

A new physics beyond the velocity of light and numerical study on cosmology

Dr. Mahendra Goray

Ph.D.

Title: Investigations on the illusive nature of photon

Supervisor: Prof. A. Ramesh Naidu

Date Of Award: 18 March, 2022

Institute: Pondicherry University, Puducherry, India



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Outline

Past Work (During Ph.D.): (2018-2022)

1. Motivation
2. Methodology
3. Results
4. Conclusion

- 
- A. Rest mass of photon
 - B. Complex momentum
 - C. Hidden energy of photon

Present Work (After Ph.D.): (2022-2024)

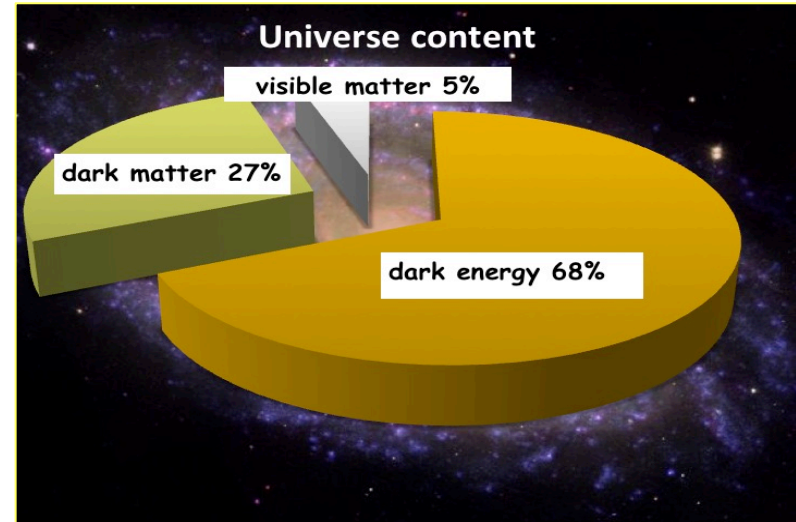
Future Plan (For JINR): (2024 - ...)

1. Motivation

❖ Mystery of dark sector (Dark matter , Dark energy):

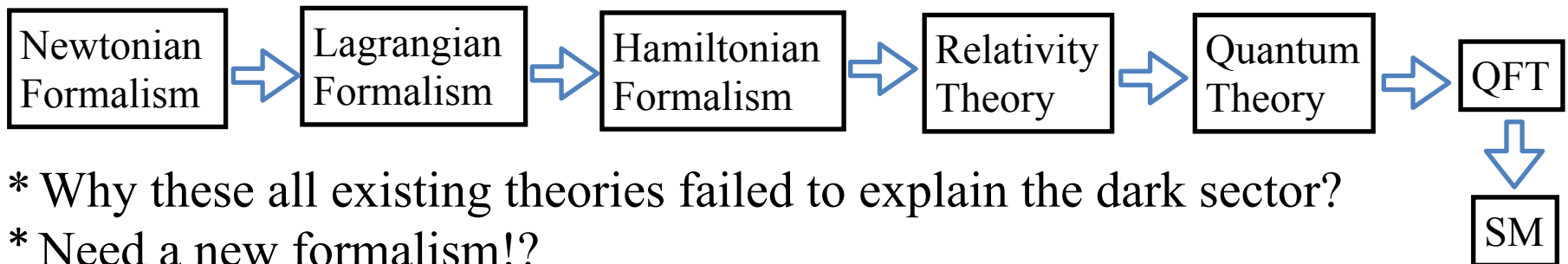
By nature,

- DM is a non-luminous, non-absorbing, non-interacting (or weakly interacting) and electrically neutral matter.
- DE exerts negative, repulsive pressure and accelerates the expansion of the universe.



https://sedsindia.org/blog_darkmatterandenergy.html

Failure of our existing theories:

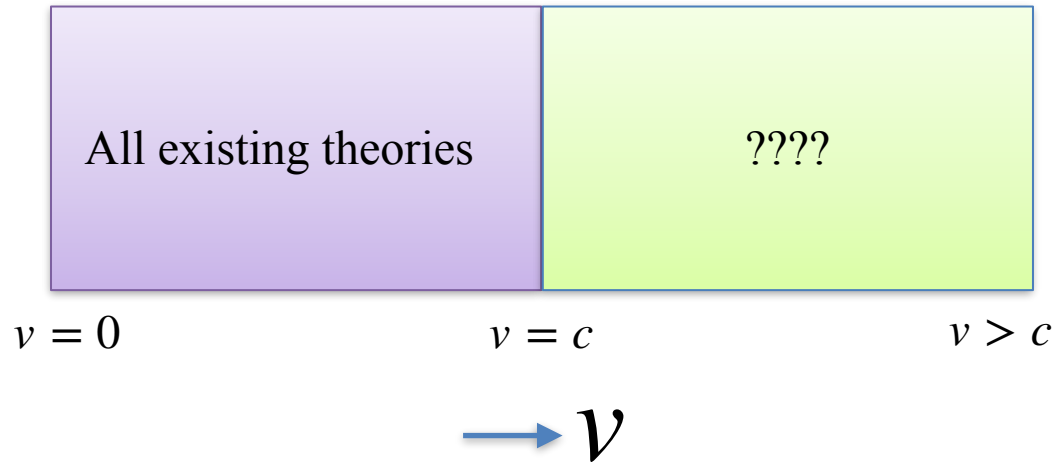


* Why these all existing theories failed to explain the dark sector?

* Need a new formalism!?

1. Motivation

❖ What is the reality beyond the velocity of light?



Key factors

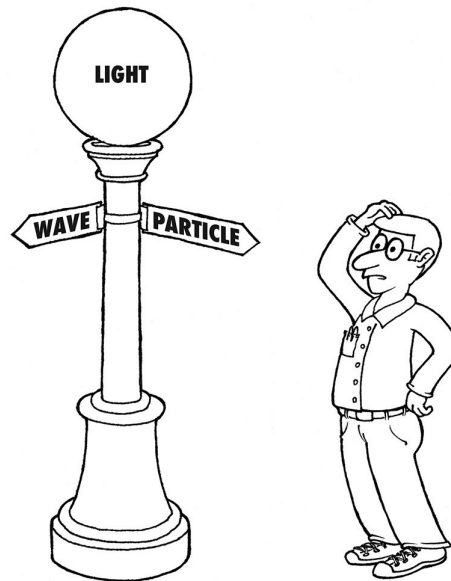
- Our experiences, realisation are regulate by the upper limit of light's velocity.
- May be c is the barrier to unlock the secret of dark sector.

**Probably we need a new formalism which is beyond the velocity of light for mystic phenomena

1. Motivation

❖ Fundamental Questions on photon's nature and rest mass

- Why photon does not carry a fixed rest-mass?
- Why light possess Dual Nature?



2. Methodology

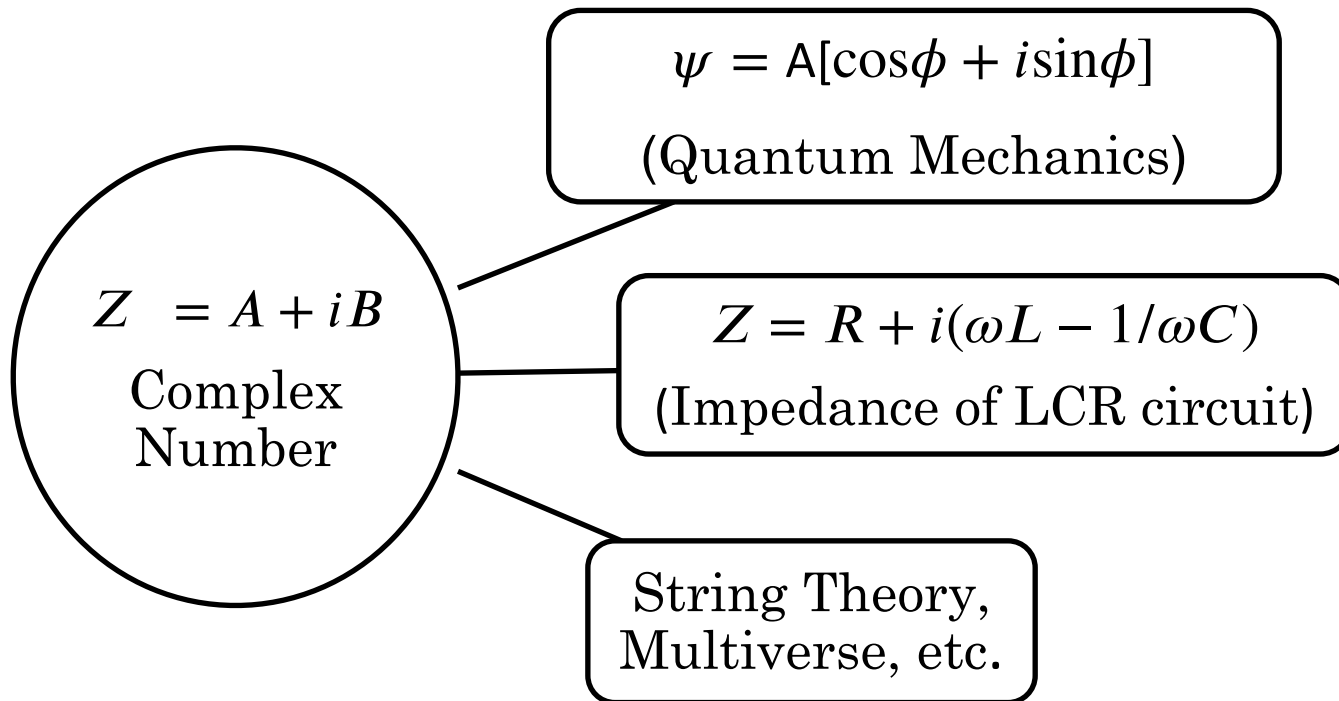
2.1 Significance of the complex number

2.2 Faster than velocity of Light

2.3 The Scalar Curvature

2.1. Significance of the complex number

□ Uses of Complex Number in Physics



[2] A. A. Antonov, "Physical reality and nature of imaginary, complex and hypercomplex numbers," General Mathematics Notes, vol. 35, no. 2, p. 40, 2016.

2.2 Faster than velocity of Light

- ❖ **Opposing Theory:** Causality, Special Theory of Relativity
- ❖ **Supporting Evidences:** Several theoretical and experimental proposals.

2.2 Faster than velocity of Light

Supporting Evidences

$$c = 1/\sqrt{\epsilon_0\mu_0}$$

[Special material which possesses less ϵ_0 or μ_0]

$\epsilon_0 \rightarrow$ vacuum permittivity

$\mu_0 \rightarrow$ vacuum permeability

Several Experiments:

[Laser pulse in an active medium, near Raman gain resonance, in the anomalous dispersion region, etc.]

Scharnhorst Effect :

[If vacuum energy is lowered than the light, then light itself start to move faster than c .]

[3] K. Scharnhorst, "On propagation of light in the vacuum between plates," Physics Letters B, vol. 236, no. 3, pp. 354{359, 1990.

[4] D. Fisher and T. Tajima, "Superluminous laser pulse in an active medium," Physical review letters, vol. 71, no. 26, p. 4338.1993.

2.2 Faster than velocity of Light

□ Photon's matter wave velocity

$$c^2 = c_p c_w$$

$$c_p < c \quad \text{and} \quad c_w > c$$

$c_p \rightarrow$ light velocity as a particle

$c_w \rightarrow$ photon's matter wave velocity

$c \rightarrow$ light velocity in vacuum

[5]. Broglie, Louis de. "XXXV. A tentative theory of light quanta." The London, Edinburgh, and Dublin Philosophical Magazine and Journal of Science 47.278 (1924): 446-458.

2.3 The Scalar Curvature

□ Space-time Ricci Scalar Curvature

$$\mathbf{R} = g^{\mu\nu} R_{\mu\nu}$$

$$g^{\mu\nu} = \frac{C(g_{\mu\nu}) \text{ in } |g|}{|g|}$$

$$|g| = \begin{vmatrix} g_{11} & g_{12} & \cdots & g_{1n} \\ g_{21} & g_{22} & \cdots & g_{2n} \\ \vdots & \vdots & \cdots & \vdots \\ g_{n1} & g_{n2} & \cdots & g_{nn} \end{vmatrix}$$

$R_{\mu\nu} \rightarrow$ Ricci tensor

$g^{\mu\nu} \rightarrow$ Inverse matrix tensor

$\Gamma_{\mu\nu}^{\rho} \rightarrow$ Christoffel symbols of the 2nd kind

$$R_{\mu\nu} = R^{\rho}_{\mu\nu\rho}$$

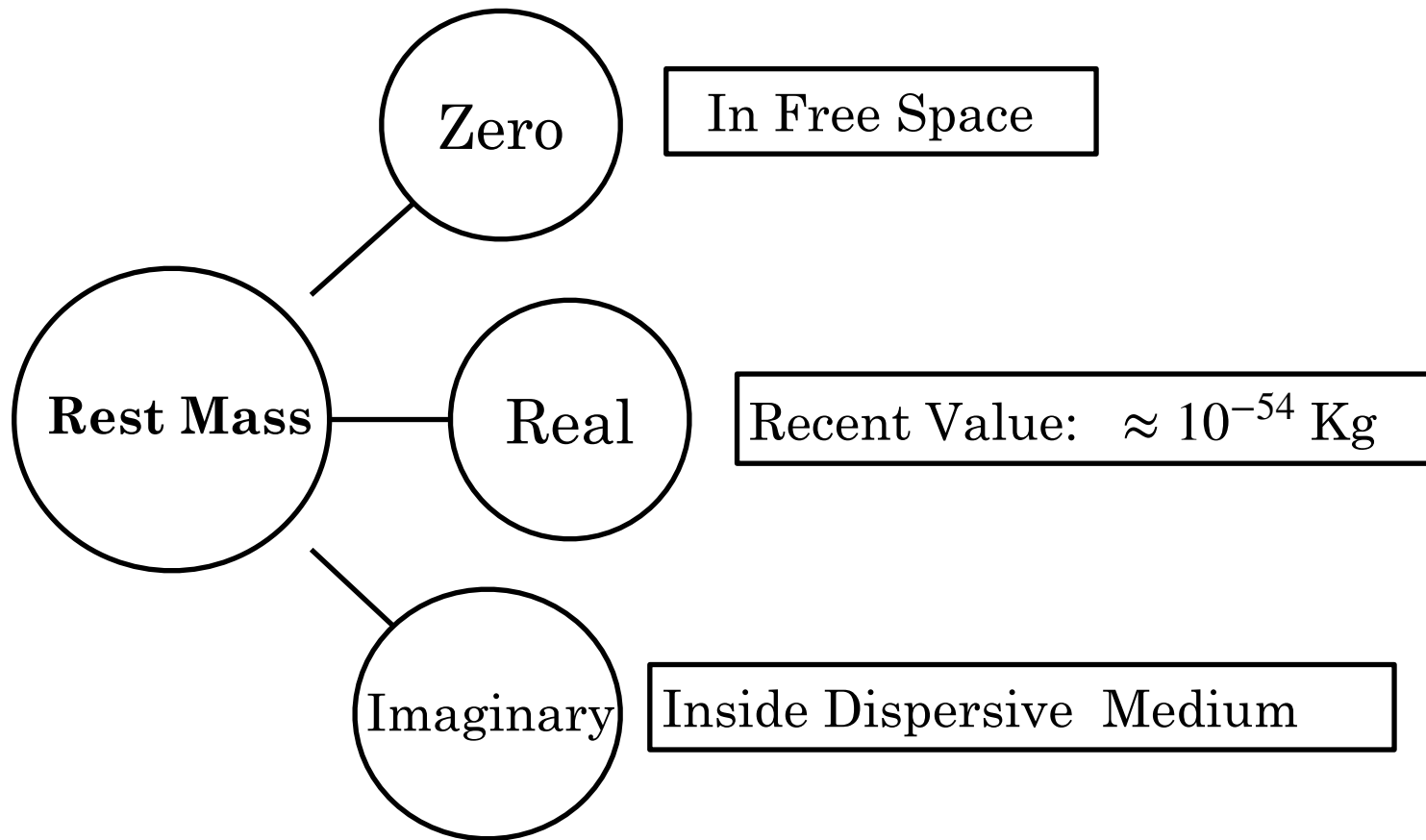
$$= \partial_{\nu}\Gamma_{\mu\rho}^{\rho} - \partial_{\rho}\Gamma_{\mu\nu}^{\rho} + \Gamma_{\mu\rho}^{\alpha}\Gamma_{\alpha\nu}^{\rho} - \Gamma_{\mu\nu}^{\alpha}\Gamma_{\alpha\rho}^{\rho}$$

3. Results

A. Rest Mass of Photon

A.1 Introduction

□ Rest mass of photon in different media



[7]. Lakes, Roderic. "Experimental limits on the photon mass and cosmic magnetic vector potential." physical review letters vol-80 no-9, p-1826. (1998)

[8]. Tan, C. Z. "Imaginary rest mass of a photon in a dispersive medium." Optik , vol-126, no-24, p-5304-5306, (2015) .

A.2 Computation and Results

$$\mathbf{m} = m(\lambda) \sqrt{1 - \frac{v_{ph}^2}{c^2}} + im'(\lambda_p) I^n \sqrt{E_i^2 - 1}$$

$$\mathbf{m} = m_1 + m_2 \quad \text{and} \quad m_2 = m'_0 I^n$$

$$m'_0 = im'(\lambda_p) \sqrt{E_i^2 - 1} \quad \text{where} \quad E_i = E_p/E_g > 1$$

If $I^n = 0$ then $\mathbf{m} = m_1$; a real number!

And light in the wave forms $\mathbf{m} = 0$

A.3 Conclusion

- ❖ Photon does not possess any fixed rest mass because of its illusive mass
- ❖ Mathematically Illusive mass is a complex number
- ❖ Illusive mass depends upon the scalar curvature of the surface of matter

Publication

*The most downloaded article in this journal



Contents lists available at [ScienceDirect](#)

Results in Physics

journal homepage: www.elsevier.com/locate/rinp



Rest mass of photon on the surface of matter

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ARTICLE INFO

Keywords:
 Illusive mass
 Morphing
 Photon rest-mass
 Space-time curvature
 Wavelength dependence
 Wave-particle duality

ABSTRACT

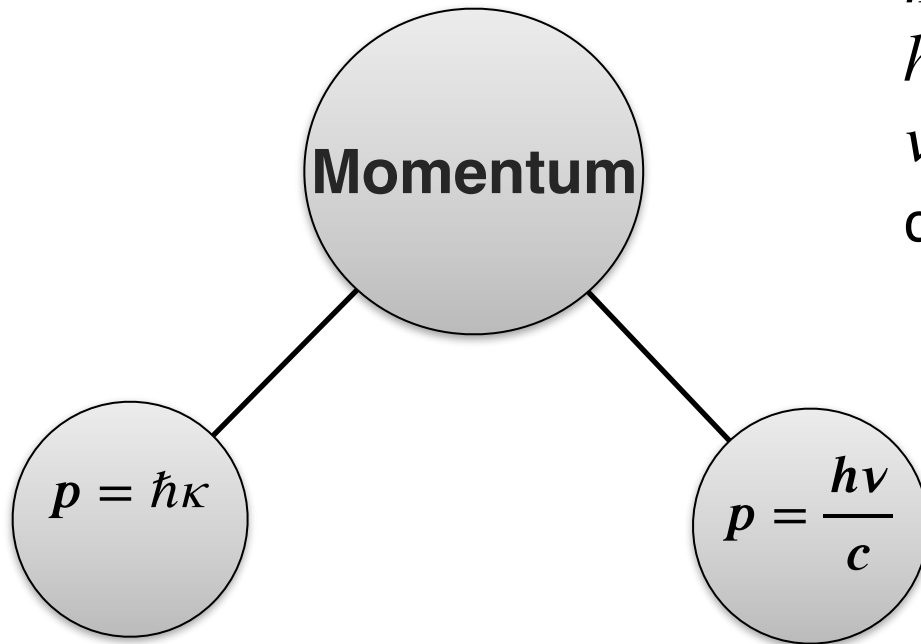
The behavior of a photon is strange. It possesses both wave nature and particle nature. Some experiments show both behaviors of photons can exist simultaneously, while some other experiment state that both properties do not co-exists simultaneously. According to electromagnetic theory, the rest mass of photon in free space is zero and also photon has non-zero rest mass, as well as wavelength-dependent. The very recent experiment revealed its non-zero value as 10^{-54} kg (5.610×10^{-25} MeV c^{-2}). Even experimental results concluded that within matter (dispersive) the photon shows its imaginary rest mass. We have no exact answer as to why photon incarnates itself with versatile mass. Here we try to theoretically investigate about the rest mass of a photon. When it touches the surface of matter, it makes illusion and mathematically the rest mass is a complex number. Rest mass of photon depends upon scalar curvature of the surface of matter and wavelength of the photon. Photon itself reveals illusion posing with mass because of its dual nature. We have investigated the wave-particle duality of light, coexistence of wave and particle nature through morphing due to pliable character of light wave. Our theoretical work about the photon's *illusive mass* will have to be experimentally verified and it might open plausible new applications in the secure communication of information.

3. Results

B. Complex Momentum of Photon

B.1 Introduction

□ Momentum of photon without mass



$\kappa \rightarrow$ wave vector

$h \rightarrow$ planck constant

$\nu \rightarrow$ frequency of light

$c \rightarrow$ velocity of light

B.2 Computation and Results


$$\mathbf{p} = \gamma_p \left[m_0(\lambda) c_p + i m'(\lambda_p) I^n \sqrt{c^2 - c_p^2} \right]$$

$$= \gamma_p \left[m_0(\lambda) c_p + i m'(\lambda_p) I^n c \sqrt{1 - \frac{c_p^2}{c^2}} \right]$$

B.3 Conclusion

- ❖ The linear momentum of photon is a complex number when light (in particle form) comes in contact with the matter.
- ❖ In free space, photon shows its usual momentum equation.
- ❖ Linear momentum of photon depends upon the scalar curvature of the surface of matter.

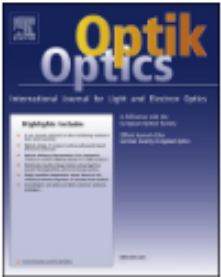
Publication



Contents lists available at [ScienceDirect](#)

Optik

journal homepage: www.elsevier.com/locate/ijleo



Original research article

A novel way of understanding the linear momentum of photon

Mahendra Goray, Ramesh Naidu Annavarapu


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ARTICLE INFO

Keywords:
 Complex momentum
 Illusive mass
 Photon's momentum
 Photon's rest mass
 Wave-particle duality

ABSTRACT

Photon shows *mass posing* i.e. it manifests itself into various forms of rest mass; non-zero rest mass, wavelength-dependent real mass and imaginary rest mass within the dispersive medium. Photon reveals different forms of rest mass due to its *illusive mass* and the dual nature of photons is the cause of *illusive mass*. Here we have calculated the momentum of the photon on the surface of matter using *illusive mass* that implies a complex number. At certain condition (absence of matter) photon shows its linear momentum.

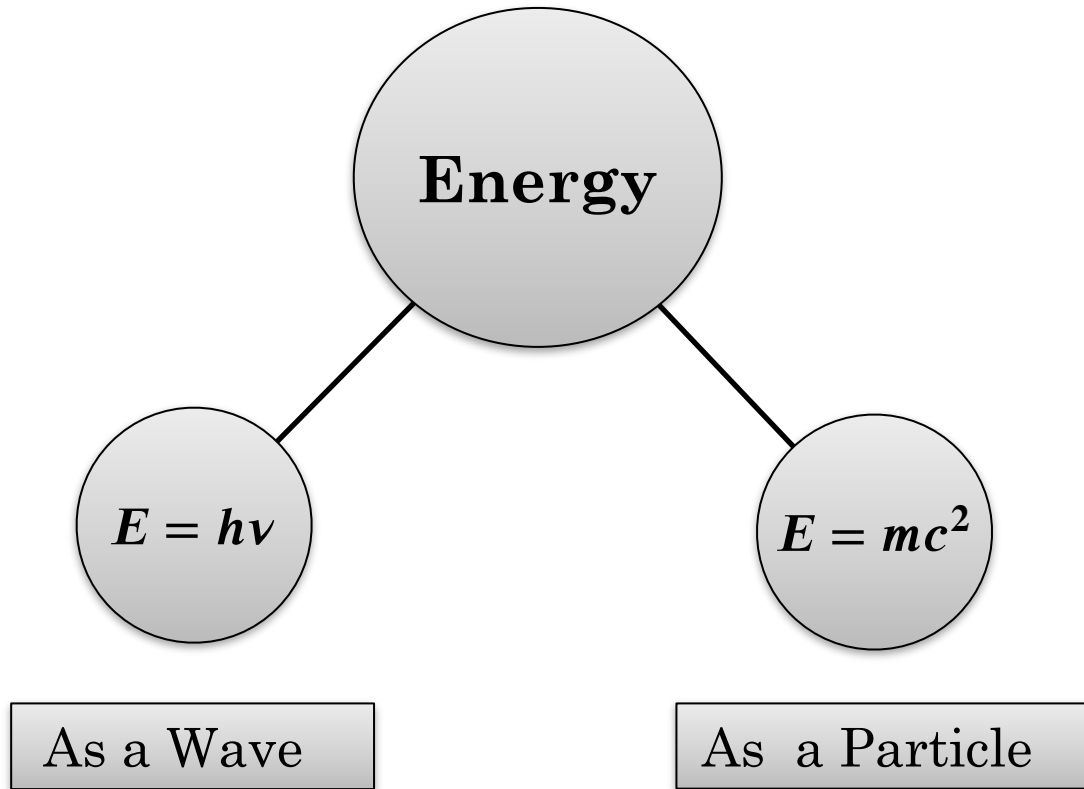


3. Results

Hidden Energy of Photon

C.1 Introduction

□ Energy of photon



$h \rightarrow$ planck constant

$\nu \rightarrow$ frequency of light

$c \rightarrow$ velocity of light

$m \rightarrow$ mass of photon

[10] R. Ionicioiu and D. R. Terno, "Proposal for a quantum delayed-choice experiment," Physical Review Letters, vol. 107, no. 23, p. 230406, 2011.

[11] L. de Broglie, "Doctor thesis, 1925," English translation by A. Kracklauer, 2004.

C.2 Computation and Results

□ Hidden energy of photon

$$\varepsilon = \frac{mc^2}{\sqrt{1 - \frac{c_p^2}{c^2}}}$$

$$= m(\lambda)c^2 + i m'(\lambda_p) I^n \sqrt{E_i^2 - 1} \left(c^2 + \frac{c_p^2}{2} \right)$$

$$= m(\lambda)c^2 + i m'(\lambda_p) I^n \sqrt{E_i^2 - 1} c_y^2 \left[\text{where, } c_y^2 = c^2 + \frac{c_p^2}{2} \right]$$

C.3 Conclusion

- ❖ Physically photon hides its energy by itself due to its illusive mass.
- ❖ Mathematically, hidden energy is a complex number.
- ❖ Hidden energy depends upon the scalar curvature of the surface of matter.

Publication

Optik - International Journal for Light and Electron Optics 248 (2021) 168076



Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Optik - International Journal for Light and Electron Optics

journal homepage: www.elsevier.com/locate/ijleo

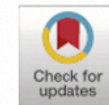


Original research article

The energy of a photon, on the geometrical perspective

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ARTICLE INFO

Keywords:

Geometrical energy-form
Illusive mass
Morphing
Photon's energy
Rest mass
Wave-particle duality

ABSTRACT

The complex number in quantum mechanics and Riemannian geometry in relativity theory is the basic framework for understanding the physical reality on small and large scales. Special theory of relativity has been produced the famous mass-energy equivalence relation. This article investigates photon's energy theoretically based on photon's rest mass. And represents the energy equation in terms of a complex number and constitutes by the surface's geometry. Photon possesses both wave nature and particle nature; due to this reason, photon reveals its various mass forms as zero rest mass, as real and imaginary rest mass. Indeed, the rest mass and energy of the photon is a complex number on the surface of the matter. The photon's energy depends upon the scalar curvature of the surface of the matter as well as on the wavelength of the photon. In reality, the photon itself reveals the illusion posing with its rest mass, and alongside it hides itself energy. And this energy equation followed all energy forms of the photon with certain norms.

Publication

Reports in Advances of Physical Sciences

Vol. 4, No. 4 (2020) 2050009 (9 pages)

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An Alternative Approach of the Dark Energy Beyond the Equation of State

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Received 18 February 2021

Accepted 8 June 2021

Published 14 August 2021

Several concepts have been proposed to explain the mystic nature of dark energy and the accelerating universe. Among them, geometrical dark energy is one such class that is based on the scalar curvature, and another type is based upon the “equation of state”. Also, another model suggests that neutrino rest-mass interaction is responsible for the “equation of state” with constant energy density. In this work, we have investigated another dark energy approach which is based on the illusive mass of the photon and a new geometrical perspective. Photon reveals its illusive mass behavior when it interacts with the surface of matter, i.e., photon manifests itself into different forms of mass. Hence, photon might hide some of its energy due to this new characteristic. This photon’s energy is embedded in the form of a curvature dependent complex number and could be considered as the new form of dark energy. Hence, we propose that the dark energy might be hiding in the photon’s illusive form and could pave the way towards unravelling the secrets of the dark energy of the universe and hence the accelerating universe.

Keywords: Accelerating universe; cosmological constant; dark energy; hidden energy; illusive mass.

Summary of Ph.D work

❖ Illusive nature:

Illusive nature is the appearance of light in various forms of rest mass.

Additionally light reveals some of its energy and hides the rest of the energy. Analogy..



Fig:-Rope-snake illusion

❖ Summary:

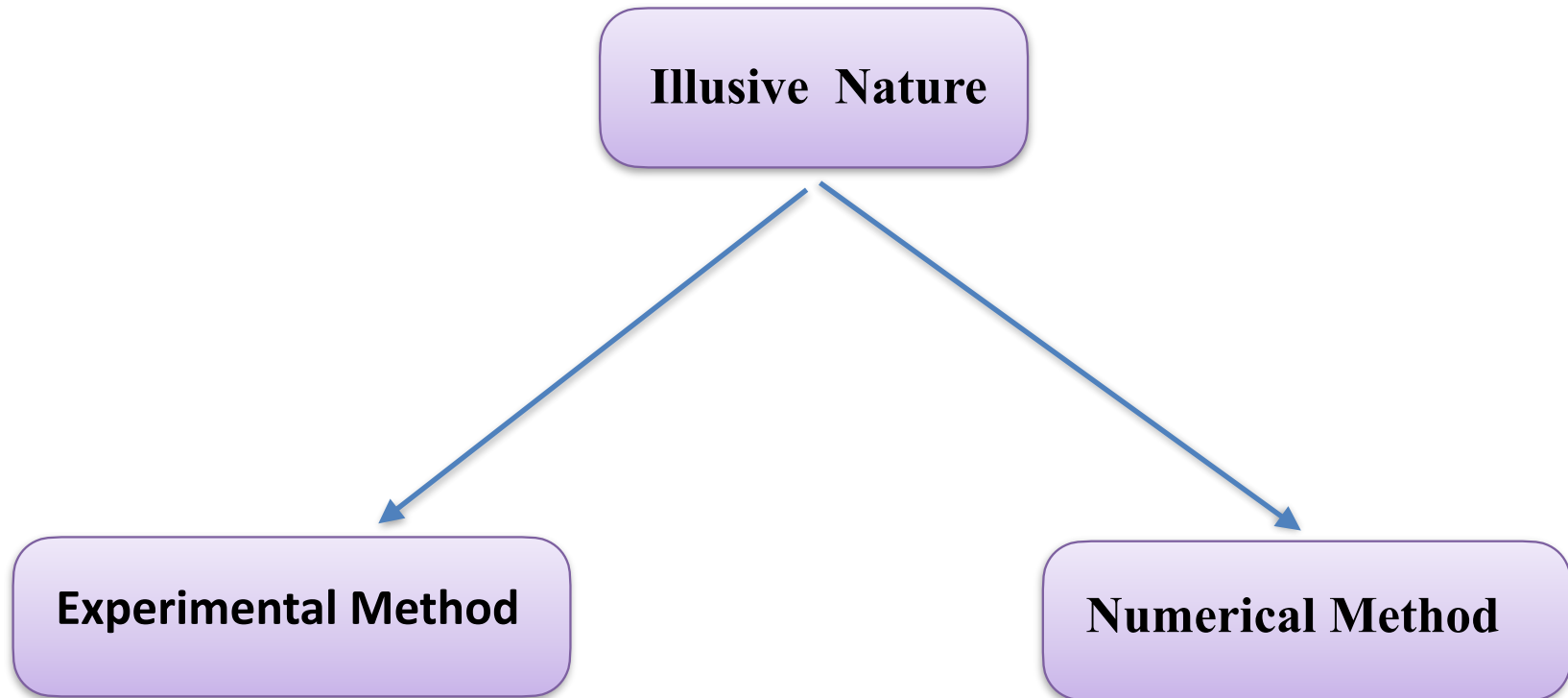
1. Mathematically, the illusive nature of photon is a complex number
2. Photon's illusive nature depends upon the scalar curvature of the surface of matter.
3. Due to illusive mass, photon does not possess fixed rest mass.

Summary of Ph.D work

4. Pliable character is the reason of wave-particle duality.
5. The hidden energy might be another form of dark energy.
6. Illusive mass can be used in quantum information processing, instead of photon's wave nature.
7. In future, by doing some simulation work we might get the contribution of hidden energy on dark energy .

Present Work (After Ph.D.): (2022-2024)

❖ Realisation of illusive nature of light:



Research work after Ph.D. (2022-2024)

1. Implementation of illusive nature of photon:

1. In quantum information processing (QIP)
2. For the reason of wave-particle duality
3. Studying QFT/SM to implement illusive nature in the dark sector (Dark matter, Dark energy)

2. Numerical study on cosmology:

1. Basic programming languages: Fortran, Python, C
2. Special software for HEP/Cosmology: LanHEP, CalcHEP, MicrOMEGAs

3. Supervised Master Thesis: (Theoretical and Numerical Study)

1. Three students in 2023
2. Three students in 2024

Experimental / Numerical Method

❖ The work is in progress:

Publication:

Optik - International Journal for Light and Electron Optics 274 (2023) 170537



Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Optik - International Journal for Light and Electron Optics

journal homepage: www.elsevier.com/locate/ijleo



Original research article

The 'pliable character' might be the reason for wave-particle duality of light

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Department of Physics, Pondicherry University, Puducherry 605 014, India



ARTICLE INFO

Keywords:

Delayed-choice experiment
 Hidden variable
 Illusive nature
 Pliable nature
 Wave-particle duality

ABSTRACT

The delayed-choice experiment is one of the best ways to illustrate the wave-particle duality. The consequences of a quantum delayed-choice experiment have shown that the photon can exhibit dual nature through morphing. There are no hidden variable theories; that can assert the real identities of a photon being a wave and a particle. An open question can emerge, what is the fundamental reason for a photon exposing dual nature. Meanwhile, the recent investigation on photon's 'illusive nature' expounds the apparently unrevealed phenomena like mass posing (zero, real-valued and imaginary rest mass), hidden energy, complex momentum form, and photon possesses this nature for wave-particle duality. The 'illusive nature' could interpret why photon does not hold fixed rest mass like another fundamental particles. This article will find out the cause of wave-particle duality from the outcomes of quantum delayed-choice experiments and the 'illusive nature' of photons. Furthermore, we will figure out a correlation between dual nature and 'illusive nature'. Indeed, a photon might manifest dual nature due to its 'pliable nature'.

Experimental / Numerical Method

❖ The work is in progress:

Submitted articles for publication

1. A novel quantum information processing without qubits of a photon

Corresponding Author: Mahendra Goray

Quantum Machine Intelligence

f9c217ed-fe49-4cd9-9a64-80f8e96adb5f | v.1.0








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Your submission has passed technical checks








13 Aug 24

The editors' decision can take several weeks as they may consult peer reviewers.

2.

Action 		Manuscript Number 	Title 	Initial Date Submitted 	Status Date 	Current Status 
Action Links		NEXRES-D-24-00337	Does a photon have zero rest mass on curved space-time?	Aug 26, 2024	Sep 27, 2024	Under Review

3.

Action 		Manuscript Number 	Title 	Initial Date Submitted 	Status Date 	Current Status 
Action Links		SHPS-D-24-00267	Physical reality and the complex nature of light	Aug 11, 2024	Sep 30, 2024	Decision in Process

Experimental / Numerical Method

♣ Supervised Master Thesis:

2023

NOTIFICATION

The following students of the 9th Semester (Mathematics) have been successfully completed the 9th Semester P.G. Dissertation / Project under the supervision of the faculty members of the Department of Mathematics during the Monsoon semester of the academic session 2023-2024.

Sl. No.	Name of the Student	Enrollment No	Topic	Supervisor
1	Sunita Bhoi	19/04/DM/03	EXTREMUM OF SEVERAL FORM OF FUNCTIONS	Dr. Ananda Biswas
2	Tejaswini Meleka	19/04/DM/06	SENSITIVITY ON THE OPTIMUM SIMPLEX TABLE	
3	Kshirapriya Sahu	19/04/DM/16	JOURNEY TO HANKEL INTEGRAL TRANSFORMS THROUGH FOURIER TRANSFORMS	
4	Chinmayee Patra	19/04/DM/02	ANALYTICAL SOLUTION OF THE BOLTZMANN EQUATION FOR WIMP DARK MATTER	Dr. Mahendra Goray
5	Anshika Senapati	19/04/DM/04	NUMERICAL SOLUTION OF THE BOLTZMANN EQUATION FOR WIMP	
6	Bhabani Maharana	19/04/DM/09	CALCULATION OF THE RELIC ABUNDANCE OF THE WIMP DARK MATTER	
7	Soumya Ranjan Sahu	19/04/DM/11	FUSION SYSTEM	Dr. Jyotiska Datta
8	Rasmita Gartia	19/04/DM/15	GLOBAL STABILITY AND BIFURCATION ANALYSIS OF ECO-EPIDEMIOLOGICAL MODEL: A THEORETICAL APPROACHES	
9	Annapurna pradhan	19/04/DM/20	SPATIO-TEMPORAL ANALYSIS OF AN ECO-EPIDEMIOLOGICAL MODEL: A THEORETICAL APPROACHES	
10	Ankit Kumar Dip	19/04/DM/17	THE STURM LIOUVILLIE'S PROBLEM AND IT'S APPLICATION	Dr. Deepak Rout
11	Alok Barik	19/04/DM/18	FOUNDATIONS OF ANALYSIS OVER SURREAL NUMBERS FIELD	
12	Akhaya Kumar Delai	19/04/DM/12	SYMMETRIC KEY CRYPTOGRAPHY USING GRAPH THEORY	Mr. Ramesh Ch. Mati
13	Sushree Meher	19/04/DM/10	MULTIPLE ENCRYPTION WITH LUCAS NUMBER AND FIBONACCI-LUCAS MATRICES	
14	Akash sahu	19/04/DM/13	CRYPTOGRAPHY WITH MODULAR MULTIPLICATION BLOCK CIPHER AND PLAYFAIR CIPHER	
15	Ankita Mohanty	19/04/DM/01	UNIVALENT FUNCTIONS AND THEIR GEOMETRICAL PROPERTIES	Dr. Sarbeswar Barik
16	Jatindra Juad	19/04/DM/07	INTRODUCTION TO SPECIAL FUNCTION	

Head of the Department
24/12/23



Copy to:

1. Controller of Examinations
2. Concerned Supervisor
3. Subject File

2024



DEPARTMENT OF MATHEMATICS

गणित विभाग

CENTRAL UNIVERSITY OF ODISHA

ओडिशा केंद्रीय विश्वविद्यालय

KORAPUT - 763004, ODISHA, INDIA

कोरापुट-७६३००४, ओडिशा, भारत

CERTIFICATE

This is to certify that the project report entitled "**An Analytical Journey to the Black Hole**" submitted by **Miss Chinmayee Patra** (Enrollment No.- 19/04/DM/02) to the Central University of Odisha, Koraput, for the partial fulfilment of requirements for the degree of 5-year integrated Master of Science in Mathematics is a bonafide record of review work carried out by them under my supervision and guidance.

The contents of this project, in full or in parts, have not been submitted to any other institute or university for the award of any degree or diploma.

Date: 09/05/2024

Place: Koraput

Dr. Mahendra Goray

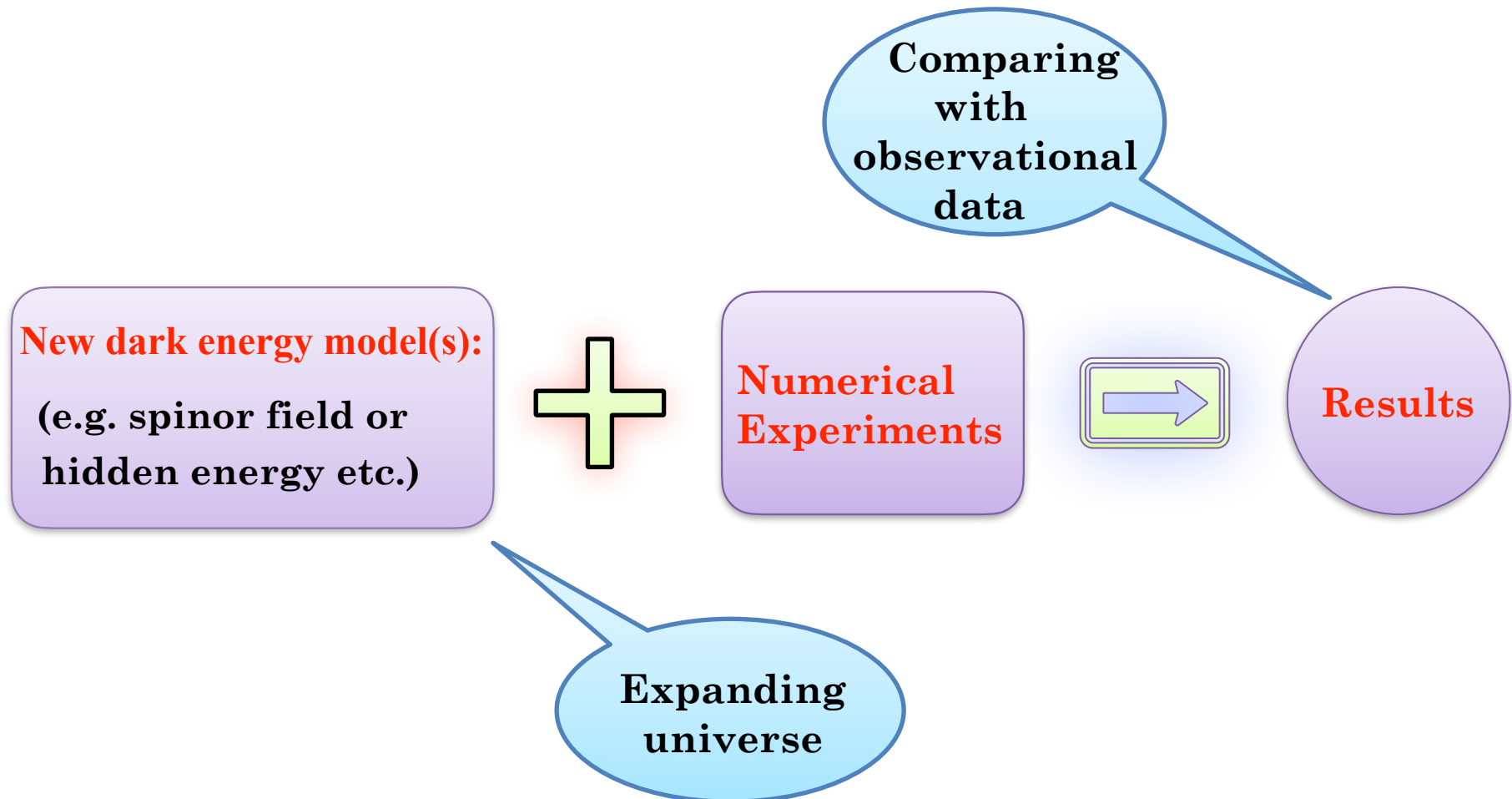
(Project Supervisor)

Approved by

Dr. Ashok Kumar Sahoo,
Associate Professor,
Head of the Department,
Department of Mathematics,
Central University of Odisha,
Koraput, Odisha-763004

Future Plan (For JINR): (2024-)

- ❖ Modelings for the accelerated universe using dark energy and comparing with observational data through a numerical experiments:



Future Plan (For JINR): (2024-)

A closer look on the future plan

First 1.5/2-months : Study the required basic and special software packages for numerical experiments.

Next 2/2.5 -months : Research and reproduce the similar kind of numerical experiments.

Next 1.5/2-months : Restudy our cosmological dark energy models (e.g. spinor field, hidden energy etc.)

Next 3-months : Testing the models with observational data through numerical experiments.

Next 2/2.5-months: Analysis the results and devotion for the publications.

In free time, wish to learn the Russian Language!

Awards

Dr. Surender Singh
Joint Secretary
Ph: 011-24115419
Email: ssingh.ugc@nic.in



UNIVERSITY GRANTS COMMISSION
(Ministry of Human Resource Development)
NET Bureau, University of Delhi, South Campus,
Benito Juarez Marg, New Delhi-110021

Joint CSIR-UGC Test
JRF AWARD LETTER

24 JUL 2019

UGC-Ref. No.: 1243/(CSIR-UGC NET DEC. 2018)



F.No. 16-6(DEC. 2018)/2019(NET/CSIR)

MAHENDRA GORAY
S/O MUKUL GORAY
VILL-MAHESHPUR, P.O. BORAH, DIST. PASCHIM
MEDINIPUR, MIDNAPORE, WEST BENGAL - 721133, INDIA

Roll No.: 507964

Subject: PHYSICAL SCIENCES

Dear Candidate,

I am pleased to inform you that you have qualified for Junior Research Fellowship (JRF) and Eligibility for Assistant Professor in the Joint CSIR-UGC Test conducted on 16th December, 2018. The tenure of fellowship is five years and it commences from the date of declaration of NET result, i.e., 2nd April 2019 (or) from the date of admission under M.Phil/Ph.D. (or) from the date of joining M.Phil/Ph.D. programme, whichever is later. The summary of financial assistance offered under the scheme is mentioned at **Annexure I** available on www.ugc.ac.in/netjrf along with other Annexures.

The Awardee is required to get admission and registration for regular and full time **M.Phil/Ph.D.** course in a University/Institution/College recognized by UGC at the first available opportunity **but not later than three years** from the date of issue of this award letter. University/Institution/College is requested to process for award of JRF based on this letter, in accordance with procedure available on www.ugc.ac.in/netjrf.

It may be noted that the fellowship amount shall be disbursed through Canara Bank to bank account of the Awardee (any bank) directly. UGC has developed a dedicated web portal (<https://scholarship.canarabank.in>) for capturing data of the awardee. The Universities / Colleges / Institutions will link the data of the awardee with the master data on the UGC web portal with unique Maker / Checker Ids which have already been provided to them along with the passwords. The Universities / Colleges / Institutions shall update the information in the master data (regarding monthly payment confirmation, HRA, up-gradation, resignation etc.) of the beneficiaries on monthly basis. Based on the data updated on UGC web portal by the concerned Universities / Colleges / Institutions, the payment of the fellowship will be made to the beneficiaries (Detailed process available at https://www.ugc.ac.in/ugc_notices.aspx?id=2153).

It may also be noted that UGC has proposed to link "AADHAAR" with bank account of students so that there can be direct cash transfer and effective disbursal of fellowship into bank account of the student. In this regard, Secretary, UGC had requested the universities to help students in Aadhaar enrolment vide D.O. No. F.14-34/2011 (CPP-II) dated 11.01.2013.

It may please be noted that the award is liable to be cancelled by Implementing/Awarding agency and it will also attract legal action against the Awardee in the following cases:

- If the awardee is found to be ineligible to receive the award at any point during the entire duration of fellowship,
- Misconduct of Awardee,
- Unsatisfactory progress of research work,
- Failure in any examination related to M.Phil/ Ph.D.,
- In case, any other fellowship is drawn from other source(s),
- Concealment of facts.

The E-certificate of Eligibility for Assistant Professor has already been uploaded on www.ugcnetonline.in. The eligibility of the candidate is to be ensured by the concerned institution/appointing authority. The category under which the candidate had appeared may be got verified from UGC.

With best wishes,

Surender Singh
(Surender Singh)

CERTIFICATE of Appreciation



THIS CERTIFICATE IS PROUDLY PRESENTED
FOR HONORABLE ACHIEVEMENT TO

Dr. Mahendra Goray

INTERNATIONAL BEST RESEARCHER AWARD
In the Field Physics

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We acknowledge and respect your achievement
for the devoting talent, efforts & performance
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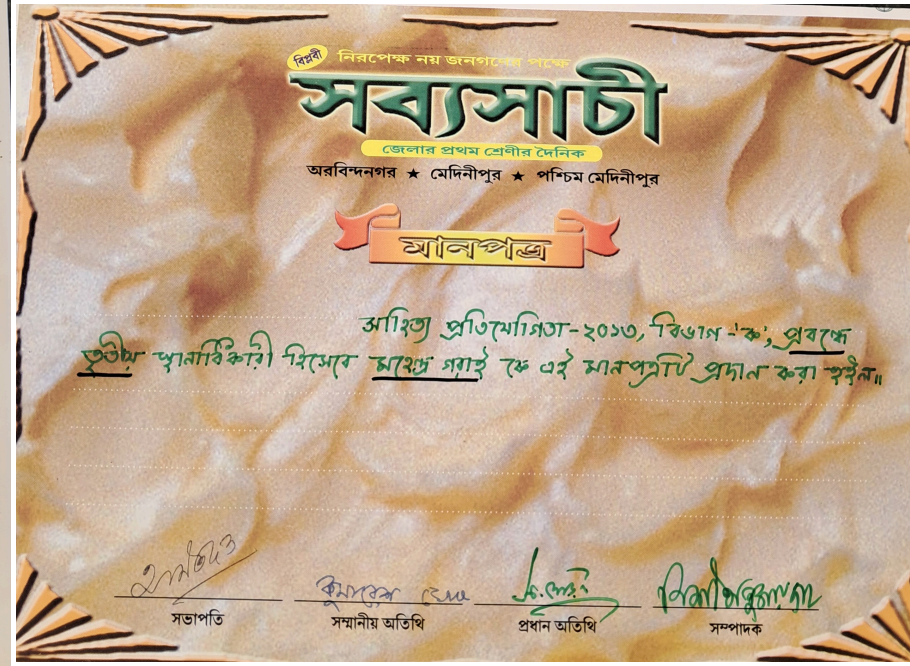
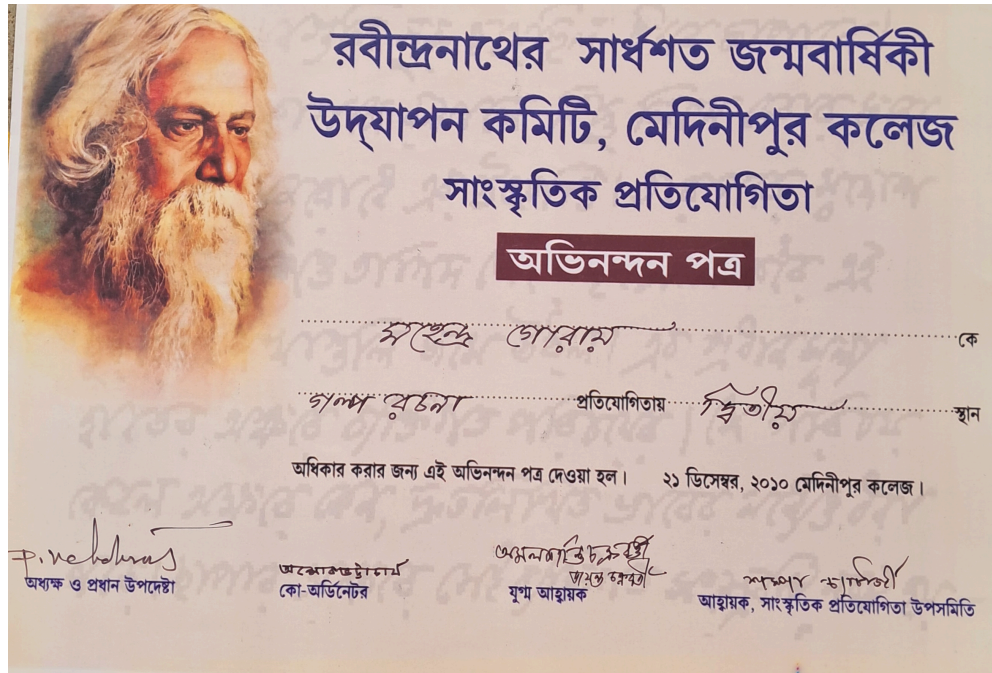


M. Maniraj M

Mr. MANIRAJ M
MANAGING DIRECTOR
ISSN AWARDS

Awards

❖ Awards in Bengali literature :



Others Activities

❖ Review activities :

- IOP Publishing Conference Series-JPCS: 2nd International Conference on Physics Research and Application (CPRA 2022).
- Several articles in the 'Journal of Modern Physics' (JMP), Scientific Research Publishing.
- Proceedings of the National Academy of Sciences, India Section A: Physical Sciences, Springer Nature.

❖ Others activities :

- Social work
- Gym
- Meditation
- Public speaking
- Poem and Essay writing

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Спасибо !!!