Online ISSN: 2249-4626
Print ISSN: 0975-5896
DOI: 10.17406/GJSFR

Global Journal of Science Frontier Research: A

Physics and Space Science

God Particle H to Heaven Particle

Production and Decay of Higgs Boson

Highlights

Energy in Gravitational Fields

The Photon and the Principles of Matter

Discovering Thoughts, Inventing Future

VOLUME 25 ISSUE 5 VERSION 1.0

Global Journal of Science Frontier Research: A
Physics & Space Science

Global Journal of Science Frontier Research: A
Physics & Space Science

Volume 25 Issue 5 (Ver. 1.0)

Open Association of Research Society

Incorporation No.: 0423089
License No.: 42125/022010/1186
Registration No.: 430374
Import-Export Code: 1109007027
Employer Identification Number (EIN):
USA Tax ID: 98-0673427

Global Journals Inc.

*(A Delaware USA Incorporation with "Good Standing"; **Reg. Number: 0423089**)*
Sponsors: Open Association of Research Society
Open Scientific Standards

Publisher's Headquarters office

Global Journals® Headquarters
945th Concord Streets,
Framingham Massachusetts Pin: 01701,
United States of America
USA Toll Free: +001-888-839-7392
USA Toll Free Fax: +001-888-839-7392

Offset Typesetting

Global Journals Incorporated
2nd, Lansdowne, Lansdowne Rd., Croydon-Surrey,
Pin: CR9 2ER, United Kingdom

Packaging & Continental Dispatching

Global Journals Pvt Ltd
E-3130 Sudama Nagar, Near Gopur Square,
Indore, M.P., Pin:452009, India

Find a correspondence nodal officer near you

To find nodal officer of your country, please email us at *local@globaljournals.org*

eContacts

Press Inquiries: *press@globaljournals.org*
Investor Inquiries: *investors@globaljournals.org*
Technical Support: *technology@globaljournals.org*
Media & Releases: *media@globaljournals.org*

Pricing (Excluding Air Parcel Charges):

Yearly Subscription (Personal & Institutional)
250 USD (B/W) & 350 USD (Color)

Editorial Board

Global Journal of Science Frontier Research

Contents of the Issue

Global Journal of Science Frontier Research: A
Physics and Space Science
Volume 25 Issue 5 Version 1.0 Year 2025
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 2249-4626 & Print ISSN: 0975-5896

The Photon and the Principles of Matter

By Changming Wang

Abstract- Matter keeps its internal potential-energy (Ep) and sharing-energy (Es) as a (part of a) unity, until being forced out of the unity by external excess-energy (Ee >= Es) as a free particle. Matter shows its sharing-energy (Es) as gravity (F) or weight (W) or inertia-at-rest to its unity centre: Es = F = W. Unity force or inertia (Fu = Es + Ee) is matter's tendency to be unity, expressed as attracting while energy sharing in a unity (Ee = 0), as gravity or weight or inertia-at-rest to its unity centre; or repelling while excess-energy transferring out of the unity (Ee → 0), as inertia-in-motion or heat. That is, gravity is redefined as matter's attraction to its unity centre, caused by its sharing-energy. Inertia is redefined and generalised to matter's unity force, caused by its sharing-energy (as inertia-at-rest or gravity) and its excess-energy (as inertia-in-motion or heat). The Big Bang created four kinds of base particles: proton (p), electron (e), neutrino (ν), and photon (γ). The photon tends to be in an electron unity (eγ), oscillating around its electron (the unity centre), attracting while energy sharing. When getting external excess-energy (Ee >= Es), the photon oscillates out of the unity as a free photon (γ^+) with wave-particle duality, leaving the external energy at the speed of light, as a gamma ray, X-ray or light particle, repelling while excess-energy transferring.

Keywords: *photon, unity, unity force, nuclear fusion, beta decay, black hole, galaxy, electromagnetism.*

GJSFR-A Classification: *LCC Codes: QC173.6*

THEPHOTONANDTHEPRINCIPLESOFMATTER

Strictly as per the compliance and regulations of:

The Photon and the Principles of Matter

Changming Wang

Abstract- Matter keeps its internal potential-energy (Ep) and sharing-energy (Es) as a (part of a) unity, until being forced out of the unity by external excess-energy (Ee >= Es) as a free particle. Matter shows its sharing-energy (Es) as gravity (F) or weight (W) or inertia-at-rest to its unity centre: Es = F = W. Unity force or inertia (Fu = Es + Ee) is matter's tendency to be unity, expressed as attracting while energy sharing in a unity (Ee = 0), as gravity or weight or inertia-at-rest to its unity centre; or repelling while excess-energy transferring out of the unity (Ee → 0), as inertia-in-motion or heat. That is, gravity is redefined as matter's attraction to its unity centre, caused by its sharing-energy. Inertia is redefined and generalised to matter's unity force, caused by its sharing-energy (as inertia-at-rest or gravity) and its excess-energy (as inertia-in-motion or heat). The Big Bang created four kinds of base particles: proton (p), electron (e), neutrino (ν), and photon (γ). The photon tends to be in an electron unity (eγ), oscillating around its electron (the unity centre), attracting while energy sharing. When getting external excess-energy (Ee >= Es), the photon oscillates out of the unity as a free photon (γ^+) with wave-particle duality, leaving the external energy at the speed of light, as a gamma ray, X-ray or light particle, repelling while excess-energy transferring. After transferring all its excess-energy, the photon shares energy with an electron that lost its photon previously, forming an electron unity (eγ) again. In a nuclear fusion centre, the base unities (pν and eγ) are so dense and hot that their sharing-energy is raised so high from their potential-energy (Ep → Es), they become energy sharing (nuclear fusing). Nuclear fusion is the unity force in action, creating nucleus unities so that every electron shares energy with two protons and one neutrino as $n(^2p\nu e)$, where atomic number n >= 2. In a nucleus unity, neutrinos and electrons are energy-sharing agents, orbiting protons to share and distribute energy. Thus, unity force replaces strong force and quantum chromodynamics. The photon is not in an atomic nucleus, because in nuclear fusion, the photon oscillates away with excess-energy as the gamma ray (γ^+). Excess-energy transferring is an essential aspect of unity force, to maintain the newly produced unities, in nuclear fusion, beta decay, or any other reactions. In the universe, most nuclear fusion centres with excess-energy-transferring form stars and planets. The rest, extra-large fusion centres with inner cores unable to transfer out excess-energy as a repelling force, form black holes with much stronger attracting unity forces (gravities) of their respective galaxies. In a black hole, matter transfers its potential-energy completely into sharing-energy Ep → Es, so that Ep = 0, and sharing-energy becomes infinity: Es = Fu = F → ∞, making the black hole into a physical singularity. Every galaxy is a unity, the ultimate unity with its ultimate unity force, with at least one black hole as the unity centre. Unity force forms the hierarchical structure of each galaxy, making the black hole its unity centre. Under a galaxy, each star is the unity centre of the star system. Under a star system, each planet is the unity centre of its moons. Then, each atomic nucleus is the unity centre of the atom. Inside the nucleus, every proton is a unity centre. Outside the nucleus, each electron is the unity centre of the electron unity (eγ). Beta decay is also unity force in action: external energy breaks an unstable nucleus unity, leading to a more energy-sharing and hence more stable nucleus unity, while transferring out the excess-energy either as a neutrino and an electron (electron emission) or just as a neutrino (electron capture). Thus, unity force also replaces weak force. A "positron" is redefined as a high-energy electron. Matter's energy is scalar, not vector. Any "antimatter" is a misconception, including the concept of a "positively charged electron" and the idea of "annihilation". When a positron meets a normal electron unity (eγ), the excess-energy transfers from the positron to the bonded photon, producing a gamma ray or an X-ray, depending on the positron's excess-energy level. After transferring all its excess-energy, the positron becomes a normal electron. External electric forces can oscillate away the outermost electrons from the atom unities of a conductor, align and energise them as stronger electron waves with magnetic effects, and simultaneously cause them to flow along the potential difference as electric currents. Electricity is the synchronized repelling force of the electric currents, in which each electron transfers its excess-energy to an electrical device, or to its bonded photon causing light. Magnetic effects result from stronger electron waves aligning weaker electron waves. Electromagnetism is electron waves showing magnetic effects while transferring excess-energy as photon waves. So, electromagnetism is the unity force of free electrons and should be called electronism. Therefore, there are no such things as magnetism, magnetic fields, or magnetic waves. They are just electron fields with electron waves transferring excess-energy as photon waves.

Keywords: photon, unity, unity force, nuclear fusion, beta decay, black hole, galaxy, electromagnetism.

Author: e-mail: changming@mountainviewgrowers.com

I. Introduction

In 1905, Albert Einstein first proposed that light, which had been considered electromagnetic waves, must also be particles. American chemist Gilbert Lewis later coined the term photon for the light particle. [1][2]

As one of the subatomic particles, having no electric charge and one unit of spin, photons are bosons that are carriers of electromagnetic energy. [1][2]

The energy of a photon depends on radiation frequency, from high-energy gamma-rays and X-rays, through visible light, to low-energy infrared and radio waves. All photons travel at the speed of light.[3]

But the photon has not been fully and correctly understood. For example:

1. Electromagnetism needs to be re-examined.
2. The idea of a positron annihilating an electron, producing gamma-rays, is disputable.

3. The above statement that the energy of a photon depends on radiation frequency should be a reverse causation: the frequency of a photon depends on its energy.

More misconceptions (see later sections) have been prevalent since the photon's discovery. Therefore, the nature of the photon needs a more profound and distinct perspective, from the fundamental principles of matter and the origin of the photon, as follows.

II. The Principles of Matter – The Laws of Unity

Here are the Principles of Matter or the Laws of Unity, updated from my original version:[4][5][6][7]

1. *Matter* is any substance that has *mass* (m) and *energy*. Mass and energy are properties of matter, not physical entities. Matter's energy is scalar, not vector.
2. Matter shows its energy as *forces*. A *force* is a vector that transfers energy.
3. Matter keeps its internal *potential-energy* (Ep) and *sharing-energy* (Es) as a (part of a) *unity*, until being forced out of the unity by external *excess-energy* (Ee >= Es) as a *free particle* (see Figure 1: Matter).
   - 3.1. Matter shows its sharing-energy (Es) as *gravity* (F) or *weight* (W) or *inertia-at-rest* to its unity centre: Es = F = W.
   - 3.2. Matter does not show its potential-energy but transfers it between its sharing-energy and excess-energy (As shown in Figure 1: Matter). For example, when going up in an airplane, our weight is decreasing while our potential-energy is increasing (Es → Ep), while the plane's external excess-energy also increases our potential-energy (Ee → Ep). When going even higher in a spaceship, we become "weightless" (weighing less). When landing on the Moon or Earth, our potential-energy is decreasing while our weight is increasing (Ep → Es).

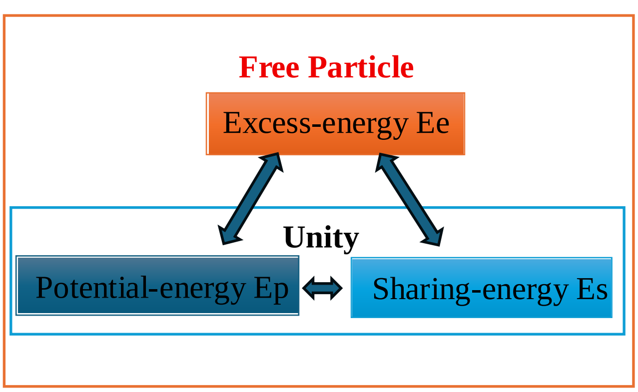


Figure 1: Matter

4. *Unity force* or *inertia* (Fu = Es + Ee) is matter's tendency to be unity, expressed as attracting while energy sharing in a unity (Ee = 0), as gravity or weight or *inertia-at-rest* to its unity centre; or repelling while excess-energy transferring out of the unity (Ee → 0), as *inertia-in-motion* or heat.
   - 4.1 A free particle oscillates away from the external excess-energy (Ee >= Es) as particle waves, transferring the excess-energy as heat or inertia-in-motion (Ee → 0) - such as light if the particle is almost massless (like a photon or a neutrino) or electron waves with magnetic effects if the particle is an electron - until returning or joining to a unity (Ee = 0).
   - 4.2 In the unity (Ee = 0), matter orbits or gravitates to its unity centre, attracting while energy sharing, like an electron orbiting an atomic nucleus or a planet orbiting a star. The orbit is the path where Ee = 0, leaving Es as the gravity (F) or weight (W) or inertia-at-rest to its unity centre: Fu = Es = F = W.
   - 4.3 Breaking a unity (or inertia-at-rest) requires strong enough external excess-energy (Ee >= Es), leading to inertia-in-motion and a new unity in the new situation (Ee → Ep or Ee → 0). The more energy is shared (Ep → Es, such as in a nuclear fusion), the tighter the formed unity (such as the produced nucleus unity), the more external excess-energy is required to break the unity, and vice versa (such as in beta decay).

In his first law of motion, Isaac Newton described inertia as the natural tendency of objects in motion to stay in motion and objects at rest to stay at rest, unless a force causes the velocity to change.[8]

As proposed above:

1. Gravity is redefined as matter's attraction to its unity centre, caused by its sharing-energy.
2. Inertia is redefined and generalised to matter's unity force, caused by its sharing-energy (as inertia-at-rest or gravity) and its excess-energy (as inertia-in-motion or heat).

So, the Principles of Matter or the Laws of Unity can be described by the unity force or inertia:

$$Fu = Es + Ee,\ \text{where,}$$

Es = F = W = mg, where m is the mass, g is the acceleration by gravity [8],
Ee = ma, where m is the mass, a is an acceleration by external force.

Therefore,

Fu = mg + ma = m(g + a), cycling through the following states:
a = 0 (in unity),
a >= g (out of unity),
a → 0 (return or join to unity).

III. The Origin of The Photon

According to the Big Bang model, the universe began 13.8 billion years ago by expanding from a single point of infinite density and heat, known as the singularity.[9]

As the universe expanded and cooled, matter formed, as four kinds of base particles: proton, electron, neutrino, and photon, in descending order of mass.[4][5][6][7]

Then, each free proton (p) shares energy with a free neutrino (ν) as a proton unity (pν) because their mass fit each other to be a unity:

$$p + \nu \rightarrow p\nu$$

Each free electron (e) shares energy with a free photon (γ) as an electron unity (eγ), also because their mass fit each other to be a unity:

$$e + \gamma \rightarrow e\gamma$$

Proton unities (pν) and electron unities (eγ) are called base unities.

The light could not propagate because each photon bonded with an electron as a unity. The base unities also made the universe opaque (Cosmic Dark Age).

So, I propose and summarise:

1. The Big Bang created the photon as one of the four base particles.
2. A photon tends to be in an electron unity (eγ), circling the electron as the unity centre.

IV. The Photon in Nuclear Fusion

In a nuclear fusion centre, the base unities have been so dense and hot that they have become more energy sharing (Ep → Es) and have begun nuclear fusion. That is, nuclear fusion is unity force in action, mainly through the proton-proton chain reaction[10], in the following simplified steps, updated from my original version:[4][5][6][7]

1. Two proton unities and two electron unities share energy to form a hydrogen-2 nucleus called deuterium, transferring out a high-energy neutrino (ν^+), a high-energy electron (e^+ or positron) and a high-energy photon (γ^+ or gamma ray) as excess-energy:

$$2\ p\nu + 2\ e\gamma \rightarrow {}^2p\nu e\gamma + \nu^+ + e^+ + \gamma^+$$

2. The deuterium $^2p\nu e\gamma$ shares energy with another proton unity to form a helium-3 nucleus, transferring another high-energy photon (γ^+ or gamma ray) as excess-energy:

$$^2p\nu e\gamma + p\nu \rightarrow {}^3p^2\nu e + \gamma^+$$

3. Two helium-3 nuclei share energy to form one helium-4 nucleus and transfer two proton unities to continue the process:

$$^3p^2\nu e + {}^3p^2\nu e \rightarrow {}^4p^2\nu^2e + 2\ (p\nu)^+$$

4. The helium-4 nucleus, $^4p^2\nu^2e = 2(^2p\nu e)$, becomes repelling while transferring the excess-energy mentioned above and moves out of the fusion centre to the outer core as the nucleus unity, and the product of the fusion.
5. Or the helium-4 nucleus $2(^2p\nu e)$ shares more energy with other nuclei or proton unities to form a heavier nucleus unity: $n(^2p\nu e)$, where atomic number $n > 2$, if the situation permits.
6. Therefore, in a newly formed nucleus unity from nuclear fusion, every electron shares energy with two protons and one neutrino as $n(^2p\nu e)$, where the atomic number $n >= 2$. Although isotopes happen, this is the main composition.
7. Most fusion centres transfer out their excess-energy as high-energy neutrinos, photons, and electrons:
   - 7.1. The high-energy neutrinos and photons (ν^+ and γ^+) carry their excess-energy away directly as light (invisible in the beginning due to high energy).
   - 7.2. The high-energy electrons (e^+) bump into outside normal electron unities (eγ), transferring the excess-energy to their bonded photons (no "annihilation"), producing gamma rays (γ^+) as light:

$$e^+ + e\gamma \rightarrow 2\ e + \gamma^+$$

8. The rest, extra-large fusion centres could not transfer out their excess-energy in the inner core but use it instead for energy sharing of tighter unities. Without repelling by excess-energy transferring, these extra-large fusion centres become black holes with much stronger attracting unity forces (gravities) of their respective galaxies.

So, I propose and summarise:

1. Nuclear fusion is the unity force in action, creating nucleus unities so that every electron shares energy with two protons and one neutrino as $n(^2p\nu e)$, where atomic number $n >= 2$. In a nucleus unity, neutrinos and electrons are energy-sharing agents, orbiting protons to share and distribute energy. Thus, unity force replaces strong force[11] and quantum chromodynamics.[5][6][7]
2. In a nucleus, every pair of (pe) shows as a neutron.
3. A "positron" is redefined as a high-energy electron. Matter's energy is scalar, not vector. Any "antimatter" is a misconception, including the

concept of a "positively charged electron" and the idea of "annihilation".

4. Excess-energy transferring is an essential aspect of unity force, to maintain the newly produced unities. As an excess-energy-transferring agent (γ^+) in nuclear fusion, the photon is not in a nucleus.
5. In the universe, most nuclear fusion centres with excess-energy-transferring form stars and planets. The rest, extra-large fusion centres with inner cores unable to transfer out excess-energy as a repelling force, form black holes with much stronger attracting unity forces (gravities) of their respective galaxies.[6][7]
6. In a black hole, matter transfers its potential-energy completely into sharing-energy Ep → Es, so that Ep = 0, and sharing-energy becomes infinity: Es = Fu = F → ∞, making the black hole into a physical singularity.
7. Mass and energy are properties of matter, not physical entities, and not exchangeable, not even in nuclear fusion. The concept of mass-energy equivalence ($E = mc^2$)[12] is deemed a misconception.
8. Every galaxy is a unity, the ultimate unity with its ultimate unity force, with at least one black hole as the unity centre. If two or more black holes exist in one galaxy, they are close enough to attract each other and will eventually merge into one.[6][7]
9. Unity force or inertia (its sharing-energy Es showing as gravity) forms the hierarchical structure of each galaxy, making the black hole its unity centre. Under a galaxy, each star is the unity centre of the star system. Under a star system, each planet is the unity centre of its moons. Then, each atomic nucleus is the unity centre of the atom. Inside the nucleus, every proton is a unity centre. Outside the nucleus, each electron is the unity centre of the electron unity (eγ).[6][7]

V. The Photon in Atom Formation

Around 380,000 years after the Big Bang, out of the fusion centres in the disks of the star systems, the temperatures were eventually cool enough for the nuclei to capture electron unities (eγ), forming the first atoms and making the cosmos transparent:[5][6][7]

1. Absent from nuclear fusion, each free proton unity attracts and shares energy with an electron unity in its orbit, forming a hydrogen atom: (pv) + (eγ), producing most of the light elements in the universe.
2. Created in the fusion centres and moved out, each helium-4 nucleus shares energy with two electron unities in its orbit, forming a helium atom: $2(^2pve) + 2(e\gamma)$, producing the rest of the light elements in the universe.
3. The heavier nuclei form atom unities the same way, with exact numbers of protons and electrons in an atom: $n(^2pve) + n(e\gamma)$, where atomic number $n > 2$.

When getting excess-energy from the environment, like nearby fusion centres, the outermost electron unity (eγ) of an atom oscillates out of the atom, becoming a free electron unity again, and in turn transfers the excess-energy to its bonded photon, producing light:

$$(e\gamma)^+ \rightarrow e + \gamma^+$$

together with the light produced from nuclear fusion, bringing the dawn of the universe.[5][6][7]

So, I propose and summarise:

1. In atom formation, absent from nuclear fusion, each free proton unity (pv) shares energy with an electron unity (eγ) in its orbit, forming a hydrogen atom: (pv) + (eγ).
2. Created in fusion centres and moved out, those nuclei share energy with electron unities in their orbits, forming atom unities: $n(^2pve) + n(e\gamma)$, with the same number of protons and electrons, but only half the number of photons and neutrinos. The other half of photons and neutrinos are transferred out as excess-energy in nuclear fusion, as free photons and neutrinos (visible and invisible light) in the universe.

VI. The Photon in Beta Decay

As stated in the section of Nuclear Fusion, the nuclei of helium and heavier atoms are created in nuclear fusion centres by every electron sharing energy with two protons and one neutrino as $n(^2pve)$, where atomic number $n >= 2$.

In a nucleus, every (pe) shows as a neutron. In the following beta decay processes, electron emission breaks a neutron (pe) into p + e; while electron capture is a reversal: p + e → pe.

According to the Laws of Unity, breaking a unity requires strong enough external excess-energy (Ee >= Es), although some very unstable unities (with more potential-energy but less sharing-energy) can break easily, almost spontaneously.

In the case of beta decay, the external excess-energy mostly comes from random environmental sources (besides manually induced in nuclear fission), including cosmic rays, high-energy photons (gamma rays, X-rays), neutrinos or electrons. Most of the sources are nearly untraceable.

Beta decays happen in two types:

1. *Electron emission*[13]. The external excess-energy breaks free an electron and a neutrino shared with a proton, causing one less neutron and one more proton:

Global Journal of Science Frontier Research (A) XXV Issue V Version I Year 2025

$$pev \rightarrow p + e^+ + v^+$$

The broken-free neutrino (v^+) carries the excess-energy away as invisible light. The broken-free electron (e^+ or positron) transfers the excess-energy to a normal electron unity (eγ), producing a gamma ray or X-ray (γ^+) depending on the energy level.

2. *Electron capture*[14]. The external excess-energy can also energise an electron in the orbit of an unstable nucleus. The energised orbiting electron can break the unity of its nucleus, forming a new unity with a proton, causing one less proton and one more neutron:

$$e^+ + pv \rightarrow pe + v^+$$

transferring out a high-energy neutrino v^+ as excess-energy and invisible light.

So, I propose and summarise:

1. Beta decay is also unity force in action: external energy breaks an unstable nucleus unity, leading to a more energy-sharing and hence more stable nucleus unity, while transferring out the excess-energy either as a neutrino and an electron (electron emission) or just as a neutrino (electron capture). Thus, unity force also replaces weak force.[5][7][15]
2. In beta decays, as agents for excess-energy transfer (γ^+ gamma ray or X-ray), photons maintain the newly produced unities.
3. In beta decays, electron emission breaks a neutron (pe) into p + e; while electron capture is a reversal: p + e → pe.
4. As stated before, the concept of a "positively charged electron" is a misconception. Beta decays should be categorised into electron emission and electron capture, instead of "negative or minus" and "positive or plus".
5. In beta decays (including nuclear fissions), the transferred energy comes from the potential-energy of the source nuclei, not from their mass. The excessive potential-energy stored in the source nuclei from nuclear fusion makes them unstable.

VII. The Photon as Gamma Ray and X-Ray

As stated in the above sections:

1. A gamma ray is a very-high-energy photon (γ^{+3}, +3 is used in this section to indicate higher energy than +2) transferred out from nuclear fusion:
   - Either directly as the photon (γ^{+3}),
   - or as a very-high-energy electron (e^{+3} or positron) that transfers its energy to a normal electron unity (eγ), also producing a very-high-energy photon (γ^{+3}):

$$e^{+3} + e\gamma \rightarrow 2\,e + \gamma^{+3}$$

2. An X-ray is a high-energy photon (γ^{+2}) produced from a high-energy electron (e^{+2} or positron) transferred out from beta decay and met a normal electron unity (eγ):

$$e^{+2} + e\gamma \rightarrow 2\,e + \gamma^{+2}$$

So, I propose and summarise:

1. When a positron meets a normal electron unity (eγ), the excess-energy transfers from the positron to the bonded photon, producing a gamma ray (γ^{+3}) or an X-ray (γ^{+2}), depending on the positron's excess-energy level. "Annihilation" is a misconception.
2. After transferring all its excess-energy, the positron becomes a normal electron (e).

VIII. The Photon in Electromagnetism

According to current knowledge, electromagnetism or electromagnetic radiation[16] is the flow of energy at the speed of light through space or a material medium in the electric and magnetic fields that make up electromagnetic waves such as radio waves, visible light, and gamma rays. In such a wave, electric and magnetic fields are mutually linked with each other at right angles and perpendicular to the direction of motion. An electromagnetic wave is characterised by its intensity and the frequency of the electric and magnetic fields. In quantum theory, electromagnetic radiation is the flow of photons through space.

According to the Principles of Matter, electromagnetic radiation is just electron waves transferring excess-energy as photon waves.[4][5]

In an electric field or a conductor, when electron unities (eγ) get excess-energy from an electric source that has a potential difference (voltage) for direction of motion, the energised electron unities $(e\gamma)^+$ oscillate away from the electric source as electron waves (the wave-particle duality) with magnetic effects (the wave property), perpendicular to the simultaneously caused electric current (the particle property), and in turn oscillating away their bonded photons as light (γ^+), at right angles to the electrons:

1. The electron unities $(e\gamma)^+$ oscillate away from their external energy (the electric source) as far away as possible, which is perpendicular to the direction of the simultaneous electric current.
2. The photons γ^+ also oscillate away from their external energy (the electrons) as far away as possible, which is at right angles to the electrons. That is why the magnetic waves (photon waves actually) are at right angles to the electron waves.

So, I propose and summarise:

1. Without external forces:
   1.1. In most materials, most electrons are in atom unities; the rest, occasional free electrons,

Global Journal of Science Frontier Research (A) XXV Issue V Version I Year 2025

make random waves that cancel each other out without magnetic effects.

1.2. In the rest materials, like iron, more free electrons can be aligned, showing some magnetic effects. A magnet has many more free electrons that are already aligned when created.

2. External electric forces can oscillate away those outermost electrons from the atom unities of a conductor, align and energise them as stronger electron waves with magnetic effects, and simultaneously cause them to flow along the potential difference as electric currents. Electricity is the synchronized repelling force of the electric currents, in which each electron transfers its excess-energy to an electrical device, or to its bonded photon causing light.[5]
3. Magnetic effects result from stronger electron waves aligning weaker electron waves. The aligned electron waves synchronise attractions and repulsions: while aligning is energy sharing, the aligned electrons all repel in the same direction, forming an electric current or potential difference. For example, a magnet or an electric source with stronger electron waves align and then attract small iron pieces with weaker electron waves.[5]
4. Electromagnetism is electron waves showing magnetic effects while transferring excess-energy as photon waves. So, electromagnetism is the unity force of free electrons and should be called electronism.[5]
5. Therefore, there are no such things as magnetism, magnetic fields, or magnetic waves. They are just electron fields with electron waves transferring excess-energy as photon waves.[5]

IX. The Photon as the Agent for Excess-Energy Transfer

When not bonded in an electron unity (eγ), as agents for excess-energy transfer, free photons (γ^+) are vitally important to the universe (as shown above), as well as to human beings.

We have used free photons (γ^+) as waves and particles in countless applications. One small example is the photovoltaic (PV) cells, also known as solar cells[17]. They are electronic devices that absorb and convert excess-energy from high-energy free photons (γ^+), producing electrical currents. These cells are the foundation of solar panels to generate electricity from sunlight.

1. *Light absorption:* The PV cells comprise materials that can absorb high-energy photons (γ^+) efficiently from the sun.
2. *High-energy electron generation:* The absorbed high-energy photons (γ^+) excite electron unities (eγ) within the material, oscillating them free as high-energy electron unities $(e\gamma)^+$:

$$\gamma^+ + e\gamma \rightarrow (e\gamma)^+ + \gamma$$

3. *Current flow:* These high-energy electron unities $(e\gamma)^+$ oscillate away to electrical contacts of the device, and flow through an external circuit, producing an electrical current.

This process of converting light into electricity is called the photovoltaic effect.[17]

X. Conclusion

1. Matter keeps its internal *potential-energy* (Ep) and *sharing-energy* (Es) as a (part of a) *unity*, until being forced out of the unity by external *excess-energy* (Ee >= Es) as a *free particle*.
2. Matter shows its sharing-energy (Es) as *gravity* (F) or *weight* (W) or *inertia-at-rest* to its unity centre:

$$Es = F = W.$$

3. *Unity force* or *inertia* (Fu = Es + Ee) is matter's tendency to be unity, expressed as attracting while energy sharing in a unity (Ee = 0), as gravity or weight or inertia-at-rest to its unity centre; or repelling while excess-energy transferring out of the unity (Ee → 0), as *inertia-in-motion* or heat.
4. That is, gravity is redefined as matter's attraction to its unity centre, caused by its sharing-energy.
5. Inertia is redefined and generalised to matter's unity force, caused by its sharing-energy (as inertia-at-rest or gravity) and its excess-energy (as inertia-in-motion or heat).
6. The Big Bang created four kinds of base particles: proton (p), electron (e), neutrino (v), and photon (γ), in descending order of mass.
7. The photon tends to be in an electron unity (eγ), oscillating around its electron (the unity centre), attracting while energy sharing, as gravity (F) or weight (W) or inertia-at-rest. Its orbit is the equilibrium of its unity force Fu = Es = F = W.
8. When getting external excess-energy (Ee >= Es), the photon oscillates out of the unity as a free photon (γ^+) with wave-particle duality, leaving the external energy at the speed of light, as a gamma ray, X-ray or light particle, repelling while excess-energy transferring. After transferring all its excess-energy, the photon shares energy with an electron that lost its photon previously, forming an electron unity (eγ) again.
9. In a nuclear fusion centre, the base unities (pv and eγ) are so dense and hot that their sharing-energy is raised so high from their potential-energy (Ep → Es), they become energy sharing (nuclear fusing).
10. Nuclear fusion is the unity force in action, creating nucleus unities so that every electron shares energy with two protons and one neutrino as $n(^2pve)$, where

Global Journal of Science Frontier Research (A) XXV Issue V Version I Year 2025

atomic number n >= 2. In a nucleus unity, neutrinos and electrons are energy-sharing agents, orbiting protons to share and distribute energy. Thus, unity force replaces strong force and quantum chromodynamics.

11. The photon is not in an atomic nucleus, because in nuclear fusion, the photon is transferred out as excess-energy - the gamma ray (γ^+).
12. Excess-energy transferring is an essential aspect of unity force, to maintain the newly produced unities, in nuclear fusion, beta decay, or any other reactions.
13. In the universe, most nuclear fusion centres with excess-energy-transferring form stars and planets. The rest, extra-large fusion centres with inner cores unable to transfer out excess-energy as a repelling force, form black holes with much stronger attracting unity forces (gravities) of their respective galaxies.
14. In a black hole, matter transfers its potential-energy completely into sharing-energy Ep → Es, so that Ep = 0, and sharing-energy becomes infinity: Es = Fu = F → ∞, making the black hole into a physical singularity.
15. Mass and energy are properties of matter, not physical entities, and not exchangeable, not even in nuclear fusion or beta decay. The concept of mass-energy equivalence ($E = mc^2$) is deemed a misconception.
16. Every galaxy is a unity, the ultimate unity with its ultimate unity force, with at least one black hole as the unity centre. If two or more black holes exist in one galaxy, they are close enough to attract each other and will eventually merge into one.
17. Unity force (its sharing-energy Es showing as gravity) forms the hierarchical structure of each galaxy, making the black hole its unity centre. Under a galaxy, each star is the unity centre of the star system. Under a star system, each planet is the unity centre of its moons. Then, each atomic nucleus is the unity centre of the atom. Inside the nucleus, every proton is a unity centre. Outside the nucleus, each electron is the unity centre of the electron unity (eγ).
18. In atom formation, absent from nuclear fusion, each free proton unity (pv) shares energy with an electron unity (eγ) in its orbit, forming a hydrogen atom:

    (pv) + (eγ).

19. Created in fusion centres and moved out, those nuclei share energy with electron unities in their orbits, forming atom unities: n(^{2}pve) + n(eγ), with the same number of protons and electrons, but only half the number of photons and neutrinos. The other half of photons and neutrinos are transferred out as excess-energy in nuclear fusion, as free photons and neutrinos (visible and invisible light) in the universe.
20. Beta decay is also unity force in action: external energy breaks an unstable nucleus unity, leading to a more energy-sharing and hence more stable nucleus unity, while transferring out the excess-energy either as a neutrino and an electron (electron emission) or just as a neutrino (electron capture). Thus, unity force also replaces weak force.
21. In a nucleus, every (pe) shows as a neutron. In beta decays, electron emission breaks a neutron (pe) into p + e; while electron capture is a reversal:

    p + e → pe.

22. A "positron" is redefined as a high-energy electron. Matter's energy is scalar, not vector. Any "antimatter" is a misconception, including the concept of a "positively charged electron" and the idea of "annihilation". Therefore, beta decays should be categorised into electron emission and electron capture, instead of "negative or minus" and "positive or plus".
23. When a positron meets a normal electron unity (eγ), the excess-energy transfers from the positron to the bonded photon, producing a gamma ray or an X-ray, depending on the positron's excess-energy level. After transferring all its excess-energy, the positron becomes a normal electron.
24. External electric forces can oscillate away the outermost electrons from the atom unities of a conductor, align and energise them as stronger electron waves with magnetic effects, and simultaneously cause them to flow along the potential difference as electric currents. Electricity is the synchronized repelling force of the electric currents, in which each electron transfers its excess-energy to an electrical device, or to its bonded photon causing light.
25. Magnetic effects result from stronger electron waves aligning weaker electron waves. The aligned electron waves synchronise attractions and repulsions: while aligning is energy sharing, the aligned electrons all repel in the same direction, forming an electric current or potential difference.
26. Electromagnetism is electron waves showing magnetic effects while transferring excess-energy as photon waves. So, electromagnetism is the unity force of free electrons and should be called electronism.
27. Therefore, there are no such things as magnetism, magnetic fields, or magnetic waves. They are just electron fields with electron waves transferring excess-energy as photon waves.

References Références Referencias

1. The Editors of Encyclopedia Britannica (2025). Photon. *Encyclopedia Britannica.* https://www.britannica.com/science/photon

2. The Editors of Encyclopedia Britannica (2025). Quantum theory of light. *Encyclopedia Britannica.* https://www.britannica.com/science/light/Quantum-theory-of-light
3. The Editors of Encyclopedia Britannica (2025). Speed of Light. *Encyclopedia Britannica.* https://www.britannica.com/science/speed-of-light
4. Changming Wang (2025). The Fundamental Forces and their Unification. *Global Journal of Science Frontier Research (A)*, Volume 25 Issue 1 Version 1.0 81-87. https://globaljournals.org/GJSFR_Volume25/4-The-Fundamental-Forces.pdf
5. Changming Wang (2025). The Nature of the Electron. *Global Journal of Science Frontier Research (A)*, Volume 25 Issue 2 Version 1.0 23-30. https://globaljournals.org/GJSFR_Volume25/4-The-Nature-of-the-Electron.pdf
6. Changming Wang (2025). The Formation of the Universe. *Global Journal of Science Frontier Research (A)*, Volume 25 Issue 2 Version 1.0 7-12. https://globaljournals.org/GJSFR_Volume25/2-The-Formation-of-the-Universe.pdf
7. Changming Wang (2025). The Nature of the Neutrino. *Global Journal of Science Frontier Research (A)*, Volume 25 Issue 3 Version 1.0 35-41. https://globaljournals.org/GJSFR_Volume25/2-The-Nature-of-the-Neutrino.pdf
8. Wikipedia (2025). Newton's laws of motion. *Wikipedia.* https://en.wikipedia.org/wiki/Newton's_laws_of_motion
9. The Editors of Encyclopaedia Britannica (2025). Big-bang Model. *Encyclopaedia Britannica.* https://www.britannica.com/science/big-bang-model
10. The Editors of Encyclopedia Britannica (2021). Proton-proton Chain. *Encyclopedia Britannica.* https://www.britannica.com/science/proton-proton-cycle
11. Christine Sutton (2025). Strong Force. *Encyclopedia Britannica.* https://www.britannica.com/science/strong-force
12. Sidney Perkowitz (2025). $E = mc^2$. *Encyclopedia Britannica.* https://www.britannica.com/science/E-mc2-equation
13. The Editors of Encyclopedia Britannica (2025). Beta Decay. *Encyclopedia Britannica.* https://www.britannica.com/science/beta-decay
14. Wikipedia (2025). Electron Capture. *Wikipedia.* https://en.wikipedia.org/wiki/Electron_capture
15. Christine Sutton (2025). Weak Interaction. *Encyclopedia Britannica.* https://www.britannica.com/science/weak-force
16. Melba Phillips, Hellmut Fritzsche (2025). Electromagnetic Radiation. *Encyclopedia Britannica.* https://www.britannica.com/science/electromagnetic-radiation
17. The Editors of Encyclopedia Britannica (2025). Photovoltaic effect. *Encyclopedia Britannica.* https://www.britannica.com/science/photovoltaic-effect

Global Journal of Science Frontier Research: A
Physics and Space Science
Volume 25 Issue 5 Version 1.0 Year 2025
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 2249-4626 & Print ISSN: 0975-5896

Features of the Homogeneous Plasmonic Structures on Porous Silicon Formation

By K. B. Tynyshtykbayev
Kazakhstan Nazarbayev University

Abstract- In this work, we demonstrate the feasibility of fabricating uniform periodic plasmonic structure of Ni-PNP/por-Si by masking the wafer surface using optical lithography, followed by pore formation and deposition of plasmonic Ni-nanoparticles (Ni-PNP) in a single-step metal-assisted electrochemical etching process. It is shown that the high energetics of nc-PS and of the nc-PS/c-Si interface facilitates the formation of uniform plasmonic Ni-PNP/PS structures using a single-step pore etching and deposition of plasmonic nanoparticles.

GJSFR-A Classification: *LCC Code: QC176.8.N35*

FEATURESOFTHEHOMOGENEOUSPLASMONICSTRUCTURESONPOROUSSILICONFORMATION

Strictly as per the compliance and regulations of:

Features of the Homogeneous Plasmonic Structures on Porous Silicon Formation

K. B. Tynyshtykbayev

Abstracts- In this work, we demonstrate the feasibility of fabricating uniform periodic plasmonic structure of Ni-PNP/por-Si by masking the wafer surface using optical lithography, followed by pore formation and deposition of plasmonic Ni-nanoparticles (Ni-PNP) in a single-step metal-assisted electrochemical etching process. It is shown that the high energetics of nc-PS and of the nc-PS/c-Si interface facilitates the formation of uniform plasmonic Ni-PNP/PS structures using a single-step pore etching and deposition of plasmonic nanoparticles.

I. Introduction

The plasmonic properties of metal nanoparticles with a high density of free electrons, Me-PNP (Au, Ag, Cu, etc.), are of great interest in terms of increasing the efficiency of solar cells, photoelectrocatalytic hydrogen generators, and biosensors [1]. However, the catalytic activity of typical plasmonic metals (Au, Ag, Cu, Al) for H2 production is comparatively low [2]. Therefore, hybrid plasmonic nanostructures are created in which the plasmonic properties of Me-PNP are combined with additional improved catalytic properties of non-plasmonic metal catalysts (Pt, Ru, Rh, Ni), which in many cases are not present in single-component analogs. The hybrid plasmonic system exhibits increased catalytic activity due to a combination of efficient absorption of light by plasmonic nanoparticles and the transfer of concentrated energy to the charge carriers of the catalyst. In such systems, the decay of plasmonic resonances changes in favor of non-radiative heat generation, compared to radiative processes (scattering) [3]. Moreover, hybrid plasmonic structures exhibit increased chemical stability due to the formation of stable chemical bonds between the boundary atoms of the interface. Thus, enhanced light absorption due to the local field of Me-PNP and the increased injection rate of hot carriers from the plasmonics to the catalytic metal improves H2 production.

Enhanced light absorption by the interface and a corresponding shift in the spatial distribution of absorption toward the catalytic metal increases the lifetime of excited catalyst carriers, thereby increasing the efficiency of H2 and O2 evolution reactions [4].

Author: Physics and Technology Institute Satbayev University, Almaty 050032, Kazakhstan Nazarbayev University, Astana 010000, Kazakhstan. e-mails: k.tynyshtykbayev@sci.kz

kurbangali.tynyshtykbayev@nu.edu.kz

Thus, the catalytic activity of plasmonic metals can be improved by combining plasmonic metals with conventional catalytically active metals, the inclusion of which can help reduce the activation energy of a reaction step or improve the dynamics of hydrogen generation on the catalyst surface. Combining the two metals reduces the chemical potential of charge carrier transfer across the interface and increases the efficiency of H2 and O2 gas separation reactions and their recovery [5]. The plasmonic properties of Ni-PNP nickel nanoparticles are weaker than those of plasmonic metals (Ag, Cu, Al) [6], as Ni-PNP exhibit stronger plasmon damping due to strong magnetic polarization [7], but they are less demanding to manufacture. The main advantage of Ni is its good catalytic properties in the hydrogen evolution reaction [8] and low cost.

To this end, we investigated the possibility of using Ni-NP nickel nanoparticles [7] to create a Ni-PNP/PS nickel plasmonic structure based on porous silicon (PS) as a supporting semiconductor core [9]. As is known [10], porous silicon nanocrystallites (nc-PS) are excellent catalysts for H2 evolution in water photoelectrolysis reactions.

PS with a periodically changing surface structure and possessing the properties of a diffraction grating [11] is attractive for the creation of a periodic structure due to its high porosity and the potential possibility of obtaining a plasmonic structure using a relatively simple electrochemical method of etching and deposition of a plasmonic-active metal - metal-stimulated etching [12]. In addition, nickel silicide NiSi, formed on the surface of PS (at the Ni-PNP/nc-PS interface), exhibits protective properties against corrosion in a wide range of pH 5-pH 11 [13].

Porous silicon, consisting of an ensemble of oxidized wide-bandgap (Eg = 1.8 - 2.9 eV) silicon nanocrystallites (nc-Si), occupies a special place in silicon technology, which still remains dominant in the electronics industry [14]. The high energy of porous silicon nanocrystallites nc Si/PS [15] determines the high catalytic activity of PS, which is twice as high as the catalytic activity of the Pt electrode in the hydrogen evolution reaction [16].

Porous silicon PS, containing nanoparticles of plasmonic metals Me-PNP, is, in essence, plasmonic nanostructures Me-PNP/PS, localizing the scattering and absorption of light near The free-electron oscillation frequencies of Me-PNPs are sources of localized

Global Journal of Science Frontier Research (A) XXV Issue V Version I Year 2025

plasmonic resonance radiation. The porous PS structure is used as a supporting framework for plasmonic PNP nanoparticles. By controlling the morphology, shape, and size of the pores, as well as the conductivity type of the silicon framework in the form of p-type silicon for the photocathode, the PS structure can be tailored for efficient photocatalysis of a specific hydrogen evolution reaction at the cathode, making them promising systems for achieving high hydrogen production selectivity. The developed PS surface allows for the concentration of plasmon-activated catalytic centers on the electrode surface near the region of plasmon resonance enhancement, increasing the efficiency of the H2 evolution reaction in the pores near the plasmonic Me-PNPs.

Furthermore, during the formation of the Ni-PNP/PS nickel plasmonic nanostructure, chemically stable silicide coatings form on the pore surface, increasing the stability of such structures in H2 evolution reactions [16].

The main drawback of plasmonic structures based on Me-PNP/PS porous silicon is the lack of periodicity in the arrangement of pores or nanocrystallites of porous silicon, nc-Si/PS. We have demonstrated the feasibility of creating a strictly periodic Ni-PNP/PS nickel plasmonic structure by masking the surface of a c-Si single crystal using optical lithography and subsequent pore formation in a single-step metal-assisted electrochemical etching process.

This paper presents the results of the fabrication of uniform periodic plasmonic Me-PNPs/por-Si structures by masking the wafer surface using optical lithography, and followed by the formation of pores and the deposition of plasmonic-active metal nanoparticles (Me-PNPs) in a single-step metal-assisted electro-chemical etching (MACE) process. The photoluminescence properties of the nickel plasmonic Ni-PNP/PS structure formed on the basis of the Ni+ ion-implanted textured surface (SiO2/c-Si) of silicon wafers by the deposition of nickel nanoparticle (Ni-NPs) in a single-step process of the formation of the periodic porous silicon (PS) structure and the deposition of Ni-NP nanoparticles by the combined EMACE method—a combination of electrochemical (EC) and MACE of single-crystal silicon c-Si—are also investigated.

II. Experimental Procedure (Method)

In this work, we used p-Si (100) single crystal wafers, 10 ohm cm, with a diameter of 100 mm and a thickness 500 mkm of grown by the Czochralski method. The samples were preliminarily thermally oxidized at 1000°C in an oxygen atmosphere for 100 min to form a 500 nm thick layer of thermal silicon oxide (SiO_2 therm.) on the surface. A checkerboard texture with alternating areas 100 × 100 μm2 of thermal SiO2 and crystalline c-Si (SiO2 therm./c-Si) was created on the oxidized silicon surface by using optical lithography for masking and opening the oxide layer, Fig. 1. The SiO2 layer was used as a protective window during etching of pores in c-Si and as an optical window of the silicon photoelectrode, transparent to sunlight, during photoelectrolysis of water [8].

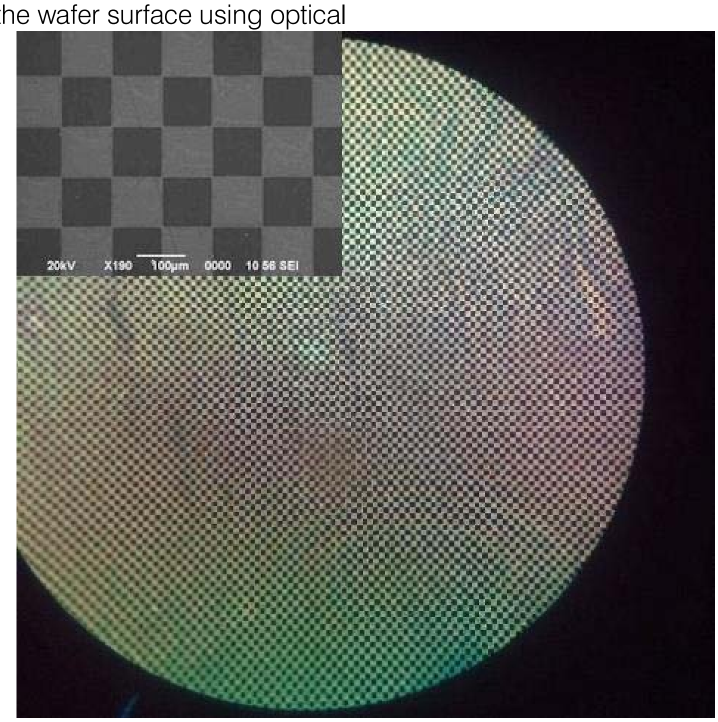


Fig. 1: Photograph of a textured silicon wafer surface with alternating areas of pure c-Si and thermal SiO2. Inset: SEM image of a textured surface area of c-Si and SiO2 thermal; 001 –SiO2 thermal, 002 – c-Si. The technique for creating alternating SiO2 thermal windows is described in detail in [16].

To form an ohmic contact, a 300 nm thick aluminum layer was deposited on the back side of the wafer using magnetron sputtering, and followed by annealing at 400°C for 30 min under a vacuum of $5 \cdot 10^{-5}$ Torr.

Pores on the textured c-Si/SiO2 thermical surface were formed by electrochemical etching (EC) in weak (8% HF: 3% H_2O_2 - E1) and strong (55% HF: 40% H2O2 - E2) hydrogen fluoride electrolytes. Weak electrolyte E1 was used to form pores in exposed areas of crystalline c-Si while preserving areas with the SiO2thermical oxide layer. Strong electrolyte E2 dissolved the SiO2 thermical silicon oxide and formed pores over the entire surface of the textured silicon wafer. The Ni-PNP/PS nickel plasmonic structure was formed by etching the textured c-Si/SiO2 surface of the silicon wafer implanted with 100 keV Ni+ ions at a dose of 10^{16} cm^{-2}. Ni+ ions were implanted in exposed areas of c-Si crystalline silicon, free from the protective SiO2 thermal oxide layer. The introduction of Ni+ ions is shown schematically in Fig. 2.

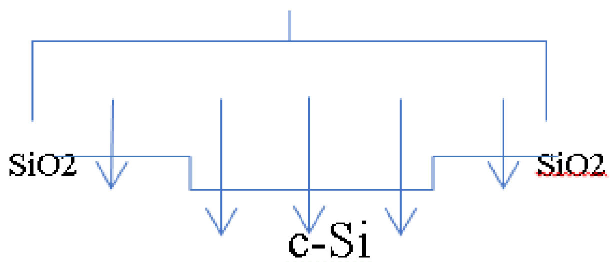


Fig. 2: Schematic diagram of Ni+ ion implantation in c-Si.

The implantation depth of Ni+ ions with an energy of E = 100 keV was approximately 60 nm, see Fig. 3.

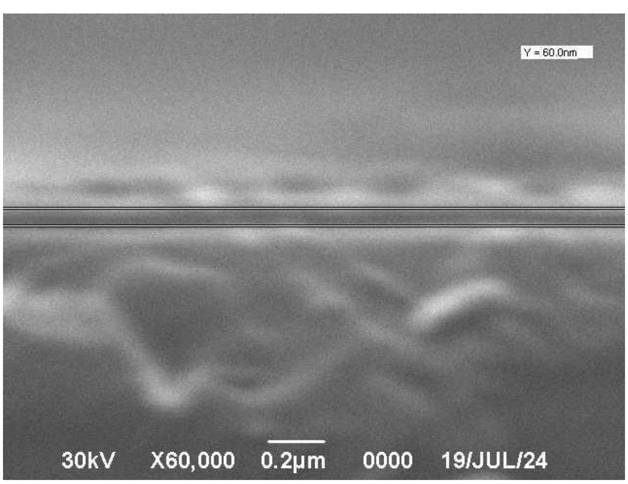


Fig. 3: SEM image of a cross-section of c-Si implanted with 100 keV Ni+ ions.

Samples were analyzed using a Carl Zeiss Auriga Crossbeam 540 Scanning Electron Microscope with an X-ray Energy-Dispersion Analyzer, a Raman spectrometer, the Horiba LabRam Evolution, a UNICO Spectro Quest 2800 spectrophotometer, and a DRON-4 X-ray diffractometer.

III. Results and Discussion

Figure 4 shows SEM images of a textured silicon wafer surface with alternating areas of porous silicon and silicon dioxide SiO2, obtained by EC etching in E1 electrolyte.

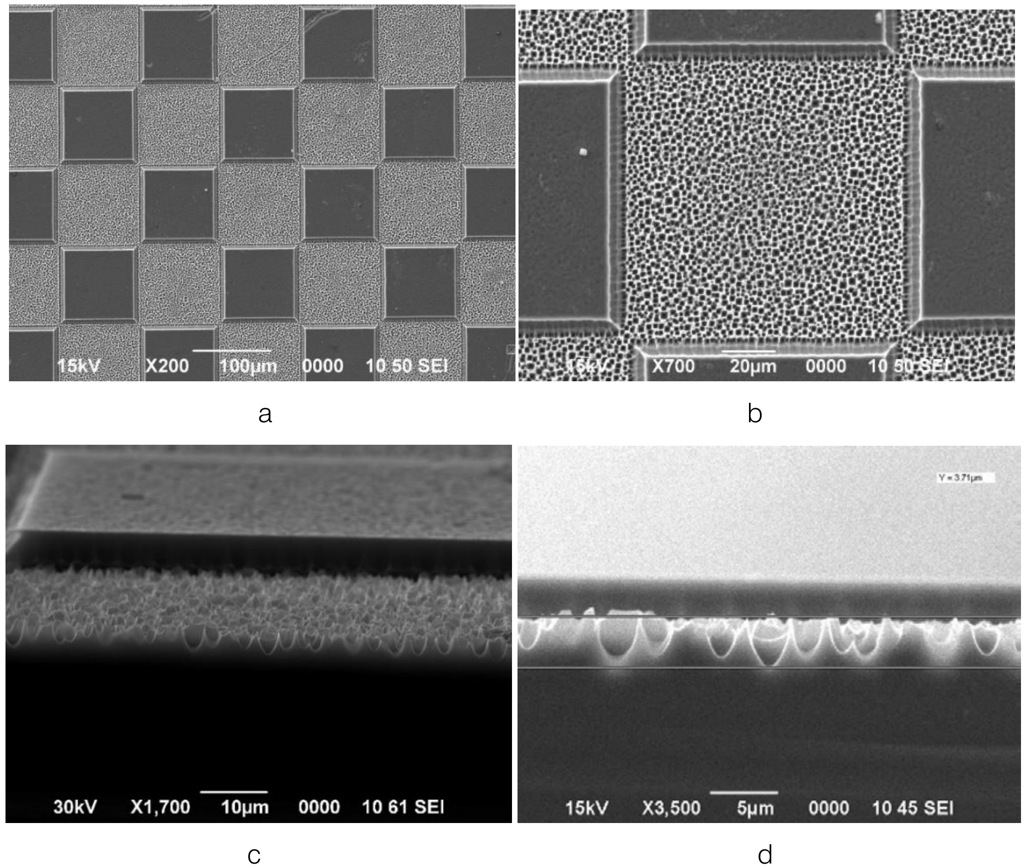


Fig. 4: SEM images of a textured silicon wafer surface with areas of PS and SiO2 (a)–(c) and a transverse cleavage (d).

It is evident that uniform pores of virtually identical sizes form in the exposed areas of crystalline c-Si silicon; the pore diameters are commensurate with their depth (Fig. 4d). This is achieved due to the action of long-range elastic-deformational stress forces arising at the c Si/SiO2 interface due to differences in their structures [15], which causes the formation of uniform pores in the near-boundary region. As these forces weaken, non-uniform pores form, Fig. 5. Thus, the action of elastic-deformational forces at the c-Si/SiO2 interface boundaries leads to the formation of uniform pores.

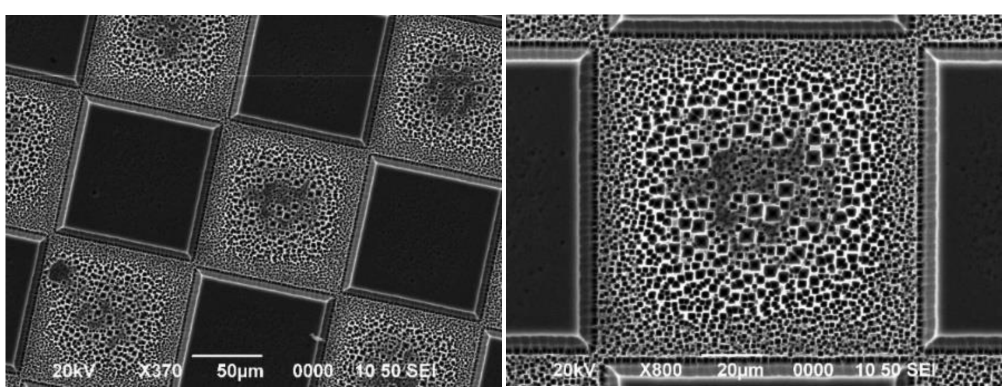
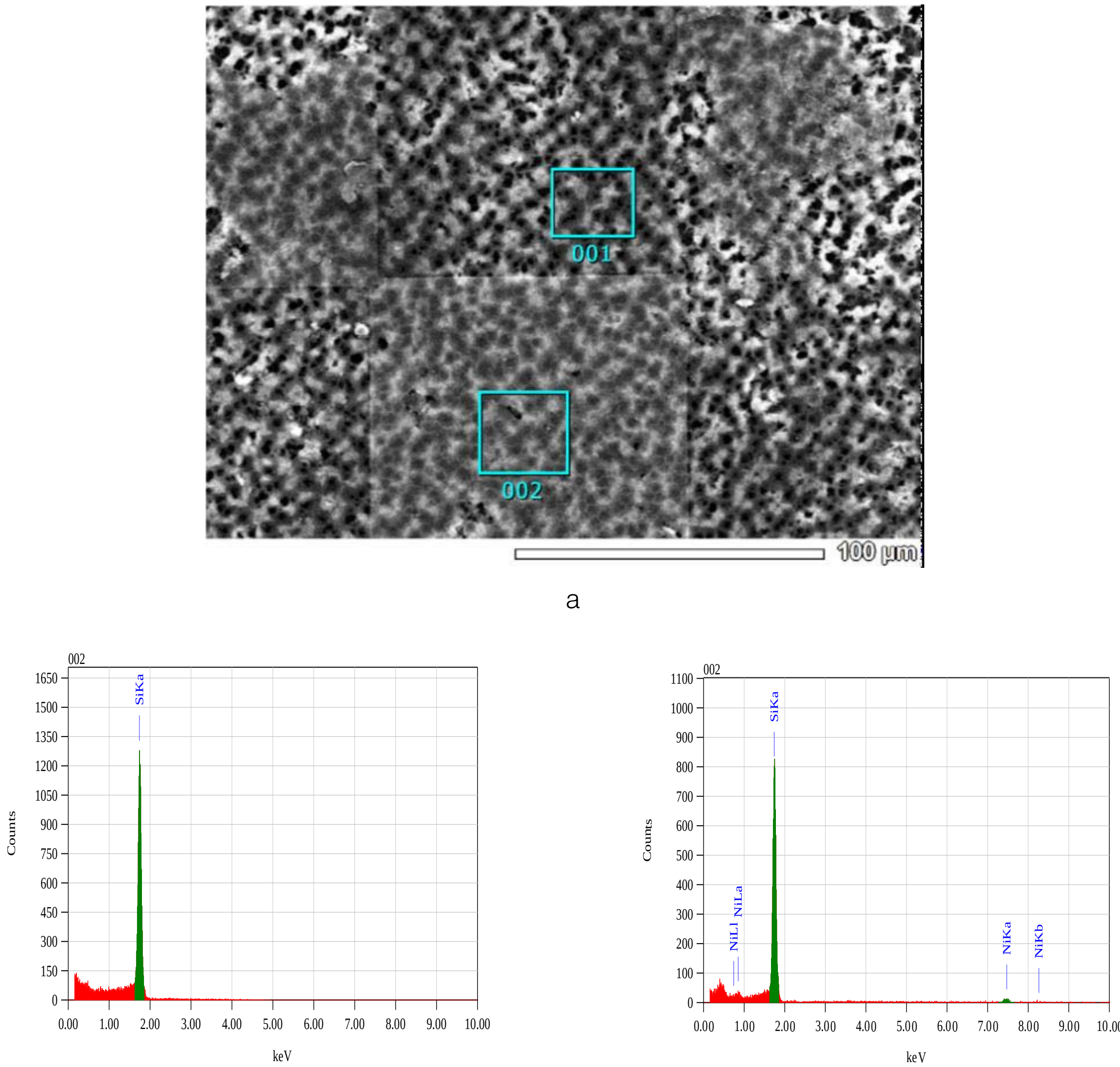


Figure 5: SEM image of the porosity distribution of the PS region with increasing distance from the interface boundaries.

Thus, creating alternating c-Si/SiO2 interface boundaries by pre-masking the silicon wafer surface using optical lithography allows for the formation of uniform pores. This will overcome the main drawback of porous silicon for formation of the Me-PNP/PS plasmonic nanostructure— the lack of periodicity in the arrangement of pores or nanocrystallites of porous silicon, nc-Si/PS and to create of periodic plasmonic structures on porous silicon by depositing plasmonic metal nanoparticles on them.

On the SEM- image of the nickel plasmonic structure Ni-PNP/PS clearly shows nickel containing areas and areas of pure porous silicon without nickel, Fig. 7a. Area 001 does not contain Ni lines in the EDS (Fig. 7b) and corresponds to purely porous silicon PS, and the ED spectrum of area 002 shows the presence of Ni peaks (Fig.7c), which indicates porous silicon with nickel content, PS<Ni>. This is also confirmed by brightness of the SEM images of region 002, which is bright, than the region 001, because the intensity of secondary reflected electrons increases with increasing average atomic number [17]; it is higher for Ni (59) than for I (28). Therefore, region 002, containing PS<Ni>, has a higher brightness than the pure PS layer without Ni, region 001.



a

b

c

Figure 6: SEM image of Ni-PNP/PS sample (a) and EDS of regions 001 (b) and 002 (c).

It should be especially noted that in Figure 6a, in region 002, a rectangular region is clearly observed, which appeared due to the silicide layer formed during thermal annealing of the contacts at 400◦C. The X-ray spectrum of this sample (Figure 7) shows the presence of NiSi lines, characteristic of nickel silicides [16].

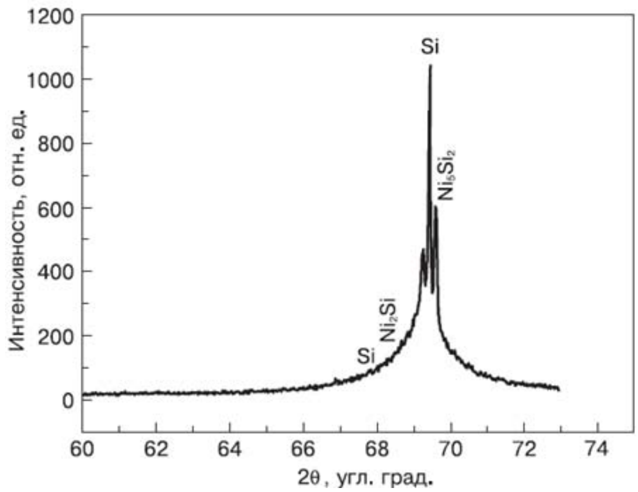
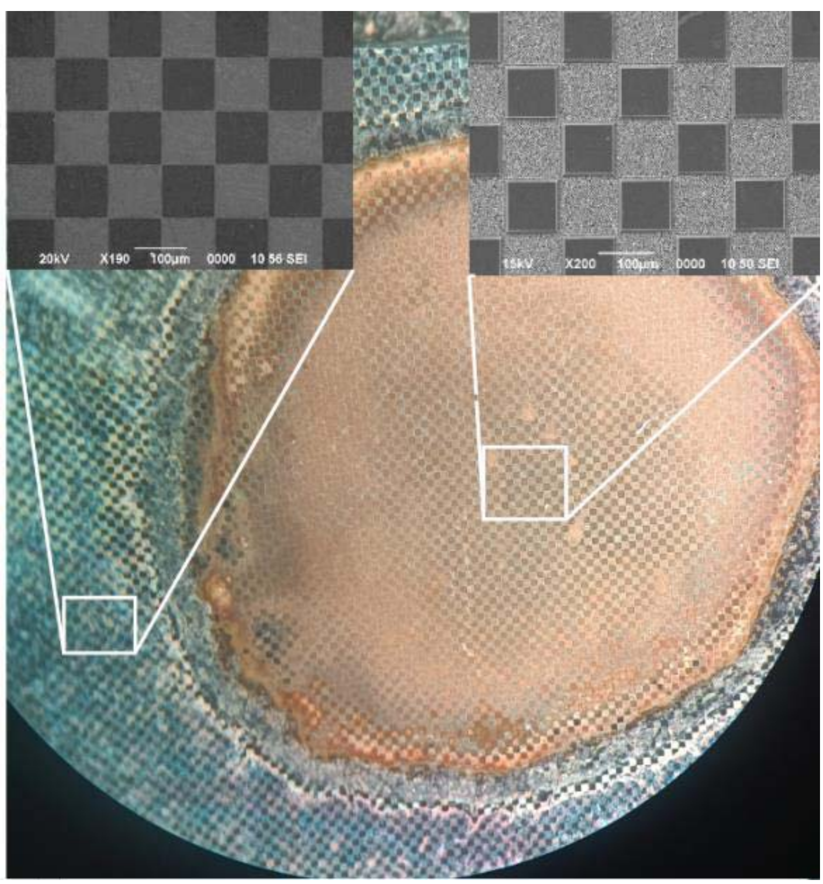


Fig. 7: X-ray diffraction spectrum of a silicide coating [16].

This silicide layer is characterized by high chemical stability [16].

Figure 8 shows optical image (a) and PL spectra (b) of a sample with a Ni-PNP/PS structure. It can be seen that the central region containing the Ni-PNP/PS is orange, unlike the edge, where the plasmonic structure did not form, and is characterized by stronger PL than the unetched region.



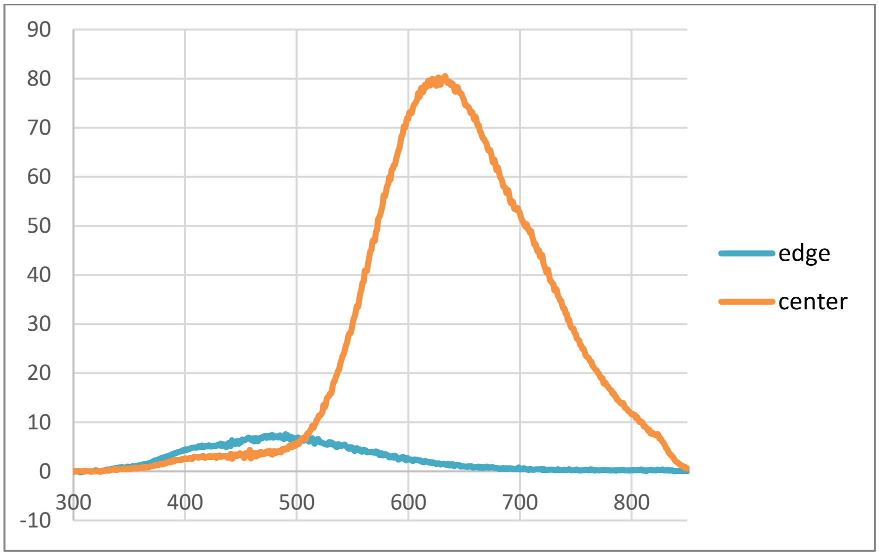
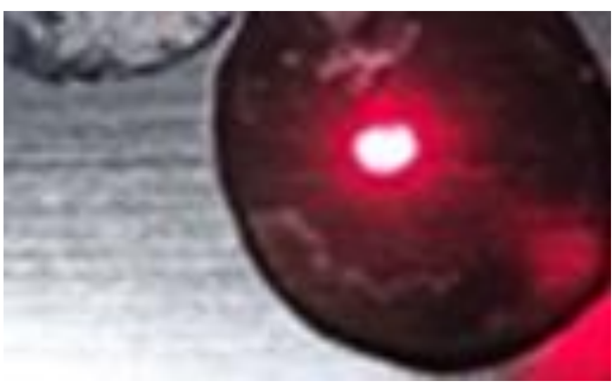


Figure 8: Photograph of a Ni-PNP/PS sample with a structure (a); PL spectra: - the etched porous region is shown in red; the unetched region is shown in blue.

When illuminated with a red LED, the porous region exhibits a brighter luminescence (Fig. 9a) than the unetched region (Fig. 9b).



a

b

Fig. 9: Photograph of the luminosity of the etched and unetched original sample region illuminated by a red LED.

To analyze the luminosity, we recorded reflectance spectra in the 200–1100 nm wavelength range, Fig. 10.

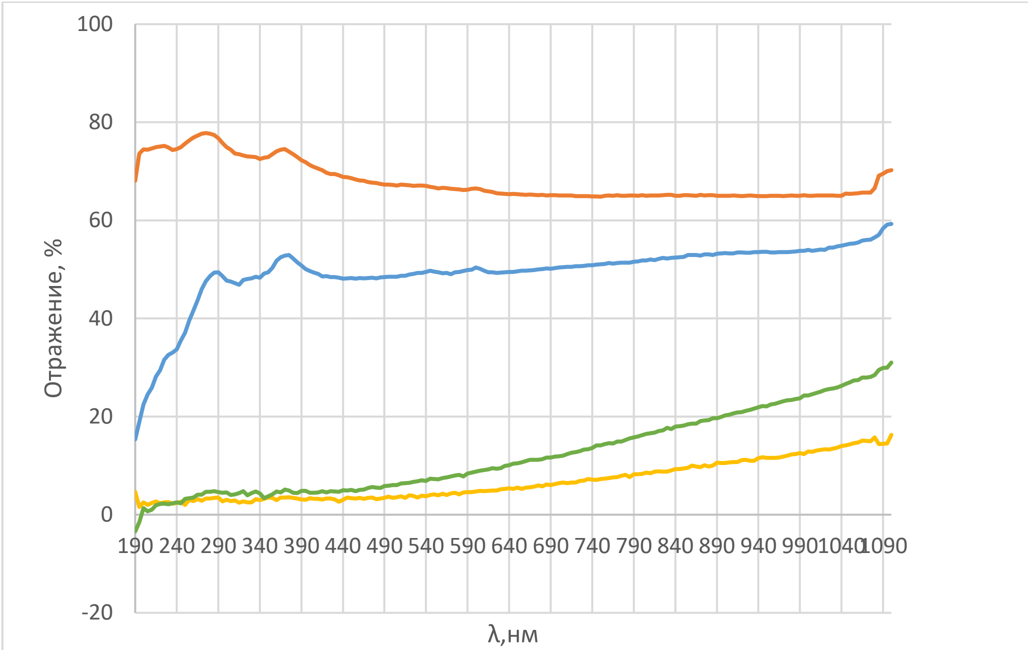


Fig. 10: Reflectance spectra of the original silicon substrate (brown), porous silicon in electrolyte E1 (blue), porous silicon in E2 (green), and plasmonic structure (yellow).

The reflectance spectra of these samples show that the reflection of light with an intensity of … in the wavelength range of 200 – 1100 nm for the matte surface of the original silicon substrate is at the level of 70%, for porous silicon from 10% to 50% depending on the porosity, and for the plasmonic structure 2-3% in the UV region, 5-7% in the visible region (400 – 700) nm and up to 15% for long wavelengths > 800 nm.

That is, the reflectance spectra indicate that the luminosity is due not to the reflectivity of the surface of the samples, but to the radiative properties of the plasmonic structure of Ni-PNP/por Si.

As is known [18], the nature of the enhancement of the optical signal of photoluminescence and Raman scattering of light by plasmonic structures is due to the resonant excitation of plasmons, Free electron vibrations in metal nanoparticles, the intensity of which depends on the morphology of the nanostructures, the electron density of the plasmonic nanoparticles, and the dielectric environment. Figure 11 shows the Raman spectra for crystalline (c-Si) and porous silicon with and without nickel, prepared by different methods.

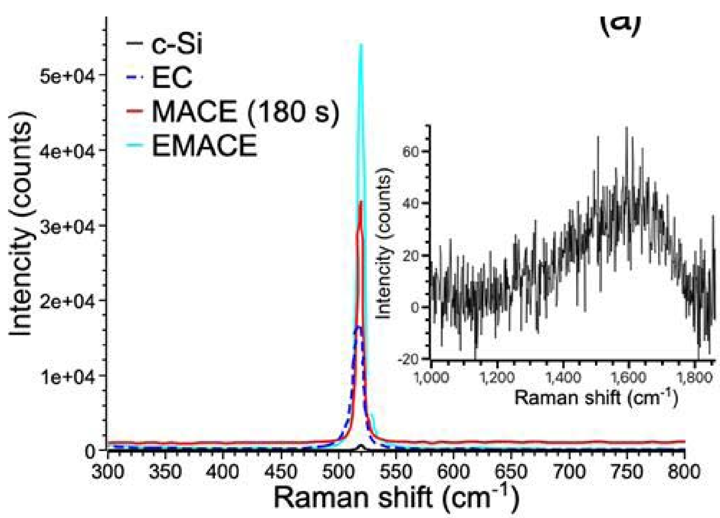


Figure 11: Raman spectra of porous silicon prepared by different methods. The Raman signals from regions associated with carbon bonds for samples prepared by the EMACE method are shown in the inset (a).

The highest intensity of the Raman peak Ipor-Si(EMACE) = 54,000 rel. units is observed for the por-Si(EMACE) sample at a Raman shift frequency of ν = 520.32 cm-1, formed by the combined method (MACE + EC). The high intensity of the Raman peak indicates a higher pore density and an increase in the concentration of scattering centers [19].

The Raman spectra also show that samples with higher porosity have a higher Raman peak intensity at a high frequency shift, as shown in Fig. 5a. The highest Raman peak intensity I_ν = 54,000 counts at a frequency of 520.32 cm-1 is observed for the sample fabricated by the EMACE method. For the MACE sample, the intensity and frequency values are 33,000 counts and 519.66 cm-1, respectively. The sample fabricated by the EC method exhibits values of 17,000 counts at 519.11 cm-1. The Raman peak intensity for c-Si is 2,000, and the corresponding frequency is 519.11 cm-1. The Raman spectra of c-Si and PS exhibit a characteristic resonance peak due to electron-phonon scattering, the intensity and frequency of which depend on the concentration of scattering centers and, consequently, on the pore formation conditions. The high-frequency shift and the decrease in the full width at half maximum (FWHM) of the main peak due to the increase in the peak intensity are most significant in the sample fabricated by EMACE. This phenomenon is attributed to the increase in the number of Raman centers in nanocrystalline silicon [18]. Since the samples fabricated by EC and EMACE exhibit similar levels of porosity (Fig. 11), the enhancement of the Raman signal cannot be attributed solely to the increase in porosity. Even a small amount of metal content can be crucial in enhancing the Raman peak intensity. Note that the Raman spectra for all samples show no Ni-related nanoscale features at 550 cm-1 [20]. A possible additional source of Raman peak enhancement is the doping of substitutional (NiSi) and interstitial (NiI) nickel atoms incorporated into the silicon matrix. Since the high rate of nickel absorption into silicon has been previously documented in numerous experiments [21], we simulated substitutional (NiSi) and interstitial (NiI) defects [22]. The simulation details are the same as in our recent work [23]. As shown in Figs. 12a and 12b, the electronic structure of the substitutional nickel impurity exhibits the same peak at the Fermi level as silver (see Fig. 12c). Since silver nanostructures exhibit Raman peak enhancement, we can attribute the increase in Raman peak intensity in the EMACE-prepared sample to changes similar to those of silver in the local electronic structures of the Ni-doped silicon matrix.

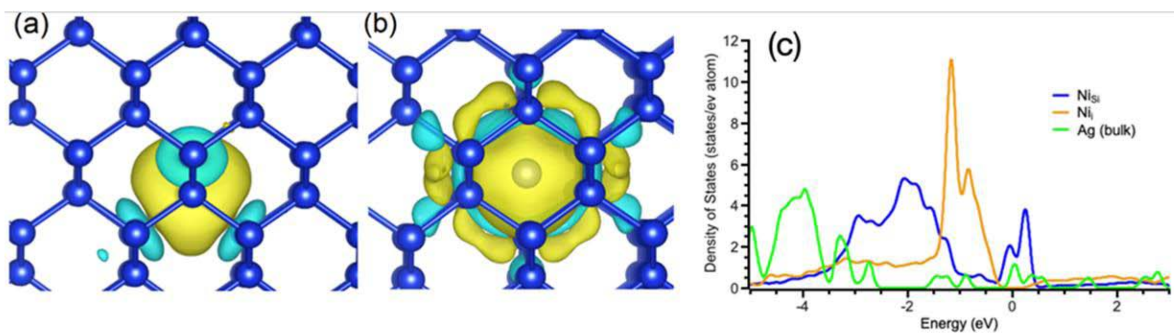


Figure 12: Changes in charge density after incorporation of substituent (a) and interstitial (b) nickel impurities. Yellow "clouds" correspond to an increase in charge density, while blue "clouds" correspond to a decrease in charge densities. Panel (sc) depicts the partial densities of states for metallic silver, substituent, and interstitial nickel impurities in the silicon matrix

To verify the possibility of carbon nucleation, described for cz-Si [24], and the formation of some ordered carbon structures, Raman spectra were obtained in the range from 1000 to 2000 cm-1 in the sample with the highest carbon content (EMACE). The results of the measurements demonstrate the presence of some carbon-carbon bonds in the spectra (see inset in Fig. 11a) without the distinct D and G peaks typical of layered carbon structures [25]. Based on the low Raman signal from these carbon structures and the absence of peaks corresponding to an ordered carbon structure, we can conclude that these carbon structures do not affect the enhancement of the Raman signal.

Moreover, the Raman peak intensity of the sample prepared by EMACE is almost twice that of the samples prepared by EC (33,000 counts versus 17,000 counts) [19].

Thus, preliminary masking of the silicon wafer surface allows for the formation of uniform pores. This avoids the main drawback of porous silicon as the backbone of the Me-PNP/PS plasmonic nanostructure—the lack of periodicity in the arrangement of pores or nanocrystallites of porous silicon, nc-Si/PS.

This allows the creation of periodic plasmonic Ni-PNP/PS structures using single-step EMACE etching, which involves masking the surface of a single-crystal silicon with a photomask and then forming pores by etching c-Si.

IV. Main Results and Conclusions

Pre-masking the surface of silicon wafers with a photomask and subsequent single-step etching in a nickel-containing hydrofluoric acid electrolyte solution using the EMACE method enables the production of periodic nickel plasmonic Ni-PNP/PS structures with plasmonic properties. Ni-PNP/PS porous silicon-based plasmonic structures exhibit enhanced Raman and photoluminescence signals.

DFT simulation results showed that even small amounts of metal content can be crucial in increasing Raman peak intensity.

Acknowledgements

The work was supported by the Ministry of Science and Higher Education of the Republic of Kazakhstan, project BR21881954 "Development of technologies for the synthesis of nanostructured materials for the creation of effective photocatalytic electrodes, photo- and gas sensitive sensors". The author acknowledges Arman Yeltay (Universidade de Brasilia), Mansur Ydyrys (Nazarbayev Intellectual School), and PhD Ardak Ainabayev (Nazarbaev University) for their assistance in the paper preparation.

References Références Referencias

1. S. Ezendam, M. Herran, L. Nan, C. Gruber, Y. Kang, F. Gröbmeyer, R. Lin, J. Gargiulo, A. Sousa-Castillo, and E. Cortés. ACS Energy Lett. , 7, 778 (2022).
2. S. Lee, H. Hwang, W. Lee, D. Schebarchov, Y. Wy, J. Grand, B. Auguie, D.H. Wi, E. Cortes, S.W. Han. ACS Energy Letters. , 5 , 3881 (2020).
3. K. Li, N.J. Hogan, M.J. Kale, N.J. Halas, P. Nordlander, P. Christopher. Nano Lett. , 17, 3710 (2017).
4. C. Engelbrekt, K.T. Crampton, D.A. Fishman, M. Law, V.A. Apkarian. ACS Nano. , 14, 5061 (2020).
5. P. Peljo, J.A. Manzanares, H.H. Girault. Langmuir. , 32, 5765 (2016).
6. M.M. Abouelela, G. Kawamura, and A. Matsuda. J. Cleaner Production. , 294, 126200 (2021).
7. J. Chen, P. Albella, Z Pirzadeh, P Alonso-González, F. Huth, S. Bonetti, V. Bonanni, J. Åkerman, J. Nogués, P. Vavassori, A. Dmitriev, J. Aizpurua, and R. Hillenbrand. Small. , 7, 2341 (2011).
8. S. Hu, C. Xiang, S. Haussener, A.D. Bergercd and N.S. Lewis. Energy Environ. Sci., 6, 2984 (2013).
9. M. Lublow, S. Kubala, J.-F. Veyan and Y. J. Chabal. J. Applied Physics., 111, 084302 (2012).
10. R. Fan, Z.Mi, M.Shen. Optics Express, 27, A51 (2019).
11. S. Sarnchez de la Morena, G. Recio-Sarnchez, V. Torres-Costa and R.J. Martırn-Palma. Scripta Materialia 74, 33 (2014).
12. H. Hana, Z. Huang, W. Lee. Nano Today., 9, 271 (2014)
13. W. Vijselaar, R. M. Tiggelaar, H. Gardeniers, J. Huskens. ACS Energy Lett., 3, 1086 (2018).
14. J. Salonen and E. Mäkilä. Adv. Mater., 30, 1 (2018).
15. K. Tynyshtykbayev, Ch. Spitas, K. Kostas, Z. Insepov. ECS J. Solid State Sci.Tech., 10, 013009 (2021).
16. K. B. Tynyshtykbaev, T. Aitmukan, A. T. Issova, B. A. Rakhymetov, M.A. Yeleuov, and S. Z. Tokmoldin. Materials Sciences and Applications, 4, 1 (2013).
17. I. H. Campbell, P.M. Fauchet. Solid State Communications., 58, 739(1986).
18. V. I. Kukushkin, V. E. Kirpichev, E. N. Morozova, V. V Solovyev, Y. V. Fedotova, I. V. Kukushkin. JETP Letters., 112 , 31 (2020).
19. D. W. Boukhvalov, D.A. Zatsepin, D. Yu. Biryukov, Yu.V. Shchapova, N.V. Gavrilov, A.F. Zatsepin. Appl. Surf. Sci., 666, 160379 (2024).
20. A. R. Neale, Y. Jin, J. Ouyang, S. Hughes, D. Hesp, V. Dhanak, G. Dearden, S. Edwardson, L.J. Hardwick. J. Power Sources., 271, 42 (2014).
21. N. Yarykin, J. Weber. Appl. Phys. Lett., 109, 102101 (2016).
22. D. W. Boukhvalov, B. Zhumabay, P. Kusherova, B. Rakymetov, K. B. Tynyshtykbayev, A. S. Serikkanov and N. V. Chuchvaga. RSC Adv., 15, 6794 (2025).
23. D. W. Boukhvalov, K. A. Abdullin, T. S. Turmagambetov, A. K. Shongalova, I. S. Nevmerzhitskiy, A.S. Serikkanov. Sep. Pur. Tech., 334 126107 (2024).
24. M. Kanamori, H. Tsuya. Jpn. J. Appl. Phys. 24 557 (1985).
25. L. Bokobza, J.-L. Bruneel and M. Couzi. J. Carbon Res. 1 , 77 (2015).

Global Journal of Science Frontier Research: A
Physics and Space Science
Volume 25 Issue 5 Version 1.0 Year 2025
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 2249-4626 & Print ISSN: 0975-5896

Quantum Superposition and the Emergence of Negative Energy in Gravitational Fields

By Gang Lee

Abstract- In this paper, we calculated the quantum superposition between states of the gravitational fields by Feynman path integration and concluded that in general, the quantum effects can be interpreted as the negative energy in gravitational field, it will lead to gravitational mass defect. Negative energy is related to Einstein's cosmological constant, and therefore also to dark energy.

GJSFR-A Classification: *LCC Code: QC173.6*

Quantum Superposition and the Emergence of Negative Energy in Gravitational Fields

Gang Lee

Abstract- **In this paper, we calculated the quantum superposition between states of the gravitational fields by Feynman path integration and concluded that in general, the quantum effects can be interpreted as the negative energy in gravitational field, it will lead to gravitational mass defect. Negative energy is related to Einstein's cosmological constant, and therefore also to dark energy.**

I. Introduction

In this paper, we calculated the quantum superposition between states of the gravitational fields by Feynman path integration. Due to the fundamental field and the Lagrangian action of gravity are given in paper 1, we can calculate the quantum superposition of the states of gravitons by Feynman path integration. The calculation results indicate that in general, the quantum effects will generate negative energy in gravitational field. As we know, negative energy is related to Einstein's cosmological constant λ, and therefore also to dark energy. In section 2, we briefly reviewed noncommutative quantum gravity. This theory is classically equivalent to general theory of relativity. We have provided some computational results of this theory and its interpretation of dark matter. In section 3, we calculated the quantum superposition effect of states between gravitational fields by Feynman path integration. In general, the quantum effects will lead to negative energy in gravitational field, which will cause the mass defect of the gravitational sources.

II. A Brief Review of Noncommutative Quantum Gravity

In the paper [1] and [2], we introduce the theory of noncommutative quantum gravity. In this theory, we give the fundamental field variables of gravity. It is a semiclassical graviton. Its form is a Dirac-δ function as follows

$$\xi^i(x,r) = \begin{cases} \xi^r = r + C^r(x)\exp(-\dfrac{r}{l_P}) \\ \xi^\theta = \theta(x) \\ \xi^\phi = \phi(x) \\ \xi^t = t + C^t(x)\exp(-\dfrac{|t|}{t_P}) \end{cases} \tag{2.1}$$

Author: e-mail: ganglee69@msn.com

The Lagrangian density is

$$\mathscr{L} = -\frac{\eta^{\mu\nu}}{2}\frac{\partial \xi^i(x,r)}{\partial x^\mu}\frac{\partial \xi^j(x,r)}{\partial x^\nu}\eta_{ij} \tag{2.2}$$

The energy-momentum tensor is

$$\begin{aligned} T_{\mu\nu} &= \eta_{\mu\nu}\mathscr{L} - \frac{\partial \mathscr{L}}{\partial(\partial^\mu \xi^i)}\partial_\nu \xi^i \\ &= -\frac{\eta_{\mu\nu}}{2}\partial^\lambda \xi^i \partial_\lambda \xi^j \eta_{ij} + \partial_\mu \xi^i \partial_\nu \xi^j \eta_{ij} \end{aligned} \tag{2.3}$$

The free field equation is a wave equation

$$\partial^\mu \partial_\mu \xi^i = 0 \tag{2.4}$$

The Green's function can be written as

$$\tilde{G}^i(k) = \begin{cases} \tilde{G}^r(k) = -\dfrac{1}{(k^r)^2}\cdot \delta\Big(k^r - \dfrac{i}{l_P}\Big) \\ \tilde{G}^\theta(k) = -\dfrac{1}{(k^\theta)^2} \\ \tilde{G}^\phi(k) = -\dfrac{1}{(k^\phi)^2} \\ \tilde{G}^t(k) = -\dfrac{1}{\omega^2}\cdot \delta\Big(\omega - \dfrac{i}{t_P}\Big) \end{cases} \tag{2.5}$$

In the paper [2], we proved that the d'Alembert operator is invariant in noncommutative quantum gravitational field. Therefore the Klein-Gordon equation is invariant noncommutative quantum gravitational field.

In the general theory of relativity, the energy-momentum tensor of gravitational field itself is:

Global Journal of Science Frontier Research (A) XXV Issue V Version I Year 2025

$$t_{\mu\nu} = \frac{1}{8\pi G}\left(\frac{1}{2}\eta_{\mu\nu}R^{(1)} - R^{(1)}_{\mu\nu}\right)$$

$$= \frac{1}{8\pi G\cdot C}\left(\frac{1}{2}\eta_{\mu\nu}\frac{\partial\xi^i}{\partial x^\kappa}\frac{\partial\xi_i}{\partial x_\kappa} - \frac{\partial\xi^i}{\partial x^\mu}\frac{\partial\xi_i}{\partial x^\nu}\right) \tag{2.6}$$

Up to a factor of a constant, it is equal to Eq.[2.3]. It is a strong evidence to prove that the quantum field theory constructed in the paper [1] and paper [2] is classically equivalent to the general theory of relativity.

In the paper [3] [4] [5] and [6], we can see that the self-interaction effects in noncommutative quantum gravity may provide an alternative explanation for dark matter-like gravitational phenomena, potentially offering a simpler theoretical framework. The metric $g_{\mu\nu}$ of the general static isotropic gravitational field with self-interaction can be written as follows

$$ds^2 = (1+\Delta_r)^2\cdot\left[1-\frac{2MG}{r}\right]^{-1}dr^2 + r^2d\theta^2 + r^2\sin^2\theta d\phi^2$$
$$- (1+\Delta_t)^2\cdot\left[1-\frac{2MG}{r}\right]dt^2 \tag{2.7}$$

where

$$\Delta_r \equiv F_r(r,M)\cdot\left[1-\frac{2MG}{r}\right]^{1/2}$$

$$F_r(r,M) = KMG\cdot \tag{2.8}$$

$$\ln\frac{\left(\sqrt{r^2+r}-\sqrt{(2MG)^2+2MG}\right)+\left(\sqrt{r(1+2MG)}-\sqrt{2MG(1+r)}\right)}{\left(\sqrt{r^2+r}-\sqrt{(2MG)^2+2MG}\right)-\left(\sqrt{r(1+2MG)}-\sqrt{2MG(1+r)}\right)}$$

The self-interaction of noncommutative quantum gravity of the static spherically symmetric metric we calculated in Paper paper [6] is shown in Fig.1

It is consistent with the distribution of dark matter halo in galaxies.

III. Quantum Effect of the Noncommutative Quantum Gravity

In the paper [1] we introduce the locally inertial system $\xi^i(x,r)$ as Eq.[2.1]. It is a wave packet approximate to the Dirac δ-function which can be explained as a semiclassical graviton. The dynamic variables of the locally inertial system are $C^i(x) = \big(C^r(x), \theta(x), \phi(x), C^t(x)\big)$. Quantization only quantizes the dynamic variable $C^i(x)$. Therefore, for simplicity, in this paper we directly consider $C^i(x)$ as the fundamental state function of gravitational field.

Let the gravitational source of $C^i_{(1)}(x)$ and $C^i_{(2)}(x)$ are $j^\mu_{(1)}$ and $j^\mu_{(2)}$, respectively. If these two gravitational sources are independent of each other, there is

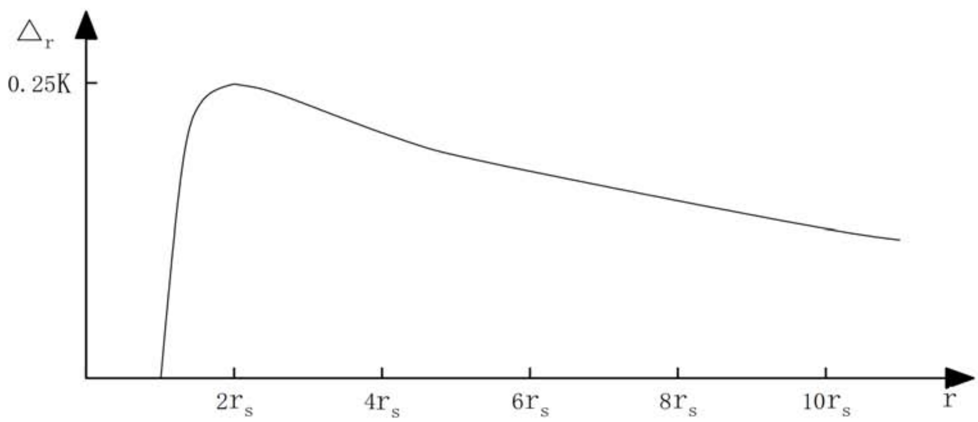


Figure 1: function Δ_r

no interaction between sources $j^\mu_{(1)}$ and $j^\mu_{(2)}$. The Feynman path integral of the initial state $C^i_{(1)}(x)$ and $C^i_{(2)}(x)$ can be written as follows

$$K_{(1)} = \int \mathscr{D}\big[C^i_{(1)}\big]\, e^{iS[C^i_{(1)}]/\hbar}$$
$$K_{(2)} = \int \mathscr{D}\big[C^i_{(2)}\big]\, e^{iS[C^i_{(2)}]/\hbar} \tag{3.1}$$

Denote $\tilde{C}^i(x)$ as the final state of $C^i(x)$. Then the final states are

$$\tilde{C}^i_{(1)}(x) = \int d^4x\, K_{(1)} \cdot C^i_{(1)}(x)$$
$$\tilde{C}^i_{(2)}(x) = \int d^4x\, K_{(2)} \cdot C^i_{(2)}(x) \tag{3.2}$$

Merge these two gravitational sources $j^{\mu}_{(1)}$ and $j^{\mu}_{(2)}$. This means that the two sources must be considered together. Let's study the gravitational field $C^i_{(1+2)}(x)$ excited by merge of sources $j^{\mu}_{(1)} + j^{\mu}_{(2)}$. The initial state is

$$C^i_{(1+2)} = C^i_{(1)} + C^i_{(2)} \tag{3.3}$$

The joint propagator $K_{(1+2)}$ of $C^i_{(1+2)}$ is

$$\begin{aligned} K_{(1+2)} &= K_{(1)} \otimes K_{(2)} \\ &= \int \mathscr{D}\left[C^i_{(1)} + C^i_{(2)}\right] e^{i\left(S[C^i_{(1)}]+S[C^i_{(2)}]\right)/\hbar} \\ &= \int \mathscr{D}\left[C^i_{(1)} + C^i_{(2)}\right] \left(e^{iS[C^i_{(1)}]/\hbar} \cdot e^{iS[C^i_{(2)}]/\hbar}\right) \end{aligned} \tag{3.4}$$

If $C^i_{(2)} = k \cdot C^i_{(1)}$, $k \in R$, for the Lagrangian density [2.2], we have

$$S[C_{(2)}] = k^2 \cdot S[C_{(1)}] \tag{3.5}$$

Then

$$\begin{aligned} K_{(1+2)} &= \int \mathscr{D}\left[C^i_{(1)} + C^i_{(2)}\right] \left(e^{iS[C^i_{(1)}]/\hbar} \cdot e^{iS[C^i_{(2)}]/\hbar}\right) \\ &= \int \mathscr{D}\left[C^i_{(1)} + C^i_{(2)}\right] \left(e^{i(1+k^2)S[C^i_{(1)}]/\hbar}\right) \end{aligned} \tag{3.6}$$

Not considering the quantum superposition of the states $C^i_{(1)}$ and $C^i_{(2)}$, the final state $\tilde{C}^i_{(1+2)}$ is

$$\tilde{C}^i_{(1+2)} = \int d^4x \, K_{(1+2)} \cdot \left(C^i_{(1)} + C^i_{(2)}\right) \tag{3.7}$$

Global Journal of Science Frontier Research (A) XXV Issue V Version I Year 2025

Considering the quantum effects of the gravitational field. The quantum effects can cause the quantum superposition between the states $C^i_{(1)}(x)$ and $C^i_{(2)}(x)$. In this case, the Feynman path integral should be written as follows

$$K_{(1\oplus 2)} = \int \mathscr{D}[C^i_{(1)} + C^i_{(2)}] \left(e^{iS[C^i_{(1)}+C^i_{(2)}]/\hbar} \right) \tag{3.8}$$

where $\oplus$ denote the quantum superposition of states.

For the Lagrangian density [2.2], if $C^i_{(2)} = k \cdot C^i_{(1)}$, we have

$$S[C^i_{(1)} + C^i_{(2)}] = (1+k)^2 \cdot S[C^i_{(1)}] \tag{3.9}$$

Then Eq.[3.8] can be written as follows

$$\begin{aligned} K_{(1\oplus 2)} &= \int \mathscr{D}[C^i_{(1)} + C^i_{(2)}] \left(e^{iS[C^i_{(1)}+C^i_{(2)}]/\hbar} \right) \\ &= \int \mathscr{D}[C^i_{(1)} + C^i_{(2)}] \left(e^{i(1+k)^2 S[C^i_{(1)}]/\hbar} \right) \end{aligned} \tag{3.10}$$

The final state $\tilde{C}^i_{(1\oplus 2)}(x)$ is

$$\tilde{C}^i_{(1\oplus 2)}(x) = \int d^4x \, K_{(1\oplus 2)} \cdot \left(C^i_{(1)}(x) + C^i_{(2)}(x) \right) \tag{3.11}$$

If $K_{(1\oplus 2)} = K_{(1+2)}$, there are no effects of quantum superposition of states, then we have $\tilde{C}^i_{(1\oplus 2)} = \tilde{C}^i_{(1+2)}$. In this case, the following two equations should be equal

$$\tilde{C}^i_{(1\oplus 2)} = \int d^4x \left(\int \mathscr{D}[C^i_{(1)} + C^i_{(2)}] \left(e^{iS[C^i_{(1)}+C^i_{(2)}]/\hbar} \right) \cdot \left(C^i_{(1)} + C^i_{(2)} \right) \right)$$

$$\tilde{C}^i_{(1+2)} = \int d^4x \left(\int \mathscr{D}[C^i_{(1)} + C^i_{(2)}] \left(e^{i\left(S[C^i_{(1)}]+S[C^i_{(2)}]\right)/\hbar} \right) \cdot \left(C^i_{(1)} + C^i_{(2)} \right) \right) \tag{3.12}$$

Global Journal of Science Frontier Research (A) XXV Issue V Version I Year 2025

If $C^i_{(2)} = k \cdot C^i_{(1)}$, it can be written as follows

$$\left(e^{iS[C^i_{(1)}]/\hbar}\right)^{(1+k)^2} = \left(e^{iS[C^i_{(1)}]/\hbar}\right)^{(1+k^2)} \tag{3.13}$$

The solution of Eq.[3.13] is:

$$e^{iS[C^\mu_{(1)}(x)]/\hbar} = 1 \tag{3.14}$$

Then the action of $C^i_{(1)}(x)$ is

$$S[C^i_{(1)}(x)] = 2n\pi\hbar,\ n \in Z \tag{3.15}$$

Therefore the action of $C^i_{(2)}(x)$ is

$$\begin{aligned} S[C^i_{(2)}(x)] &= S[k \cdot C^i_{(1)}(x)] \\ &= k^2 \cdot S[C^i_{(1)}(x)] \\ &= 2nk^2\pi\hbar,\ n \in Z \end{aligned} \tag{3.16}$$

where k must satisfy the condition of quantization of the action.

Only in the case of that the gravitational field $C^i_{(1)}$ and $C^i_{(2)}$ excited by the sources $j^\mu_{(1)}$ and $j^\mu_{(2)}$ satisfy the solution [3.15] and [3.16], we have

$$\tilde{C}^i_{(1\oplus 2)} = \tilde{C}^i_{(1+2)} \tag{3.17}$$

Then we can deduce the gravitational source from the gravitational field in reverse by Eq.[3.17]:

$$j^\mu_{(1\oplus 2)} = j^\mu_{(1+2)} \tag{3.18}$$

In other cases, the propagator $K_{(1\oplus 2)}$ is different to $K_{(1+2)}$

$$K_{(1\oplus 2)} \neq K_{(1)} \otimes K_{(2)} \tag{3.19}$$

Then the final states will be different

$$\tilde{C}^i_{(1\oplus2)} \neq \tilde{C}^i_{(1+2)} \tag{3.20}$$

Therefore the sources will be different

$$j^\mu_{(1\oplus2)} \neq j^\mu_{(1+2)} \tag{3.21}$$

Obviously, Eq.[3.19] Eq.[3.20] and Eq.[3.21] represents the general case, while Eq.[3.17] and Eq.[3.18] is a special case. The change in gravitational field in Eq.[3.20] means a change in the energy of gravitational field itself. We can also deduce that this will change the gravitational source $j^\mu_{(1+2)}$ of the final states to become $j^\mu_{(1\oplus2)}$. If energy cannot be absorbed from the outside, Eq.[3.20] can only causing it to lose energy. Therefore, in general, when the gravitational sources merge, the effects of quantum superposition can be interpreted as negative energy in gravitational field. This negative energy does not depend on the choice of the zero point of energy and therefore different from the negative gravitational potential energy. Negative energy is related to Einstein's cosmological constant λ, So that it is also related to dark energy. Eq.[3.21] indicates that the effects of quantum superposition can lead to the mass defect of the gravitational sources caused by negative energy in the gravitational field. Thus this negative energy contribution manifests as a measurable mass defect in the gravitational source. This is consistent with the conclusions of the general theory of relativity, but differs in that it doesn't originate from the energy conversion of kinetic and potential energy during the kinetic merger of gravitational sources, just caused by the quantum superposition of the states of gravitational fields.

IV. Conclusion

Since the fundamental field and the Lagrangian action of gravity are given in paper [1], we can calculate the quantum superposition between the gravitational fields by Feynman path integration. The calculation results indicate that in general, the quantum effects will generate negative energy in gravitational field. As we know, negative energy is related to Einstein's cosmological constant λ, and therefore also to dark energy. The negative energy leading to the mass defect of the gravitational sources. Its origin is different from the origin of the mass defect in general theory of relativity. The mass defect in general theory of relativity originates from the energy conversion between the kinetic energy of gravitational sources and the potential energy between gravitational sources, while the mass defect of gravitational sources in this paper is caused by the effect of quantum superposition induced by Feynman path integration. There will be no quantum superposition effect only when the actions of the gravitational sources satisfy specific conditions Eq.[3.14], Eq.[3.15] and Eq.[3.16].

References Références Referencias

1. A New Approach to Quantum Gravity.
   DOI: https://doi.org/10.34257/GJSFRAVOL20IS2PG1
2. Noncommutative Quantum Gravity and Symmetry of Klein-Gordon Equation.
   DOI: https://doi.org/10.34257/GJSFRAVOL22IS7PG19
3. Noncommutative Quantum Gravity and Dark Matter.
   DOI: https://doi.org/10.34257/GJSFRAVOL23IS4PG7
4. Macroscopic E˙ect of Quantum Gravity in General Static Isotropic Gravitational Field.
   DOI: https://doi.org/10.34257/GJSFRAVOL24IS2PG49
5. Calculation of Macroscopic E˙ect of Quantum Gravity in General Static Isotropic Gravitational Field.
   DOI: https://doi.org/10.34257/GJSFRAVOL24IS4PG75
6. The Role of Noncommutative Quantum Gravity in Galactic Dynamics and Dark Matter Phenomena.
   DOI: https://doi.org/10.34257/GJSFRAVOL25IS2PG13

This page is intentionally left blank

Global Journal of Science Frontier Research: A
Physics and Space Science
Volume 25 Issue 5 Version 1.0 Year 2025
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 2249-4626 & Print ISSN: 0975-5896

Production and Decay of Higgs Boson, From God Particle H to Heaven Particle Π

By ShaoXu Ren

Tongji University

Abstract- This paper suggests an interesting idea: Based on quark genera $(t, b), (c, s), (u, d)$ harmony flavor symmetry and Mass Principle $Q^2(\xi) - \xi^2 = Q^2$, Heaven particle Π with $M(\Pi) = 692$ *Gev* should instead of God particle *H* with $M(H) = 125$ *Gev*. $M(\Pi)$ as four times as heavy as ground state $Q^2(t)$ of *t* top quark.

Keywords: god particle H, heaven particle Π, production and decay, mass principle, deep neural networks.

GJSFR-A Classification: *LCC Code: QC793.5.H53*

Global Journal of Science Frontier Research (A) XXV Issue V Version I Year 2025

Production and Decay of Higgs Boson, From God Particle H to Heaven Particle Π

ShaoXu Ren

Abstract-

This paper suggests an interesting idea: Based on quark genera $(t, b), (c, s), (u, d)$ harmony flavor symmetry and Mass Principle $\mathbf{Q}^2(\xi) - \xi^2 = \mathbf{Q}^2$, Heaven particle Π with $M(\Pi) = 692\ Gev$ should instead of God particle H with $M(H) = 125\ Gev$. $M(\Pi)$ as four times as heavy as ground state $\mathbf{Q}^2(t)$ of t top quark.

Keywords: God particle H, Heaven particle Π, Production and Decay, Mass Principle, deep neural networks.

Author: Institute of P hysical S cience and E ngineering, T ongji Unive rsity. 200092, S hanghai, Chin a. e-mail: shaoxu-ren@hotmail.com

Introduction

- Both Higgs production modes and Higgs decay branching ratio are related to Higgs boson mass. For examples: Associated production with a pair of heavy quarks ($t\tilde{t}H, b\tilde{b}H$), Dominant decay branching ratio for bottom pair ($H \rightarrow b\tilde{b}$, BR $\sim 58\%$) with $M(H) = 125\ Gev$.

An amazing phenomenon, since quark genera $(t, b), (c, s), (u, d)$ are attributed to the same flavor symmetry, the decay $H \rightarrow q\tilde{q}$ for $q = c, u, d, s, b,$ are observed, BUT up to now the species t is still excluded from decay $H \rightarrow t\tilde{t}$? Why ?

God particle H may be not the perfect boson that as we wanted, expected before. A possible heavier zero spin particle named as *Heaven particle* Π boson, Π instead of H ?

This paper aims to discuss the above questions.

- In the analysis of physics experimental data, *deep neural networks* of artificial intelligence are operating on the masses of particles. Specially on searching for a new particle X of unknown mass by the parameterized neural networks [1].

In dealing with the production and decay of this hypothetical particle X, Pierre, Peter and Daniel " In order to test how well a parameterized neural network generalizes to new parameter values, ", they used three samples, then the " three different training data sets with $m_X = 500, 750, 1000, 1250, 1500\ Gev$ " were put into Feynman diagrams of particle physics. The mass distributions of m_X is relevent to the production and decay of X particle in the processes of $q\tilde{q}, gg \rightarrow X \rightarrow t\tilde{t} \rightarrow W^{+}bW^{-}\tilde{b}$.

At the time of introducing the postulation *Mass Principle* [2], we found an eccentric scalar product $\mathbf{Q}^2 = \frac{692 Gev}{0.511}$, as four times as heavy as ground state $\mathbf{Q}^2(t)$ of t top quark, that always wandering around our calculations related to the origin of Higgs mechanism, which could ensure the processes of "pure production" and "pure decay" *for all the six flavor quarks* $q = t, c, u, d, s, b$. Now this mass $692\ Gev$ looks like an interesting parameter value for m_X in *the deep neural network* mentioned above.

- This paper includes three parts:

Part A endeavors to depict a story about a boson $\mathbb{B}$ and a color-pair of quark q & a antiquark $\tilde{q}$. Their color representations are given by $\mathbf{Q}(\mathbb{B}, \xi(\mathbb{B})) + i\xi(\mathbb{B})$ and $\mathbf{Q}(q, \xi) + i\xi(q)$ & $\mathbf{Q}(\tilde{q}, \tilde{\xi}) + i\tilde{\xi}(\tilde{q})$ respectively.

Part B aims at explaining why, $\mathbb{B} = H \rightarrow t\tilde{t}$, the decay process of *God particle* H, has not be observed, and why can't be happened. Because the mass principle $\mathbf{Q}^2(H) - \xi^2(H, t) = \mathbf{Q}^2(H)\ (\frac{M(H)}{0.511})$ is violated. Due to the value of $\xi^2(H, t)$, the arithmetic square, is less than zero.

Part C gives the minimum critical value of $\mathbf{Q}^2(\mathbb{B} = \Pi) = 4\mathbf{Q}^2(t) - \frac{16}{3} = \frac{691997.2746666668}{0.511} Mev$ of *Heaven particle* Π, as $\xi^2(\Pi, t) = 0$.

Part A Color Relation Formula bwteen Color Boson $\mathbf{Q}(\mathbb{B})$ and Fermion Color-Pair $\mathbf{Q}(q,\xi)+i\boldsymbol{\xi}(q)$ and $\mathbf{Q}(\tilde{q},\tilde{\xi})+i\tilde{\boldsymbol{\xi}}(\tilde{q})$

Relation Formula $\mathbf{Q}(\mathbb{B})=\mathbf{Q}(\mathrm{F}\overline{\mathrm{F}})$ [2] between a Boson $\mathbb{B}$ and a Quark q & an Antiquark $\tilde{q}$ could be written more detailedly as below

Boson $\mathbb{B}$, that be consisten with a color-pair quark q and a color-pair antiquark $\tilde{q}$ in complex field $\mathbb{C}$

$$\underline{\mathbf{Q}(\mathbb{B},\xi(\mathbb{B}))\ +\ i\boldsymbol{\xi}(\mathbb{B})} \ = \ \underline{\mathbf{Q}(q,\xi)\ +\ i\boldsymbol{\xi}(q)} \ + \ \underline{\mathbf{Q}(\tilde{q},\tilde{\xi})\ +\ i\tilde{\boldsymbol{\xi}}(\tilde{q})} \tag{0}$$

Here: $\mathbb{B}$ boson and $q,\tilde{q}$ fermions are required to satisfy the following Mass Principles

$$\mathbf{Q}^2(\mathbb{B},\xi(\mathbb{B})) - \boldsymbol{\xi}^2(\mathbb{B}) = \mathbf{Q}^2(\mathbb{B}) = \frac{M(\mathbb{B})}{0.511} \tag{0.1}$$

$$\mathbf{Q}^2(q,\xi) - \boldsymbol{\xi}^2(q) = \mathbf{Q}^2(q) = \frac{M(q)}{0.511} \tag{0.2}$$

$$\mathbf{Q}^2(\tilde{q},\tilde{\xi}) - \tilde{\boldsymbol{\xi}}^2(\tilde{q}) = \mathbf{Q}^2(\tilde{q}) = \frac{M(\tilde{q})}{0.511} \tag{0.3}$$

Where the above, $\mathbf{Q}^2(q)$ & $\mathbf{Q}^2(\tilde{q})$ are the mass of ground states of quarks & antiquarks that are shown following

$$\mathbf{Q}^2(t) = \mathbf{Q}^2(\tilde{t}) = 338,551.859\ 099\ 8043 = \frac{173000.000\ 000\ 0000}{0.511} \tag{1}$$

$$\mathbf{Q}^2(c) = \mathbf{Q}^2(\tilde{c}) = 2,504.892\ 367\ 9061 = \frac{1280.000\ 000\ 0000}{0.511} \tag{2}$$

$$\mathbf{Q}^2(u) = \mathbf{Q}^2(\tilde{u}) = 4.500\ 978\ 4736 = \frac{2.300\ 000\ 0000}{0.511} \tag{3}$$

$$\mathbf{Q}^2(d) = \mathbf{Q}^2(\tilde{d}) = 9.393\ 346\ 3796 = \frac{4.800\ 000\ 0000}{0.511} \tag{4}$$

$$\mathbf{Q}^2(s) = \mathbf{Q}^2(\tilde{s}) = 185.909\ 980\ 4305 = \frac{95.000\ 000\ 0000}{0.511} \tag{5}$$

$$\mathbf{Q}^2(b) = \mathbf{Q}^2(\tilde{b}) = 9,197.651\ 663\ 4051 = \frac{4700.000\ 000\ 0000}{0.511} \tag{6}$$

Global Journal of Science Frontier Research (A) XXV Issue V Version I Year 2025 31

Back to (0), and decomposes it into Real part **Q** and Imaginary part ξ respectively below

【 Real part Q 】 $$\mathbf{Q}(\mathbb{B}, \xi(\mathbb{B})) = \mathbf{Q}(q, \xi) + \mathbf{Q}(\tilde{q}, \tilde{\xi}) \equiv \mathbf{Q}(q\tilde{q}, \xi\tilde{\xi}) \quad (0.4)$$

【 Imaginary part ξ 】 $$\xi(\mathbb{B}) = \xi(q) + \tilde{\xi}(\tilde{q}) \equiv \xi(q\tilde{q}) \quad (0.5)$$

Here imaginary part (0.5) takes (0.6)

$$\tilde{\xi}(\tilde{q}) = -\xi(q) \quad (0.6)$$

yield

$$\xi(\mathbb{B}) = \xi(q\tilde{q}) = 0 \quad (0.7)$$

In case of (0.7), Color Relation Formula (0) becomes to (7) and (8) below

$$\mathbf{Q}(\mathbb{B}) = \mathbf{Q}(q, \xi) + i\xi(q) + \mathbf{Q}(\tilde{q}, \tilde{\xi}) + i\tilde{\xi}(\tilde{q}) \quad (7)$$

$$\mathbf{Q}(\mathbb{B}) = \mathbf{Q}(q, \xi) + \mathbf{Q}(\tilde{q}, \tilde{\xi}) \quad (8)$$

Following we explore formulas (7) and (8) respevtively.

【 discussion of (7) 】

- In left hand in (7), the color representation of $\mathbf{Q}(\mathbb{B})$ is given below

$$\mathbf{Q}(\mathbb{B}) = \left(\frac{X}{3}, \frac{X}{3}, \frac{-2X}{3}\right) \tag{9}$$

- FROM (9), obtain

$$\mathbf{Q}^2(\mathbb{B}) = \left(\frac{X}{3}, \frac{X}{3}, \frac{-2X}{3}\right)^2 = \frac{1}{9}(6X^2) = \frac{2}{3}X^2$$

obtain

$$X = X_{\pm} = \pm\sqrt{\frac{3}{2}\mathbf{Q}^2(\mathbb{B})} \tag{10}$$

- In right hand in (7), the color representation of $\mathbf{Q}(q,\xi) + i\boldsymbol{\xi}(q)$, $\mathbf{Q}(\tilde{q},\xi) + i\boldsymbol{\xi}(\tilde{q})$ are given below

$$q = t, c, u \qquad \mathbf{Q}(q,\xi) + i\boldsymbol{\xi}(q) = \left(\frac{x(\xi)}{3}, \frac{x(\xi)}{3}, \frac{-2x(\xi)+6}{3}\right) + i\left(\frac{\xi(q)}{3}, \frac{\xi(q)}{3}, \frac{-2\xi(q)}{3}\right) \tag{11.1}$$

$$\tilde{q} = \tilde{t}, \tilde{c}, \tilde{u} \qquad \mathbf{Q}(\tilde{q},\xi) + i\boldsymbol{\xi}(\tilde{q}) = \left(\frac{\alpha(\xi)}{3}, \frac{\alpha(\xi)}{3}, \frac{-2\alpha(\xi)-6}{3}\right) - i\left(\frac{\xi(q)}{3}, \frac{\xi(q)}{3}, \frac{-2\xi(q)}{3}\right) \tag{11.2}$$

$$q = d, s, b \qquad \mathbf{Q}(q,\xi) + i\boldsymbol{\xi}(q) = \left(\frac{x(\xi)}{3}, \frac{x(\xi)}{3}, \frac{-2x(\xi)-3}{3}\right) + i\left(\frac{\xi(q)}{3}, \frac{\xi(q)}{3}, \frac{-2\xi(q)}{3}\right) \tag{12.1}$$

$$\tilde{q} = \tilde{d}, \tilde{s}, \tilde{b} \qquad \mathbf{Q}(\tilde{q},\xi) + i\boldsymbol{\xi}(\tilde{q}) = \left(\frac{\alpha(\xi)}{3}, \frac{\alpha(\xi)}{3}, \frac{-2\alpha(\xi)+3}{3}\right) - i\left(\frac{\xi(q)}{3}, \frac{\xi(q)}{3}, \frac{-2\xi(q)}{3}\right) \tag{12.2}$$

Where

$$\boldsymbol{\xi}(q) = \left(\frac{\xi(q)}{3}, \frac{\xi(q)}{3}, \frac{-2\xi(q)}{3}\right) = -\boldsymbol{\xi}(\tilde{q}) \tag{13}$$

Base on Mass Principles (0.2) (0.3), obtain color-scalar equations (14.1) (14.2) & (15.1) (15.2) of color (11.1) (11.2) & color (12.1) (12.2) following

Global Journal of Science Frontier Research (A) XXV Issue V Version I Year 2025 33

Global Journal of Science Frontier Research (A) XXV Issue V Version I Year 2025 34

$$x^2 - 4x - \tfrac{3}{2}(\mathbf{Q}^2(q,\xi) - 4) = 0 \quad (14.1)$$

$$\alpha^2 + 4\alpha - \tfrac{3}{2}(\mathbf{Q}^2(\widetilde{q},\xi) - 4) = 0 \quad (14.2)$$

$$x^2 + 2x - \tfrac{3}{2}(\mathbf{Q}^2(q,\xi) - 1) = 0 \quad (15.1)$$

$$\alpha^2 - 2\alpha - \tfrac{3}{2}(\mathbf{Q}^2(\widetilde{q},\xi) - 1) = 0 \quad (15.2)$$

AND (16) (17) the solutions of the above equation are given below

- for $q = t, c, u$ (14.1), $\widetilde{q} = \widetilde{t}, \widetilde{c}, \widetilde{u}$ (14.2)

$$x(q,\xi) = +2 \pm \sqrt{\tfrac{3}{2}\mathbf{Q}^2(q,\xi) - 2} \quad (16.1)$$

$$\alpha(\widetilde{q},\widetilde{\xi}) = -2 \pm \sqrt{\tfrac{3}{2}\mathbf{Q}^2(q,\xi) - 2} \quad (16,2)$$

$$x_{\pm}(q,\xi) + \alpha_{\pm}(\widetilde{q},\xi) = \pm 2\sqrt{\tfrac{3}{2}\mathbf{Q}^2(q,\xi) - 2} \quad (16.3)$$

- for $q = d, s, b$ (15.1), $\widetilde{q} = \widetilde{d}, \widetilde{s}, \widetilde{b}$ (15.2)

$$x(q,\xi) = -1 \pm \sqrt{\tfrac{3}{2}\mathbf{Q}^2(q,\xi) - \tfrac{1}{2}} \quad (17.1)$$

$$\alpha(\widetilde{q},\widetilde{\xi}) = +1 \pm \sqrt{\tfrac{3}{2}\mathbf{Q}^2(q,\xi) - \tfrac{1}{2}} \quad (17,2)$$

$$x_{\pm}(q,\xi) + \alpha_{\pm}(\widetilde{q},\xi) = \pm 2\sqrt{\tfrac{3}{2}\mathbf{Q}^2(q,\xi) - \tfrac{1}{2}} \quad (17.3)$$

【 discussion of (8) 】

From previous formulas (11.1) (11.2) and (12.1) (12.2) we have

$$q = t, c, u \qquad \mathbf{Q}(q, \xi) = \left(\frac{x(\xi)}{3}, \frac{x(\xi)}{3}, \frac{-2x(\xi)+6}{3} \right) \tag{18.1}$$

$$\tilde{q} = \tilde{t}, \tilde{c}, \tilde{u} \qquad \mathbf{Q}(\tilde{q}, \xi) = \left(\frac{\alpha(\xi)}{3}, \frac{\alpha(\xi)}{3}, \frac{-2\alpha(\xi)-6}{3} \right) \tag{18.2}$$

$$q = d, s, b \qquad \mathbf{Q}(q, \xi) = \left(\frac{x(\xi)}{3}, \frac{x(\xi)}{3}, \frac{-2x(\xi)-3}{3} \right) \tag{19.1}$$

$$\tilde{q} = \tilde{d}, \tilde{s}, \tilde{b} \qquad \mathbf{Q}(\tilde{q}, \xi) = \left(\frac{\alpha(\xi)}{3}, \frac{\alpha(\xi)}{3}, \frac{-2\alpha(\xi)+3}{3} \right) \tag{19.2}$$

THEN (18.1) plus (18.2) and (19.1) plus (19.2), finally formula (8) could be rewritten as (20). And then obtain (21) below

$$\mathbf{Q}(q, \xi) + \mathbf{Q}(\tilde{q}, \xi) = \left(\frac{x(\xi)+\alpha(\xi)}{3}, \frac{x(\xi)+\alpha(\xi)}{3}, \frac{-2(\,x(\xi)+\alpha(\xi)\,)}{3} \right) \tag{20}$$

$$\mathbf{Q}(\mathbb{B}) = \left(\frac{X}{3}, \frac{X}{3}, \frac{-2X}{3} \right) \tag{9}$$

$$x(\xi) + \alpha(\xi) = X \tag{21}$$

Because of (21) (10), the left hands of (16.3) and (17.3) could be rewritten as (22) and (23) respectively

$$q = t, c, u \qquad 2\sqrt{\tfrac{3}{2}\mathbf{Q}^2(q, \xi) - 2)} = \sqrt{\tfrac{3}{2}\mathbf{Q}^2(\mathbb{B})} \tag{22}$$

$$q = d, s, b \qquad 2\sqrt{\tfrac{3}{2}\mathbf{Q}^2(q, \xi) - \tfrac{1}{2}} = \sqrt{\tfrac{3}{2}\mathbf{Q}^2(\mathbb{B})} \tag{23}$$

After square of (22) and (23), and use (0.2) (0.3),

$$\mathbf{Q}^2(q, \xi) - \boldsymbol{\xi}^2(q) = \mathbf{Q}^2(q) \tag{0.2}$$

$$\mathbf{Q}^2(\tilde{q}, \tilde{\xi}) - \tilde{\boldsymbol{\xi}}^2(\tilde{q}) = \mathbf{Q}^2(\tilde{q}) \tag{0.3}$$

LAST Yielding $\mathbf{Q}^2$ (24) (25) and ξ^2 (26) (27) below

$$q = t, c, u \qquad \mathbf{Q}^2(q,\xi) = \mathbf{Q}^2(q) + \xi^2(q) = \frac{1}{4}\mathbf{Q}^2(\mathbb{B}) + \frac{4}{3} \tag{24}$$

$$q = d, s, b \qquad \mathbf{Q}^2(q,\xi) = \mathbf{Q}^2(q) + \xi^2(q) = \frac{1}{4}\mathbf{Q}^2(\mathbb{B}) + \frac{1}{3} \tag{25}$$

$$q = t, c, u \qquad \underline{\xi^2(q)} = \frac{1}{4}\mathbf{Q}^2(\mathbb{B}) - \mathbf{Q}^2(q) + \frac{4}{3} \tag{26}$$

$$q = d, s, b \qquad \underline{\xi^2(q)} = \frac{1}{4}\mathbf{Q}^2(\mathbb{B}) - \mathbf{Q}^2(q) + \frac{1}{3} \tag{27}$$

After Substitute (24) (25) back into (16.1) (16.2) and (17.1) (17.2) respectively, we get solutons x, α of color representation (28) (29) below

- $q = t, c, u, \quad \tilde{q} = \tilde{t}, \tilde{c}, \tilde{u}$

$$x(q,\xi) = +2 \pm \sqrt{\frac{3}{2}\mathbf{Q}^2(q,\xi)^2 - 2} = +2 \pm \frac{1}{2}\sqrt{\frac{3}{2}\mathbf{Q}^2(\mathbb{B})} \tag{28.1}$$

$$\alpha(\tilde{q},\tilde{\xi}) = -2 \pm \sqrt{\frac{3}{2}\mathbf{Q}^2(q,\xi) - 2} = -2 \pm \sqrt{\frac{3}{8}\mathbf{Q}^2(\mathbb{B})} \tag{28,2}$$

- $q = d, s, b, \quad \tilde{q} = \tilde{d}, \tilde{s}, \tilde{b}$

$$x(q,\xi) = -1 \pm \sqrt{\frac{3}{2}\mathbf{Q}^2(q,\xi) - \frac{1}{2}} = -1 \pm \frac{1}{2}\sqrt{\frac{3}{2}\mathbf{Q}^2(\mathbb{B})} \tag{29.1}$$

$$\alpha(\tilde{q},\tilde{\xi}) = +1 \pm \sqrt{\frac{3}{2}\mathbf{Q}^2(q,\xi) - \frac{1}{2}} = +1 \pm \sqrt{\frac{3}{8}\mathbf{Q}^2(\mathbb{B})} \tag{29.2}$$

Next part, we will search for production $q\tilde{q} \to H$ and decay $H \to q\tilde{q}$, base on the above logistic background of between Boson $\mathbb{B}$, a color-pair quark q, a color-pair antiquark $q\tilde{}$

Part B $\mathbb{B} = H$

- In case of $\mathbb{B}= H$, (8) turns to

$$\mathbf{Q}(H) = \mathbf{Q}(q,\xi) + \mathbf{Q}(\tilde{q},\tilde{\xi}) \tag{30}$$

AND (28.1) (28.2) and (29.1) (29.2) bocome (31.1) (31.2) and (32.1) (32.2) respectively

$$x(q,\xi) = +2 \pm \tfrac{1}{2}\sqrt{\tfrac{3}{2}\mathbf{Q}^2(\mathbb{B}= H)} \tag{31.1}$$

$$\alpha(\tilde{q},\tilde{\xi}) = -2 \pm \tfrac{1}{2}\sqrt{\tfrac{3}{2}\mathbf{Q}^2(\mathbb{B}= H)} \tag{31.2}$$

$$x(q,\xi) = -1 \pm \tfrac{1}{2}\sqrt{\tfrac{3}{2}\mathbf{Q}^2(\mathbb{B}= H)} \tag{32.1}$$

$$\alpha(\tilde{q},\tilde{\xi}) = +1 \pm \tfrac{1}{2}\sqrt{\tfrac{3}{2}\mathbf{Q}^2(\mathbb{B}= H)} \tag{32.2}$$

Where

$$\mathbf{Q}^2(H) = 244618.395\ 303\ 3268 = \frac{125000}{0.511} \tag{33}$$

$$\tfrac{1}{2}\sqrt{\tfrac{3}{2}\mathbf{Q}^2(H)} = \pm 302.872\ 742\ 6474 \tag{34}$$

THEN (31.1) (31.2) and (32.1) (32.2) offer following results:

$$x(q,\xi) = +2 \pm 302.872\ 742\ 6474 = (\ +304.8727426474,\ \ -300.8727426474\ ) \tag{35.1}$$

$$\alpha(\tilde{q},\tilde{\xi}) = -2 \pm 302.872\ 742\ 6474 = (\ +300.8727426474,\ \ -304.8727426474\ ) \tag{35.2}$$

$$x(q,\xi) = -1 \pm 302.872\ 742\ 6474 = (\ +301.8727426474,\ \ -303.8727426474\ ) \tag{36.1}$$

$$\alpha(\tilde{q},\tilde{\xi}) = +1 \pm 302.872\ 742\ 6474 = (\ +303.8727426474,\ \ -301.8727426474\ ) \tag{36.2}$$

Global Journal of Science Frontier Research (A) XXV Issue V Version I Year 2025 37

AND further

$$q \;=\; t, c, u \qquad \frac{x(q,\xi)}{3} = (\;+101.6242475491,\;\; -100.2909142158\;) \tag{37.1}$$

$$\tilde{q} \;=\; \tilde{t}, \tilde{c}, \tilde{u} \qquad \frac{x(\tilde{q},\tilde{\xi})}{3} = (\;+100.2909142158,\;\; -101.6242475491\;) \tag{37.2}$$

$$q \;=\; d, s, b \qquad \frac{x(q,\xi)}{3} = (\;+100.6242475491,\;\; -101.2909142158\;) \tag{38.1}$$

$$\tilde{q} \;=\; \tilde{d}, \tilde{s}, \tilde{b} \qquad \frac{x(\tilde{q},\tilde{\xi})}{3} = (\;+101.2909142158,\;\; -100.6242475491\;) \tag{38.2}$$

Put (37.1) (37.2) and (38.1) (38.2) into (18.1) (18.2) (19.1) (19.2), then obtain two groups of color representations of $\mathbf{Q}(q, \xi)$ and $\mathbf{Q}(\tilde{q}, \tilde{\xi})$ (notice (30)) below :

Group ▲

$q \;=\; t, c, u$

▲ $$\mathbf{Q}(q, \xi) \;=\; (\;+101.6242475491,\;\; +101.6242475491,\;\; -201.2484950982\;) \tag{39.1}$$

▲ $$\mathbf{Q}(\tilde{q}, \tilde{\xi}) \;=\; (\;+100.2909142158,\;\; +100.2909142158\;\; -202.5818284316\;) \tag{39.2}$$

$$\mathbf{Q}(q\tilde{q}, \tilde{\xi}) \;=\; \mathbf{Q}(q, \xi) + \mathbf{Q}(\tilde{q}, \tilde{\xi})$$

$$= (+201.9151617649,\;\; +201.9151617649,\;\; -403.8303235298) \;=\; \mathbf{Q}_{+}(H) \tag{39.3}$$

$q \;=\; d, s, b$

▲ $$\mathbf{Q}(q, \xi) \;=\; (\;+100.6242475491,\;\; +100.6242475491,\;\; -202.2484950982\;) \tag{40.1}$$

▲ $$\mathbf{Q}(\tilde{q}, \tilde{\xi}) \;=\; (\;+101.2909142158,\;\; +101.2909142158,\;\; -201.5818284316\;) \tag{40.2}$$

$$\mathbf{Q}(q\tilde{q}, \tilde{\xi}) \;=\; \mathbf{Q}(q, \xi) + \mathbf{Q}(\tilde{q}, \tilde{\xi})$$

$$= (+201.9151617649,\;\; +201.9151617649,\;\; -403.8303235298) \;=\; \mathbf{Q}_{+}(H) \tag{40.3}$$

AND Group ▼

$q \;=\; t, c, u$

▼ $$\mathbf{Q}(q, \xi) \;=\; (\; -100.2909142158,\;\; -100.2909142158,\;\; +202.5818284316\;) \quad (41.1)$$

▼ $$\mathbf{Q}(\tilde{q}, \tilde{\xi}) \;=\; (\; -101.6242475491,\;\; -101.6242475491\;\; +201.2484950982\;) \quad (41.2)$$

$$\mathbf{Q}(q\tilde{q}, \tilde{\xi}) \;=\; \mathbf{Q}(q, \xi) + \mathbf{Q}(\tilde{q}, \tilde{\xi})$$

$$= (\; -201.9151617649,\;\; -201.9151617649,\;\; +403.8303235298\;) \;=\; \mathbf{Q}\_(H) \quad (41.3)$$

$q \;=\; d, s, b$

▼ $$\mathbf{Q}(q, \xi) \;=\; (\; -101.2909142158,\;\; -101.2909142158,\;\; +201.5818284316\;) \quad (42.2)$$

▼ $$\mathbf{Q}(\tilde{q}, \tilde{\xi}) \;=\; (\; -100.6242475491,\;\; -100.6242475491,\;\; +202.2484950982\;) \quad (42.2)$$

$$\mathbf{Q}(q\tilde{q}, \tilde{\xi}) \;=\; \mathbf{Q}(q, \xi) + \mathbf{Q}(\tilde{q}, \tilde{\xi})$$

$$= (\; -201.9151617649,\;\; -201.9151617649,\;\; +403.8303235298\;) \;=\; \mathbf{Q}\_(H) \quad (42.3)$$

Square of (39.3) (40.3) (41.3) (42.3)

$$\mathbf{Q}^2_{\pm}(H) \;=\; (\; \pm 201.9151617649,\;\; \pm 201.9151617649,\;\; \mp 403.8303235298)^2 \;=\; 244618.3953032742 \;=\; \frac{12499.9999999731}{0.511} \quad (43)$$

Then compare (43) with Higgs boson theoretical value (44)

$$\mathbf{Q}^2_{Theo}(H) \;=\; 244618.3953033268 \;=\; \frac{125000}{0.511} \quad (44)$$

We see: $\mathbf{Q}^2_{\pm}(H) = \mathbf{Q}^2_{Theo}(H)$ means the above color representations of $\mathbf{Q}_{\pm}(H)$ and $\mathbf{Q}(q, \xi)$ $\mathbf{Q}(\tilde{q}, \tilde{\xi})$ satify relationship (30).

Following discussions will lead to throw doubt on *God particle* H.

- In case of $\mathbb{B}=H$, (26) (27) turn to

$$q = t, c, u \qquad \underline{\xi^2(q)} = \tfrac{1}{4}\mathbf{Q}^2(\mathbb{B}=H) - \mathbf{Q}^2(q) + \tfrac{4}{3} \tag{45}$$

$$q = d, s, b \qquad \underline{\xi^2(q)} = \tfrac{1}{4}\mathbf{Q}^2(\mathbb{B}=H) - \mathbf{Q}^2(q) + \tfrac{1}{3} \tag{46}$$

AS the left hand of (45) (46)

$$\xi^2(q) > 0 \tag{47}$$

The right hand of (45) (46) should be greater than zero too

$$q = t, c, u \qquad \tfrac{1}{4}\mathbf{Q}^2(H) - \mathbf{Q}^2(q) + \tfrac{4}{3} > 0 \tag{48}$$

$$q = d, s, b \qquad \tfrac{1}{4}\mathbf{Q}^2(H) - \mathbf{Q}^2(q) + \tfrac{1}{3} > 0 \tag{49}$$

HOWEVER, the following calculations show: quarks c, u satisfy (48) (see (53.2) (53.3)), quarks d, s, b satisfy (49) (see (54.1) (54.2) (54.3)). BUT ONLY TOP QUARK, $q = t$ CONFLICTS WITH formula (48) ! (see (53.1))

Using (44) and (50)

$$\mathbf{Q}^2(H) = 244618.3953033268 = \frac{125000}{0.511} \tag{44}$$

$$\tfrac{1}{4}\mathbf{Q}^2(H) = 61154.5988248317 = \frac{31250}{0.511} \tag{50}$$

Obtain

$$q = t \qquad \tfrac{1}{4}\mathbf{Q}^2(H) - \mathbf{Q}^2(t) + \tfrac{4}{3} = 61154.5988248317 - 338551.8590998043 + \tfrac{4}{3} \tag{51.1}$$

$$q = c \qquad \tfrac{1}{4}\mathbf{Q}^2(H) - \mathbf{Q}^2(c) + \tfrac{4}{3} = 61154.5988248317 - 2504.8923679061 + \tfrac{4}{3} \tag{51.2}$$

$$q = u \qquad \tfrac{1}{4}\mathbf{Q}^2(H) - \mathbf{Q}^2(u) + \tfrac{4}{3} = 61154.5988248317 - 4.5009784736 + \tfrac{4}{3} \tag{51.3}$$

$$q = d \qquad \tfrac{1}{4}\mathbf{Q}^2(H) - \mathbf{Q}^2(d) + \tfrac{1}{3} = 61154.5988248317 - 9.3933463796 + \tfrac{1}{3} \tag{52.1}$$

$$q = s \qquad \tfrac{1}{4}\mathbf{Q}^2(H) - \mathbf{Q}^2(s) + \tfrac{1}{3} = 61154.5988248317 - 185.9099804305 + \tfrac{1}{3} \tag{52.2}$$

$$q = b \qquad \tfrac{1}{4}\mathbf{Q}^2(H) - \mathbf{Q}^2(b) + \tfrac{1}{3} = 61154.5988248317 - 9197.6516634051 + \tfrac{1}{3} \tag{52.3}$$

OR

$$\xi^2(H,t) = \xi^2(t) = \tfrac{1}{4}\mathbf{Q}^2(h) - \mathbf{Q}^2(t) + \tfrac{4}{3} = -277395.9269406393 < 0 \tag{53.1}$$

$$\xi^2(H,c) = \xi^2(c) = \tfrac{1}{4}\mathbf{Q}^2(h) - \mathbf{Q}^2(c) + \tfrac{4}{3} = +58651.0397912589 > 0 \tag{53.2}$$

$$\xi^2(H,u) = \xi^2(u) = \tfrac{1}{4}\mathbf{Q}^2(h) - \mathbf{Q}^2(u) + \tfrac{4}{3} = +61151.4311806914 > 0 \tag{53.2}$$

$$\xi^2(H,d) = \xi^2(d) = \tfrac{1}{4}\mathbf{Q}^2(h) - \mathbf{Q}^2(d) + \tfrac{1}{3} = +61145.5388127854 > 0 \tag{54.1}$$

$$\xi^2(H,s) = \xi^2(s) = \tfrac{1}{4}\mathbf{Q}^2(h) - \mathbf{Q}^2(s) + \tfrac{1}{3} = +61145.5388127854 > 0 \tag{54.2}$$

$$\xi^2(H,b) = \xi^2(b) = \tfrac{1}{4}\mathbf{Q}^2(h) - \mathbf{Q}^2(b) + \tfrac{1}{3} = +51957.2804957599 > 0 \tag{54.3}$$

It is obviously for *God particle* H, $\mathbf{Q}^2(H)= \frac{125000}{0.511}$, ($\frac{1}{4}\mathbf{Q}^2(h)$ (50)) is too sm all to hold $\xi^2(t)$ to be greater than zero (see (53.1)) ! This is why the phenomenons, " pure production " $i\tilde{t} \to H$ and " pure decay " $H \to t\tilde{t}$, have not been observed up to now [3],[4],[5],[6]. Next part the boson π debuts.

Part C $\mathbb{B} = \Pi$

Instead of working at *God particle* H (45) (46), we looking for a new boson Π, named *Heaven particle* (55) (56)

$$q = t, c, u \qquad \underline{\xi^2(q)} = \tfrac{1}{4}\mathbf{Q}^2(\mathbb{B}=\Pi) - \mathbf{Q}^2(q) + \tfrac{4}{3} \tag{55}$$

$$q = d, s, b \qquad \underline{\xi^2(q)} = \tfrac{1}{4}\mathbf{Q}^2(\mathbb{B}=\Pi) - \mathbf{Q}^2(q) + \tfrac{1}{3} \tag{56}$$

(55) (56) are required to guarantee physical modes $q\tilde{q} \to \Pi$ production and $\Pi \to q\tilde{q}$ decay for all the six flavor quarks, specially for the heaviest quark, *top quark*, $t\tilde{t} \to \Pi$ production and $\Pi \to t\tilde{t}$ decay. Our aim at this paper is to find out the minimum critical values of $\mathbf{Q}^2(\mathbb{B}=\Pi)$ (or $\frac{M(\mathbb{B}=\Pi)}{0.511}$).

- Following suppose (57) in formula (55), then (55) becomes (58)

$$q = t \qquad \underline{\xi^2(q = t)} = 0 \tag{57}$$

$$\underline{\xi^2(t)} = \tfrac{1}{4}\mathbf{Q}^2(\Pi) - \mathbf{Q}^2(t) + \tfrac{4}{3} = 0 \tag{58}$$

From (58), have relations (59) (60) below.

$$\tfrac{1}{4}\mathbf{Q}^2(\Pi) = \mathbf{Q}^2(t) - \tfrac{4}{3} \tag{59}$$

$$\mathbf{Q}^2(\Pi) = 4\mathbf{Q}^2(t) - \tfrac{16}{3} \tag{60}$$ ★1

Substitute (59) back to (55) (56), using $\mathbf{Q}^2(t) - \frac{4}{3}$ to replace $\frac{1}{4}\mathbf{Q}^2(\Pi)$. YIELDING two key relation expressions (61) (62) and (63) (64) below

$$q = t, c, u \qquad \underline{\xi^2(q)} = \tfrac{1}{4}\mathbf{Q}^2(\Pi) - \mathbf{Q}^2(q) + \tfrac{4}{3} = \mathbf{Q}^2(t) - \tfrac{4}{3} - \mathbf{Q}^2(q) + \tfrac{4}{3} = \mathbf{Q}^2(t) - \mathbf{Q}^2(q)$$

$$q = d, s, b \qquad \underline{\xi^2(q)} = \tfrac{1}{4}\mathbf{Q}^2(\Pi) - \mathbf{Q}^2(q) + \tfrac{1}{3} = \mathbf{Q}^2(t) - \tfrac{4}{3} - \mathbf{Q}^2(q) + \tfrac{1}{3} = \mathbf{Q}^2(t) - \mathbf{Q}^2(q) - 1$$

OR

$$q = t, c, u \qquad \xi^2(q) = \mathbf{Q}^2(t) - \mathbf{Q}^2(q) \qquad (61) \quad \bigstar 2$$

$$q = d, s, b \qquad \xi^2(q) = \mathbf{Q}^2(t) - \mathbf{Q}^2(q) - 1 \qquad (62) \quad \bigstar 3$$

AND

$$q = t, c, u \qquad \mathbf{Q}^2(q, \xi) = \mathbf{Q}^2(q) + \xi^2(q) = \mathbf{Q}^2(t) \qquad (63) \quad \bigstar 4$$

$$q = d, s, b \qquad \mathbf{Q}^2(q, \xi) = \mathbf{Q}^2(q) + \xi^2(q) = \mathbf{Q}^2(t) - 1 \qquad (64) \quad \bigstar 5$$

NOTICE: Both $\mathbf{Q}^2(q, \xi)$, $\xi^2(q)$ and $\mathbf{Q}^2(\Pi)$ are the functions of $\mathbf{Q}^2(t)$.

- Base on (60) $\bigstar 1$

$$4\mathbf{Q}^2(t) = 4(\ 338,551.859\ 099\ 8043\ ) = 1354207.4363992172 = \frac{692000}{0.511} \qquad (65)$$

$$\underline{(60)\ \bigstar 0 \qquad \mathbf{Q}^2(\Pi) = 4\mathbf{Q}^2(t) - \frac{16}{3}} = 1354207.4363992172 - \frac{16}{3}$$

$$= 1354202.1030658840 = \frac{691997.2746666668}{0.511} \qquad (66)$$

(66) (65) shows: Msss $M(\Pi) = 692000\,Mev$ of the new boson Π is about four times of $M(t) = 173000Mev$ top quark !

Global Journal of Science Frontier Research (A) XXV Issue V Version I Year 2025
43

AND

t, H, Π Data compared below

$$M(\Pi) - M(t) = 692000 - 173000 = 456000 \; Mev \quad (67)$$

$$\frac{M(\Pi)}{M(t)} = \frac{692000}{173000} = 4 \quad (68)$$

$$M(\Pi) - M(H) = 692000 - 125000 = 567000 \; Mev \quad (69)$$

$$\frac{M(\Pi)}{M(H)} = \frac{692000}{125000} = 5.536 \quad (70)$$

- More details about $\xi^2(q)$ (61) ★2 and (62) ★3 below

$$q = t \qquad \xi^2(t) = \mathbf{Q}^2(t) - \mathbf{Q}^2(t) = 338551.8590998043 - 338551.8590998043 = 0 \quad (71.1)$$

$$q = c \qquad \xi^2(c) = \mathbf{Q}^2(t) - \mathbf{Q}^2(c) = 338551.8590998043 - 2504.8923679061 = 336046.9667318982 > 0 \quad (71.2)$$

$$q = u \qquad \xi^2(u) = \mathbf{Q}^2(t) - \mathbf{Q}^2(c) = 338551.8590998043 - 4.5009784736 = 338547.3581213307 > 0 \quad (71.3)$$

$$q = d \qquad \xi^2(d) = \mathbf{Q}^2(t) - \mathbf{Q}^2(d) - 1 = 338551.8590998043 - 9.3933463796 - 1 = 338541.4657534247 > 0 \quad (72.1)$$

$$q = s \qquad \xi^2(s) = \mathbf{Q}^2(t) - \mathbf{Q}^2(s) - 1 = 338551.8590998043 - 185.9099804305 - 1 = 338364.9491193738 > 0 \quad (72.2)$$

$$q = b \qquad \xi^2(b) = \mathbf{Q}^2(t) - \mathbf{Q}^2(b) - 1 = 338551.8590998043 - 9197.6516634051 - 1 = 329353.2074363992 > 0 \quad (72.3)$$

- More details about $\mathbf{Q}^2(q,\xi)$ (63) ★4 and (64) ★5, then create a table below

Table: $\mathbf{Q}^2(q,\xi)$

$\mathbf{Q}^2(q,\xi)$	338551.8590998043	338551.8590998043	338551.8590998043	338550.8590998043	338550.8590998043	338550.8590998043
$\mathbf{Q}^2(q)$	338551.8590998043	2504.8923679061	4.5009784736	9.3933463796	185.9099804305	9197.6516634051
	$\mathbf{Q}^2(t)$	$\mathbf{Q}^2(c)$	$\mathbf{Q}^2(u)$	$\mathbf{Q}^2(d)$	$\mathbf{Q}^2(s)$	$\mathbf{Q}^2(b)$
$\xi^2(q)$ $\frac{3}{2}\xi^2(q)$	0	+336046.9667318982	+338547.3581213307	+338541.4657534247	+338364.9491193738	+329353.2074363992
$\xi^2(q)$	0	504070.4500978473	507821.0371819960	507812.1986301371	507547.4236790607	494029.8111545988
$\xi(q)$ $\sqrt{\frac{3}{2}\xi^2(q)}$	0	709.9791899048	712.6156307449	712.6094292318	712.4236265587	702.8725426097
$\frac{1}{3}\xi(q)$	$\frac{0}{3}$	$\frac{709.9791899048}{3}$	$\frac{712.6156307449}{3}$	$\frac{712.6094292318}{3}$	$\frac{712.4236265587}{3}$	$\frac{702.8725426097}{3}$
$\sqrt{\frac{1}{6}\xi^2(q)}$	0	236.6597299683	237.5385435816	237.5364764106	237.4745421862	234.2908475366

17

Global Journal of Science Frontier Research (A) XXV Issue V Version I Year 2025

NEXT search for $x(q,\xi)$ $\alpha(\widetilde{q},\widetilde{\xi})$. In case of $\mathbb{B} = \Pi$. PUT (60) ★0 into (28.1) (28.2) and (29.1) (29.2), Having (74.1) (74.2) and (75.1) (75.2) below

$$\mathbf{Q}^2(\Pi) = 4\mathbf{Q}^2(t) - \tfrac{16}{3} \qquad (60) \quad ★0$$

$$\sqrt{\tfrac{3}{8}\mathbf{Q}^2(\Pi)} = \sqrt{\tfrac{3}{8}(4\mathbf{Q}^2(t) - \tfrac{16}{3})} = \sqrt{\tfrac{3}{2}\mathbf{Q}^2(t) - 2}$$

$$\sqrt{\tfrac{3}{8}\mathbf{Q}^2(\Pi)} = \sqrt{\tfrac{3}{2}\mathbf{Q}^2(t) - 2} \qquad (73)$$

- $q = t, c, u, \quad \widetilde{q} = \widetilde{t}, \widetilde{c}, \widetilde{u}$

$$x(q,\xi) = +2 \pm \sqrt{\tfrac{3}{2}\mathbf{Q}^2(q,\xi)^2 - 2} = +2 \pm \sqrt{\tfrac{3}{8}\mathbf{Q}^2(\mathbb{B}=\Pi)} = +2 \pm \sqrt{\tfrac{3}{2}\mathbf{Q}^2(t) - 2} \qquad (74.1)$$

$$\alpha(\widetilde{q},\widetilde{\xi}) = -2 \pm \sqrt{\tfrac{3}{2}\mathbf{Q}^2(q,\xi) - 2} = -2 \pm \sqrt{\tfrac{3}{8}\mathbf{Q}^2(\mathbb{B}=\Pi)} = -2 \pm \sqrt{\tfrac{3}{2}\mathbf{Q}^2(t) - 2} \qquad (74,2)$$

- $q = d, s, b, \quad \widetilde{q} = \widetilde{d}, \widetilde{s}, \widetilde{b}$

$$x(q,\xi) = -1 \pm \sqrt{\tfrac{3}{2}\mathbf{Q}^2(q,\xi) - \tfrac{1}{2}} = -1 \pm \sqrt{\tfrac{3}{8}\mathbf{Q}^2(\mathbb{B}=\Pi)} = -1 \pm \sqrt{\tfrac{3}{2}\mathbf{Q}^2(t) - 2} \qquad (75.1)$$

$$\alpha(\widetilde{q},\widetilde{\xi}) = +1 \pm \sqrt{\tfrac{3}{2}\mathbf{Q}^2(q,\xi) - \tfrac{1}{2}} = +1 \pm \sqrt{\tfrac{3}{8}\mathbf{Q}^2(\mathbb{B}=\Pi)} = +1 \pm \sqrt{\tfrac{3}{2}\mathbf{Q}^2(t) - 2} \qquad (75.2)$$

AS (76)

$$\mathbf{Q}^2(t) = 338,551.859\ 099\ 8043 = \frac{173000.000\ 000\ 0000}{0.511} \qquad (1)$$

$$\tfrac{3}{2}\mathbf{Q}^2(t) = \tfrac{3}{2}(338,551.8590998043) = 507,827.7886497065$$

$$\tfrac{3}{2}\mathbf{Q}^2(t) - 2 = 507825.7886497065 \qquad (76)$$

$$\sqrt{\tfrac{3}{2}\mathbf{Q}^2(t) - 2} = \sqrt{507825.7886497065} = \pm 712.6189645594$$

PUT (76) back to (74.1) (74.2) and (75.1) (75.2), Consequently obtain (77.1) (77.2) and (78.1) (78.2) following

- $$x(q,\xi) = +2 \pm 712.6189645594 = (+714.6189645594, \quad -710.6189645594) \qquad (77.1)$$
- $$\alpha(\tilde{q},\tilde{\xi}) = -2 \pm 712.6189645594 = (+710.6189645594, \quad -714.6189645594) \qquad (77,2)$$
- $$x(q,\xi) = -1 \pm 712.6189645594 = (+711.6189645594, \quad -713.6189645594) \qquad (78.1)$$
- $$\alpha(\tilde{q},\tilde{\xi}) = +1 \pm 712.6189645594 = (+713.6189645594, \quad -711.6189645594) \qquad (78.2)$$

Further obtain following expressions

$$q = t, c, u \qquad \frac{x(q,\xi)}{3} = (+238.2063215198, \quad -236.8729881865) \qquad (79.1)$$

$$\tilde{q} = \tilde{t}, \tilde{c}, \tilde{u} \qquad \frac{x(\tilde{q},\tilde{\xi})}{3} = (+236.8729881865, \quad -238.2063215198) \qquad (79.2)$$

$$q = d, s, b \qquad \frac{x(q,\xi)}{3} = (+237.2063215198, \quad -237.8729881865) \qquad (80.1)$$

$$\tilde{q} = \tilde{d}, \tilde{s}, \tilde{b} \qquad \frac{x(\tilde{q},\tilde{\xi})}{3} = (+237.8729881865, \quad -237.2063215198) \qquad (80.2)$$

Each of the above four formulas has two groups (▲ and ▼) of quark color representations for *Heaven particle* Π, which similar to that for *God particle* H appeared in **Part B** previously. The relevant formulas for these quark color representations (▲ and ▼) are given below

Global Journal of Science Frontier Research (A) XXV Issue V Version I Year 2025

- For $q = t, c, u$ and $\tilde{q} = \tilde{t}, \tilde{c}, \tilde{u}$

▲ $$\mathbf{Q}(t,\xi)= \mathbf{Q}(c,\xi)= \mathbf{Q}(u,\xi) = (+238.2063215198,\ +238.2063215198,\ -474.4126430396) \quad (81.1)$$

▲ $$\mathbf{Q}(\tilde{t},\tilde{\xi})= \mathbf{Q}(\tilde{c},\tilde{\xi})= \mathbf{Q}(\tilde{u},\tilde{\xi}) = (+236.8729881865,\ +236.8729881865\ \ -475.7459763730) \quad (81.2)$$

PLUS

$$\mathbf{Q}(q\tilde{q},\tilde{\xi}) = \mathbf{Q}(q,\xi) + \mathbf{Q}(\tilde{q},\tilde{\xi}) = (+475.0793097063,\ +475.0793097063,\ -950.1586194126) = \mathbf{Q}_{+}(\Pi) \quad (81.3)$$

▼ $$\mathbf{Q}(t,\xi)= \mathbf{Q}(c,\xi)= \mathbf{Q}(u,\xi) = (-236.8729881865,\ -236.8729881865,\ +475.7459763730) \quad (82.1)$$

▼ $$\mathbf{Q}(\tilde{t},\tilde{\xi})= \mathbf{Q}(\tilde{c},\tilde{\xi})= \mathbf{Q}(\tilde{u},\tilde{\xi}) = (-238.2063215198,\ -238.2063215198\ \ +474.4126430396) \quad (82.2)$$

PLUS

$$\mathbf{Q}(q\tilde{q},\tilde{\xi}) = \mathbf{Q}(q,\xi) + \mathbf{Q}(\tilde{q},\tilde{\xi}) = (-475.0793097063,\ -475.0793097063,\ +950.1586194126) = \mathbf{Q}_{-}(\Pi) \quad (82.3)$$

- For d, s, b and $\tilde{d}, \tilde{s}, \tilde{b}$

▲ $$\mathbf{Q}(d,\xi)= \mathbf{Q}(s,\xi)= \mathbf{Q}(b,\xi) = (+237.2063215198,\ +237.2063215198,\ -475.4126430396) \quad (83.1)$$

▲ $$\mathbf{Q}(\tilde{d},\tilde{\xi})= \mathbf{Q}(\tilde{s},\tilde{\xi})= \mathbf{Q}(\tilde{b},\tilde{\xi}) = (+237.8729881865,\ +237.8729881865,\ -474.7459763730) \quad (83.2)$$

PLUS

$$\mathbf{Q}(q\tilde{q},\tilde{\xi}) = \mathbf{Q}(q,\xi) + \mathbf{Q}(\tilde{q},\tilde{\xi}) = (+475.0793097063,\ +475.0793097063,\ -950.1586194126) = \mathbf{Q}_{+}(\Pi) \quad (83.3)$$

▼ $$\mathbf{Q}(d,\xi)= \mathbf{Q}(s,\xi)= \mathbf{Q}(b,\xi) = (-237.8729881865,\ -237.8729881865,\ +474.7459763730) \quad (84.2)$$

▼ $$\mathbf{Q}(\tilde{d},\tilde{\xi})= \mathbf{Q}(\tilde{s},\tilde{\xi})= \mathbf{Q}(\tilde{b},\tilde{\xi}) = (-237.2063215198,\ -237.2063215198,\ +475.4126430396) \quad (84.2)$$

PLUS

$$\mathbf{Q}(q\tilde{q},\tilde{\xi}) = \mathbf{Q}(q,\xi) + \mathbf{Q}(\tilde{q},\tilde{\xi}) = (-475.0793097063,\ -475.0793097063,\ +950.1586194126) = \mathbf{Q}_{-}(\Pi) \quad (84.3)$$

OR

$$\mathbf{Q}(q\tilde{q},\tilde{\xi}) = \mathbf{Q}(q,\xi) + \mathbf{Q}(\tilde{q},\tilde{\xi}) = (\ \pm 475.0793097063,\ \pm 475.0793097063,\ \mp 950.1586194126\ ) = \mathbf{Q}_{\pm}(\Pi) \tag{85}$$

• • SUBSEQUENT corlor representations of t top quark and $\tilde{t}$ anti-top quark, that correspond to $\mathbf{Q}_{+}(\Pi)$ (or $\mathbf{Q}_{-}(\Pi)$) above, are given by (86) (87)

$$\mathbf{Q}(t) = (\ +238.206\ 321\ 5198,\ +238.206\ 321\ 5198,\ -474.412\ 643\ 0396\ ) \tag{86}$$

$$\mathbf{Q}(\tilde{t}) = (\ +236.872\ 988\ 1865,\ +236.872\ 988\ 1865,\ -475.745\ 976\ 3730\ ) \tag{87}$$

LAST OBTAIN (88)

$$\mathbf{Q}(t\bar{t}) = \mathbf{Q}(t) + \mathbf{Q}(\bar{t}) = \mathbf{Q}(q,\xi) + \mathbf{Q}(\tilde{q},\tilde{\xi}) = \mathbf{Q}_{+}(\Pi) \tag{88}$$

Square of the above expression

$$\mathbf{Q}^2_{+}(\Pi) = \mathbf{Q}^2(t\bar{t}) = 1354,202.1030660877 = \frac{691997.2746667708}{0.511} \tag{89}$$

Notice: Compare (89) with *Heaven particle* Π theoretical value (66) and (65)

$$\mathbf{Q}^2_{Theo}(\Pi) = 4\mathbf{Q}^2(t) - \frac{16}{3} = 1354202.1030658840 = \frac{691997.2746666668}{0.511} \tag{66}$$

$$4\mathbf{Q}^2(t) = 1354207.4363992172 = \frac{692000}{0.511} \tag{65}$$

Epilogue

The relationship (88) and (89) are the portrail of *Heaven particle* boson relevant to production and decay of Π boson. Eagerly looking forward to probing into the excistence of *Heaven particle*, Hoping for experimentalists.

Acknowledgements

Thanks to GJSFR, offering a academic platform for researchers all over the world.

References Références Referencias

[1] Pierre Baldi, Peter Sadowski and Daniel Whiteson. Deep Learning from Four Vectors, ARTIFICIAL INTELLIGENCE for HIGH ENERGY PHYSICS 59-83, © 2022 World Scientific Publishing Company, https:/10.1142/978-981-123-402-6_0003. ISBN 978-981-123-402-6

[2] Shao-Xu Ren. Colorization of Gell-mann-Nishijima Relation and Mass Principle, Origins of Mass; Fermions and Charges, Bosons and Color-Pairs. *GLOBAL JOURNAL OF SCIENCE FRONTIER RESEARCH*: A PHYSICS AND SPACE SCIENCE Volume 25 ISSUE 3 Version 1.0 Year 2025 93-128. Online ISSN: 2249-4626 & Print ISSN: 0975-5896

https://globaljournals.org/GJSFR_Volume25/E-Journal_GJSFR_(A)_Vol_25_Issue_3.pdf

[3] Daniel Denegri. Claude Guyot. Andreas Hoecker. Lydia Roos (2021). The Adventure of the LARGE HADRON COLLIDER From the Big Bang to the Higgs Boson. World Scientific. ISBN: 978-981-3236-08-0

[4] Regina Demina. Aran Garcia-Bellido (2023). Electroweak Symmetty and its Breaking. University of Rochester. World Scientific. ISBN: 978-981-122-224-5

[5] PASCAL PAGANINI (2023), FUNDAMENTALS OF PARTICLE PHYSICS. CAMBRIDGE UNIVERSITY PRESS ISBN 978-1-009-17158-8

[6] Ikaros I Bigi. Giulia Ricciardi. Marco Pallavicini (2021), New Era for CP Asymmetries, Axions and Rare Decays of Hadrons and Leptons. World Scientific. ISBN: 978-981-3233-07-2

Global Journals Guidelines Handbook 2025

www.GlobalJournals.org

Memberships

FELLOWS/ASSOCIATES OF SCIENCE FRONTIER RESEARCH COUNCIL

FSFRC/ASFRC MEMBERSHIPS

Introduction

FSFRC/ASFRC is the most prestigious membership of Global Journals accredited by Open Association of Research Society, U.S.A (OARS). The credentials of Fellow and Associate designations signify that the researcher has gained the knowledge of the fundamental and high-level concepts, and is a subject matter expert, proficient in an expertise course covering the professional code of conduct, and follows recognized standards of practice. The credentials are designated only to the researchers, scientists, and professionals that have been selected by a rigorous process by our Editorial Board and Management Board.

Associates of FSFRC/ASFRC are scientists and researchers from around the world are working on projects/researches that have huge potentials. Members support Global Journals' mission to advance technology for humanity and the profession.

FSFRC

FELLOW OF SCIENCE FRONTIER RESEARCH COUNCIL

FELLOW OF SCIENCE FRONTIER RESEARCH COUNCIL is the most prestigious membership of Global Journals. It is an award and membership granted to individuals that the Open Association of Research Society judges to have made a 'substantial contribution to the improvement of computer science, technology, and electronics engineering.

The primary objective is to recognize the leaders in research and scientific fields of the current era with a global perspective and to create a channel between them and other researchers for better exposure and knowledge sharing. Members are most eminent scientists, engineers, and technologists from all across the world. Fellows are elected for life through a peer review process on the basis of excellence in the respective domain. There is no limit on the number of new nominations made in any year. Each year, the Open Association of Research Society elect up to 12 new Fellow Members.

Benefits

To the institution

Get letter of appreciation

Global Journals sends a letter of appreciation of author to the Dean or CEO of the University or Company of which author is a part, signed by editor in chief or chief author.

Exclusive Network

Get access to a closed network

A FSFRC member gets access to a closed network of Tier 1 researchers and scientists with direct communication channel through our website. Fellows can reach out to other members or researchers directly. They should also be open to reaching out by other.

Career | Credibility | Exclusive | Reputation

Certificate

Receive a print ed copy of a certificate

Fellows receive a printed copy of a certificate signed by our Chief Author that may be used for academic purposes and a personal recommendation letter to the dean of member's university.

Career | Credibility | Exclusive | Reputation

Designation

Get honored title of membership

Fellows can use the honored title of membership. The “FSFRC” is an honored title which is accorded to a person’s name viz. Dr. John E. Hall, Ph.D., FSFRC or William Walldroff, M.S., FSFRC.

Career | Credibility | Exclusive | Reputation

Recognition on the Platform

Better visibility and citation

All the Fellow members of FSFRC get a badge of "Leading Member of Global Journals" on the Research Community that distinguishes them from others. Additionally, the profile is also partially maintained by our team for better visibility and citation. All fellows get a dedicated page on the website with their biography.

Career | Credibility | Reputation

Future Work

Get discounts on the future publications

Fellows receive discounts on future publications with Global Journals up to 60%. Through our recommendation programs, members also receive discounts on publications made with OARS affiliated organizations.

Career | Financial

GJ Internal Account

Unlimited forward of Emails

Fellows get secure and fast GJ work emails with unlimited forward of emails that they may use them as their primary email. For example, john [AT] globaljournals [DOT] org.

Career | Credibility | Reputation

Premium Tools

Access to all the premium tools

To take future researches to the zenith, fellows and associates receive access to all the premium tools that Global Journals have to offer along with the partnership with some of the best marketing leading tools out there.

Financial

Conferences & Events

Organize seminar/conference

Fellows are authorized to organize symposium/seminar/conference on behalf of Global Journal Incorporation (USA). They can also participate in the same organized by another institution as representative of Global Journal. In both the cases, it is mandatory for him to discuss with us and obtain our consent. Additionally, they get free research conferences (and others) alerts.

Career | Credibility | Financial

Early Invitations

Early invitations to all the symposiums, seminars, conferences

All fellows receive the early invitations to all the symposiums, seminars, conferences and webinars hosted by Global Journals in their subject.

Exclusive

Publishing Articles & Books

Earn 60% of sales proceeds

Fellows can publish articles (limited) without any fees. Also, they can earn up to 60% of sales proceeds from the sale of reference/review books/literature/ publishing of research paper. The FSFRC member can decide its price and we can help in making the right decision.

Exclusive Financial

Reviewers

Get a remuneration of 15% of author fees

Fellow members are eligible to join as a paid peer reviewer at Global Journals Incorporation (USA) and can get a remuneration of 15% of author fees, taken from the author of a respective paper.

Financial

Access to Editorial Board

Become a member of the Editorial Board

Fellows may join as a member of the Editorial Board of Global Journals Incorporation (USA) after successful completion of three years as Fellow and as Peer Reviewer. Additionally, Fellows get a chance to nominate other members for Editorial Board.

Career Credibility Exclusive Reputation

And Much More

Get access to scientific museums and observatories across the globe

All members get access to 5 selected scientific museums and observatories across the globe. All researches published with Global Journals will be kept under deep archival facilities across regions for future protections and disaster recovery. They get 10 GB free secure cloud access for storing research files.

ASFRC

ASSOCIATE OF SCIENCE FRONTIER RESEARCH COUNCIL

ASSOCIATE OF SCIENCE FRONTIER RESEARCH COUNCIL is the membership of Global Journals awarded to individuals that the Open Association of Research Society judges to have made a 'substantial contribution to the improvement of computer science, technology, and electronics engineering.

> The primary objective is to recognize the leaders in research and scientific fields of the current era with a global perspective and to create a channel between them and other researchers for better exposure and knowledge sharing. Members are most eminent scientists, engineers, and technologists from all across the world. Associate membership can later be promoted to Fellow Membership. Associates are elected for life through a peer review process on the basis of excellence in the respective domain. There is no limit on the number of new nominations made in any year. Each year, the Open Association of Research Society elect up to 12 new Associate Members.

Benefits

To the Institution

Get letter of appreciation

Global Journals sends a letter of appreciation of author to the Dean or CEO of the University or Company of which author is a part, signed by editor in chief or chief author.

Exclusive Network

Get access to a closed network

A ASFRC member gets access to a closed network of Tier 1 researchers and scientists with direct communication channel through our website. Associates can reach out to other members or researchers directly. They should also be open to reaching out by other.

Career | Credibility | Exclusive | Reputation

Certificate

Receive a print ed copy of a certificate

Associates receive a printed copy of a certificate signed by our Chief Author that may be used for academic purposes and a personal recommendation letter to the dean of member's university.

Career | Credibility | Exclusive | Reputation

Designation

Get honored title of membership

Associates can use the honored title of membership. The “ASFRC” is an honored title which is accorded to a person’s name viz. Dr. John E. Hall, Ph.D., ASFRC or William Walldroff, M.S., ASFRC.

Career | Credibility | Exclusive | Reputation

Recognition on the Platform

Better visibility and citation

All the Associate members of ASFRC get a badge of "Leading Member of Global Journals" on the Research Community that distinguishes them from others. Additionally, the profile is also partially maintained by our team for better visibility and citation. All associates get a dedicated page on the website with their biography.

Career | Credibility | Reputation

Future Work

Get discounts on the future publications

Associates receive discounts on the future publications with Global Journals up to 60%. Through our recommendation programs, members also receive discounts on publications made with OARS affiliated organizations.

Career Financial

GJ Internal Account

Unlimited forward of Emails

Associates get secure and fast GJ work emails with unlimited forward of emails that they may use them as their primary email. For example, john [AT] globaljournals [DOT] org.

Career Credibility Reputation

Premium Tools

Access to all the premium tools

To take future researches to the zenith, fellows receive access to almost all the premium tools that Global Journals have to offer along with the partnership with some of the best marketing leading tools out there.

Financial

Conferences & Events

Organize seminar/conference

Associates are authorized to organize symposium/seminar/conference on behalf of Global Journal Incorporation (USA). They can also participate in the same organized by another institution as representative of Global Journal. In both the cases, it is mandatory for him to discuss with us and obtain our consent. Additionally, they get free research conferences (and others) alerts.

Career Credibility Financial

Early Invitations

Early invitations to all the symposiums, seminars, conferences

All associates receive the early invitations to all the symposiums, seminars, conferences and webinars hosted by Global Journals in their subject.

Exclusive

Publishing Articles & Books

Earn 30-40% of sales proceeds

Associates can publish articles (limited) without any fees. Also, they can earn up to 30-40% of sales proceeds from the sale of reference/review books/literature/publishing of research paper.

Exclusive Financial

Reviewers

Get a remuneration of 15% of author fees

Associate members are eligible to join as a paid peer reviewer at Global Journals Incorporation (USA) and can get a remuneration of 15% of author fees, taken from the author of a respective paper.

Financial

And Much More

Get access to scientific museums and observatories across the globe

All members get access to 2 selected scientific museums and observatories across the globe. All researches published with Global Journals will be kept under deep archival facilities across regions for future protections and disaster recovery. They get 5 GB free secure cloud access for storing research files.

Associate	Fellow	Research Group	Basic
$4800 **lifetime designation**	$6800 **lifetime designation**	$12500.00 **organizational**	APC **per article**
Certificate, LoR and Momento 2 discounted publishing/year **Gradation** of Research 10 research contacts/day 1 **GB** Cloud Storage **GJ** Community Access	**Certificate,** LoR and Momento **Unlimited** discounted publishing/year **Gradation** of Research **Unlimited** research contacts/day 5 **GB** Cloud Storage **Online Presense** Assistance **GJ** Community Access	**Certificates,** LoRs and Momentos **Unlimited** free publishing/year **Gradation** of Research **Unlimited** research contacts/day **Unlimited** Cloud Storage **Online Presense** Assistance **GJ** Community Access	**GJ** Community Access

Preferred Author Guidelines

We accept the manuscript submissions in any standard (generic) format.

We typeset manuscripts using advanced typesetting tools like Adobe In Design, CorelDraw, TeXnicCenter, and TeXStudio. We usually recommend authors submit their research using any standard format they are comfortable with, and let Global Journals do the rest.

Alternatively, you can download our basic template from https://globaljournals.org/Template.zip

Authors should submit their complete paper/article, including text illustrations, graphics, conclusions, artwork, and tables. Authors who are not able to submit manuscript using the form above can email the manuscript department at submit@globaljournals.org or get in touch with chiefeditor@globaljournals.org if they wish to send the abstract before submission.

Before and during Submission

Authors must ensure the information provided during the submission of a paper is authentic. Please go through the following checklist before submitting:

1. Authors must go through the complete author guideline and understand and *agree to Global Journals' ethics and code of conduct,* along with author responsibilities.
2. Authors must accept the privacy policy, terms, and conditions of Global Journals.
3. Ensure corresponding author's email address and postal address are accurate and reachable.
4. Manuscript to be submitted must include keywords, an abstract, a paper title, co-author(s') names and details (email address, name, phone number, and institution), figures and illustrations in vector format including appropriate captions, tables, including titles and footnotes, a conclusion, results, acknowledgments and references.
5. Authors should submit paper in a ZIP archive if any supplementary files are required along with the paper.
6. Proper permissions must be acquired for the use of any copyrighted material.
7. Manuscript submitted *must not have been submitted or published elsewhere* and all authors must be aware of the submission.

Declaration of Conflicts of Interest

It is required for authors to declare all financial, institutional, and personal relationships with other individuals and organizations that could influence (bias) their research.

Policy on Plagiarism

Plagiarism is not acceptable in Global Journals submissions at all.

Plagiarized content will not be considered for publication. We reserve the right to inform authors' institutions about plagiarism detected either before or after publication. If plagiarism is identified, we will follow COPE guidelines:

Authors are solely responsible for all the plagiarism that is found. The author must not fabricate, falsify or plagiarize existing research data. The following, if copied, will be considered plagiarism:

- Words (language)
- Ideas
- Findings
- Writings
- Diagrams
- Graphs
- Illustrations
- Lectures

- Printed material
- Graphic representations
- Computer programs
- Electronic material
- Any other original work

Authorship Policies

Global Journals follows the definition of authorship set up by the Open Association of Research Society, USA. According to its guidelines, authorship criteria must be based on:

1. Substantial contributions to the conception and acquisition of data, analysis, and interpretation of findings.
2. Drafting the paper and revising it critically regarding important academic content.
3. Final approval of the version of the paper to be published.

Changes in Authorship

The corresponding author should mention the name and complete details of all co-authors during submission and in manuscript. We support addition, rearrangement, manipulation, and deletions in authors list till the early view publication of the journal. We expect that corresponding author will notify all co-authors of submission. We follow COPE guidelines for changes in authorship.

Copyright

During submission of the manuscript, the author is confirming an exclusive license agreement with Global Journals which gives Global Journals the authority to reproduce, reuse, and republish authors' research. We also believe in flexible copyright terms where copyright may remain with authors/employers/institutions as well. Contact your editor after acceptance to choose your copyright policy. You may follow this form for copyright transfers.

Appealing Decisions

Unless specified in the notification, the Editorial Board's decision on publication of the paper is final and cannot be appealed before making the major change in the manuscript.

Acknowledgments

Contributors to the research other than authors credited should be mentioned in Acknowledgments. The source of funding for the research can be included. Suppliers of resources may be mentioned along with their addresses.

Declaration of funding sources

Global Journals is in partnership with various universities, laboratories, and other institutions worldwide in the research domain. Authors are requested to disclose their source of funding during every stage of their research, such as making analysis, performing laboratory operations, computing data, and using institutional resources, from writing an article to its submission. This will also help authors to get reimbursements by requesting an open access publication letter from Global Journals and submitting to the respective funding source.

Preparing your Manuscript

Authors can submit papers and articles in an acceptable file format: MS Word (doc, docx), LaTeX (.tex, .zip or .rar including all of your files), Adobe PDF (.pdf), rich text format (.rtf), simple text document (.txt), Open Document Text (.odt), and Apple Pages (.pages). Our professional layout editors will format the entire paper according to our official guidelines. This is one of the highlights of publishing with Global Journals—authors should not be concerned about the formatting of their paper. Global Journals accepts articles and manuscripts in every major language, be it Spanish, Chinese, Japanese, Portuguese, Russian, French, German, Dutch, Italian, Greek, or any other national language, but the title, subtitle, and abstract should be in English. This will facilitate indexing and the pre-peer review process.

The following is the official style and template developed for publication of a research paper. Authors are not required to follow this style during the submission of the paper. It is just for reference purposes.

Manuscript Style Instruction (Optional)

- Microsoft Word Document Setting Instructions.
- Font type of all text should be Swis721 Lt BT.
- Page size: 8.27" x 11'", left margin: 0.65, right margin: 0.65, bottom margin: 0.75.
- Paper title should be in one column of font size 24.
- Author name in font size of 11 in one column.
- Abstract: font size 9 with the word "Abstract" in bold italics.
- Main text: font size 10 with two justified columns.
- Two columns with equal column width of 3.38 and spacing of 0.2.
- First character must be three lines drop-capped.
- The paragraph before spacing of 1 pt and after of 0 pt.
- Line spacing of 1 pt.
- Large images must be in one column.
- The names of first main headings (Heading 1) must be in Roman font, capital letters, and font size of 10.
- The names of second main headings (Heading 2) must not include numbers and must be in italics with a font size of 10.

Structure and Format of Manuscript

The recommended size of an original research paper is under 15,000 words and review papers under 7,000 words. Research articles should be less than 10,000 words. Research papers are usually longer than review papers. Review papers are reports of significant research (typically less than 7,000 words, including tables, figures, and references)

A research paper must include:

a) A title which should be relevant to the theme of the paper.
b) A summary, known as an abstract (less than 150 words), containing the major results and conclusions.
c) Up to 10 keywords that precisely identify the paper's subject, purpose, and focus.
d) An introduction, giving fundamental background objectives.
e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition, sources of information must be given, and numerical methods must be specified by reference.
f) Results which should be presented concisely by well-designed tables and figures.
g) Suitable statistical data should also be given.
h) All data must have been gathered with attention to numerical detail in the planning stage.

Design has been recognized to be essential to experiments for a considerable time, and the editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned unrefereed.

i) Discussion should cover implications and consequences and not just recapitulate the results; conclusions should also be summarized.
j) There should be brief acknowledgments.
k) There ought to be references in the conventional format. Global Journals recommends APA format.

Authors should carefully consider the preparation of papers to ensure that they communicate effectively. Papers are much more likely to be accepted if they are carefully designed and laid out, contain few or no errors, are summarizing, and follow instructions. They will also be published with much fewer delays than those that require much technical and editorial correction.

The Editorial Board reserves the right to make literary corrections and suggestions to improve brevity.

Format Structure

It is necessary that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.

All manuscripts submitted to Global Journals should include:

Title

The title page must carry an informative title that reflects the content, a running title (less than 45 characters together with spaces), names of the authors and co-authors, and the place(s) where the work was carried out.

Author details

The full postal address of any related author(s) must be specified.

Abstract

The abstract is the foundation of the research paper. It should be clear and concise and must contain the objective of the paper and inferences drawn. It is advised to not include big mathematical equations or complicated jargon.

Many researchers searching for information online will use search engines such as Google, Yahoo or others. By optimizing your paper for search engines, you will amplify the chance of someone finding it. In turn, this will make it more likely to be viewed and cited in further works. Global Journals has compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

Keywords

A major lynchpin of research work for the writing of research papers is the keyword search, which one will employ to find both library and internet resources. Up to eleven keywords or very brief phrases have to be given to help data retrieval, mining, and indexing.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy: planning of a list of possible keywords and phrases to try.

Choice of the main keywords is the first tool of writing a research paper. Research paper writing is an art. Keyword search should be as strategic as possible.

One should start brainstorming lists of potential keywords before even beginning searching. Think about the most important concepts related to research work. Ask, "What words would a source have to include to be truly valuable in a research paper?" Then consider synonyms for the important words.

It may take the discovery of only one important paper to steer in the right keyword direction because, in most databases, the keywords under which a research paper is abstracted are listed with the paper.

Numerical Methods

Numerical methods used should be transparent and, where appropriate, supported by references.

Abbreviations

Authors must list all the abbreviations used in the paper at the end of the paper or in a separate table before using them.

Formulas and equations

Authors are advised to submit any mathematical equation using either MathJax, KaTeX, or LaTeX, or in a very high-quality image.

Tables, Figures, and Figure Legends

Tables: Tables should be cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g., Table 4, a self-explanatory caption, and be on a separate sheet. Authors must submit tables in an editable format and not as images. References to these tables (if any) must be mentioned accurately.

Figures

Figures are supposed to be submitted as separate files. Always include a citation in the text for each figure using Arabic numbers, e.g., Fig. 4. Artwork must be submitted online in vector electronic form or by emailing it.

Preparation of Eletronic Figures for Publication

Although low-quality images are sufficient for review purposes, print publication requires high-quality images to prevent the final product being blurred or fuzzy. Submit (possibly by e-mail) EPS (line art) or TIFF (halftone/ photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Avoid using pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings). Please give the data for figures in black and white or submit a Color Work Agreement form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

For scanned images, the scanning resolution at final image size ought to be as follows to ensure good reproduction: line art: >650 dpi; halftones (including gel photographs): >350 dpi; figures containing both halftone and line images: >650 dpi.

Color charges: Authors are advised to pay the full cost for the reproduction of their color artwork. Hence, please note that if there is color artwork in your manuscript when it is accepted for publication, we would require you to complete and return a Color Work Agreement form before your paper can be published. Also, you can email your editor to remove the color fee after acceptance of the paper.

Tips for Writing a Good Quality Science Frontier Research Paper

Techniques for writing a good quality Science Frontier Research paper:

1. Choosing the topic: In most cases, the topic is selected by the interests of the author, but it can also be suggested by the guides. You can have several topics, and then judge which you are most comfortable with. This may be done by asking several questions of yourself, like "Will I be able to carry out a search in this area? Will I find all necessary resources to accomplish the search? Will I be able to find all information in this field area?" If the answer to this type of question is "yes," then you ought to choose that topic. In most cases, you may have to conduct surveys and visit several places. Also, you might have to do a lot of work to find all the rises and falls of the various data on that subject. Sometimes, detailed information plays a vital role, instead of short information. Evaluators are human: The first thing to remember is that evaluators are also human beings. They are not only meant for rejecting a paper. They are here to evaluate your paper. So present your best aspect.

2. Think like evaluators: If you are in confusion or getting demotivated because your paper may not be accepted by the evaluators, then think, and try to evaluate your paper like an evaluator. Try to understand what an evaluator wants in your research paper, and you will automatically have your answer. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

3. Ask your guides: If you are having any difficulty with your research, then do not hesitate to share your difficulty with your guide (if you have one). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work, then ask your supervisor to help you with an alternative. He or she might also provide you with a list of essential readings.

4. Use of computer is recommended: As you are doing research in the field of science frontier then this point is quite obvious. Use right software: Always use good quality software packages. If you are not capable of judging good software, then you can lose the quality of your paper unknowingly. There are various programs available to help you which you can get through the internet.

5. Use the internet for help: An excellent start for your paper is using Google. It is a wondrous search engine, where you can have your doubts resolved. You may also read some answers for the frequent question of how to write your research paper or find a model research paper. You can download books from the internet. If you have all the required books, place importance on reading, selecting, and analyzing the specified information. Then sketch out your research paper. Use big pictures: You may use encyclopedias like Wikipedia to get pictures with the best resolution. At Global Journals, you should strictly follow here.

6. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right? It is a good habit which helps to not lose your continuity. You should always use bookmarks while searching on the internet also, which will make your search easier.

7. Revise what you wrote: When you write anything, always read it, summarize it, and then finalize it.

8. Make every effort: Make every effort to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in the introduction—what is the need for a particular research paper. Polish your work with good writing skills and always give an evaluator what he wants. Make backups: When you are going to do any important thing like making a research paper, you should always have backup copies of it either on your computer or on paper. This protects you from losing any portion of your important data.

9. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several unnecessary diagrams will degrade the quality of your paper by creating a hodgepodge. So always try to include diagrams which were made by you to improve the readability of your paper. Use of direct quotes: When you do research relevant to literature, history, or current affairs, then use of quotes becomes essential, but if the study is relevant to science, use of quotes is not preferable.

10. Use proper verb tense: Use proper verb tenses in your paper. Use past tense to present those events that have happened. Use present tense to indicate events that are going on. Use future tense to indicate events that will happen in the future. Use of wrong tenses will confuse the evaluator. Avoid sentences that are incomplete.

11. Pick a good study spot: Always try to pick a spot for your research which is quiet. Not every spot is good for studying.

12. Know what you know: Always try to know what you know by making objectives, otherwise you will be confused and unable to achieve your target.

13. Use good grammar: Always use good grammar and words that will have a positive impact on the evaluator; use of good vocabulary does not mean using tough words which the evaluator has to find in a dictionary. Do not fragment sentences. Eliminate one-word sentences. Do not ever use a big word when a smaller one would suffice.

Verbs have to be in agreement with their subjects. In a research paper, do not start sentences with conjunctions or finish them with prepositions. When writing formally, it is advisable to never split an infinitive because someone will (wrongly) complain. Avoid clichés like a disease. Always shun irritating alliteration. Use language which is simple and straightforward. Put together a neat summary.

14. Arrangement of information: Each section of the main body should start with an opening sentence, and there should be a changeover at the end of the section. Give only valid and powerful arguments for your topic. You may also maintain your arguments with records.

15. Never start at the last minute: Always allow enough time for research work. Leaving everything to the last minute will degrade your paper and spoil your work.

16. Multitasking in research is not good: Doing several things at the same time is a bad habit in the case of research activity. Research is an area where everything has a particular time slot. Divide your research work into parts, and do a particular part in a particular time slot.

17. Never copy others' work: Never copy others' work and give it your name because if the evaluator has seen it anywhere, you will be in trouble. Take proper rest and food: No matter how many hours you spend on your research activity, if you are not taking care of your health, then all your efforts will have been in vain. For quality research, take proper rest and food.

18. Go to seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

19. Refresh your mind after intervals: Try to give your mind a rest by listening to soft music or sleeping in intervals. This will also improve your memory. Acquire colleagues: Always try to acquire colleagues. No matter how sharp you are, if you acquire colleagues, they can give you ideas which will be helpful to your research.

20. Think technically: Always think technically. If anything happens, search for its reasons, benefits, and demerits. Think and then print: When you go to print your paper, check that tables are not split, headings are not detached from their descriptions, and page sequence is maintained.

21. Adding unnecessary information: Do not add unnecessary information like "I have used MS Excel to draw graphs." Irrelevant and inappropriate material is superfluous. Foreign terminology and phrases are not apropos. One should never take a broad view. Analogy is like feathers on a snake. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Never oversimplify: When adding material to your research paper, never go for oversimplification; this will definitely irritate the evaluator. Be specific. Never use rhythmic redundancies. Contractions shouldn't be used in a research paper. Comparisons are as terrible as clichés. Give up ampersands, abbreviations, and so on. Remove commas that are not necessary. Parenthetical words should be between brackets or commas. Understatement is always the best way to put forward earth-shaking thoughts. Give a detailed literary review.

22. Report concluded results: Use concluded results. From raw data, filter the results, and then conclude your studies based on measurements and observations taken. An appropriate number of decimal places should be used. Parenthetical remarks are prohibited here. Proofread carefully at the final stage. At the end, give an outline to your arguments. Spot perspectives of further study of the subject. Justify your conclusion at the bottom sufficiently, which will probably include examples.

23. Upon conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print for the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects of your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form which is presented in the guidelines using the template.
- Please note the criteria peer reviewers will use for grading the final paper.

Final points:

One purpose of organizing a research paper is to let people interpret your efforts selectively. The journal requires the following sections, submitted in the order listed, with each section starting on a new page:

The introduction: This will be compiled from reference matter and reflect the design processes or outline of basis that directed you to make a study. As you carry out the process of study, the method and process section will be constructed like that. The results segment will show related statistics in nearly sequential order and direct reviewers to similar intellectual paths throughout the data that you gathered to carry out your study.

The discussion section:

This will provide understanding of the data and projections as to the implications of the results. The use of good quality references throughout the paper will give the effort trustworthiness by representing an alertness to prior workings.

Writing a research paper is not an easy job, no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record-keeping are the only means to make straightforward progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear: Adhere to recommended page limits.

Mistakes to avoid:

- Insertion of a title at the foot of a page with subsequent text on the next page.
- Separating a table, chart, or figure—confine each to a single page.
- Submitting a manuscript with pages out of sequence.
- In every section of your document, use standard writing style, including articles ("a" and "the").
- Keep paying attention to the topic of the paper.
- Use paragraphs to split each significant point (excluding the abstract).
- Align the primary line of each section.
- Present your points in sound order.
- Use present tense to report well-accepted matters.
- Use past tense to describe specific results.
- Do not use familiar wording; don't address the reviewer directly. Don't use slang or superlatives.
- Avoid use of extra pictures—include only those figures essential to presenting results.

Title page:

Choose a revealing title. It should be short and include the name(s) and address(es) of all authors. It should not have acronyms or abbreviations or exceed two printed lines.

Abstract: This summary should be two hundred words or less. It should clearly and briefly explain the key findings reported in the manuscript and must have precise statistics. It should not have acronyms or abbreviations. It should be logical in itself. Do not cite references at this point.

An abstract is a brief, distinct paragraph summary of finished work or work in development. In a minute or less, a reviewer can be taught the foundation behind the study, common approaches to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Use comprehensive sentences, and do not sacrifice readability for brevity; you can maintain it succinctly by phrasing sentences so that they provide more than a lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study with the subsequent elements in any summary. Try to limit the initial two items to no more than one line each.

Reason for writing the article—theory, overall issue, purpose.

- Fundamental goal.
- To-the-point depiction of the research.
- Consequences, including definite statistics—if the consequences are quantitative in nature, account for this; results of any numerical analysis should be reported. Significant conclusions or questions that emerge from the research.

Approach:

- o Single section and succinct.
- o An outline of the job done is always written in past tense.
- o Concentrate on shortening results—limit background information to a verdict or two.
- o Exact spelling, clarity of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else.

Introduction:

The introduction should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable of comprehending and calculating the purpose of your study without having to refer to other works. The basis for the study should be offered. Give the most important references, but avoid making a comprehensive appraisal of the topic. Describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will give no attention to your results. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here.

The following approach can create a valuable beginning:

- Explain the value (significance) of the study.
- Defend the model—why did you employ this particular system or method? What is its compensation? Remark upon its appropriateness from an abstract point of view as well as pointing out sensible reasons for using it.
- Present a justification. State your particular theory(-ies) or aim(s), and describe the logic that led you to choose them.
- Briefly explain the study's tentative purpose and how it meets the declared objectives.

Approach:

Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done. Sort out your thoughts; manufacture one key point for every section. If you make the four points listed above, you will need at least four paragraphs. Present surrounding information only when it is necessary to support a situation. The reviewer does not desire to read everything you know about a topic. Shape the theory specifically—do not take a broad view.

As always, give awareness to spelling, simplicity, and correctness of sentences and phrases.

Procedures (methods and materials):

This part is supposed to be the easiest to carve if you have good skills. A soundly written procedures segment allows a capable scientist to replicate your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order, but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt to give the least amount of information that would permit another capable scientist to replicate your outcome, but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section.

When a technique is used that has been well-described in another section, mention the specific item describing the way, but draw the basic principle while stating the situation. The purpose is to show all particular resources and broad procedures so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step-by-step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

Materials may be reported in part of a section or else they may be recognized along with your measures.

Methods:

- Report the method and not the particulars of each process that engaged the same methodology.
- Describe the method entirely.
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures.
- Simplify—detail how procedures were completed, not how they were performed on a particular day.
- If well-known procedures were used, account for the procedure by name, possibly with a reference, and that's all.

Approach:

It is embarrassing to use vigorous voice when documenting methods without using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result, when writing up the methods, most authors use third person passive voice.

Use standard style in this and every other part of the paper—avoid familiar lists, and use full sentences.

What to keep away from:

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings—save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part as entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Use statistics and tables, if suitable, to present consequences most efficiently.

You must clearly differentiate material which would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matters should not be submitted at all except if requested by the instructor.

Content:

- Sum up your conclusions in text and demonstrate them, if suitable, with figures and tables.
- In the manuscript, explain each of your consequences, and point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation of an exacting study.
- Explain results of control experiments and give remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or manuscript.

What to stay away from:

- Do not discuss or infer your outcome, report surrounding information, or try to explain anything.
- Do not include raw data or intermediate calculations in a research manuscript.
- Do not present similar data more than once.
- A manuscript should complement any figures or tables, not duplicate information.
- Never confuse figures with tables—there is a difference.

Approach:

As always, use past tense when you submit your results, and put the whole thing in a reasonable order.

Put figures and tables, appropriately numbered, in order at the end of the report.

If you desire, you may place your figures and tables properly within the text of your results section.

Figures and tables:

If you put figures and tables at the end of some details, make certain that they are visibly distinguished from any attached appendix materials, such as raw facts. Whatever the position, each table must be titled, numbered one after the other, and include a heading. All figures and tables must be divided from the text.

Discussion:

The discussion is expected to be the trickiest segment to write. A lot of papers submitted to the journal are discarded based on problems with the discussion. There is no rule for how long an argument should be.

Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implications of the study. The purpose here is to offer an understanding of your results and support all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of results should be fully described.

Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact, you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved the prospect, and let it drop at that. Make a decision as to whether each premise is supported or discarded or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."

Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work.

- You may propose future guidelines, such as how an experiment might be personalized to accomplish a new idea.
- Give details of all of your remarks as much as possible, focusing on mechanisms.
- Make a decision as to whether the tentative design sufficiently addressed the theory and whether or not it was correctly restricted. Try to present substitute explanations if they are sensible alternatives.
- One piece of research will not counter an overall question, so maintain the large picture in mind. Where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

When you refer to information, differentiate data generated by your own studies from other available information. Present work done by specific persons (including you) in past tense.

Describe generally acknowledged facts and main beliefs in present tense.

The Administration Rules

Administration Rules to Be Strictly Followed before Submitting Your Research Paper to Global Journals Inc.

Please read the following rules and regulations carefully before submitting your research paper to Global Journals Inc. to avoid rejection.

Segment draft and final research paper: You have to strictly follow the template of a research paper, failing which your paper may get rejected. You are expected to write each part of the paper wholly on your own. The peer reviewers need to identify your own perspective of the concepts in your own terms. Please do not extract straight from any other source, and do not rephrase someone else's analysis. Do not allow anyone else to proofread your manuscript.

Written material: You may discuss this with your guides and key sources. Do not copy anyone else's paper, even if this is only imitation, otherwise it will be rejected on the grounds of plagiarism, which is illegal. Various methods to avoid plagiarism are strictly applied by us to every paper, and, if found guilty, you may be blacklisted, which could affect your career adversely. To guard yourself and others from possible illegal use, please do not permit anyone to use or even read your paper and file.

CRITERION FOR GRADING A RESEARCH PAPER (COMPILATION) BY GLOBAL JOURNALS

Please note that following table is only a Grading of "Paper Compilation" and not on "Performed/Stated Research" whose grading solely depends on Individual Assigned Peer Reviewer and Editorial Board Member. These can be available only on request and after decision of Paper. This report will be the property of Global Journals.

Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

INDEX

save our planet

Global Journal of Science Frontier Research

Visit us on the Web at www.GlobalJournals.org | www.JournalofScience.org
or email us at helpdesk@globaljournals.org

ISSN 9755896