contained in that point.

Immediately following the Big Bang (actually more of an “energy surge”), very little matter existed. The “point” of energy expanded to about the size of a grapefruit in trillionths of a fraction of a second. That phase is referred to as “inflation”. Sub-atomic particles began to form in the extreme heat of the tiny Universe, which continued to expand.

Within 1 to 3 minutes of the Big Bang, the basic constituents of matter (quarks) combined to form the sub-atomic particles protons and neutrons; all the sub-atomic material in existence was formed at that time. However, the heat from the Big Bang was too intense for atoms to form.

After about 380,000 years the Universe cooled to 3,000 degrees Kelvin (4,940 degrees Fahrenheit), cool enough for the protons and neutrons to form atoms. The first elements formed by the first atoms were hydrogen and helium (the diagram above shows the atomic structure of a helium atom).

### **The first two elements formed were hydrogen and helium, and all the matter in the universe was formed by their interactions.**

Hydrogen is the first element on the periodic table and is the simplest element, being composed of one proton and one electron (hydrogen has no neutrons). It is the most abundant element in the universe - in fact, 90% of all atoms are hydrogen. The heavier elements were originally made either from hydrogen atoms, or from other elements that were first formed by hydrogen atoms.

Helium is the second element on the periodic table. It is the second most abundant element in the universe, after hydrogen. In addition to being found throughout space, helium is also formed in the earth by natural radioactive decay and migrates to the surface, but due to its low molecular weight, most of it escapes into space. Helium has two each of protons, neutrons and electrons.