On Stability of Atomic Orbitals and a New Theory of Nuclear Forces

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Abstract

Quantum mechanics (QM) only gives a partial explanation of the stability of atomic orbitals. QM says that the electrons in an atom exist only in stable, discrete, allowable orbits. But it doesn't tell us how the electron enters such stable orbit in the first place and how it stays there indefinitely. The stability of the nucleus is also one of the unsolved mysteries in physics. What is the force holding protons together in the nucleus, overcoming the tremendous electrostatic repulsive force between them? The strong nuclear force and the weak nuclear force, two of the supposed four fundamental forces in the universe, have been invented to explain nuclear forces. This paper reveals a new theory on how protons can exist together in the nucleus without invoking any kind of new 'force'. The 'weak force' naturally arises from the new explanation for the 'strong force'.

Introduction

Physics tells us that there are four fundamental forces in the universe: electromagnetic, gravitational, the strong nuclear and the weak nuclear forces. These forces are thought to be fundamentally different from each other and professional physicists are satisfied with this description.

However, such description is not satisfactory to the casual observer or to an amateur researcher who is not used to the mainstream thinking. Inventing a fundamentally different kind of force or particle whenever physicists fail to explain some phenomena is not the same as discovering a novel idea or a novel way of combining existing knowledge.

Another example of the unsatisfactory state of current physics regards atomic orbitals. Quantum Mechanics (QM) tells us that electrons in an atom exist only in those stable, discrete orbits with radius such that the circumference of the orbit is an integral multiple of the electron wavelength. However, QM doesn't tell us how an electron enters such orbit in the first place; it just assumes that the electron enters its stable orbit by itself. QM doesn't address the fact that for an electron to stay in its stable orbit indefinitely, an almost infinite initial fine tuning is required. QM doesn't tell us how an electron stays in its orbit despite possible perturbations such as by random incident photons or random collisions of the atom with other atoms . It assumes that the electron absorbs

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only those photons with energy equal to the difference between discrete orbital energy levels in the atom and just “ignores” all other photons.

This paper reveals a novel idea that explains the strong nuclear force and the weak nuclear force, which automatically arises from the explanation of the strong force. Also the problem of stability of atomic orbits is stated and a solution is proposed.

Stability of atomic orbitals

Bohr’s atomic model was developed to solve the problem that electrons revolving around the nucleus would continuously radiate electromagnetic energy and spiral into the nucleus. Niels Bohr suggested that electrons would not radiate energy if they are in orbits with radius such that the circumference of the orbit is an integral multiple of the electron wavelength. Bohr’s model succeeded in predicting emission lines for the hydrogen atom.

However, physicists have never noticed that Bohr’s model and the subsequent quantum mechanics, despite its success, is incomplete in that it does not raise and solve the problem of how an electron enters its stable orbit in the first place. One can see that, for an electron to stay in its orbit indefinitely, an almost infinite fine tuning of initial conditions is required. Even the slightest deviation from its nominally stable orbit would soon develop into the instability of the orbit with time. But we know that electrons in an atom are stable and stay in their orbit indefinitely. The question is who or what does the almost infinite fine tuning of the initial conditions of the electron, so that it stays in its orbit (almost) indefinitely? I present this as one of the scientific evidences of God.

But an electron in its stable orbit is also subject to continuous perturbations from random incident photons or random collisions of the atom with other atoms or molecules. How can we explain the fact that the electron stays in its stable orbit despite these perturbations? Quantum mechanics tells us that an atom absorbs only photons with allowable energy levels and just “ignores” all other photons. One can see that it is not a satisfactory ‘explanation’ to state that the atom just “ignores” all other photons with “wrong” energies.

I propose a new ‘postulate’ as follows.

A photon can interact with an atom (or a molecule) in two ways. If the energy of the photon is equal to the energy difference between atomic orbital energy levels, the photon will be *completely* absorbed by the atom. The atom can emit *another* photon with the same energy as the electron returns to its ground state. This is a process in which an atom completely absorbs an incident photon and re-emits a *different* photon. The new photon can be emitted in any random direction, independent of the direction of propagation of the original (incident) photon.

The second way in which a photon interacts with an atom is when the photon energy does not match the energy difference between atomic orbital energy levels. In this case the atom *partly* absorbs the photon energy and immediately re-emits energy. In this process, unlike the complete absorption mentioned above, the original photon is not destroyed and only modified in a subtle way which is experimentally inaccessible[1]. All we can observe is that this process does not affect the original (incident) photon at all. This process can explain why photons with “wrong” energies (wavelengths) are not affected while passing through a vapor of atoms, as in atomic absorption spectrometry. It may also explain how light passes through glass completely unchanged[2].

Returning to the question of why/how an electron returns to its stable orbit even after being hit by a random incident photon, I propose the following ‘postulate’:

An atom or a molecule completely returns to its initial state after being perturbed with a random incident photon or by random collisions with other atoms, after it completely re-radiates the energy it absorbed from the incident photon.

I quoted ‘postulate’ because it is yet to be proved.

The strong nuclear force

One of the mysteries not truly solved in physics yet is how protons exist together in the nucleus, overcoming the tremendous electrostatic repulsion force between them. Physicists have invented the ‘strong force’, a fundamentally different force, as an explanation. Obviously, this is not satisfactory because there is nothing novel about this ‘discovery’. Making new assumptions to describe physical phenomena is not the same as finding novel ideas or novel ways of applying existing knowledge.

I propose a novel way in which protons can co-exist in the nucleus, as follows (Fig.1).

Traditionally, the protons in the nucleus are thought to exist separately, as shown in Fig.2. Each proton is thought to be a spherical entity. The new view proposed here is that the protons exist in the nucleus intermingled (but never touching each other).

Fig.1 shows a hypothetical nucleus consisting of three protons, shown in different colors. The new theory is that a proton, as a quantum object, is not a point particle but exists distributed in a finite region of space.

We can see that although there is always a repulsive force between the protons, the nucleus will not fly apart because the protons are intermingled.

It should be noted that the distribution of each photon in the nucleus is not static but continuously changing (dynamic). This is due to a new internal dynamics I proposed for quantum particles such as electrons and photons[3].

A fundamental question is : if the nucleus and its protons are a dynamic system, how can it be ensured that this dynamics does not eventually lead to a point where the nuclear *balance* is lost and the tremendous electrostatic force makes the protons fly apart ?

Again, I propose the stability of the nucleus (despite the internal dynamics) as a scientific evidence of God. The initial conditions of the nucleus (the protons) are fine-tuned so that the nucleus remains stable (almost) indefinitely.

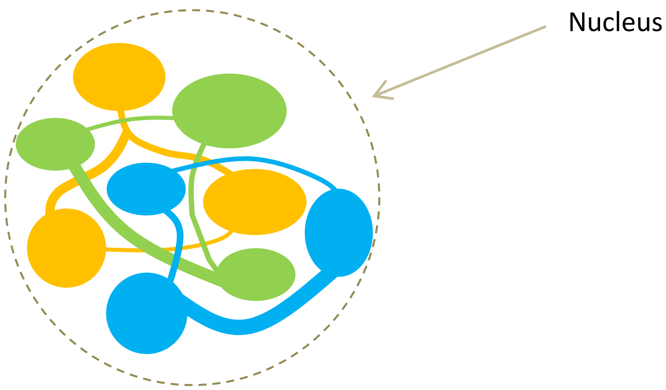

Fig.1 New view of the nucleus

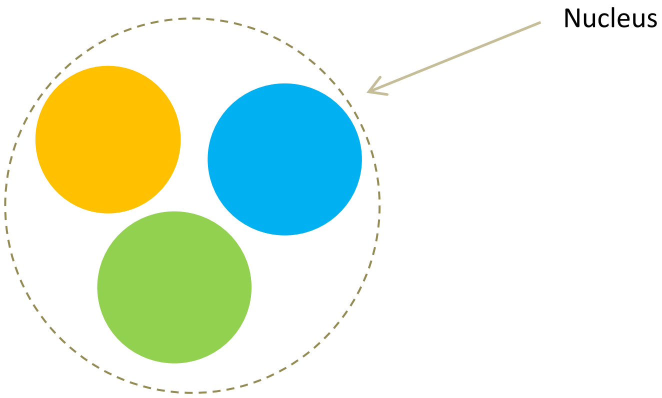

Fig. 2 Traditional view of the nucleus

We can also see that bombarding the nucleus with an energetic particle would disrupt this nuclear balance and lead to its disintegration.

The weak nuclear force

The new explanation for the weak nuclear force, which is responsible for nuclear fission, naturally arises from the new theory for the strong force. Nuclear fission simply arises when the internal dynamics of the protons eventually leads to unbalance in the nucleus. The new theory predicts that even stable nuclei may eventually disintegrate, the only difference being that their half-lives are many orders higher than that of unstable nuclei.

Conclusion

The co-existence of protons in the nucleus has been one of the unsolved mysteries in physics. Why the protons do not repel each other and fly apart when they are so close to each other in the nucleus but repel each other with tremendous electrostatic force when they are slightly moved apart has been a century-old puzzle. In this paper we have seen a novel idea that can solve this puzzle.

Glory be to God and His Mother, Our Lady Saint Virgin Mary

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