New Concept of Elementary Particles Classification

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Abstract

In contemporary physics elementary particles are classified by energy, live time and other properties. In contradiction to this very basic principle of contemporary physics, this article proposes a new concept that particles in the gravitation field like in the electric field have allowed energy levels. Only four elementary particles, i.e., electron, proton, photon and neutrino are in the ground state. They are intrinsically elementary particles. All other particles are excited states of said intrinsic particles in the gravitation field of Earth.

Keywords: elementary particles---space---gravitation---Standard Model---classification

PACS Classification codes:

13.20.-v Leptonic, semileptonic, and radiative decays of mesons; 13.30.-a Decays of baryons; 13.35.-r Decays of leptons; 14.65.-q Quarks; 13.66.Bc Particle production by electron-positron collisions.

Introduction

The Standard Model (SM) of particle physics is a theory concerning to the electromagnetic, weak and strong nuclear interactions of particles. The Standard Model has 61 elementary particles [1] divided in three groups: bosons (photons, gluons, ...), hadrons and fermions. The leptons (electrons, neutrino …) are fermions. The bosons and hadrons are mesons (pions, kaons, ...), the fermions and hadrons are baryons (neutrons, protons, ...). The mesons and baryons are made from quarks and so on.

The Standard Model is inherently an incomplete theory [2]. There are many problems that cannot be adequately explained by SM: gravity, origin of mass, dark energy, dark

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matter, matter-antimatter asymmetry, strong CP problem, neutrino oscillations, solar neutrino problem etc.

What is an Elementary Particle

The National Academy of Physics (NAP) explains:
We call a piece of matter an elementary particle when it has no other kinds of particles inside of it and no subparts that can be identified. We think of an elementary particle as occupying no room in space; indeed, we often think of it as a point particle.
How do we know whether a particle is elementary? We know only by experimenting with it to see if it can be broken up or by studying it to determine if it has an internal structure or parts [3]. End of quotation.
According to Britannica Online Encyclopedia (BE) it is "subatomic particle, also called elementary particle, any of various self-contained units of matter or energy that are the fundamental constituents of all matter" [4].
In the elementary particle listings [5] more than 500 items are mentioned. The mass of particles is in the boundaries from 0 to more above than 11 GeV/c^2. Mass of hydrogen atom is 0,9 GeV/c^2. Only a dozen mesons and leptons has mass below 0,9 GeV/c^2. The largest number of particles is heavier than hydrogen atom. Therefore, they cannot be considered as subatomic components of matter.
Therefore, the definitions of elementary particles given by NAP and BE both are inconsistent. The correct definition is as follows:
"Elementary or fundamental particles are independent primary entities from which something else can be derived" [6].

Generation of particles

When one looks at an object one sees the light reflected from the surface of the object. In other words, one sees the scattering of photons by the surface of the object. If the object is transparent, one can see what is inside the object or, in other words, the scattering of photons by non-homogeneities inside the object. The scattering of photons is converted to a picture by the mind. The eyes are only detectors of photons. The wave length of photons must be much shorter than the dimensions of the object. Nowadays it is impossible to get photons with a wave length shorter than the dimensions of an atom nucleus. In this case the scattering of small particles (electrons, protons, neutrons) by nucleus is used. The particles are accelerated to very high energies for penetration inside the nucleus.

As a result, there is a burst of particles containing primary accelerated particles and many new ones.

Decay of particles

The new particles have a very short live time: from 10^{-6} to 10^{-20} seconds. After it they decay to smaller ones. The decay end products of particles are electron, proton, photon or neutrino. They are stable.

Finally one gets the same electrons or protons which were accelerated.

In a nutshell, such are the facts.

This suggests that particles are only excited states of well-known constituents of atoms: electrons, protons and neutrons. The excited electrons in the electric field of nucleus can return to the ground state by emitting a particle (photon or phonon). The emitted particle carries away the energy difference between the excited state and the ground state of an electron (Fig. 1).

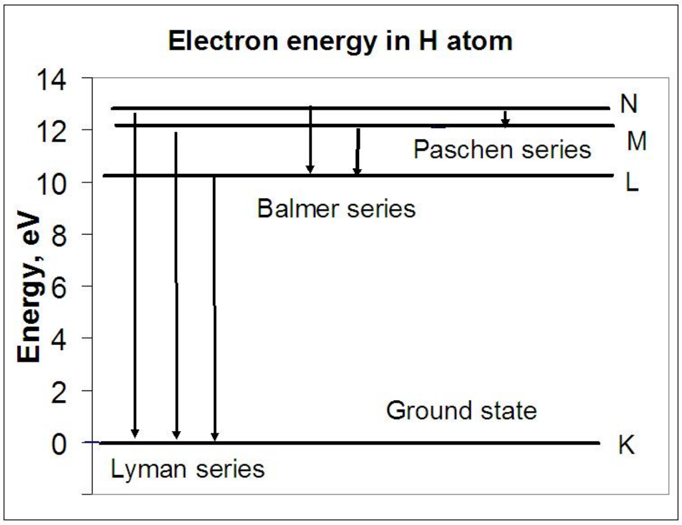

Fig. 1. Electron energy levels in hydrogen atom.

Emitted photons are classified by energy in series: Lyman, Balmer, Pashen.

In the case of free electrons the energy level diagram is similar (Fig. 2.).

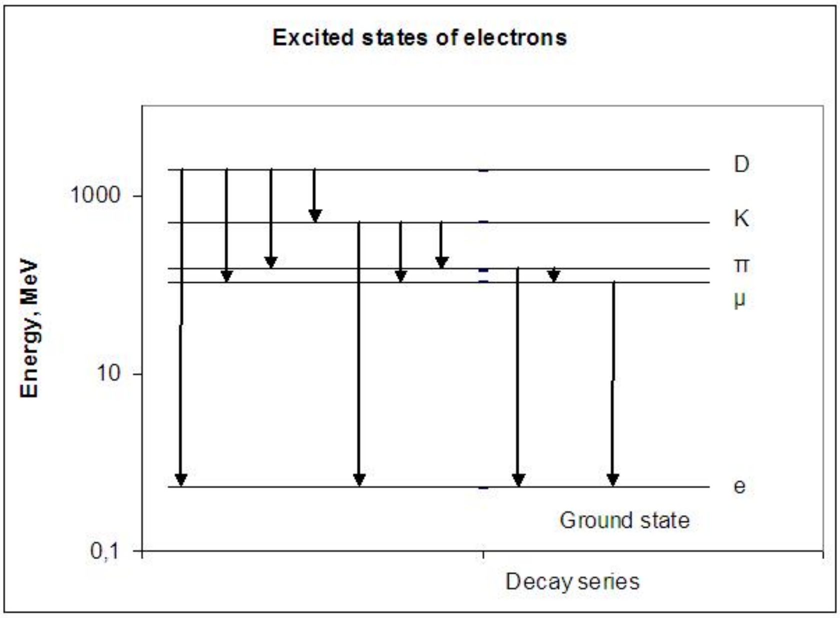

Fig.2. Electron energy levels in gravitation field.

An electron can return to the ground state directly or by lower levels K, π, μ. The electron on the μ level is called muon, on the the π level – pion, on the K level – kaon. Muon decays to the electron ground state by emitting neutrino and anti-neutrino. Pion can decay directly to the electron ground state or to muon and then from the muon to the electron ground state. Excess energy is carried away by neutrinos.

Kaon can decay into 3 modes: to pion, to muon or directly to the electron ground state. There are many variants how to carry away excess energy: by neutrinos, by photons or by neutral mesons, the latter finally converting to photons.

Similar decay diagrams containing all decay modes can be created for protons, neutrons and photons.

Classification of Particles

The new concept disposes particle classification by stable end products of decay: electrons, protons, photons, neutrons and neutrinos. The question about the stability of the last two items should be discussed for the following reasons. The neutrons are stable in the nucleus of atom, but they decay outside the nucleus in the gravitation field of Earth. Information about the nature of neutrinos is inconsistent and insufficient.

As a result, one gets three classes of elementary particles and antiparticles: electrons (leptons), protons (baryons) and photons (bosons). Leptons and baryons are fermions.

All other particles are excited states of elementary particles:

1. Excited states of electrons are: muons, charged pions, charged kaons, τ, D and other leptons and charged mesons.

2. Excited states of protons are: Λ, Σ, Δ, Ξ and other baryons.

3. Excited states of photons are: uncharged pions, neutral kaons and other neutral mesons.

The quarks are only projections of the 4D nuclear space on the 3D gravitation space [7, 8]. They are not particles.

Conclusions

The Standard Model of elementary particles fails to explain the origin of mass, i.e., how particles get mass, how mass disappears when particles decay and what the nature of mass is.

According to the conception of the current article, the origin of mass is energy supplied by an accelerator in accordance with Einstein equation $E = mc^2$. The energy of motion converts to mass in the gravitation field of Earth. When the excited particle decays the excess energy is carried away by the massless particles (photons, neutrino) or by the particle – antiparticle pairs. The mass of the antiparticle is negative [9, 10] and equal by magnitude to the mass of the corresponding particle. Therefore the total mass of energy carrying particles is zero. Finally they annihilate and convert to photons.

The so-called "particle physics" really is physics of energy levels of the gravitation field. Until now all experiments with particles have been performed only in the gravitation field of Earth. In other fields of gravitation (on Moon, on Mars, in the interstellar space, etc.) the results must be different.

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