Journal of Nuclear and Particle Physics 2018, 8(1): 1-5
DOI: 10.5923/j.jnpp.20180801.01

The Quanta

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Abstract This paper is about an alternative theoretical framework to quantum field theory. A Completely relativistic theoretical framework, where all massless quanta are photons and all massive quanta are matter quanta. This means all gluons and gravitons don't exist and the higgs boson, Z^0 boson and the $W^{\pm}$ bosons are matter quanta. All molecules, atoms, nuclei, nucleons, mesons, quarks and leptons are indivisible and immutable. This means quantum leaps, quantum tunneling and gluons are eliminated. In any reaction the reactants have products with sum rest mass lesser than their own or the greatest sum rest mass greater than their own. Meaning all probabilities regards reaction products are eliminated. Annihilation-creation i.e in any reaction the reactants are annihilated and the products are created. Thus all probabilities regards rates of decay and spontaneous emissions are eliminated. Field reaction is a reaction where space and all quanta are annihilated and a new space (with a different geometrical structure and energy than the reactant space) and new quanta are created, such that the number of quanta and types is not changed. Space has zero momentum as the concept of motion implies it and thus can not be applied to it. The energy of space will be symbolised as Φ. $\Phi + \sum (p_n c)^2 + (m_{0n}c^2)^2 = \Phi + \sum (p_n c)^2 + (m_{0n}c^2)^2$, $\Phi_{\text{before reaction}} \neq \Phi_{\text{after reaction}}$ implying that the energy of all the quanta before reaction is not equal to that after reaction and the sum rest mass before reaction is the same as that after reaction. Where all the quanta of before reaction have zero sum momentum and those after also have zero sum momentum.

Keywords Quanta, Annihilation-creation and energy-momentum relation

1. Introduction

This paper is written as an attempt at a theory which deals with difficulties of quantum field theory. QFT has fields as basic entities and all elementary particles as excitions of these quantised fields. Photons as quantum excitions of the electromagnetic fields, qluons as excitions of the color field, weak bosons (i.e the $W^{\pm}$ and Z^0 bosons) as excitions of the weak field and leptons and quarks as excitions of matter fields. What drove the author to seek a new theoretical framework was the probabilities inherent in QFT. Probabilities regards products of interactions and rates decay reactions as these processes are viewed as being fundamentally stochastic. The probabilities regards products of interactions can be seen in the case of decay and collision reactions. The case of a neutron, a neutron with zero momentum in QFT has at least three different decay routes. Decay route number one which is the most likely is (n^0, p^{+}'e^{-}) anti-ν, second (n^0, p^{+}'e^{-}'ν)γ and the least likely being (n^0, $^1H^0$) anti-ν. In QFT it seems that two identical unstable quanta with both zero momentum can undergo different decay reactions. The probabilities regards rates of decay reactions, here too in QFT seems that two identical unstable quanta created at the same time can decay at different times as radioactivity is regarded as completely random. Then there's case of forces being treated as being an exchange of gauge bosons, which are exchanged as virtual particles. Charged particles interact electromagnetically via exchange of virtual photons. Weinberg's electroweak theory with the higgs mechanism treats neutron decay as a reaction mediated by the W boson. The theory of neutrino oscillations by Pontecorvo which postulates that neutrinos can change flavor depending on their distance from the source and their energies.

2. Definitions

Quantum: an indivisible and immutable unite of matter or light.

Majorana quantum: any particle which is its own anti-particle.

Dirac quantum: any particle which is not its own anti-particle.

Dirac property: color charge, electric charge, neutrino charge and w-charge.

Matter quantum: any massive quantum with Dirac properties either resultant or none resultant.

Light quantum: any massless quantum without Dirac properties i.e a photon.

Elementary quantum: any quantum with one elementary

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Published online at http://journal.sapub.org/jnpp

Dirac property e.g electron, up quark, electron neutrino or w.

Composite quantum: any quantum with the Dirac properties of two or more elementary quanta.

Decay reaction: any reactant quantum which annihilates with two or more product(quanta) created. $(pc)^2 + (m_0c^2)^2 = \sum(p_nc)^2 + (m_{0n}c^2)^2$, where $E_{0\text{before reaction}} > \sum E_{0\text{after reaction}}$ or $E_{0\text{before reaction}} < \sum E_{0\text{after reaction}}$. [1]

Collision reaction: any reactant quanta which annihilate with one or more product(quanta) created. $\sum (p_nc)^2 + (m_{0n}c)^2 = (pc)^2 + (m_0c^2)^2 / \sum (p_nc)^2 + (m_{0n}c^2)^2$, where $\sum E_{0\text{before reaction}} > \sum E_{0\text{after reaction}}$ or $\sum E_{0\text{before reaction}} < E_{0\text{after reaction}} / \sum E_{0\text{after reaction}}$ and $\sum E_{0\text{before reaction}} = \sum E_{0\text{after reaction}}$ or $\sum E_{0\text{before reaction}} < \sum E_{0\text{after reaction}}$. [2]

Field reaction: a reaction where space and all quanta are annihilated and a new space (with a different geometrical structure and energy than the reactant space) and new quanta are created,such that the number of quanta and types is not changed. Space has zero momentum as the concept of motion implies it and thus can not be applied to it. The energy of space will be symbolised as Φ. $\Phi + \sum (p_nc)^2 + (m_{0n}c^2)^2 = \Phi + \sum (p_nc)^2 + (m_{0n}c^2)^2$, $\Phi_{\text{before reaction}} \neq \Phi_{\text{after reaction}}$ implying that the energy of all the quanta before reaction is not equal to that after reaction and the sum rest mass before reaction is the same as that after reaction. Where all the quanta of before reaction have zero sum momentum and those after also have zero sum momentum. [3]

Stable quantum: any quantum which doesn’t decay.

Unstable quantum: any quantum which decays.

3. Principles

Quantum conservation: quanta are created from the annihilation of other quanta and annihilated quanta always have as products created quanta.

Space is continuous and immutable.

Dirac property conservation: e.g the conservation of the electric charge.

Annihilation-creation: in any reaction the reactants are annihilated and the products are created.

In any reaction the reactants have products with the least sum rest mass lesser than their own or the greatest sum rest mass greater than their own. Meaning the products with the least sum rest mass is a set of stable particles.

The rule of mins: in any reaction the products always have the least number of quanta such that no conservation laws are violated.

A Dirac quantum is always created with its ant-particle e.g a hydrogen atom can not be created with an excited anti-hydrogen atom.

All massless quanta are photons, $m_0=0$

All massive quanta are matter quanta, $m_0>0$

Quanta: e.g photons, leptons, quarks, mesons, nucleons, nuclei, atoms and molecules.

$E^2 = (pc)^2 + (m_0c^2)^2$, $m \geq 0$&E is positive. [4]

A quantum is unstable if there exists a set of quanta with a sum rest mass lesser than its own rest mass which it can decay to without violating any laws.

Energy-momentum conservation.

Any quantum can not exist for zero duration, Thus $\Delta t'>0$.

Quanta have a non-zero volume thus they are not black-holes since reactions occur. Because if quanta were micro-black-holes then the products of every reaction would coalesce into a singularity but then in our observation this doesn't happen reactions occur all the time.

Identical reactants in reactions have identical products in every respect. Meaning identical unstable quanta have identical products e.g two identical stationary muons or neutral pions have identical products.

Identical unstable quanta have the same life-span (i.e $\Delta t'$).

4. Explanation of Definitions and Principles

A quantum is an indivisible and immutable unite of matter or light and that molecules, atoms, nuclei, nucleons and such are quanta. What does the author mean by this exactly? Does all this go against experimental facts and didn't Rutherford's celebrated gold foil experiments prove that atoms can't be indivisible? What is meant by saying atoms are indivisible and more specifically to say the protium atom is indivisible? Nothing more than that this type of hydrogen atom is not a made up of a proton and an electron. But that this atom has the Dirac properties of both the proton and electron. But one will ask then what of our chemical facts such as when a sample of hydrogen atoms is ionised via irradiation with photons to protons and electrons? Where do the electrons and protons come from if the atoms are not individually made of a proton and an electron bound together by the electromagnetic field mediated by virtual photons? The atom when in collision with a photon both are annihilated and the proton and electron are created. This theoretical framework unlike quantum field theory suggests that atoms are indivisible just like electrons are so viewed in the Standard Model. Such that during a photochemical reaction such the one above electrons are not knocked out of their atoms by a photon via the destruction of the photon by tranfering all its energy to the electrons there by allowing them to escape the potential bearier of the protons in the atoms. So in short this theoretical framework introduces a new model of the atom which is very different from that of QFT but which doesn't contradict the experiments. As our chemical facts don't imply that atoms are not indivisible but that any theory which says hydrogen is made of atoms must explain how it's reducible to protons and electrons, which both models seem able to explain. Now the author ask or rather hopes that the experimental physicists put this new model to the test and see if it or the QFT model of the atom is a better approximation of further experiments.

The immutability part of the definition means simple this that these indivisible units can't change their velocities. If an atom can't change its state of motion and hence is always moving at a constant velocity then what of the change we observe and measure with our instruments in our experiments? Bodies surely change their states of motion i.e they accelerate don't they? Here too the annihilation-creation principle explains how a world filled with bodies that move only at constant velocity and can't change their velocities can possibly have this apparent change. Since each quantum is created with a certain state of motion with respect to a frame of reference be it stationary or moving i.e constant motion and can't change it. Say this quantum is stationary and collides with a moving quantum according to our principle both quanta are annihilated and the quanta emerging from such a collision are new creations and thus the momenta of the products is not the result of one quantum transfering momentum to the other one. This picture is clearly different from the one given by QFT or Classical mechanics and relativistic mechanics. This theoretical framework thus introduces a different theory of mechanics. A modified form of special relativity as bodies don't accelerate which means only a subset of special relativity kinematics is a model of motion. A kinematics without acceleration and thus angular momentum and concepts directly related to acceleration such as force and impulse and inertia. To explain gravity and electromagnetic field acceleration in this theoretical framework, these processes are viewed as the result of field reaction where all the quanta in the universe and space are annihilated and a new space with a different geometrical structure and energy is created with new quanta with different energy from the reactant quantum i.e if it was moving as a reactant the new electron has a different velocity or is stationary.

Is the principle that all massless quanta are photons and all massive quanta are matter quanta in line with experiments? Haven't the experimental physicists proven that gluons exist and that not all massive particles are matter particles? The author in positing that all massless quanta are photons saw that this idea doesn't contradict experiments as gluons have never been observed as free particles and gravitons or any other kind of massless quanta which are not photons. Since the only massless particles which we observe are photons thus far. And in this theoretical framework the need for gluons proves superfluous as all nucleons and nuclei are quanta so there's no need for a force that bounds the quarks to form nucleons other baryons and mesons. As nucleons are not made up of quarks bound by a color field mediated by virtual gluons in this new framework. The case of massive quanta being matter quanta means that the higgs boson, Z boson and the W bosons are all matter quanta. Since the higgs boson and Z boson are their own anti-particles thus they are matter majorana quanta. Hence they have each the Dirac properties of an elementary quantum and its anti-particle meaning they are the same kind of quanta as are the positronium and neutral pi-meson. The W bosons are Dirac quanta as they have electric charge and they are either elementary quanta or composite quanta.

The postulate that a quantum is unstable if and only if there exist a set of quanta with sum rest mass lesser than its own such that no other laws are violated means that an electron and all other stable charged particles can't emit i.e an electron can't decay to an electron plus a photon as the rest mass before reaction equals to that after reaction as any photon has zero rest mass. Thus only excited molecules, excited ions, excited atoms, excited nuclei or excited nucleons can emit as they are all unstable quanta. An example makes this clear an excited hydrogen atom (protium) decays to an uncited hydrogen atom (protium) plus a photon where the rest mass before reaction is greater than that after reaction. And because of the principle of least sum rest mass products an electron and proton must always form an uncited hydrogen atom plus a photon(s) but never an excited hydrogen atom plus photon(s). And also excited atoms can't decay to other excited atoms plus photons.

5. Reactions

Here the author aims to apply the definitions and principles of this theoretical framework to reactions, so as to show differences and similarities between this system and QFT. Hoping that through doing so the different predictions of the two systems may be clear and that it is left to the experimentalists to decide which theory is more realistic. In this system a neutron with zero momentum has but one possible decay reaction (n^0, $^1H^0$ ν_e)w. this being the consequence of the principle of least sum rest mass products. The principle also means that positronium at rest only decays (p^0, 2γ) so does the neutral pion (π^0, 2γ) and other majorana matter quanta such as the Z boson or Higgs boson (Z^0, 2γ), (H^0, 2γ). So these majorana matter quanta (e.g p^0, π^0, Z^0 & H^0) all can not decay to matter quanta with sum rest mass lesser than their own. Thus (π^0, e^-)e^+ is an impossible reaction. Thus (p^0, e^-)e^+ irreversible ,is possible while (p^0, ν_e) anti-ν_e is impossible but the reverse reaction is possible. Emission is a decay reaction hence stable quanta can not emit. Thus the electron and stable charged quanta don't emit. Since atoms are quanta and excited atoms are quanta too, a set can be created of an an unexcited atom and all the excited atoms. The set will be a finite set ordered according to increasing rest mass such that $\{b_0,b_1,b_2,b_{3,}b_{4\ldots\ldots}b_n\}$ thus from our principle it follows that if the first element of the set is stable the all the other elements decay to it. This explains transition probabilities, as it implies there are no intermediate decays where an excited atom decays to another excited atom of lower energy as all excited atoms must decay to the unexcited atom. But if the first element is unstable then all the other elements have the same decay as it. Thus radioactive substances have no emission spectra only absorption spectra. An excited atom with enough kinetic energy can decay to an ion plus an electron or electrons e.g ($^1H_1^0$, p^+)e^-. From the same principle it is evident that every unstable nuclei at rest decays to a stable isobar, hence all heavy nuclei such uranium, plutonium and such decay to heavy isobars, so uranium decays to a stable isobar. Thus if this theory be true then there should exist an isotope of an element as heavy as uranium which is stable and it and uranium are isobars. For every set of isobars only one element is stable the one with the least rest mass. Tritium atom decays ($^3H^0$, $^3H^+$)e^- though when at rest ($^3H^0$, $^3He^0$ ν)w. Our principle implies the irreversibility of many reaction hence the it breaks time-reversal symmetry. Thus the different products of any reactants occur at different energy ranges thus evading all probabilities regards reactions. Let the case of a neutron decays (n^0, $^1H^{0}$'v_e)w where E of n^0 is greater or equal to its E_0 and lesser than or equal to the sum E_0 of the next reaction which is (n^0, p^{+*}'e^-'v_e)w with a E_o greater than that of the neutron. Its also the case that the products of all the reactions of $p^+ + e^-$ are the same as all the decay products of $^1H^{0*}{}_n$ as a consequence of our principle. Thus a sample of neutrons will have decay reactions dependent on temperature as the population will have hydrogen decay reactions as the temperature is equal to or near absolute zero and less of these reactions as the temperature goes up the dominant products will be beta decay followed by gamma decay of the proton. The excited proton can decay to a neutron when it has enough energy while the uncited proton can't even it has enough energy as it's stable. During decay or collision reaction the energy before reaction is always greater than that of the products when there is more than one matter quanta in the set of products but if there's on quantum as product then the reactant energy can be equal or greater than rest mass of the product. The application of the rule of mins to reactions also implies a violation of time-reversal symmetry, here we are given reaction one which to identical photons create positronium with zero momentum and reaction two which has four different photons create positronium with zero momentum. Then as we postulate that two identical quantum should have the same reaction then these two positronia should either both decay to two photons or four photons but thanks to our principle of the rule of mins positronium one and two both decay to two photons meaning reaction two is irreversible and so in general any reaction where the reactants are identical photons creating a positronium with zero momentum where the number of photons is even and greater than two are all irreversible reactions hence they violate time-reversal symmetry. A QFT analysis of the case mentioned above is very different for it allows for both reations to be reversible meaning that two identical quanta in the QFT framework can decay to different products. The collision reaction (2γ,$^1H^0$)anti-$^1H^{0*}$ is impossible but its reverse reaction is possible this is implied by the principle that a Dirac quanta is always created with its anti-particle in such reactions. (2γ,$^1H^0$)anti-$^1H^0$ and (2γ,$^1H^{0*}$)$^1H^{0*}$ are both possible and reversible collision reactions.

Say we have a quantum A created at a time t with momentum p and another quantum B created at the same time with momentum -p. If these quanta collide both are annihilated and what ever quanta that emerge from such a collision are new quanta. So since a quantum is immutable the distance it travels is always equal to the absolute value of its displacement. The distance traveled by an accelerated electron moving in the direction opposite the acceleration STR is not equal to the absolute value of its displacement if the electron reaches a standstill and then moves in the direction of the acceleration. In fact in STR the displacement is always lesser than or equal to the distance traveled by a body (e.g a quantum).

6. Rates of Decay

Any two identical quanta have the same life-span i.e $\Delta t' = \gamma \Delta t$ as Einstein's STR dictates. Thus if two identical tritium atoms are created at the same time they decay at the same time same with two identical muons. If two identical tritium atoms are created same time but collide with each other before they decay as the annihilation-creation principle dictates the reactants will be destroyed and two products created a tritium atom and an excited tritium atom, the new tritium atom will decay later than the reactant atoms would decay as it was created at a later time than them. This principle gives a none random picture of radioactivity, where the QFT picture of these processes as being random in a fundamental sense is destroyed. A quantum is immutable meaning it doesn't change and it can't exist for zero duration, thus a moving electron and stationary one are different quanta in the sense that a stationary electron created in a field will exist for a while and then annihilate with the creation of a moving one as a product. This is a field reaction. If the principle is applied to the muon or any unstable particle it clear that what were changes in motion in mechanics affect the rates of decay, as a stationary muon created will undergo a field reaction a moving muon created which will decay at a later time than would the stationary muon or a muon identical to the moving one just created at the same time as the stationary muon as the new moving muon is created at different time. Thus quanta don't accelerate hence mechanics is reduced to kinematics and Einstein's STR in this modified form is a universal theory. Where the laws of STR hold in all physical situations. In a field reaction all quanta and space are annihilated and a new space (with a different geometrical structure and energy) and new quanta are created. The concepts of inertia, acceleration and force are superfluous in this theoretical framework.

7. Elementary Quanta

There's the w quantum with one elementary Dirac property, it is stable as it has the least rest mass of matter quanta. The neutrino are each have two Dirac properties, one elementary Dirac property which is the same for all neutrinos that is the neutrino charge and different fractional w-charges. The neutrino with the least rest mass is the electron neutrino and hence is the only stable neutrino hence the muon neutrino decays (ν_μ,ν_e)w. This reaction is what neutrino oscillation is, as electron neutrinos and w quanta from a source collide with each other creating the unstable muon neutrino which decays back to them at a later stage. The electron is the only stable charged lepton as it has the least rest mass of all charged quanta. The up quark is the only stable quark for the very same reasons.

w				
ν_e	ν_μ	ν_τ	ν_x	ν_y
e^-	μ^-	τ^-	x^-	y^-
u	d	c	s	b

The elements in group one are all stable and those in the other groups are all unstable.

Mass increases in moving down a group and in moving right across a period and down diagonally.

The elements of period 3 all each have three Dirac properties with one being the elementary Dirac electric charge. The other Dirac property is the neutrino charge which is fractional and the w-charge which is also fractional.

The elements in period 4 each have four Dirac properties with one being the elementary Dirac color charge. The other Dirac property is the electric charge which is fractional, the neutrino charge which is also fractional and the w-charge which is fractional too.

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