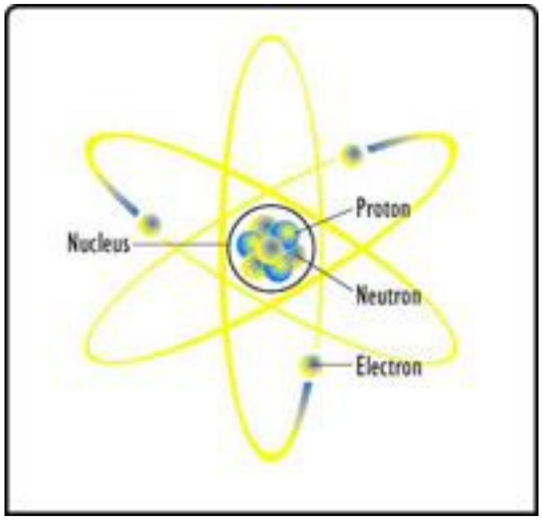

- **sub·a·tom·ic particle**

(sŭb′ə-tŏm′ĭk)
One of the basic units of which atoms and all matter are made. Protons, neutrons and electrons are subatomic particles.
Did You Know? Until the 20th century, scientists thought that atoms were the smallest units of matter. This view started to change following some experiments in the late 1800s involving electrical discharges. By the early 1900s it was clear that these discharges were composed of a new kind of particle, one that was much lighter than an atom of the lightest chemical element, hydrogen. These particles were named *electrons.* It was further learned that atoms themselves contained electrons; the electron thus became the first known *subatomic particle.* Since electrons have negative electrical charge, but the atoms containing them are neutral in charge, researchers believed that atoms must also contain positively-charged particles that balanced the negatively-charged electrons. This idea, together with research into radioactivity, led Ernest Rutherford to the discovery of the atomic nucleus in 1911. Rutherford saw the nucleus as the home of these positively-charged particles (now called *protons*). Further experiments on radioactivity showed, by 1932, that the nucleus also contained a third kind of particle, the *neutron.* While electrons, protons, and neutrons are the most familiar subatomic particles, they are not the only ones: dozens more have since been identified. Scientists now think that many subatomic particles are themselves made up of smaller units called *elementary particles,* such as neutrinos and quarks.

In the physical sciences, **subatomic particles** are particles much smaller than atoms.There are two types of subatomic particles: elementary particles, which according to current theories are not made of other particles; and *composite* particles.[2] Particle physics and nuclear physics study these particles and how they interact.

In particle physics, the concept of a particle is one of several concepts inherited from classical physics. But it also reflects the modern understanding that at the quantum scale matter and energy behave very differently from what much of everyday experience would lead us to expect.

The idea of a particle underwent serious rethinking when experiments showed that light could behave like a stream of particles (called photons) as well as exhibit wave-like properties. This led to the new concept of wave–particle duality to reflect that quantum-scale "particles" behave like both particles and waves (also known as wavicles). Another new concept, the uncertainty principle, states that some of their properties taken together, such as their simultaneous position and momentum, cannot be measured exactly. In more recent times, wave–particle duality has been shown to apply not only to photons but to increasingly massive particles as well.

Interactions of particles in the framework of quantum field theory are understood as creation and annihilation of *quanta* of corresponding fundamental interactions. This blends particle physics with field theory.

In theoretical physics, **quantum field theory** (**QFT**) is the theoretical framework for constructing quantum mechanical models of subatomic particles in particle physics and quasiparticles in condensed matter physics. QFT treats particles as excited states of the underlying physical field, so these are called field quanta.

In quantum field theory, quantum mechanical interactions among particles are described by interaction terms among the corresponding underlying quantum fields. These interactions are conveniently visualized by Feynman diagrams, which are a formal tool of relativistically covariant perturbation theory, serving to evaluate particle processes.