FATIMA MATA NATIONAL COLLEGE (AUTONOMOUS)

Physics Magazine

Cygnus

DEPARTMENT OF PHYSICS

Motto : "Imparting energy and momentum for life"

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CYGNUS

Chief Editors

Dr Shyma Mary Y

Ms Bindhu Christopher

Editorial Board

Hariram M.

Ramoona Antony Thomas

Ibin S. Mathew

Jincy Mary Jackson

Meenu Krishnan

Aleena.A

Devika Omanakuttan

Coverpage Design

Jishnu J. L.

Sketch artist

Beji Terense

CYGNUS

DEPARTMENT MAGAZINE

DEPARTMENT OF PHYSICS

FATIMA MATA NATIONAL COLLEGE

(AUTONOMOUS)

KOLLAM

Special Thanks

Ms Vimala V
HOD,
Department of
Physics

Dr Sheena Mary Y
Assistant Professor

Editorial Board

“Look deep into nature, and then you will understand everything better”

Albert Einstein

We, the members of the Department of Physics, present before the readers, the second issue of the biannual magazine CYGNUS.

It was a cherished desire of the Physics Department to bring out a Physics magazine for the students.

We express our gratitude to the manager, Rev. Dr. Rolden Jose Jacob for supporting us in this venture. Our Principal, Dr. Vincent B. Netto, provided us with all the facilities required for the completion of this work. We thank you Sir for your encouragement. We are thankful to Ms.Vimala V, Head of the Department of Physics for her suggestions. We thank all the faculty members, especially Ms. Bindhu Christopher and Dr. Sheena Mary Y, and the students of our department for their support and help. We thank the contributors for submitting their articles in time. With the blessings from the God Almighty we are presenting this issue.

For the editorial Board

Dr. SHYMA MARY.Y

The Messenger

Hariram M.,

I M.Sc. Physics

SETI, California

Today

The big and widely lit neon sign read ‘Search for Extra-terrestrial Intelligence’. George was in awe! He had heard of SETI before, it was a pioneering institute searching for life in the cosmos. He had assumed that it had to be something important when the government officials came to escort him, but didn’t have the guts to ask where they were taking him.

George was having a peaceful mundane day until then. Going to college lecturing about cryptography for half a day and coming back home to read David Khan’s infamous book ‘The code breakers’ for the umpteenth time, which was what drove him to choose cryptography as a career option in the first place. He had just reached the car porch on his Mustang when he heard his own name being shouted! He peeked through the rear-view mirror to see two smartly dressed gentlemen waiting at the door and they were gracefully waving at him. After a polite handshake they asked him to come along with them. All they said to him was ‘there is a need for deciphering a message’, and George was content with it. ‘Deciphering is what I am good at’ he muttered to himself.

‘Good evening ‘a pleasant voice shook him back to the real world. A blonde confident looking middle-aged woman was standing beside him and was apparently shaking his hand!

‘Evening’, George stammered back a reply. It was a really cold evening. The lady introduced herself as Juliet. She was the chief executive of Search for Extra-terrestrial intelligence. She escorted George into the oddly shaped building of SETI.

‘I hope you are familiar with our organisation? The blonde lady asked as she walked briskly escorting George through a long corridor.

‘Yes indeed, George replied enthusiastically clearly fumbled by the sheer enigmaticity of the building. He couldn’t help himself feel important. But didn’t have a clue on why he was brought here? Maybe what he had in mind clearly reflected on his innocent face, Juliet had an apologetic smile as she began to speak.

‘Now I know professor you might be wondering why we contacted you and I am also aware that all these urgency and commotion may seem theatrical, but unfortunately the situation demands it. Juliet paused and continued changing her tone into a slightly authoritative one. We received some messages, Err... signals to be precise actually. You are here to check on those signals and if possible decode it. Juliet replied.

‘Messages... From outer space! George was flabbergasted. This was what he day dreamed and fantasized about! Decoding this would make me a legend he thought to himself. At the same time a thought creeped into his head. ‘What made you think ‘this signal’ was a message?' he asked. He had heard scientists claiming such beams

of radiowaves or other high energy signals being received. But none had been proved nor had anyone tried to decode it, because they were in actuality the creation of random outbursts of supernovae or pulsars.

Juliet seemed uneasy as if she had not enough time to convince the professor about the signals. Her brisk walk slowly came to a halt. “The signals came from a known source professor”, Juliet replied. 'It came from Oumuamua'.

‘Oumuamua’ George uttered the word again, A Messenger from distant past, it was a Hawaiian word which he had heard about a few years back. Oumuamua was an overnight media sensation, a subject of intense scrutiny to which half of the world’s telescope had their prying eyes zoomed in. The UFO theorists had taken huge interest on this interstellar visitor. But scientists across the globe had cruelly crushed their hopes of it being an alien spaceship. They were certain that it was just some rock. If it was just a random cosmic rock, how is it possible for it to send signals?

As thoughts had started to cloud George’s mind they turned right from the corridor to a long hall where a lot of lab coated scientists where waiting for them. They all smiled and shook hands with him as if they were buddies. George thought he was dreaming!

Few years back...
University of Hawaii
October 19, 2017

Robert Weryk was sleep deprived. He was keenly observing a dim object. Even with his highly efficient and reliable PAN-STARRS telescope, Weryk found it hard to

keep track of it! It followed a weird path as if it had no idea where it was going. He concentrated and increased the resolution with precision. The object was currently skimming above the rings of Saturn! Robert was trying to get an idea of its shape. It seemed to him as if it was a rod!

Robert took his eyes off the telescope and smiled looking at the sky above him, serene and beautiful as ever. This was what drove him to choose this career. He was always fascinated by the cosmos. It was religion that introduced him to the world of cosmos, Ideas of how the world was built. But that didn't quench the thirst of young Weryk and he seeks 'his' bigger truth... Science! He followed his passion and here he was on the brim of discovering an object from outer space. Not just some object... This was by far the most curious one he had ever seen!

Excited he placed his eyes back to the universe... But the object was nowhere to be seen.

He had calibrated the telescope to be locked on to the object and it took him a week to complete the calculations, but it seems all was in vain. He couldn't believe his bad luck! He was sure that there was no error in the calculation as he knew he had painfully calculated its random trajectory. So what could have made the object go out of visual? A stray thought came to his mind. What if the object stopped moving? He was well aware of Newton and his laws and that seemed highly impossible. The gravitational field of Saturn could have changed its trajectory he thought. But that hadn't come up in the calculations. The only possibility his mind saw of this outcome was that the object stopped! And that was eerily spooky.

'This is way out of my hands', Robert took a deep breath and stretched taking his laptop with his right hand and started typing an email to NASA!

NASA

November 3, 2017

It was on this date that scientists and the common folk clearly saw the visitor and also the day they came to certain conclusions about this cosmic entity. It was named as Oumuamua, a visitor from distant past.

Our visitor had some peculiar characteristics. First among them was its shape. It could not be labelled as an asteroid for it had a very elongated shape. Then some scientists came to the viewpoint that it might be a comet. But the visitor showed no sign of external combustion or more over a tail! It moved freely as it willed.

This was what triggered the UFO theorists. With Newton and his deterministic world, the scientists should have been able to determine the path of the visitor, which unfortunately they couldn't. Our visitor showed non-gravitational acceleration, one that is not attributed by the gravitational attraction of the Sun or the planets, that is it behaved like a spacecraft. So NASA had to leave this to his younger brother who specialized on these kinds of stuff. SETI, Search for extra-terrestrial intelligence!

Today

SETI hall, California

George was given the data that had been obtained from the microwave transmission. He beamed into the data charts that were carelessly spread over a huge table. He couldn't make sense of the graphs that had labels like amplitude, frequency loss and so on. 'What am I going to do with this'? He thought to himself trying in vain to get a peek on Juliet, who apparently was busy speaking to someone else. All the white coated scientists where beaming eagerly at him as if he was going to conjure out the message from the data.

'These are the data sheets obtained from the signals can you make any sense of it'?

Juliet queried from behind. George with a wry smile on his face shook his head so as to convey a 'No'.

'Professor you are not here to analyse that!! Here listen to this, we converted the obtained microwave transmission to an audio signal. 'Juliet continued with a wide smile on her face.

With that she gave him an old Sony Walkman onto which a cassette tape was inserted. 'Cassettes! Even today, Vintage'. George thought to himself.

The white coats hadn't taken their eyes off him. They continued to ogle at him as if he was some strange scientific specimen. George felt uneasy. But he set that thought aside and concentrated on the mission at hand as he plugged the headset onto his ear.

As the cassette slowly rolled into motion, he started hearing faint clicks and claps. At first, he thought maybe the Walkman was hay wiring. But quickly understood that this was indeed the audio signal. George's immersed himself into the audio time and time again and nearly after half an hour he rose up from the chair. Juliet and the other scientist had retreated to their table of 'messy' data sheets. Seeing him rise up with an uncertain look in his face Juliet called out to him 'Professor any luck with the audio? As George remained silent Juliet continued. 'The clicks and claps, does it resemble any code? We ourselves checked binary and some other codes but our search was in vain.

George broke his silence and replied. 'I think you should seek the help of a linguist. Though he also might face the same fundamental difficulty as I did, he can probably give a better opinion.'

The expectant faces of Juliet and the white coats suddenly turned gloomy. He knew if they had enough proof of an alien life, the discovery would change our perspective of the universe. It will be a path breaking discovery, one that will finally cement the fact that we are not alone in this cosmic ocean.

'What fundamental difficulty' ? Cried out someone from the white coats. George was startled, he himself was in a shower of thoughts. But quickly regained his composure and replied 'maybe because of the gap in our thought process'

'But science is universal. 'Juliet replied doubtfully as if she herself was not sure about it. 'Yes, I completely agree madam, but it seems they have not communicated any equation nor any universal language. Anyway if you give me some more time to analyse the data. I can come back after a week's time with full report of my research and let's see how it goes. Meanwhile you guys continue your work'.

With that George took the Walkman in his hand and began to leave the room. Juliet came beside him running. 'Professor wait', she said panting. George beamed at her. 'The public need not be aware of the scenario until we are sure of what the signal is' she said to which George agreed with a curt nod of his head and walked out of that odd building onto the cold night with loads of thoughts in his mind!

Seti Headquarters Hall

After a week's time,

'Ladies and gentlemen, Scientists and dignitaries, I thought long and hard before coming and speaking to you. Last week as you all know I was given a secret data, presumed to be an alien message. For once I would have to agree with the UFO conspiracy theorists, because it's not a conspiracy anymore! Dear friends, we are not alone in this universe. That was a message indeed.'

The great hall of Seti exploded with loud applause and cheers. The white coated scientists were seen hugging one another with joy as if they had won a million dollars. George observed all this hustle and commotion tight lipped. Because the bad part hadn't come yet.

EY… Georgie, What's the message? Someone cried out from the crowd. George smiled wryly and continued as the cheers had hushed to enthusiastic murmurs.

'I came to this conclusion after long consultation and receiving expert opinions on the matter. We analysed many languages, the programming experts from SETI who were instrumental in confirming our assumption was a great help as they created a simulation program to test and configure the audio data we had received from the microwave transmission. The patterns observed from the audio signal where about 80-90 percent similar to the many conversations in different languages that we tested with. So we can be certain that someone was indeed trying to contact us. But unfortunately we couldn't crack the message.'

There was a stunned silence for a moment and then the hushed murmur with more intensity than before resumed. George had anticipated this so he continued.

' Let me explain myself, first of all this is not an excuse for our inability to decipher the message. This simple fact that I am going to tell you might be hard for you to accept after seeing all these films where 'aliens' speak English fluently, for Christ's sake we are Scientists, intellectuals. We ought to think beyond that! In fact, anyone with a logical brain should be able to think beyond that. If I speak Latin here many of you wouldn't understand me! But it can be understood, because our species are culturally bonded, we have a common origin. Our thought processes are similar. But that's not how it is with aliens.

There are two reasons that I would like to put forward for my inability to decipher the message of our visitor. One is the Intellectual gap and the other is Linguistic gap. Chances that the two of them being solved are astronomical. In a universe where finding life itself is astronomical, finding life forms having the same level of intelligence is like a dream.

Now this doesn't mean that even in the future we won't be able to decipher such a message, only the chances are astronomical. Let's see how it all unfolds.

Let me conclude my disappointing little speech, our guest from a far out world was rightly named Oumuamua, A messenger send out from afar! Now all we can

hope for is that they were saying adios to our beautiful planet and not something else. Thank you all for listening.'

George's speech was greeted at the end with a weak applause, which made it clear that they hadn't taken it well. Juliet patted him on his shoulder and curtly nodded her head as to show appreciation for his speech. As he walked besides the smirking face, he heard someone claiming to solve the message with arrogant confidence. George smirked and said to himself 'Too much Hollywood movies' as he walked out of there smiling with his head held high.

Epilogue

Far away in the unknown vessel, Oumuamua

Today

The giant cosmic entity Oumuamua is seen skimming through the cosmic ocean. Inside it two curious creatures where talking to one another in a strange yet peculiar language which sounded like click and claps.

(The Clicks and Claps…)

'That was a nice green planet' said a meek voice.

'Their sun has probably some 500 million years left' Replied a huffy voice.

It would be perfect for us! Won't it? It has just the right amount of nitrogen and all!

Our new home? Asked the meek voice.

Yes. But it wouldn't be fair not to warn them? Wouldn't it? Asked he huffed voice in a sarcastic tone.

'Ha ha if they can decipher it' said the meek voice.

Together they pressed on an unusual button which seemed to have charged an antenna like machine. With that they turned towards it and spoke together.

"**WE ARE COMING FOR YOU EARTHLINGS ".**

The Fifth Fundamental Force…

By Ramoona Antony Thomas,I M.Sc.Physics

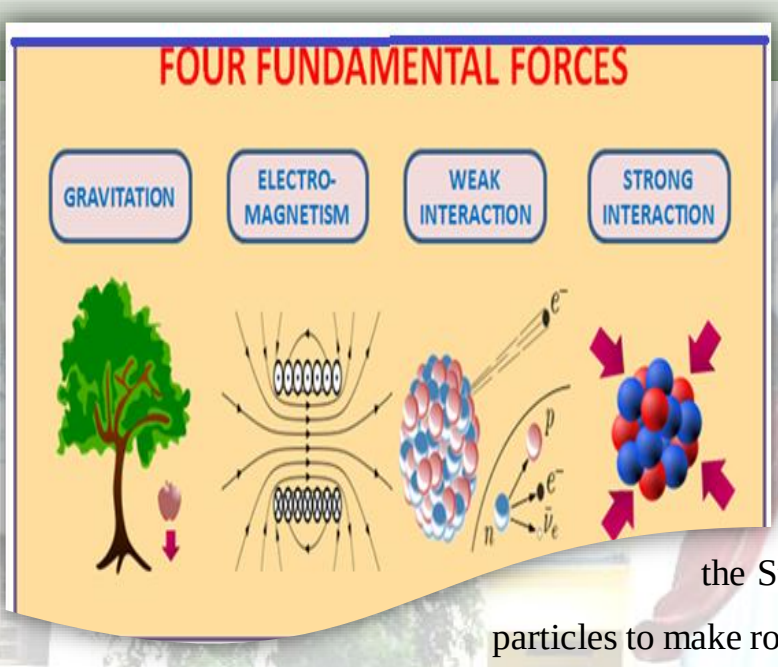
Basically, there are four kinds of forces in the universe, namely: gravitational, weak, electromagnetic, and nuclear forces. Physicists now think they've spotted the actions of a fifth physical force emerging from a helium atom. A few years ago, they saw it in the decay of an isotope of beryllium. Now the same team has seen a second example of the mysterious force at play - and the particle they think is carrying it, which they're calling X17.If the discovery is confirmed, we will be able to understand the forces that govern our Universe, and also it help scientists to solve the dark matter problem once and for all. Attila Krasznahorkay and his colleagues from the Institute for Nuclear Research in Hungary suspected something weird was going on back in 2016, after analysing the way an excited beryllium-8 emits light as it decays. If that light is energetic enough, it transforms into an electron and a positron, which push away from one another at a predictable angle before zooming off.

Based on the law of conservation of energy, as the energy of the light producing the two particles increases, the angle between them should decrease. Oddly, this isn't quite what Krasznahorkay and his team saw. Among their tally of angles there was an unexpected rise in the number of electrons and positrons separating at an angle of 140 degrees. The study seemed robust enough, and soon attracted the attention of other researchers around the globe who suggested that a whole new particle could be responsible for the anomaly.

We currently know of four fundamental forces, and we know that three of them have bosons carrying their messages of attraction and repulsion. The force of gravity is carried by a hypothetical particle known as a 'graviton', but sadly scientists have not yet detected it. This new boson couldn't possibly be one of the particles carrying the four known forces, thanks to its distinctive mass of and tiny life span. So all signs point to the boson being the carrier of some new, fifth force. Fortunately, Krasznahorkay's team haven't exactly been sitting on their laurels over the past few years. They've since changed focus from looking at the decay of beryllium-8 to a change in the state of an excited helium nucleus.

Similar to their previous discovery, the researchers found pairs of electrons and positrons separating at an angle that didn't match currently accepted models. This time, the number was closer to 115 degrees. Working backwards, the team calculated the helium's nucleus could also have produced a short-lived boson with a mass just under 17 MeV. To keep it simple, they're calling it X17. It's a long way from being an official particle we can add to any models of matter.

With the ghostly pull of dark matter posing one of the biggest mysteries in physics today, a completely new fundamental particle could point to a solution we're all craving, providing a way to connect the matter we can see with the matter we can't.



In fact, a number of dark matter experiments have been keeping an eye out for a 17 Megavolt oddball particle. So far, they've found nothing, but with plenty of room left to explore, it's too early to rule anything out. Rearranging the Standard Model of known forces and their particles to make room for a new member of the family would be a massive shift, and not a change to make lightly. Still, something like X17 could be just what we're looking for.

When Dream Comes True

Mr Ibin S. Mathew,

II M.Sc. Physics

It was quite usual in our childhood times that we used to see magicians and other trick-players performing their skills in roadsides and junctions. We do find people who are looking at it with great surprise and enthusiasm. This is all about the case with science. As we go deeper, we do get enthusiastic and will feel the ease to know more. We are surrounded by a web which has its backbone in science and technology.

Ours was a long journey from the people who don't care about any space mission, to a land where almost every house had its television kept ON during Midnight to witness the soft-landing procedures of Chandrayaan 2. People started discussing the science behind every invention they come to know about. Youngsters are in close contact with science. They are the bridge that interlinks the senior generation with science. As the great Indian Dr.A.P.J. Abdul Kalam says" Dream is not that which you see while sleeping, it is something that don't let you sleep". Now we dream of new inventions and possibilities.

With knowledge in science the impossible has turned to be possible. Things which we thought, that would never happen, a few years ago becomes a reality at the present. A temperature as high as that of the sun was beyond imagination, in the

planet Earth. But now as we all know the human brain has even developed an artificial sun. The most interesting fact is that it is even hotter than that of the sun. There is a healthy competition and collaboration between different countries in the field of science and technology, which helps to achieve such a great and quick jump towards the 'earlier impossible'.

China's artificial sun project HL-2M Tokamak, is expected to complete by this year. It is designed to replicate the nuclear fusion process which occurs naturally in sun, to provide unlimited clean energy. The main problem that the scientists face, was to overcome the issue of confining the hot plasma.
With the current facilities available it is quite sure that the scientists will be overcome these difficulties with ease and will go for further improvement in the Field of science and technology. And the key here is the youth who are well aware of what is happening around them and are well aware of the facts and possibilities.

Does Time have a direction?

Jincy Mary Jackson,

I DC Physics

For a long time, scientists including Albert Einstein thought that the universe was static and infinite. Later observations have shown that it is fast expanding and that too at an accelerating rate. But we do see the past when we look at the night sky. This goes will with Einstein's theory of relativity. Everything's past, present and future is relative.

When we consider space and time, everything about space moves forward and backward but time always pushes us to forward direction. Time and space behave asymmetrically. That is why the equations of motion and conservation laws operate differently over time and space. So, why is time irreversible? All the laws, governing mechanics is time independent. It operates in the same manner in the past as in the present. "Past is real in a way that the future is not so that the present consists of something like coming in to being of determinate reality."

To know why time is irreversible, we need to know the process in nature that is also irreversible- 'Entropy'. The law that entropy always increase with time's arrow which expresses this one way property of time. Every time a process occurs in the universe entropy increase which means we are running out of useable energy; we are running out of time.

If the universe had an infinite past, then the night sky would have been completely bright-filled with light from infinite stars. Big bang may not have been the beginning. There may in fact be "parallel universes" where time runs in different directions.

"Experiments on subatomic particles over the past 50 years show that nature doesn't treat both directions of time equally" said Vaccaro. In particular subatomic particles called K and B mesons behave slightly differently depending on the direction of time." That they behave differently determines which way we move through time.

To investigate she reworked the equations of quantum mechanics, assuming that time wasn't identical in both directions, and the results showed that these calculations could accurately describe our universe.

"When this subtle behaviour is included, we see the universe changing from being fixed at one moment in time to continuously evolving" Said Vaccaro in other words the subtle behaviour appears to be responsible for making the universe move forward in time."

CHANDRAYAAN -2 –THE STORY OF INDIA'S PRIDE…

Meenu Krishnan,

II DC Physics

Ten –eleven years of waiting in the wings and hardships, finally on 22nd July 2019, at Indian Standard Time 14:43, our pride mission CHANDRAYAAN -2 began its journey in geosynchronous satellite launch vehicle Mark -3 from Sathish Dhawan Space Centre's Second launch pad, Sriharikota. Completing the first two sections successfully, due to just a software glitch at the closure section, the pride mission of our nation get confined to the status of history.

The second lunar exploration mission developed by Indian space Research Organisation (ISRO) after Chandrayaan -1 is THE CHANDRAYAAN-2. It constitutes The Lunar Orbiter, The Vikram Lander and The Pragyan Rover, all of which were developed in our nation itself. It was launched on 22nd July 2019 (planned) from Satish Dhawan Space Centre (Sriharikota)second launch pad in Geosynchronous satellite launch vehicle MARK 3-M1 rocket. Its orbital insertion took place on 20th April 2019.The main objectives of the mission

include demonstration of soft landing on the lunar surface and the operations of a robotic rover on the surface. Orbital studies of lunar topography, mineralogy, elemental abundance, the lunar exosphere and signature of hydroxyl and water ice; carrying no man in the vehicle. It's planned to be launched in GSLV in the summer of 2019.The orbiter will carry the combined stack up to the moon till the lunar orbital insertion.

The crucial question is "Is Chandrayaan -2 a success or a failure?". Nevertheless, the mission's orbiter remain safely in lunar orbit, with a yearlong scientific mission ahead of it…The majority of attempts to land robots on the moon have ended in failure, either during launch or on the way to surface .The mission is a highly complex one that it represents a technological leap compared to the previous missions of ISRO leading to a new understanding of origin and evolution of moon.

On 2019 Trans Lunar Insertion took place. The vehicle escaped from orbiting the earth and followed a path that took it to the moon's vicinity. On August 20th2019, it was successfully inserted into lunar orbit in preparation for landing. Subsequently, two de-orbit manoeuvres were performed on Vikram Lander so as to change its orbit and begin circling the moon in a 100 km X 35 km orbit.

Vikram's descent was a very planned one and normal performance was observed up to an altitude of 2.1 km. Subsequently, communication from the lander to the ground stations was lost. The orbiter placed in its intended orbit around moon

will enrich our knowledge on moon's evolution ,mineralogy ,and water molecules in polar regions of moon using it's "Eight State Of The Art" scientific instruments .The orbiter camera is the highest resolution camera (.3m) in any lunar mission so far and will provide high resolution images helping global scientific community .The precise launch and mission management has ensured a long life of almost seven years instead of planned one year .The orbiter payloads will conduct remote sensing observations from a 100 km orbit while lander and rover payloads will perform in-site measurements near the landing site .Vikram and rover were scheduled to land on south polar region at latitude of about 70 degree south on September 2019 and to conduct experiments for one lunar day which approximates to two earth weeks. "A successful soft landing would've made our nation "the fourth after USSR, US and PRC to do soft-landing."

However, the lander deviated from its intended trajectory starting at 2.1 km altitude and had lost communication. Initial reports suggesting a crash was confirmed by ISRO chairman K.Shivan stating, ″it must have been a hard launching″. The failure analysis committee concluded that the crash was caused by a software glitch…JUST A SOFTWARE GLITCH…pointing to mission repeat CHANDRAYAAN-3.

REPORT ON ADD ON COURSE –'RADIATION PHYSICS'

Ms Bindhu Christopher
Radiation Physics (Add-on Course)
Coordinator

The Add on course in Radiation Physics conducted by the Physics Department was co-ordinated by Ms. Bindhu Christopher with the HoD Ms. V.Vimala as the convener . Launching of Add on course in Radiation Physics was conducted on 22th August 2019 with a grand ceremony and was inaugurated by our manager **Rev. Dr Rolden Jose Jacob.**

Mr Niju T Thankachan, Assistant professor, Department of Radiotherapy, Government Medical College, Trichur, was the chief guest in the function. He delivered an inspiring talk on '**Radiological diagnoses, Radiation treatments and Cancer prospects'.**

About 56 students from various departments were selected for the course. Six teachers from the department of Physics were the resource persons for the course. Dr Jojo P. J. introduced the fundamental ideas of

electromagnetic rays and radiation physics and enlightened the students with his inspiring class. About 25 theory classes and 5 practical classes were arranged.

Theory classes included the fundamental topics of radioactivity, latest reviews on mobile phone radiation, calculation of radiation rate from mobile phone and other wireless technology.

The most significant part of the course was that it introduced the medical diagnostic techniques and treatments such as X-ray radiography, Fluoroscopy, Magnetic resonance imaging (MRI),Medical ultrasonography or ultrasound, Endoscopy, Elastography, Tactile imaging, Thermography ,Medical photography and nuclear medicine functional imaging techniques e.g. positron emission tomography (PET),Computed Tomography, How a CT system works, Advances in Technology and Clinical Practice, What is General Nuclear Medicine, Diagnosis, Therapy, What are some common uses of the nuclear medicine-Heart, Lungs, Bones, Brain, Other Systems, Nuclear medicine therapies, Medical Ultrasound ,Foetal imaging, Diagnostic imaging, What is radiation therapy, Side effects, Short-term side effects, Long-term side effects, Radiation therapy and chemotherapy.

As part of the course, practical sections were also provided to the students. by Ms Bindhu Christopher and Parvathy Dathan. The main experimental arrangements were,

1. Calculation of power densities from different mobile phone with same frequency range and different frequency range using hand held microwave leakage detector.

2. Calculation of ionizing radiation rate of artificial radiation sources with different voltage using GM counter.

3. Calculation of temperature variation and SAR values of Brain tissues (demo) using Lutron thermometer.

4. Comparison of radiation rate from natural source of radiation and artificial source of radiation by using survey meter.

An industrial visit was also conducted by the department. Innovative teaching methods like Case Study, Group discussions using audio- visual tools etc were carried out.

During the first week of January a Case Study was conducted for the students. The Case Study was mainly focused on calculation of SAR values of brain eye and skin tissues of freshly collected samples of Goat due to mobile phone radiation. Students showed keen interest and each one submitted a brilliant case study report with great effort. Reports of Nicymol Shaji, II DC Zoology and Aleena A, II DC Physics were selected as the best case study reports.

Another remarkable day of the course was the industrial visit day. On 14th February 2020, about 35 students were selected for the industrial visit based on the attendance percentage and quality of case study report. Quilon Scan Centre, one of the leading scan centres in Kollam granted permission for the industrial visit. Facilities provided by the management team of the scan centre was amazing. They gave a detailed explanation about various medical imaging techniques. Detailed review of their explanations are as follows:

The industrial visit was conducted on 14 Feb,2020 under the supervision of Ms Bindhu Christopher, Dr Sheena Mary Y ,and Ms Parvathy Dathan of Physics department. The purpose of the industrial visit was to know about the different diagnostics tools used for scanning and its mechanisms.

Ultrasound

An ultrasound scan is a medical test that uses high frequency sound waves to capture live images from inside of our body. It is also called sonography. It allows doctor to see problems with organs, vessels and tissues without needing to make an incision.



Ultrasound uses no radiation. So, it is a preferred method for viewing a developing foetus during pregnancy. These scans can provide an expectant mother with the first view of her unborn child. An Ultrasound can provide view of the bladder, brain, kidney, liver etc.

An Ultrasound technician will apply special lubricating gel to skin so as to rub ultrasound transducer on skin. Gel transmit the sound waves, transducers sends ultrasound waves in to the body. These waves get reflected and echoed back in to the computer. They form a picture that can be examine by the doctor. All procedure last less than 30 minutes.

After an ultrasound Doctor will review image and check for any abnormalities. If anything, abnormal turns up one need to undergo other diagnostic techniques such as CT scan, MRI etc. It can operate with frequencies from 20KHz up to several Gigahertz. Ultrasound is sound waves with frequencies higher than upper audible limits of human hearing.

X-rays

X- rays are parts of electromagnetic spectrums with wavelengths shorter than visible light. They are high energy EM waves. An X-ray machine uses an X-ray generator and X-ray detector. It is used to detect bone fractures.

Grids: A bucky potter grid may be placed between the patient and detector to reduce the quantity of scattered X-rays that reach the detectors. This improves contrast resolution of the image, but also increases radiation exposure for patients.

Detectors: It can be divided in to major categories -Imaging detectors and X-ray films replaced by digitalizing devices like image plates and dose measurements devices used to measure local radiation.

Shielding: Lead is the main material used by radiography personnel for shielding against scattered X-rays.

Bone X-ray uses a very small dose of ionizing radiation to produce pictures of any bone. It is used to diagnose fractured bones/joint dislocations. Bone X-rays are used to access bone fractures, injuries and joint abnormalities. Patients are made to lie down either on anatomical /lateral position. In case of bone and tissue different dosage of radiation are used.

X-ray working

A small amount of ionizing radiation is passed through the body. X-rays examination are more likely to use a devise that will capture transmitted X-rays to create an electronic image.

The calcium in bones block the passage of radiation, so healthy bones show up white or grey. Radiation easily passes through air spaces so lungs that are healthy appear black.

- The radiographer will instruct in positioning for X-ray.
- Patient placed between X-ray machine and imaging devises to transmit rays through the body.
- Radiographer will shield parts of body with lead apron.
- Radiographer will need patient to position correctly.
- Radiographer operates control while each image taken.
- Patients are asked to hold breathe for preventing blurring image.
- A straightforward X-ray taken a few minutes or may take longer.

Medical Issues with X-ray exam

- Pregnant patient should never take X-ray.
- Conventional X-ray required hospital gown.
- Some involve use of iodinated contrast agent which improve details of images.
- Frequencies of X-rays range from 30 petahertz to 30 exahertz and energy is range 100 eV to 1000 eV.
- Exposure to high radiation can have a range of effects such as vomiting, bleeding, fainting, hair loss and loss of skin.

Mammogram

A mammogram is an X ray picture of the breast. Doctors use a mammogram to look for early signs of breast cancer. For taking a mammogram patient will stand in front of an X-ray machine.

A technologist will place their breast on a clear plastic plate. Another plate will firmly press the breast from above. The plates will flatten the breast holding it while X-ray is taken. The steps are repeated to get side view of breast. The other breast X-rayed in same way. The technologist checks the four X-rays to make sure they do not need to redone. Technologist cannot tell the patient about results of mammogram. A radiologist reads the mammogram and reports the results to patient and doctor.

If Mammogram is abnormal

Additional test shall be taken before confirming that there is cancer patients may also be referred to a breast specialist or surgeon.

Main risks and adverse consequences from screening mammography include discomfort from screening mammography include discomfort form breast compression, patient recall for additional imaging and false positive biopsies.

CT Scan

CT Scan or Computed tomography scan makes use of computer processed combination of many X-ray measurements taken from different angles to produce cross-sectional images of specific areas of scanned objects allowing user to see inside the objects without cutting. These images provide more detailed information than normal X-rays images. They can show soft tissues blood vessels, bones etc. A CT scan can be used to visualize the head, shoulder, spine etc.

CT can diagnose infection, muscle disorders, bone fractures etc. It can pin point the location of masses and tumours, study blood vessels, guide surgeries, monitor the effectiveness of treatment etc.

CT Scan Procedures

Patient is asked to take a special dye called contrast material that help internal structure to see. Depending on the part that being inspected one may need to drink a

liquid that contain contrast. After changing into the hospital gown without any jewelleries, patient will lie face up on a table that slides into the scanner. The technician will leave the control room and they will communicate with patient with intercom.

Once the table is into the scanner, X-ray machine will rotate and each rotation produces numerous images of thin slices of our body. Entire procedure takes 20 minutes to 1 hour.

Risk with CT Scan

The risk for cancer may increase over time if multiple X-ray or CT scan. The risk of cancer is increased in children receiving CT scans. Some people are allergic to contrast material. Though the radiation from the CT scan is unlikely harm our body, then the doctor may recommend another diagnosis such as ultrasound, MRA scan etc.

CT scans are taken within 24 hours after an accident. Nowadays machine are designed to give more precision with less time and lesser radiation. Cooling in the room is a must for proper functioning of CT scan machine.

OPG (Orthopantomogram)

- An OPG is a scan that gives a panoramic view of jaw and teeth. Scan can provide information on wisdom teeth, bone loss, orthodontic assessment. OPG unit is specially designed to rotate around patient's head during scan. It can take approximately 20 seconds. This can be used for surgical planning. Patient need to bite on mouthpiece and rest chin on plastic rest. Head is kept still and part of machine rotates around head as images are taken.

EEG (Electroencephalogram), ECG(Electrocardiogram)

EEG is a non-invasive test that records electrical patterns in or brain. It is used to diagnose seizure, epilepsy, dizziness, headache, brain tumour etc. It can be used to confirm brain death. ECG is the test that measures the electrical activity of heart beat. It is used for assessing cardiovascular diseases. It is also used for detection of myocardial ischemia and infarction. ECG records heart's activity on a strip of paper.

Case Study on Mobile Phone Radiation and its Effects

(Best Case Study Report Among Physics Students)

ALEENA.A

II DC PHYSICS

ABSTRACT

The growth in the use of cellular phone has raised the concerns about the possible interaction between the Electro Magnetic Fields (EMF) radiation and the biological effects on human tissues, particularly the brain and the human immune system. These concerns have induced a large volume of research studies. A study was conducted on the effect of mobile phone radiation and its after effects on human body. With the help of Lutron Thermometer, the rise of temperature on the tissue of brain, eyes and skin are noted. The specific absorption value of brain, skin and eye is obtained from the study and from the obtained value mobile phone radiation is noted. Our conclusions show that long-term exposure to EMF radiation from a cell phone could cause health effects, such as brain cancer.

INTRODUCTION

It is just to say that we live in a modern world with advanced technology. Requiring access to information and communications everywhere has created a new world. A device such as a cell phone has been used extensively due to having supreme communicative technology, but a cell phone is the main source of electromagnetic waves which can influence human tissues. The World Health Organization has reported dispersion of radio frequency waves as one of the most

polluting sources, which are hazardous for human beings. Cell phones are considered as an important invention that has changed communication ways in this modern world. However, using cell phones had irregular growing rate in recent years. This rapid increase of using cell phones has provided worries about radiated frequency waves resulted from cell phones is increasing the temperature of body issues. Using cell phones near the head has provided general worries about damaging effects on the central nervous system confronting with radio frequency waves during conversation with the phone. In a study, after a 30 min confrontation of a cell phone with brain tissue, the brain temperature increased by 4.5^0C. Cell phones users often complain about warming of their ears due to having contact with cell phones. This temperature increase may be due to radio frequency and electromagnetic waves absorbed by the user's head. Since the cell phone antenna is placed near the ear and head during contacts, the head is necessarily facing radio frequency waves and this has caused anxieties in this regard. Lindholm stated that the temperature of ear canals in users increased up to 1.5^0C in confronting with the radio frequency waves of cell phone for 35min.

Since during contacts, cell phones are placed near the ear and head and also because the sensitivity of brain tissue to changing of the temperature, the aim of this study is to determine the effect of mobile phone radiation.

Methods

This study was an experimental study. A goat's brain was used to evaluate the effect of cell phone radiation. A mobile phone was used to investigate the thermal effect of mobile phone radio frequency, as if a person is talking on a cell phone. Temperature increase in eye, skin is also measured.

Laboratory Equipment

Lutron thermometer (Model: TM-917) with precision of 0.01 was used for measuring the tissue temperatures. It is made of platinum sensor. Lutron thermometer could measure in both Fahrenheit and Celsius units, Celsius unit was used for this study. The temperature changes were measured and recorded in a momentary basis. Thermocouple consist of two wire legs made from different metals. The wire legs are welded together at one end, creating a junction. This junction is where the temperature is measured. The operating principle of the thermocouple is based on the Peltier effect. The thermocouple circuit consists of two metals joined together to form two junctions of different temperatures. A Peltier emf is generated due to the difference in temperatures of the two junction of circuit.

Figure -1 Precision 0.01˚ Thermometer

Fig.1 represents precision 0.01^0 Thermometer Model: TM- 917

- Professional thermometer with high accuracy & 0.01 resolution.
- Accept multi type temperature probe input: Platinum PT 100-ohm, thermocouple type K/J/T/E/R
- With 0.01 high resolution for both platinum and thermocouple probe input.

- PT 100 probe input cooperate with an 0.000385 alpha co-efficient meet DIN IEC 751.
- Cooperate with 4 wires Pt- 100 Ω probe, high precision.
- Wide range display from – 100 to 1370^0c. (Type K)
- Build in ^{0}C &^{0}F select button on the front panel.
- Super large LCD with unit display, easy read out.
- Memory function to record the maximum & minimum reading with recall.
- Data hold function for stored the desired value on display.
- Built in low battery indication.
- Build in REL button useful for relative measurement.
- Optional heavy duty & compact housing case, designed for easy carry out.

PREPARATION

The Goat's brain tissue was placed in the skill. A cell phone was used to investigate the thermal effect of mobile phone radio frequency placed on a distance on the lefty of the brain tissue, as if a person is talking on a phone. After adjustments, the thermometer was turned on and connected and the related software was operated.

The temperature balance between the environment inside the compartment and the tissue for reducing the errors regarding the contact between the tissues and the cell phone was not fulfilled at the beginning, until the temperature of the tissue and the compartment became similar and the thermometer showed a fixed temperature, the stabled temperature was recorded and this temperature was called the base temperature (i.e. tissue temperature before confronting with the mobile phone). Then the contact was made

between the issues and the cell phone, as if a person was talking on the phone. The confrontation time, the contact time was considered 15 min. After finishing the confrontation time, the contact (temperature) was cut off. For the next stage, the tissue was kept for 15 min for its temperature to be reduced without confrontation and the presence of radio frequency waves.

After attaining base temperature, the thermometer is connected to goat's brain. The Lutron thermometer contains a very sensitive thermocouple (model TM – 917) Fig. 1) to measure the temperature. The goat's brain has an initial temperature of 0.8^0c. The thermometer has a precision of 0.01^0c. The mobile phone is brought in calling mode and placed near the brain which is placed inside a human skill. For every minute the rise in temperature is noted.

Similarly, the thermocouple is placed in skin and eye, closed to the eye socket and the corresponding change in temperature is noted. The temperature measurements for each 600 seconds are noted for different positions. From the specific Absorption Rate (SAR) value, the effect of mobile radiation on human body can be studied.

The SAR value for brain, skin and eye was calculated using the equation.

$$\text{SAR} = \frac{\text{Increase in temperature} \times \text{Specific Heat Capacity}}{\text{Time}}$$

Table 1. Specific Heat Capacities

Body Tissue	Heat capacity	
	Average(J/kg/^{0}c)	Maximum(J/kg/^{0}c)
Brain	3630	3682
Skin	3391	3662
Eye (Cornea)	3615	3615
Eye (Iris)	3421	3799
Eye (Lens)	3133	3644
Eye (Retina)	3696	3753

For microwaves the dosimetry quantity of interest is given by the specific absorption rate SAR, which is defined by the absorbed power per unit mass. The SAR is difficult to determine and may be estimated for example by measurements of the electric field strength of the radiation, the temperature increase or by numerical stimulations. The International Commission on Non-Ionizing Radiation Protection (ICNIRP) has recommended limits. These limits are based on the knowledge, that an exposure of the whole body with an average SAR of 4 W/kg will lead to a temperature rise of 1^0c.

RESULT

Temperature measurements for each 600 seconds are noted for different positions with same power conditions. The SAR value for brain, skin and eye were calculated using equation.

$$SAR = \frac{\text{Increase in temperature} \times \text{Specific Heat Capacity}}{\text{Time}}$$

The observed instantaneous values of temperature at various points and the SAR values calculated are presented in the Table 2.

TABLE 2: Observed Average values of temperature variation and estimated SAR values for eye, skin and brain tissues for positions from different hand set.

RADIATION SOURCE	TIME (SECOND)	TISSUE	SPECIFIC HEAT CAPACITY Jk^{-1} kg^{-1}	RISE IN TEMPERATURE	SAR VALUES Wkg^{-1}
HAND SETs	600	BRAIN	3696	0.08	0.49
		EYE	3615	0.02	0.13
		SKIN	3391	0.10	0.56

DISCUSSION & BIOLOGICAL EFFECTS

The present study evaluated the effect of increasing the distance of cell phones to brain tissue on temperature change in brain, skin, eye, due to the heat generated by radio frequency waves. The distance of brain tissue to the cell phone had more relations with the increasing rate of tissue temperature and by increasing the distance, less amount of increase in the tissues was observed.

Most of the hazardous biologic effects about the cell phone waves on humans are considered to be due to the effects of temperature increase, such that some of the all phone waves are transferred to human body as heat by current activated hyper polarization induced by the electric field and vibration of polar molecules, in going through an environment. Temperature is higher in brain tissue as compared to other tissues with low metabolic aspects in generating heat.

By increasing the temperature of the brain, the blood circulation is rapidly increased and the thermal self-adjusting reactions are activated. Measuring heart automatic responses and evaluation of brain blood flow are used as the indirect wideness of the interactions of blood circulation and adjusting the temperature during confrontation with radio frequency waves. Thus, separating confrontation

and high temperature of the brain tissue even after some time from the confrontation would make undesirable effects on brain health after a passage of time. In the studies by Beason, about the electromagnetic effects on brain, they showed that the similar waves to cell phone tele communication system could lead in 52% of case in increasing brain neuron activities. The results obtained from some epidemiologic studies show that even with lower densities than the permissible limits, all phone waves can cause signs and symptoms such as headache, feeling high temperature in ears, weakness of memory and fatigue. In a study regarding the effects of waves due to radiation generated by cell phones on vital signs in users. Mortazavi and Atefi obtained significant relations between using cell phones and disorder in paying attention, learning and concentration in users. Negative effects of waves resulted from cell phones and disorders in paying attention, learning and concentration in users. Negative effects of waves resulted from cell phones on the brain activities, and capabilities are confirmed in some studies. It was reported in a study that cell phone waves provide considerable changes in the density of dopamine, norepinephrine and serotonin in hippocampus, cerebellum, medulla in the brains of mature mice. The change in the rate of the densities of neural intermedias can be effective in creating anxiety and problems regarding memory and learning.

- Ca^{2+} efflux nervous tissue
- Permeability of the blood – brain – barrier
- Changes in metabolic level
- Changes in ECG – and sleep parameters
- Behavior changes
- Influence on blood pressure
- Evidence for non-thermal effects in experimental systems.
- Subjective symptoms

- Genotoxic effects
- Cell proliferation
- Tumor promotion and progression
- Incident rate for leukemia and solid tumors.

REPORTS

- In 1984, Dulta et al. uses a frequency of 915 MHZ for 30 min. The SAR value founded war 0.05 and there is an increase in calcium efflux in brain etc.
- In 1997, stagg uses a frequency of 836 MHZ for 24n. The SAR value formed was 0.0059 and Glioma cells show significant increase in thymidine incorporation, which may be a indicator of increase in cell division.
- In 2001, Kuree uses a frequency of 960MHZ for 20min. The SAR value was found to be 0.002. There is increased stress protein in human epithelial amnion cells.
- In 2010 campus uses a frequency of 900MHZ for 14 days 20 min per day. The SAR value was found to be 0.045. A DNA damage in human gial cell is found.
- On 28 March of 2019, the scientific per review of a landmark United states government study conducted that there is ‘clear evidence’ that radiation from mobile phones cause cancer, specifically, a heart tissue cancer in rates that is too rare to be explained as random occurrence.

CONCLUSION

The temperature difference could be related to one side to heterogeneity of brain tissue during movement from the brain membrane to its depth. Which is due to changing of grey matter of brain to white matter. From another point of view, the differences in building and temperature in various depths could be related to the aspect of generating optimum induced temperature in different depths, with regards

to different variables such as frequency of waves and the direction of radiations, all of which should be considered in the future studies. This study shows that the temperature of brain tissue is incorrect after contacts with electromagnetic waves generated by all phones. The fact that the effects of these waves could be observed and recorded is an introductory for predicting the mentioned effects and the probable effects due to them.

TIME UP-TIME DOWN

Time travel

By Devika

Omanakuttan, II D.C. Physics

So many questions are arising about Einstein special theory of relativity and the possibility of time travel. According to Einstein when you can travel in the speed of the light, you can time travel to our future. Time dilation is happening everywhere in earth 365 days and 24 hours but we are not aware of it because it's so insignificant to feel it but outside the earth things god different. International Space Station is orbiting the earth at the speed of 27000 kilometer per hour. The speed is too small comparing to the speed of the light but at least we can feel the phenomena of time dilation in Space Station. The person who is in space Station Falls behind the time on earth by 0.05seconds that means when he come back to earth, he literally travels to the Future by 0.05 seconds but that is just an insignificant amount of time, so it can't be said

as the time traveled. That is if we travel at the speed of light time slows down. let's talk about time machines imagine we are time travelling in a vehicle around the earth continuously at the speed of light that is 300000 kilometer per second and that will continue for100 years now time travel is going to happen. The person inside the vehicle will only feel 10 hours passed but outside the vehicle that is on the earth the people would see that vehicle is running around the globe for continuous hundred years. The wrist watch and even the Heartbeat of the traveler inside the vehicle will get slow down after hundred years. When the vehicle stops the traveler is now reached the hundred years to the future. This is the velocity time dilation when we talk about gravitational time dilation, this effect measures the amount of time that has elapsed between two events by observer at different distances from a gravitational mass. In other words, time run slower whenever gravity is strongest and this is because gravity curves spacetime. It is true that after few hundred years we can invent the time machine and we can go to the Future because science is growing too fast of course we can travel through our future but we cannot travel to our past this is explained on the basis of Grandfather Paradox. The grandfather paradox is a paradox of time travel in which inconsistencies emerge through changing the past. The name comes from the paradox's common description: a person travels to the past and kills their own grandfather before the conception of their father or mother, which prevents the time traveler's existence. The grandfather paradoxdoesnotexclusivelyregardthecontradictionofkillingone'sowngrandfat hertopreventone's birth. Rather, the paradox regards any action that alters the past, since there is a contradiction whenever the past becomes different from the way it was.

Departmental Activities and Achievements (September 2019 -March 2020)


II PG Students(2018-20) as Volunteers of "Sasthrajaalakam -2019",SIET,Govt of Kerala on 20-22,Nov 2019


Students of II DC Physics (2018-21) as Volunteers of "Sasthrashikshak", Science Fest on 23-24,Jan 2020


Powerpoint Presentation Competition for Physics Students on 30 Jan, 2020


Poster Competition organised by Physics Dept on 12 Dec, 2019. I Prize: Beji Terense (I DC Physics)

Departmental Activities and Achievements (September 2019 -March 2020)

Talk on 'Awareness about Cancer' by Dr V. P. Gangadharan famous Oncologist (Senior Consultant and HOD of Medical & Paediatric Oncology, VPS Lakeshore, Kochi, Kerala) on 11th December 2019

സീനിയർ ബേസ് ബോൾ ചാമ്പ്യൻഷിപ്: ഫാത്തിമ കോളേജ് ചാമ്പ്യൻമാർ

കൊല്ലം ▸ ജില്ലാ ബേസ് ബോൾ അസോസിയേഷന്റെ നേതൃത്വത്തിൽ അബ്ദുൽ ഹമീദ് മെമ്മോറിയൽ എവർ റോളിങ് ട്രോഫിക്കായുള്ള സീനിയർ ബേസ് ബോൾ ചാമ്പ്യൻഷിപ്പിൽ ഫാത്തിമ മാതാ നാഷണൽ കോളേജ് ടീം ചാമ്പ്യൻമാരായി.

നിലമേൽ എൻ.എസ്.എസ്. കോളേജിനെ 2-3 എന്നനിലയിലാണ് പരാജയപ്പെടുത്തിയത്. മികച്ച കളിക്കാരനായി ഫാത്തിമ കോളേജിലെ അഖിൽരാജിനെ തിരഞ്ഞെടുത്തു.

ചാമ്പ്യൻമാരായ ഫാത്തിമ കോളേജ് ടീം

Seminar on 'Right Attitude for success' by Mr Ajith Kumar Ramaswamy (Dir, MIML,Kollam)

Mr Nibin N IstPG Physics won the SBBChampionship on 20th November 2019

College Tour 2017-20 BSc Physics Batch

Dr Jojo P J receiving gratitude memento from RCQH

Departmental Activities and Achievements (September 2019 -March 2020)

Kiran K.S.,III DC Physics, Naval NCC Cadet, receiveing memento from Smt Mercykutty Amma (Minister of Fisheries & Small Industries) on 2/10/19

Physics Students during "RUN FOR A SAFE CHILDHOOD", Mini Marathon by District Administration

Physics Students who got selection for Naval NCC pavilion,NCC Day Celebration,Kerala State

Ibin S.Mathew, II PG Physics,receiving I prize (Essay Competition, Co-operative Bank,FMNC) from Principal

II PG Students during visit to ShantiDaan,Old age home,Tangassery on 27 Jan,2020

Launching of "Radiation Physics -Add on course" and "Cygnus"-Physics Magazine Release on 22 Aug,2019


Beji Jerome
I DC Physics