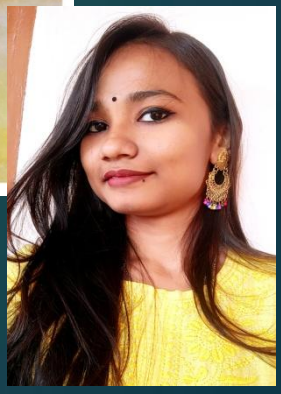
Phyletter

Durgapur Government College
Department of Physics

Art by Riya Biswas
B.Sc (Hons), 6th Semester



Contents

Message from HOD

Department of Physics focuses on Research oriented Undergraduate Education in fundamental and applied areas of Physics. The mission of the Department is to contribute to the advancement of the understanding of our Universe through basic and applied teaching and make the students engage in the excitement of the world of physics, what they see or what is beyond their vision. Beside undergraduate courses, considerable attention is given to research as well. The Ph.D. Program also runs here under the University of Burdwan. The faculty members of the department are dedicated to provide top-notch instructions in the most effective manner. They contribute to the world of research by publishing research papers in prestigious academic journals and deliver lectures as invitee in different academic Institutions.

Dr Anisur Rahaman

Student's Write Up Section

The Rhythm of Light And Darkness

The Light and the Sky
Will always be up high,
With the Sun glowing white
And the Moon reflecting bright.
The Stars, millions of miles away
Forming the great Milkyway,
Will always give us light with Serenity
Until being destroyed by the Gravity.

Then comes the Darkness,
Dwelling in the Universe,
Along with the light,
The Cosmos being completely diverse.
Mysterious yet with most abundance
The Dark matter controls the balance
And the ever flowing Dark energy
Always negates the power of Gravity.

So much mystery is still hidden,
So much is still to be found,
The secret of Light and Darkness
Is still everywhere, lurking around.
The Universe is full of magic,
Most of which still has no trace,
Hiding between the depths
Of this ocean of time and space.

Arijit Raha Roy
B.Sc. (Hons),
2nd Semester

Holography: bringing images to life

Debangana Dutta
B.Sc (Hons.)
6th semester

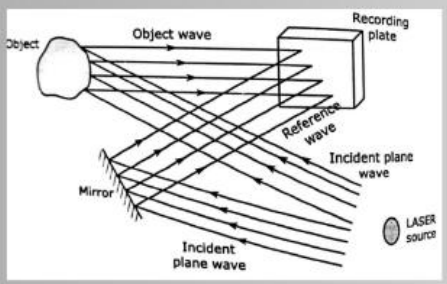
Introduction

Whenever we think of a physical copy of an image, we relate it to a conventional photograph. But the images formed on a photographic plate through an optical lens is 2 dimensional. A complete recording of an image's intensity along with the phase of the wavefront is what gives this 3D imaging technique it's name: holography (Greek: *holos*; "whole", *graphe*; "writing"). A hologram is a recording of an interference pattern which can reproduce a 3D light field using diffraction.

The phenomenon of holography is a *two-step process*. Recording of the hologram and reconstruction of the hologram to produce the image of the original object, both in intensity and phase. To carry out the experiment one requires a laser beam(for highly directional coherent light), a beam splitter, mirror, holographic plate and an object.

Recording of the hologram

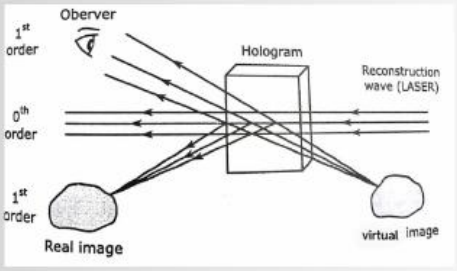
The coherent laser beam is split into two waves; the object beam that falls on the photographic plate after being scattered from the object, and the reference beam that reaches the film directly without passing the scene. The object beam interferes with the reference beam and the superposition of these two beams produces an *interference* pattern (in the form of dark and bright fringes) and this pattern is recorded on the photographic plate.



1.

Reconstruction of the image

The hologram iacts as a *diffraction* grating when a laser beam identical to the reference beam. called the reconstruction beam falls on it and produces a real as well as virtual images. One of the diffracted beams emerging from the hologram appears to diverge from an apparent object when projected backward. This virtual image is at the original site of the object and exhibit true 3D characteristics. The real image formed can be recorded on a photographic plate.



2.

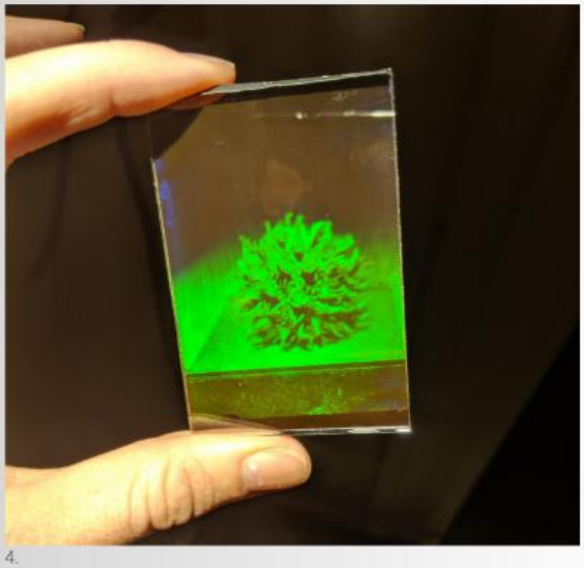
Photograph vs Holograph

A regular photograph captures the intensity and colour of light on a light-sensitive film and results in a 2D representation of the object, A holograph on the other hand captures along with the intensity and colour, the phase information and the reconstruction therefore has the appearance of depth and even parallax depending on the angle of view.
Each point on a photograph corresponds to a conjugate point of the object and the intensity and colours are replicated by an according proportionality of pixel density. But each point on a hologram receives information from different parts of the whole object. So, if a photograph is torn in half, it only shows the image imprinted on the remaining half, while even if a hologram is partly destroyed, each fragment can still reproduce information of the whole scene as at the time of recording.
Photographs store only a single image while multiple images can be recorded on the same physical medium, by the method of multiplexing.

Applications

- Medicine: it is used to create 3D images of internal organs and tissues, aiding in diagnosis and treatment planning.
- Astronomy: *Interferometry* is a technique that involves combining light from two or more telescopes to create a high-resolution images of astronomical objects. Holography can be used to improve the accuracy and precision of interferometric measurements. It is also used in the creation of holographic gratings, ideal for use in *spectroscopy*.
- Security: holograms are used as security features on credit cards, passports, and other important documents to prevent counterfeiting.
- Archaeology: this method is used to create 3D models of archaeological structures and artifacts, enhancing the understanding and preservation of cultural heritage.
- Data storage: allows for high capacity data storage. While optical/magnetic data storage allows bit by bit data storage on the surface of the recording medium, holographic storage enables recoding huge data in parallel throughout the volume of the medium.

3.

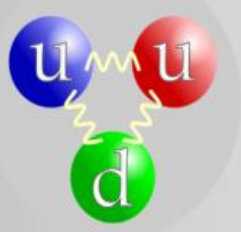


4.

Content source: I. Fundamentals of Optics by Jenkins and White: section 31.1, 31.2. II. Article by Winner Science. III. Wikipedia article.
Image references: I. title background image: Wikipedia> holography. II. (1),(2) Winner Science article : lasers>recording and reconstruction process in holograms. III. (3) Martina Mrongovius 'The Hover' (2004). IV. (4) Martina Mrongovius 'The Conqueror' (2019)

Interaction of 'colour'

Debangana Dutta
B.Sc (Hons.) , 6th semester



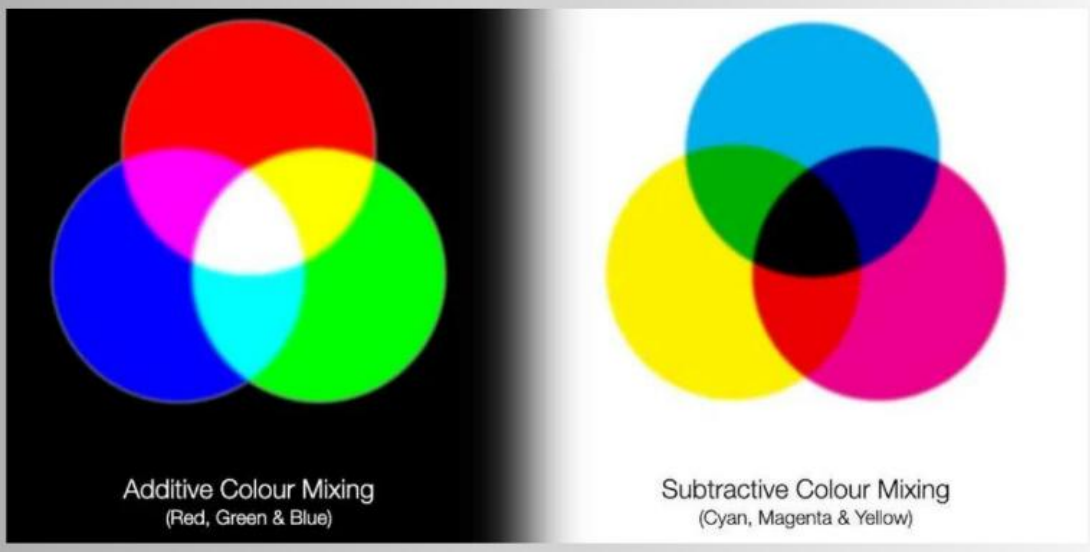
History

A quark is an elementary particle which combine to form composite particles like protons and neutrons. But the interpretation of quarks as actual physical entities was initially posed by two major problems. First, quarks had to have half-integer spin (intrinsic angular momentum) values for the model to work, but at the same time they seemed to violate the Pauli exclusion principle.[1] In many of the baryon configurations constructed of quarks, sometimes two or even three identical quarks had to be set in the same quantum state—an arrangement prohibited by the exclusion principle. Second, quarks appeared to defy being freed from the particles they made up. Quarks are never found in isolation; they can be found only within hadrons.

A new quantum number

So, providing some understanding of the problem of binding and eliminating an apparent violation of the exclusion principle, a new quantum number was assigned to quarks: the **colour** charge. *The colour quantum number is to the true strong interaction as the electric charge is to the electromagnetic interaction*. Just as the electromagnetic interaction is the exchange of photons emitted and absorbed by electric charge, so the **real strong interaction** is the exchange of gluons emitted and absorbed by colour "charge". This colour interaction is to be distinguished from the interaction between hadrons, sometimes referred to as the nuclear interaction. The latter has been called the strong interaction, *but the true strong interaction is that due to colour.*

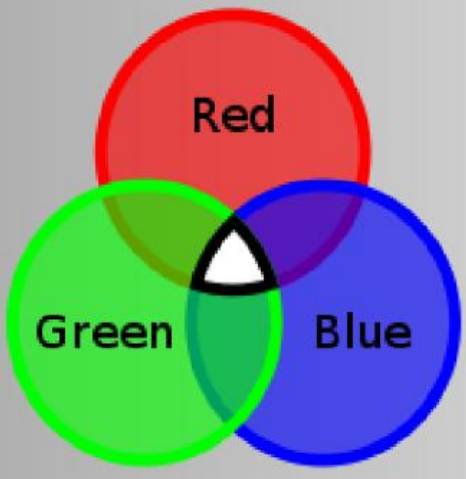
The terminology 'colour' is not literal as we usually think of it. The three possibilities for the quantum number ‘colour’ will here be designated as the subtractive primary colours red, yellow, and blue, since these three mixes as pigments to give colourless **black**. Often red, green, and blue are used, since these additive primary colours when mixed as light give colourless white. According to QCD (quantum chromodynamics), all combinations of quarks must contain mixtures of these colours that cancel out one another, with the resulting particle having no net colour. This allows only two combinations; quark-antiquark and three quarks which can achieve complete annihilation of colour, and hence only these combinations produce bound states. Quarks change their colour as they emit and absorb gluons, and the exchange of gluons maintains proper quark colour distribution. Gluons have a combination of two-colour charges (one of red, green, or blue and one of antired, antigreen, or antiblue) in a superposition of states which are given by the Gell-Mann matrices.

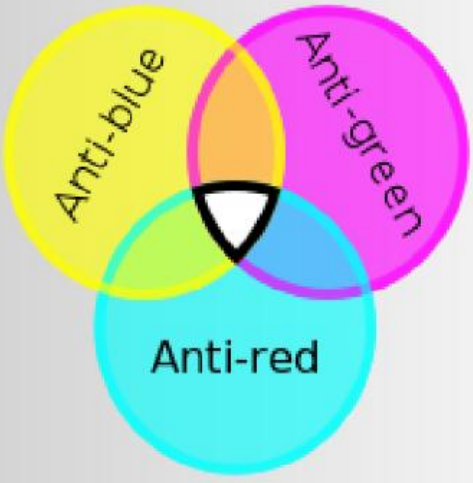


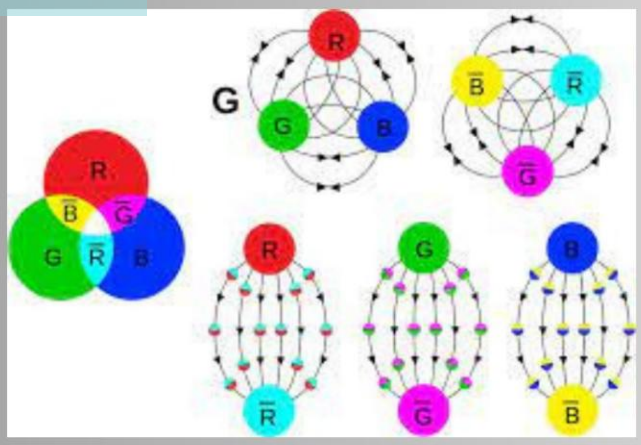
2.

Understanding the colour charge carriers: gluons

On a colour wheel with red, green and blue at three equidistant locations, like an equilateral triangle, the areas between red and green would be yellow; between green and blue would be cyan; between red and blue would be magenta. These in-between colour charges correspond to the colours of the antiparticles: the anticolors. Cyan is the same as anti-red; magenta is the same as anti-green; yellow is the same as anti-blue. Just as you could add up three quarks with red, green and blue colours to make a colourless combination (like a proton), you could add up three antiquarks with cyan, magenta and yellow colours to make a colourless combination (like an antiproton). As the way strong forces work is by exchanging gluons, so if a blue quark emits a gluon and turns red that indicates the colour charge on the emitted gluon is blue and cyan(anti-red), enabling colour conservation.







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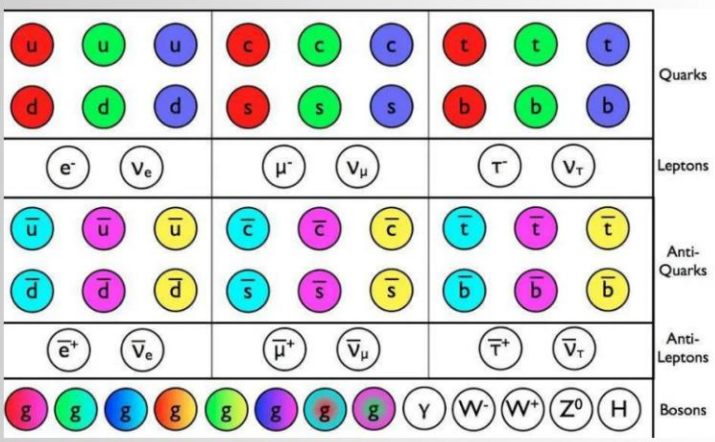
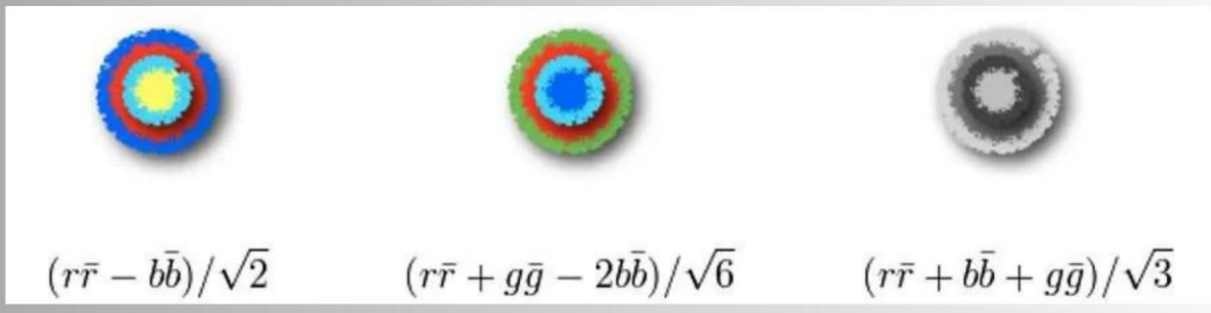


4.

Why are there only 8 gluons?

From all this information one might think then with three colours and three anticolours there would be 9 possible types of gluon. But there are only 8 gluons that exist. Imagine a red quark emitting a red/magenta gluon and turns green. This gluon if meets with a green quark that annihilates its magenta, then it turns red. So six such combinations are obvious: red/magenta, red/yellow, green/cyan, green/yellow, blue/cyan, blue/magenta. The remaining three combinations red/cyan, green/magenta and blue/yellow are colourless, and their mixtures form orthogonal eigen functions. Two asymmetric combinations among three still have some colour are: $(r\bar{r} - b\bar{b})/\sqrt{2}$ and $(r\bar{r} + y\bar{y} - 2b\bar{b})/\sqrt{3}$ still have colour. The last symmetric combination $(r\bar{r} + b\bar{b} + g\bar{g})/\sqrt{3}$ is a singlet, i.e., it is colourless and cannot physically interact. Therefore, there are only 8 physical gluons.



5.

While we ascribe colours to quarks, anticolours to antiquarks, and color-anticolor combinations to gluons, it's only a limited analogy. In truth, none of the particles or antiparticles have a colour at all, but merely obey the rules of an interaction that has three fundamental types of charge, and *only combinations that have no net charge under this system are allowed to exist in nature.*

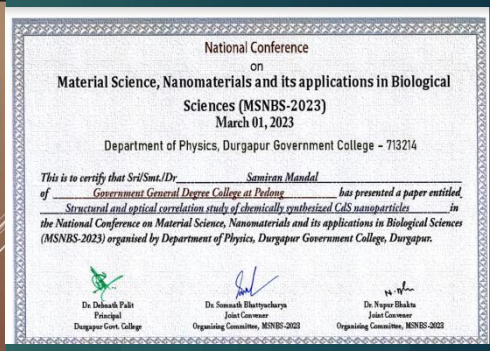
Content source: *Quantum physics by Robert Eisberg and Robert Resnick* section 18-5,18-7, Wikipedia.
Image references: (1)Wikipedia, (2)Athabasca University/Wikimedia Commons, (3) Maschen/Wikimedia Commons, (4)*Beyond the galaxy*-Ethan Seigal, (5) E. Siegal blogpost.

Activities and Event Section

DBT STAR COLLEGE SCHEME sponsored One-day State Level Seminar on Solitons and its applications in Biophysics and Telecommunications (SABT- 2023) on 28.01.2023

DBT STAR COLLEGE SCHEME sponsored 3-day workshop on telescope making and stargazing (TMS - 2023)

DBT STAR COLLEGE SCHEME sponsored One-day National Conference on Material Science, Nanomaterials and its applications in Biological Science (MSNBS-2023)

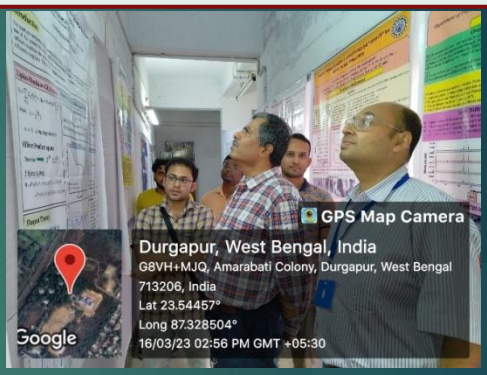

National Conference
on
Material Science, Nanomaterials and its applications in Biological Sciences (MSNBS-2023)
March 01, 2023
Department of Physics, Durgapur Government College – 713214

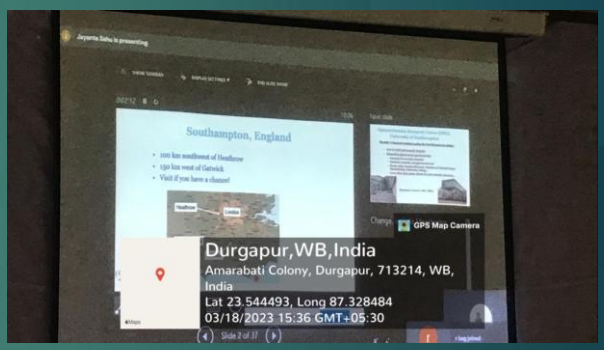
This is to certify that Sri/Smt./Dr. Samiran Mandal of Government General Degree College at Pedong has presented a paper entitled Structural and optical correlation study of chemically synthesized CdS nanoparticles in the National Conference on Material Science, Nanomaterials and its applications in Biological Sciences (MSNBS-2023) organised by Department of Physics, Durgapur Government College, Durgapur.

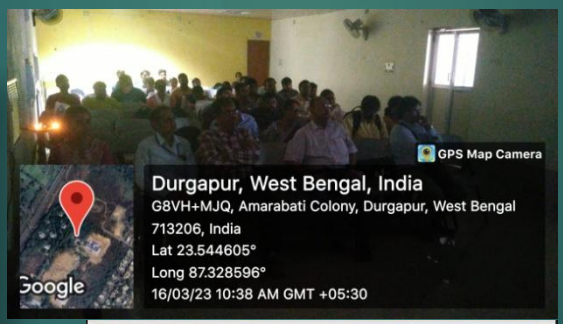
Dr. Debnath Palit, Principal, Durgapur Govt. College
Dr. Somnath Bhattyacharya, Joint Convener, Organising Committee, MSNBS-2023
Dr. Nupur Bhakta, Joint Convener, Organising Committee, MSNBS-2023

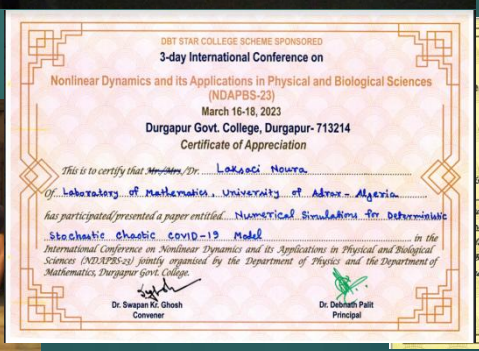
Sample Certificate

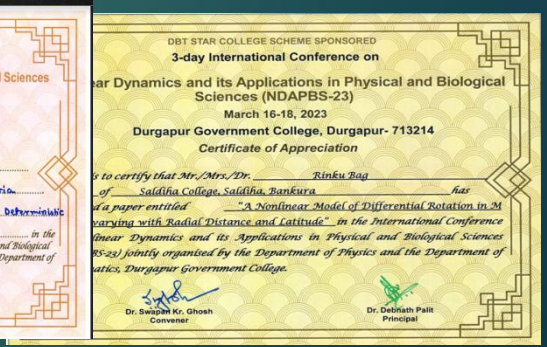
DBT STAR COLLEGE SCHEME sponsored International Conference on Nonlinear Dynamics and its Applications in Physical and Biological Sciences (NDAPBS-23)








DBT STAR COLLEGE SCHEME SPONSORED
3-day International Conference on
Nonlinear Dynamics and its Applications in Physical and Biological Sciences (NDAPBS-23)
March 16-18, 2023
Durgapur Govt. College, Durgapur- 713214
Certificate of Appreciation
This is to certify that Mr./Mrs./Dr. Lakaci Noura.
of Laboratory of Mathematics, University of Adrar - Algeria.
has participated/presented a paper entitled Numerical Simulations for Deterministic Stochastic Chaotic COVID-19 Model in the International Conference on Nonlinear Dynamics and its Applications in Physical and Biological Sciences (NDAPBS-23) jointly organised by the Department of Physics and the Department of Mathematics, Durgapur Govt. College.
Dr. Swapan Kr. Ghosh
Convener
Dr. Debnath Palit
Principal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of Saldiha College, Saldiha, Bankura has
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varying with Radial Distance and Latitude" in the International Conference
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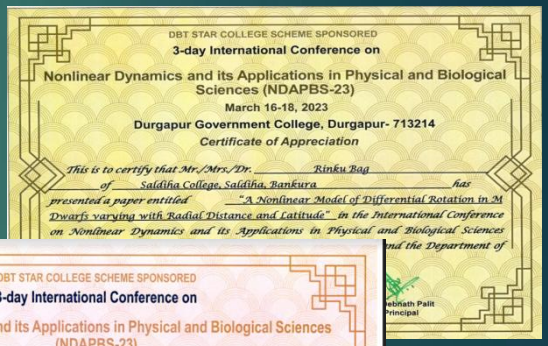
Dr. Swapan Kr. Ghosh
Convener
Dr. Debnath Palit
Principal

Sample Certificates

DBT STAR COLLEGE SCHEME sponsored International Conference on Nonlinear Dynamics and its Applications in Physical and Biological Sciences (NDAPBS-23)



DBT STAR COLLEGE SCHEME SPONSORED
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March 16-18, 2023
Durgapur Government College, Durgapur- 713214
Certificate of Appreciation

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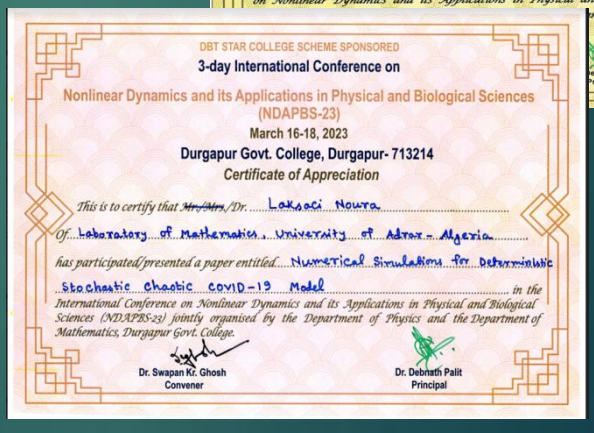
Debnath Palit
Principal



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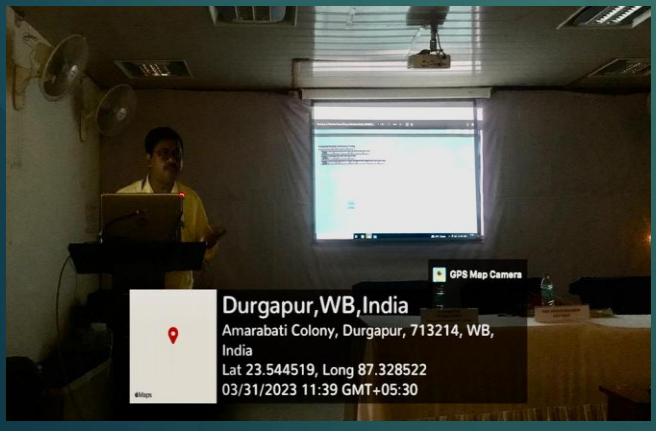
Dr. Swapan Kr. Ghosh
Convener

Dr. Debnath Palit
Principal

Sample Certificates

DBT STAR COLLEGE SCHEME sponsored Workshop on Electrical House Wiring and Electrical Safety on 31st March, 2023



Our Achievement

Utkarsha Samman for the years 2019 (PG only), 2020 (UG and PG), 2021 (UG and PG) and 2022 (UG and PG) on 22nd February, 2023.

Poster Section

BIOELECTROMAGNETISM

AUTHORS: Arijit Raha Roy (2nd semester, Hons)
(arijit162020@gmail.com)
Risha Roy (4th semester, Hons)
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AFFILIATION: Department of physics, Durgapur Government College. (physics.dgpgovtcollege@gmail.com)

INTRODUCTION

Bioelectromagnetism is an interdisciplinary subject that deals with the study of electromagnetism and its impact on living organisms. Our body is strongly dependent on the electric and magnetic field inside and outside our body. The first experiment on bioelectricity was done in 1780 by Latin Physiologist Luigi Galvani, by showing the excitation of a frog's muscle cell in presence of electric field. Later on, bioelectromagnetism started evolving into one of the most interesting and vital subjects in physiology and medical physics.

BIOELECTRIC EXCITATION OF NERVE AND MUSCLE CELLS

The nerve cells and the muscle cell's membranes are electrically excitable. The cell membranes consists of small pores called ion channels, through which sodium, potassium and chloride ions passes. The motion of these ions forms the basis of bioelectricity in these cells. The transmembrane voltage (Vm) of an excitable cell is defined as the potential at the inner surface (Φi) relative to that at the outer surface (Φo) of the membrane. For voltage greater than the Threshold potential, the nerve cells will only produce an impulse. (See Fig. 1)

The transmembrane voltage can be classified as follows:

1) Resting Potential
2) Changing Potential —
   a) Pacemaker Potential
   b) Transducer Potential —
      I) Generator and Receptor
      II) Synaptic

In the myocyte cells in heart, electric activation takes place by the inflow of sodium ions and outflow of the potassium ions. The average time for this cell activation is 300ms, and the activation potential for both nerve and muscle cells are about 100mV. The graph below (Fig. 2) illustrates the electrical activity and mechanical contraction in a frog's heart muscle.

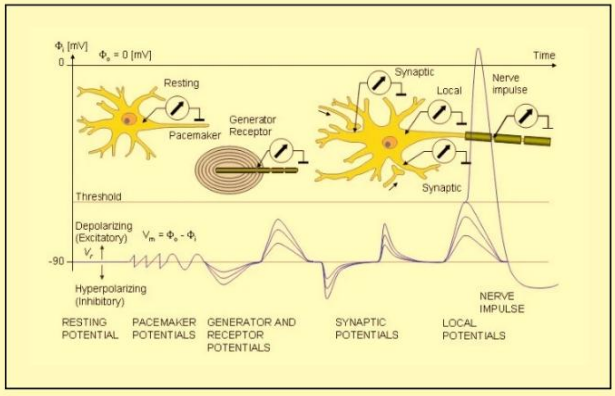


Fig. 1

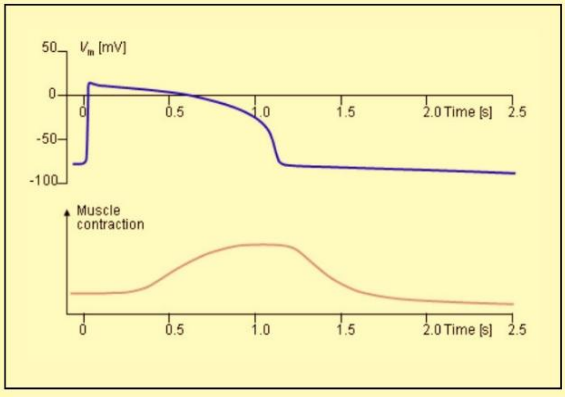


Fig. 2

MEASUREMENT OF ELECTRIC AND MAGNETIC FIELD GENERATED BY HEART AND BRAIN.

The heart and the brain of a living organism can also be considered as a source of electric and magnetic field, and the magnitude of those fields can be measured and used to treat medically using these processes:

1) ELECTROENCEPHALOGRAM (EEG):

EEG is the process of measuring spontaneous activity in the brain of a living individual. It is mainly used to detect and investigate epilepsy in aperson. The output signals of EEG depends on the consciousness of a person (Fig. 3), and its signal bandwidth ranges from 1-50 Hz and its amplitude ranges from 100μV to 2mV.

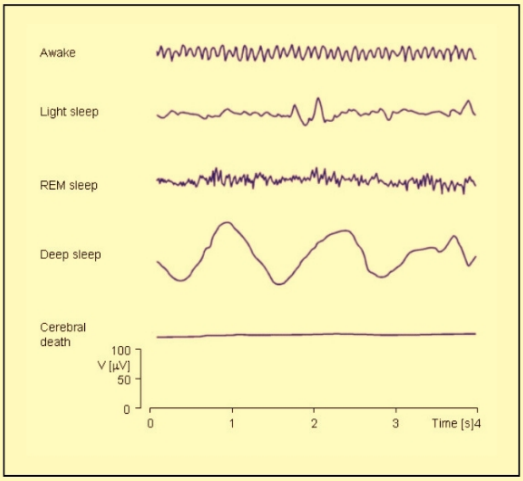


Fig. 3

2) MAGNETOENCEPHALOGRAM (MEG):

MEG is the process of measuring the magnetic field generated from the brain. Unlike EEG signals, these signals are a bit less powerfull, having an amplitude of 100 fT (femto Tesla). These signals can be detected using special Super-conductor Quantum Interference Device (SQUID), coupled with magnetometer, and is kept in a magneticcally shielded room. An advantage of MEG signal over EEG is that it passes though the head without any distortion. It is used to produce high resolution images of the brain and to diagnose diseases in brain.

3) ELECTROCARDIOGRAM (ECG):

ECG is the process for making Electrocardiographs, graphs that shows the activity of an individual's heart. It uses sensors that senses the electric field generated each time the heart beats. The electricity generated while contraction and relaxation of the myocytes produces this electric field.

CONCLUSION

Bioelectromagnetism is a very vital subject in medical science. Without this subject, biophysics and medical physics is almost incomplete. The advent of this subject since it was first discovered proves the vitality of this field, and it is a fact that there is still more to be found about this in the near future.

Arijit Raha Roy
B.Sc. (Hons),
2nd Semester

Risha Roy
B.Sc. (Hons)
4th Semester

Note: Images and Graphs in this poster are taken as a reference from the book "Principles and Applications of Bioelectric and Biomagnetic Fields" by Jaakko Malmivuo and Robert Plonsey for a better understanding on the matter.

CONTROVERSY ON LIGHT

Pritam

Sir, what is light actually ?

Huygen

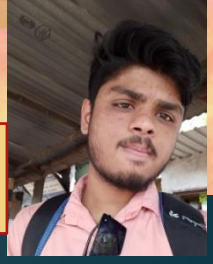
light is a longitudinal wave in the aether medium - a medium that pervades the entire universe.

Isaac Newton

No you are wrong Huygen. Light consists of large number of particles, propagation of light is caused by the rectilinear motion of light particles which he termed light corpuscles.

No I'm correct,Light behaves as a wave - it undergoes reflection, refraction, and diffraction just like any wave would.

No,I'm correct Because waves do not move in straight lines, the geometric character of light reflection and refraction could only be explained if light were composed of particles called corpuscles.



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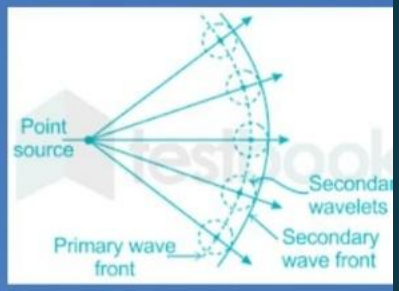
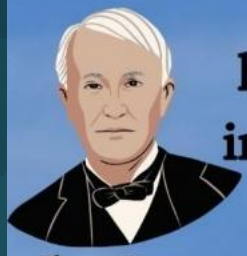
CONTROVERSY ON LIGHT

Every point on a wavefront is in itself the source of spherical wavelets which spread out in the forward direction at the speed of light. The sum of these spherical wavelets forms the wavefront.

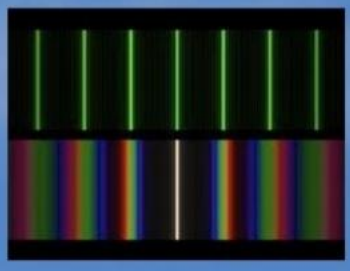


You know an interesting fact if we project light through a prism it will split into seven colors.



Thomas Young

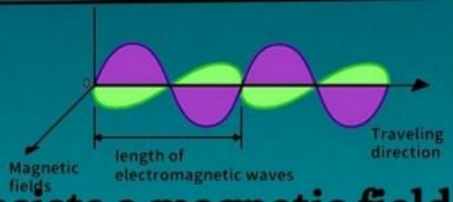
light shows the phenomena of interference it is now clear that light is a wave .

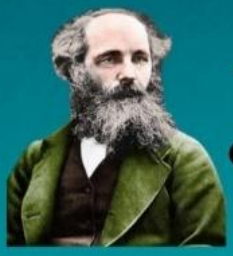


Étienne-Louis Malus

you are right Young, light is a wave , but according to Huygen light is longitudinal wave which is not correct. I discovered the Phenomena of Polarisation which prove that light is a transverse wave .

CONTROVERSY ON LIGHT



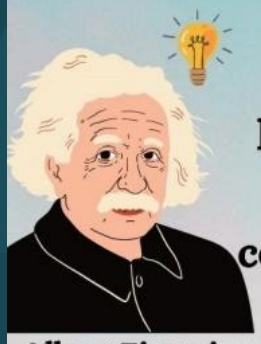


Maxwell

Yes , light is a wave it consists a magnetic field and electric field which are perpendicular to each other and also perpendicular to the direction of propagation of light

Heinrich Rudolf Hertz

I discovered a new phenomena 'Photo-Electric' effect. Can you explain the phenomena by considering light is a wave ? The most interesting thing is that this effect doesn't depend on intensity whatever the intensity if the frequency is less then there is no emission of photo electrons. So it's energy doesn't depend on the intensity so may be light is not a wave



Albert Einstein

light possess dual nature. It consists large numbers of Photons having energy hf (where h is the plank constant and f is the frequency) and it's energy depends on the frequency.

CONCLUSION : Light possess dual nature

Wave nature as well as particle nature. Polarisation, Interference, Diffraction these experiments are the evidences that light is a wave and on the other hand Compton effect, Photo electric effect can be explain by considering light is made up of large number of particle called 'Photon'.

The Secret of Darkness

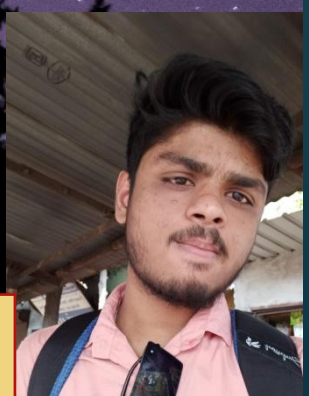
How many stars are there in our Universe?

Using the Milky Way as our model, we can multiply the number of stars in a typical galaxy (100 billion) by the number of galaxies in the universe (2 trillion). The answer is an absolutely astounding number. There are approximately 200 billion trillion stars in the universe.

Ohh 😮. So why is it dark at night if only 0.0000....01% light can come from these stars then it will be bright.

The darkness of the night sky is one of the pieces of evidence for a dynamic universe, such as the Big Bang model. That model explains the observed non-uniformity of brightness by invoking expansion of the universe, which increases the wavelength of visible light originating from the Big Bang to microwave scale via a process known as redshift. The resulting microwave radiation background has wavelengths much longer (millimeters instead of nanometers), which appears dark to the naked eye and bright for a radio receiver.

"The universe is made of stories, not of atoms, atoms"
~ Muriel Rukeyser



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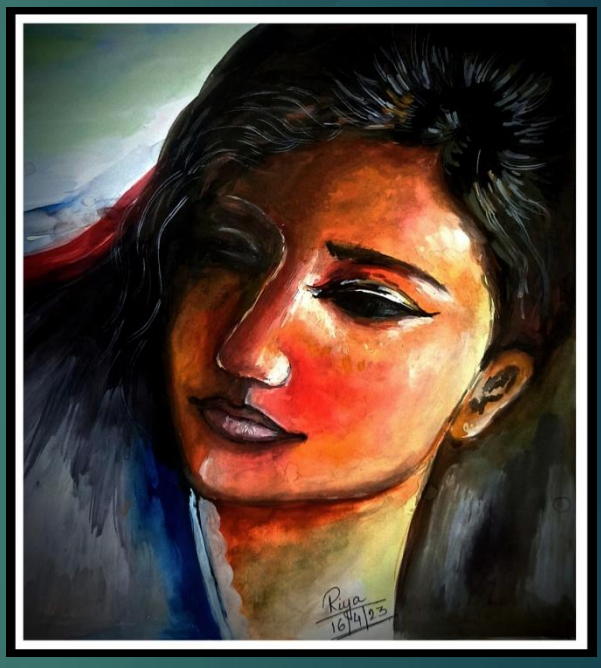

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