

QUINTESSENCE

A PHYSICS MAGAZINE

2022

WHAT'S INSIDE

Why Santa Claus is younger than you and why Cinderella would've preferred flats over heels!

LATEST SCIENTIFIC BREAKTHROUGHS

Find out about the discovery of Time Crystal and Jupiter's New Moon

A SCIENCE KWEEZ FOR EVERYONE

Give it a shot, if you can't do it the answers are on the same page!

TEN

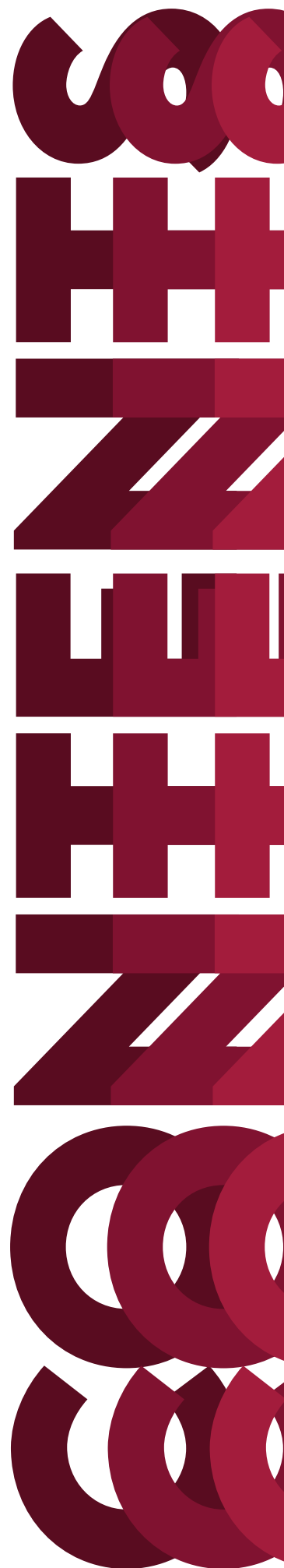
**FACTS YOU DIDN'T
KNOW ABOUT**

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01

FACULTY &
STUDENTS



1961 - 2021

Prof. C. Sheela Reddy
Principal

श्री वेङ्कटेश्वर कलाशाल
Sri Venkateswara College
(University of Delhi)
NAAC 'A' Accredited

FROM THE PRINCIPAL'S DESK

"Quintessence" is a platform for students to develop their creativity and scientific temperament. The magazine brings together every ounce of student's curiosity. This edition of the magazine looks at Physics from an entirely different perspective, thanks to the detailed and well researched insights it offers. The student editorial team has worked well to squeeze huge pieces of scientific information into insightful, properly sculpted articles. This edition of the magazine is more vibrant and richer in context it offers its readers. The quiz questions are intellectually stimulating and invigorating. The amalgamation of core scientific writing with poetic perspective is appreciable.

C. Sheela Reddy
PRINCIPAL

Proud History.....Promising Future

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PHY
DEPT



2021-
2022



Dr. Pratima Vyas

Pratima ma'am is not only a good mentor but also one of the most supporting professors we have ever got. Her teaching methodology makes her lectures interesting, requiring the participation of almost every student. The way she breaks a bigger problem into smaller chunks to reach incredible conclusions leaves us in awe. Her amiable nature guards us whenever we need any help.



Prof. K.C. Singh

Chandramani sir is an exceptional professor. He is always willing to help us solve problems and encourage us to make decisions that can be beneficial for us in the long run. Apart from academics, he even encourages us to partake in extracurricular activities to break the monotony of life. His teaching style is not only insightful but also greatly inspirational. Attending his lectures is always a delight.



Dr. Manoj Giri

Manoj sir has been one of the finest teachers and mentors we have ever come across. He has a peculiar way of providing education and pushing students to be the best version of themselves. He has always been supportive and would go through his own concepts before presenting them to everyone around him. He is one of the smartest people we know and his wide array of research achievements speak for themselves.



Dr. Garima Saxena

Garima ma'am has a refreshing way of teaching which makes her lectures interesting. She not only knows the worth of knowledge from books but also their applications in everyday life. She teaches concepts lucidly like laminar flow. She is truly passionate about explaining each and every topic to her students. Always there to have our back in critical situations, Garima ma'am helps us to rise and shine!



Dr. A.K. Chaudhary

A.K. Chaudhary sir is an extremely skilled professor. He encourages us to take advantage of every opportunity that comes our way and assists us in honing our research abilities, which can prove to be extremely valuable for our academics. His anecdotes related to various topics expand our horizons of knowledge. He is kind, supportive and to say the least, a source of inspiration.



Prof. Anant Pandey

Anant sir is an extremely supportive and dedicated teacher. Rather than referring to books, Anant sir holds open discussions in class allowing us to brainstorm solutions and reach conclusions on our own. His classes are fun and informative at the same time. Apart from being an amazing professor, Anant sir assists us with our day-to-day decisions, while reciting about his life experiences which stand as an inspiration to do better every day.



Dr. Narender Kumar

Narender sir is an exceptional leader of the department, who not only recognises the potential of all his students but also encourages us to step out of our comfort zone by exploring new domains. His knowledge and passion for physics, combined with his amazing mentorship has allowed the students and the department to succeed in academia. He fosters active participation in his classroom.



Dr. Ram L. Awasthi

Brimming with knowledge, training his students for elephant challenges and never refusing help, Dr. Ram Lal Awasthi sets an ideal example of a professor. His eloquent explanations and comforting voice during interaction make his personality even more impactful. With inquisitive eyes, he approaches every novel subject and likes keeping himself sound about it. We love his sense of satire.



Dr. Chandrabhan Dohare

Chandrabhan sir is a diligent and meticulous teacher. He makes us comfortable in class and values our thoughts and ideas. His subject knowledge and zeal towards physics inspires us a lot. Not only does he teach us physics concepts and principles, but also tells us about the great people who derived or discovered that. He has always taught us to respect our roots and aim for the sky!



Dr. Surendra

Surendra sir's articulate method of teaching always leaves us astounded. His thorough method of teaching makes the hardest concepts very easy to understand. His passion for the subject is awe-inspiring. He manages to give real-life instances to explain concepts like time dilation which would seem almost impossible to do! He also makes sure to connect with all his students during the class.

From the teacher-in-charge

It has been yet another remarkable year for the Department of Physics of Sri Venkateswara College, University of Delhi, and as the teacher-in-charge of the department, this has been a memorable journey. Most of the academic activities and events happened during this academic year in virtual mode as compelled by the COVID-19 pandemic, but the pandemic didn't stop the students from going on this great voyage. I would like to applaud the coordination and efforts behind our team consisting of all the teachers, non-teaching staff, and students of the department for making such a fruitful and memorable year. Much to our delight, the teaching shifted back to offline mode but despite the unforeseen changes and increased pressure of workload, the students took up the challenge positively. Their efforts have thus continued to make us proud.

Nurturing creativity and aspiring innovation are two vital elements of a successful education and our department magazine "Quintessence" is a perfect amalgamation of both. Our magazine harnesses the creativity of young minds and distils the essence of their inspired imagination in the most brilliant way possible. It brings out the latent talent in our students through articles, poems, quizzes, and experiences. I am therefore extremely delighted to learn that our magazine, Quintessence, is ready for publication. I congratulate the editorial team on their successful completion of the daunting task of putting together the myriad thoughts and dreams of our students and bringing out this magazine on time. I wish them all success in reaching greater heights in life.

Finally, I would like to take this opportunity to give my best wishes to our dear outgoing students of the batch 2019-2022 whom I saw just at the starting and now at the very end of this journey. Nonetheless, your virtual presence on my laptop screen during the online classes will remain in my memories forever. Think big thoughts and be optimistic about whatever you are doing. On behalf of the college, I bid you farewell and wish you the best of luck in the days ahead. Finally, I welcome other batches to offline mode, in the hope that the pandemic is losing its power and will no longer impact our life in unprecedented ways. May you all soar high in uncharted skies with the wings of education and bring glory to this department.

- DR NARENDER KUMAR



From the Convenor

Pushing for Progress



As I sit to draft my fourth note for *Quintessence*, I am reminded of my journey of mentoring Principia for the past four years, the time well spent meeting various challenges and devising ways to solve each, every time aiming to give more and better. We here in Principia, cherish the spirit of evolution aiming to accomplish Aristotle's vision of supralunary heights while sticking to the form of modern science. With this vision Principia in 2019 vowed to publish *Quintessence* every year without any miss outs and I proudly say that the society has been able to keep its commitment in spite of the very difficult situations faced during the pandemic period. I would like to say that this issue of *Quintessence* epitomizes resilience and renewal.

I applaud the coordination and efforts of my team for working hard the year round, together fighting against all odds and bringing out this magazine in its present form. *Quintessence 2022* is the outcome of the exuberant efforts of the authors, editorial board and all the team members. It is their willingness to share knowledge, concerns and special insights with fellow beings that has made this magazine possible.

Quintessence is Principia's effort to push teaching learning boundaries beyond the curriculum limits, nurturing creativity and inspiring innovation in our students. The ideology is aptly reflected through the contents of the magazine wherein the articles by students amalgamate creative fecundity and richness of expression with the scientific temperament.

This issue focusses on different perspectives of Physics. The usual notion is that Physics implies complicated mathematical structures and tiring

experimental analysis. The editorial articles in this edition raze this illusion and highlights that Physics is everywhere, it's in art, in philosophy, in fiction, in poetry... in fact it's in the very never-ending unsatisfying quest to understand the existence of being and not -being, justifying the name getting derived from the Greek theological term 'Physis' meaning 'nature'. Next, all the activities organized by Principia in this academic year are well summarized under report section. The events though were held in virtual mode as compelled by the covid-19 pandemic, the engagement and enthusiasm of participants was commendable. The other half of this edition is dedicated to the science savvy brains where our students have talked about the new scientific breakthroughs, lesser-known physical science facts, and the research projects done along with their college studies. There is also a science quiz for everyone adding the flavour of entertainment.

I hereby end, wishing the readers an enlightening and thought-provoking experience and hope that *Quintessence 2022* will serve as a knowledge contributor to its readers.

- DR GARIMA SAXENA



The Student Council



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Editor



SWASTIKA THAKUR
Editor



YUVAJ SHARMA
Editor



GUNJAN JAIN
Content Creator



AARATHI RATHISH
Content Creator



GAYATHRI PILLAI
Content Creator

President's Note



When, for the first time, a chat with my mother piqued my curiosity, I was too young to appreciate the grandeur of this creation. That was the start of my adventure towards science and exploration. Physics has always got my attention, therefore I opted to take a bachelor's degree in the field at Sri Venkateswara College, University of Delhi.

The college's physics department introduced me to Principia, The Physics Society, which is one of the most fascinating societies. I've gone a long way in this journey, serving as editor and vice president of the society for the previous two sessions before becoming its president for the session 2021-22.

Principia has taught me things that I would not have been able to learn in any other way. It has aided in the development of my overall personality, taught me the importance of giving back to society while also encouraging creativity and curiosity through the organisation of various events, assisted me in making valuable connections, and served as a strong foundation for my future prospects.

Along with Dr. Garima Saxena as our convener and Dr. Narender Kumar as our HOD, this family of mine consists of 16 other truly dedicated and determined jewels. I am grateful to each of them since it is due to their efforts that I was able to put together a fantastic tenure and publish Quintessence 2022, a magazine dedicated entirely to realms and charisma of Physics.

Our fantastic editing team, led by Editor-in-chief Bhumika Taneja, and designed by General Secretary Muskan Singh, is responsible for this edition's appearance. Not only will you find editorial articles in this section, but also student research, an introduction to the department and physics professors at Sri Venkateswara College, our alumni, and much more.

As a result, I hope that not only will we be able to expose you to Principia, but also to the power it possesses to mould minds, nurture creativity, and promote the relevance of physics and science in general in one's life, through this edition. We hope you enjoy it as much as we do!

- KAMALPREET KAUR

LETTER FROM THE

Editor



I do not know how to be profound, so I will try to be honest. To say that I am a writer would be an exaggeration, for most of what I've written remains in the confines of my bedside journal. But I am convinced that ink is more potent than all the weapons ever invented and that words wield the power of both bandages and bullets. The few twenty-six alphabets when woven into indestructible words can pierce through one's bones only to act as a lifeboat when you find yourself drowning and bleeding, and in this, I believe with all my heart. This belief has been my biggest motivation for each moment I have spent crafting this piece of art. I feel humbled and privileged that my teachers and peers instilled in me the trust of serving as the Editor-in-Chief of Quintessence 2021-22, the annual magazine of the Department of Physics of Sri Venkateswara College, an esteemed institution of Delhi University.

Magazines have always been my favourite form of print media. Unlike television shows, movies, as well as books, magazines have something in store for everyone. The right amount of edification and entertainment. The right depth of intellectual engagement. The right amount of time sitting still. Pictures that could speak a thousand words. Pictures that could speak what words could not. A magazine could be picked up, put down, returned to, or even passed on to a friend, enabling your thoughts to travel far beyond the carriage of paper and ink. Keeping this view, I believe there could not have been a better title for our annual magazine. Quintessence is nothing but quintessential. It is a communion of science with art, for I believe the two are as different as alike – a vivid representation of limitless possibilities stretching far beyond the realm of this pale blue dot.

The current edition of Quintessence comprises engrossing articles, imaginative poetry, an entertainment section entailing fascinating facts and a perplexing quiz, research reports exhibiting the passionate efforts of students in various fields, and an insight into the annual events held by Principia, the Physics Society of Sri Venkateswara College, University of Delhi in the term 2021-22. The magazine ends with a few words of wisdom from our seniors of batch 2018-2021 who have always acted as a guiding light for us.

I am grateful to our President, Kamalpreet Kaur for constantly pushing all the team members to perform to the best of their abilities and for getting this edition published. My sincere appreciation goes to Mansha Ahuja, the serving Literary Secretary, for helping me in the consolidation of the contents of the magazine as well as at every stage of editing the same. Had it not been the sincere efforts of the members

editorial team incorporating Poornima Gaur, Anshika Gaira, Swastika Thakur, and Yuvraj Sharma, this magazine would never have come to life. I would also like to thank Muskan Singh, the General Secretary of the society, for tirelessly designing the magazine as pretty as a picture. Without her efforts, this publication would have been nothing more than black letters on white paper. Last but not the least, I would like to express my heartfelt gratitude to every member of Principia for actively contributing to this creation, as well as my professors, whose endless support and guidance kept us all going.

For us, Quintessence is much more than just a magazine. It is a memoir of a year spent celebrating the essence of physics through the continuous efforts of the whole department. It is a triumph and fruit of numerous endeavours. It is a legacy of good people doing great things being carried forward for years, and hopefully, beyond. For the shared love of good writing and science, complementing art and text, typography, heart and wisdom laid onto the pages of this magazine, I, on behalf of all members of Principia, shall now hand over this forever admired craft of ours to all our readers. And while this seems like an overwhelming end to a voyage, it is nothing but the start of a new beginning, with nothing but love pouring from each fragment of its pages. We hope you find solace in them.

- BHUMIKA TANEJA

Editor-in-Chief

02

**EDITORIAL
ARTICLES**

The winner of Exagium

The universe surrounds us in all its complexity. This reality is subject to the different perceptions and interpretations of physics and art. While physics tries to dissect and understand, art accepts as a whole and tries to capture the essence of something. This divergence is bridged by the fact that both these fields are driven by the same human characteristics - wonder and creativity. They are bound to merge!

Historical distinctions between the two notions are scarce. The same man's imagination that created the Mona Lisa also made detailed notes of advanced inventions and machinations. Leonardo da Vinci was an artist and a scientist!

Physics offers theories and explanations about the unseen which can be learned on paper. Art helps visualise the invisible. Yoko Shimizu has used such a physical concept of surface tension to create an installation art piece called "Defying Gravity". Her piece is an intricate chandelier made from inverted test tubes containing ink coloured water. Photographer Fabian Oefner made a pop-art piece using ferrofluids and watercolours which utilises the magnetic property of the former. David C. Roy also uses his knowledge of mechanics to make mesmerising kinetic sculptures. In the ancient spirituality of Nataraja statues, scientists found the cosmic dance of the universe.

Another fascinating art piece is the "Collective

Suicide" by Siqueiros. It is a fluid painting, a method discovered by Siqueiros, produced by pouring different paints on the canvas. He claimed that the fluid itself created the painting. Scientifically, that is correct! The painting was made due to the differences in the densities of the paints making Siqueiros an "accidental fluid mechanist". Such artistic interpretations are free from all jargon and gratify laymen while piquing their curiosity. It provides a means for them to appreciate the beauty of ubiquitous physical phenomena without having to study them in detail, hence reaching a wider audience.

Advancements in physics have also spurred the development of technologies creating new forms of literary and visual arts for the masses. The genre of science fiction in novels and movies is the paragon of physics and art existing in harmony. Dan Brown constantly has underlying themes of physics and related sciences in his books, the robots in Isaac Asimov's novels are becoming a reality and astronomical occurrences are very commonly interpreted in movies.

Physics and arts are creative fields that explore new ideas and break boundaries, growing and evolving together. They investigate and question the world. Art can be a medium to give form to the abstract ideas of physics and make them non-intimidating. With their combined emotionality and rationality, they speak to both the heart and the brain.

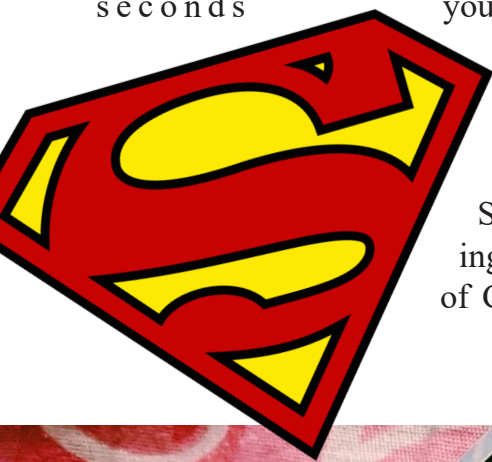
BY SHIVANGI JOSHI



PHYSICS

PHYSICS II

We all have seen movies and heard tales that made us go “WOW!” but as much as we love them, so many of them fail to make sense when viewed through the scientific lens. If there is one thing the mind of a hardcore physicist is governed by, then it is, well - logic (and ofcourse thinking about the credibility of whatever they see around and extracting bits of trivia from it). By the way, did you know if Santa Claus has to deliver all his gifts in one night or say 12 hours, he’d have to travel at a speed that’s 0.76% of the speed of light? We know Einstein’s theory states that time moves slower for an object in motion relative to a stationary object. Thus, bringing the principle of time dilation into account, after spending 194 years delivering gifts on the eve of Christmas, Santa Claus is 242 seconds younger than all of us.



Physicists never limit their spectrums of research. So, while examining the mushy tale of Cinderella and her glass heels

that made us all go “aww” at some point in our childhood, a journal published by the University of Leicester pointed out that if Cinderella’s heels were higher than half-an-inch, they would have shattered when she started running owing to the force on one foot. An intellectual Cinderella, thus, would always prefer flats over pumps when opting for glass footwear.

Similarly, in Superman (1978), the Man of Steel time travels to the past by flying at a speed that causes the earth to rotate backwards. Though this seems unrealistic at first, scientists say that it is actually possible! According to the General Theory of Relativity given by Einstein, the mass of an object increases as its speed approaches the speed of light. If Superman flew fast enough, his relativistic mass would’ve increased to 13.7 million times his original mass and this would create a gravitational field strong enough to change Earth’s spin polarity (not to mention, it would’ve attracted nearby asteroids as well). However, according to NASA, this would result in everything that isn’t firmly secured to bedrock being flung into space and Superman might return to a barren planet with several cracks.

CTION

N FICTION

Public Advisory: DO NOT TRY THIS AT HOME!

Even Cameron's *Titanic* (1997) fails to get all Physics right. Astrophysicist Neil de Grasse Tyson pointed out that when Rose is staring up at the stars, lying on a piece of driftwood, the starfield that's shown is all wrong. That's not the starfield that would've been present over the Atlantic Ocean in 1912 at that time of the year. And so, known for perfectionism, Cameron altered the starfield to match the one suggested by Neil de Grasse Tyson when the 3-D version of the movie was released in 2012!

On the TV show, *The Flash*, the lightning-quick superhero's shoes catch fire in one scene because he runs so fast. Now assuming he wore shoes with rubber soles, according to Physicists, he would have to run at a speed of 6,911 metres per second to create sufficient frictional heat for that to happen. In that case, however, his shoes would've worn out entirely once he hit the speed of 394 metres per second. At this point, we are just hoping that no real-world wannabe superhero sets their feet on fire.

Science enthusiasts love challenges and problem-solving, but it turns out that a lot of physics problems we encounter in our daily lives have already been answered. And so, it does



no harm to turn to the world of fiction and fairy tales once in a while for getting instances to brainstorm over. Over time, there has been a realisation that there might not always exist a consolidated answer to every problem, however, we continue to get better questions to think about. Every challenge and every assessment done whether on-screen or off-screen sows in a person a seed of innovation which may spring to life in the real world. After all, all we need to move forward towards enlightenment of knowledge and advancement is this – an undying curiosity that keeps fuelling the fire of an idea in the mind.

BY MANSHA AHUJA



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-by
Anshika
Gairra

Since the nineteenth century, the meaning of 'Nihilism' has been misunderstood by a lot. The term was first used in 1829 by Nikolai Nadezhdin in regard to Russian poet Aleksandr Pushkin, who later came to be known as the founder of modern Russian literature. Being a nihilist at that time meant you were against the pre-existing ideals and were in the support of social reform. It incorporated theories like atheism, materialism, positivism, and rational selfishness. The revolutionary movement of Russia was also named after it, the Russian nihilist movement.

Oxford dictionary defines Nihilism to be "philosophy of the belief that life has no meaning or purpose and that religious and moral principles have no value". Summed as an ideology of nothing.

Now the question that we want an answer to is - can science, which believes life to be a mere accident diminish our beliefs eventually leading to nihilism? Looking into any religion, it is accepted that humans were created by God himself for a purpose of finding the meaning from worldly goals and moral virtues, to live with purity, strength, kindness, and integrity. This purpose tells us the wrong and the right, the bad and the good. But science, when steps in with the Big Bang, rules out the beliefs leaving us with no purpose and no goals. Originating from an explosion and ending with a big freeze, life is just a fragment of the transformation of the universe. In the end, we are nothing. Hence, does life really carry a meaning after all? How are we supposed to differentiate the right from the wrong, the good from the bad? Based on what ultimate goals are the morals and values made? Science destroys our purpose and throws it into oblivion.

But science does not really have the power to make us feel like nothing because it is just trying to fulfil its purpose i.e., finding out the reasons behind everything. 'Why' and 'How' the universe works the way it does, it merely wants to solve the unsolved and dissolve the illusion that we believe in. Darwin, while giving his theory of natural selection showed us how

adapting and evolving keep us from extinction. Science here is just trying to help us out, to live. But like dinosaurs, every trace of humans will also one day cease to exist. Then in the long run I don't think it really matters which species got extinct centuries before the other. I don't think our existence in itself will even matter and thinking this makes me realise that everything is nothing at all.

Thinking about all of it as one, from the beginning of the universe to the end, taking no time, no space might make us think of all of it as meaningless. It's science that gives all of it a meaning. Since the rising of the sun to midnight, it makes sense of it all. Finding a reason behind our evolution, finding out about our ancestors and where we originate from, gives it meaning. Science makes sense out of all the weird stuff. With its help today, we are on the verge of creating artificial brains. How amazing is that?

Science does not give concrete proof of anything. Maybe what we have today is nothing near to the truth. Maybe it's all just a shadow of something huge. Maybe we will never find out the real truth. But science gives us something to hold on to. It believes in evolving and improving until we find a theory and then working to fail it all over again. And when there comes belief, there is no question of nihilism.

My apologies if reading this article landed you in a state of more confusion than you were before diving in. But everything I thought of contradicted everything I was not thinking of! I think this is what philosophy is. How can we say one thing to be right and another to be wrong? How can I state a point and not take others into account? If science is the path to nihilism then how do half of the scientists themselves believe in some form of deity or a higher power? Or is it because of science that we have the rest of 50% who don't? I am unable to reach a conclusion. If you are, then perhaps if you question yourself further, you too might end up in a spiral that will leave you with no definite stance. Because just like the never-ending cosmos, thoughts too, never come to an end.



Life Beyond the Lab

STEREOTYPES SCIENTISTS ARE SICK OF HEARING

Isn't it weird that we all have a vivid image of what reality looks like rather than seeing it for what it truly is? This is nothing else but stereotyping. We have characterised almost everything unfairly on some parameters borne out of baselessness or traditional mindset. The



real world is so accustomed to being scrutinised under several cliches for ages that we find it extremely difficult to accept it otherwise or question the existence of mainstream hacky beliefs. Nothing has escaped from the claws of conventional norms, not even a super-rational subject like science. Science and

scientists have modernised the world but yet they have been subjected to severe typecasting for decades.

Scientists are usually seen as total nerds worldwide. So, very often people automatically assume that scientists lack hobbies. They are considered indifferent beings who are rarely willing to engage in recreational activities. However, this is far from the truth. Everybody regardless of their profession or passion has a life to live and intend to enjoy it as much as any of us do. Who knew that the 'Mother of Modern Physics'- Marie Curie, who is known for her remarkable research in the field of radiation, was an avid long-distance cyclist. Richard Feynman, a brilliant theoretical physicist of the 20th century, besides working on groundbreaking theories, also used to paint his heart out under the pseudonym "Ofey". One of the greatest physicists of all time - Albert Einstein, was an amateur violinist. He played duets with Max Planck, the 'Father of Quantum Physics' who was an incredible pianist. The list

is endless which shows that even the greatest of scientists had multiple interests and passions which they pursued parallelly with their academic pursuits. Why is this even surprising? We all have certain hobbies and so do scientists! But this is not the way scientists are described. It is so because of some stereotypes that have crept deep into our subconsciousness.

Moreover, scientists are believed to be exceptionally smart, talented, hard-working and prodigious in some way or another, like memory, reasoning or intelligence. It may be an appreciation for them, but it sets some unrealistically high standards for those who want to pursue research. Even worse, these presumed idealistic characteristics spawn a sense of apathy among the majority for such research based fields. Another major belief prevailing in the world is about associating science and maths mostly with men and not women, it is believed that men have better aptitude for research and STEM careers than women. It was further confirmed by a study conducted in the US where 5000 elementary school students were asked to draw a scientist. The collected drawings represented 99% of scientists to be men. Clearly, even primary school kids link science with men rather than women. Although

the figure has improved to 79% in 2016, this is still an unfortunate statistic. The number of women is as low as less than 30% in STEM related fields which may be attributed to the inflexible working hours, no gender neutral pay and a big struggle against societal norms. These hindrances need immediate attention for significant changes in representation ratio of males and females.

Scientists wear glasses, white coats, lack a sense of humour and are super serious atheists, tearing apart nature for technology are some other stereotypes set against scientists. It is very easy to create their forged image because they work in secluded labs, hospitals, space stations, universities and almost everywhere but they perform their job quite confidentially. Therefore their work always remains hidden until it becomes the headline and thus a scientist in action many a time never makes it to the public eye. We must understand that a scientist is a lot more than a hustler behind closed doors. These assumptions about “what a scientist looks like?” are mere stereotypes, not more than an illusion created by people on their own and we must look for reality, not a compromised version.

BY POORNIMA GAUR



METAVVERSE

A REALITY AWAY FROM REALITY

“No, I won’t accept this assignment. Your essay is plagiarized and you have to rewrite it!”, the teacher said angrily. “Umm...okay ma’am”, muttered Billy with her head down. On her way home, Billy felt frustrated. If she tried to write that essay again, she wouldn’t be able to play the War Pilot game she had been looking forward to playing since she bought it the day before. She also needed to buy herself new haptic gloves. Billy felt stuck in this uninvited situation until an idea suddenly occurred to her. She murmured, “But what if I bunk my class tomorrow? I won’t have to submit the assignment and I can enjoy my game as well. Why didn’t I get this idea before?”. Just then, Billy’s phone vibrated. It was a voice note from her teacher. When she played it, her teacher’s stern voice boomed – “Are you thinking about bunking your class again, Billy? I heard the word “bunk” from your mouth. The due date for the assignment is tomorrow and if you are absent from my class tomorrow, be ready to get a zero!”. “Oh no! I shouldn’t have said that word out loud. I should be using my words carefully!” Billy said to herself.

Her teacher was able to do it with an improvised speech detector that could catch and report a specific word spoken or murmured by a person whose laptop is connected to the main server. Imagine sitting at your home, wearing some weird

suit and a pair of gloves, and enjoying your friend’s birthday party who resides hundreds of kilometers away from you. Sounds interesting, doesn’t it? Metaverse will do it for you. 3D spaces in the metaverse will let you socialize, learn, collaborate and play in ways that go beyond what we can imagine.

The term ‘metaverse’ has its origin in the 1992 science fiction novel Snow Crash, as a portmanteau of ‘meta’ and ‘universe’. A metaverse is a network of 3D virtual worlds focused on social connection. In futurism and science fiction, the term is often described as a hypothetical iteration of the internet as a single, universal virtual world that is facilitated by the use of virtual and augmented reality headsets.

As soon as Billy reached home, she found out that she had left her VR goggles in school. This wasn’t the first time she had made

this mistake. “Why can’t the school allow me to attend classes from my home using the



VR technology?”, she said out of utter frustration. “So that you can enjoy your college life. You know, when I was your age, there was a virus called COV...”. Billy was tired of her dad repeating his never-ending tales about the deadly pandemic. Annoyed as she already was, she rolled her eyes as she slammed the door and bicycled towards the school.

“Oh my, I have to be fast. The war is going to start in just thirty minutes.” Billy bicycled as fast as possible. Upon reaching the school, she found her VR goggles at the gate, kept safely with the watchman, and bicycled back home like a storm. She connected her VR goggles and those fouled haptic gloves she had been procrastinating buying for the past two months to her laptop and clicked on the first link that appeared.

“Have they changed the game interface or is this a new level?”, she thought as the interface looked unfamiliar to her. “Okay, let me just see where the aircraft hangar is.”

Far more than a Call of Duty match, the metaverse refers to a 24/7 online world, inhabited by economies that incentivize a new network of creators and infrastructure providers. Games like Minecraft and Roblox have been providing metaverse-like experiences for the better part of a decade. Companies like MetaHub are creating virtual hangout spaces for conferences and business events.

“Oh wow, its name is... Hunter MK-56 aircraft, let’s try this”.

As soon as Billy entered the aircraft cockpit she knew that she was playing the wrong game because she wasn’t even able

to read the names on most of the buttons in the cockpit. Although she had flown many planes in other games with controls she could easily understand, this one seemed just like a real fighter jet. She came out of the plane and to her amusement, there was no other plane in the sky and everything seemed to be so real and primitive as if she’s in a mid-20th-century war. She glared at her yellow badge which read “Air Marshal Aspy Merwan Engineer”. Just then, an officer came running towards A.M. Engineer and said, “The enemy is getting uncontrollable, Sir. We require more troops to counter them. The Air Marshal asked the officer, “Why aren’t we using our fighter jets?”. The officer said, “We are not allowed to use them because of the orders by the President and the Prime Minister, the reason behind which is unclear!”

When Billy entered as the Air Marshal in mid-war, she didn’t know about any political orders given earlier and the PM’s order was no exception. Then the Air Marshal ordered all the squadron leaders to get into the aircrafts and take on the enemies via air as quickly as possible. After an intense war, the planes returned victoriously. Fighter jets destroyed the enemy troops and their camps and returned to their country. It was a huge victory for the country and everyone was congratulating A.M. Engineer for the daring decision to go against the PM’s decision. The game ended and when Billy was removing her VR glasses she found out that the glasses were not hers. She was awestruck. She went to school immediately only to find out that her goggles were exchanged with a teacher. “Oh gosh! At last, I found them! Thanks, young lady”, the teacher said to Billy when she returned his goggles to him. “Sir, do you also like online games?” Billy

asked in amusement. “No.” He replied with a little laugh. “I teach History and I forgot these when I came to the science block for some office work. They contain a chip that has the virtual environment of 1962 Indo-Chinese War and how it proceeded. I need to give it to my students for tomorrow’s test. It is from the point of view of the then Air Marshal of the Indian army because he was mostly unutilized. I hope they do well. Thank you once again.”

On the next day, Billy still couldn’t digest what had happened the day before. She was sitting in her classroom, looking out of the window and diving deep into her thoughts. Her mind was racing, looking for answers. Suddenly, her thoughts were disrupted by her friend who had an awkward grin and disbelief on her face, “Did you hear about the news from the history department? All the students failed the exam. Interestingly, all of them made the same mistake

in their answers and are holding the teacher accountable for teaching them the wrong facts.” Billy couldn’t help but smile. “Poor history students”, she thought. Just then a familiar voice brought her back from her thoughts. “You look really happy today Billy. I am sure you are done with your essay. Please keep your notebook here on the teacher’s desk”, said her English literature teacher who had just entered the classroom for her regular lecture of the day. As Billy stood in punishment outside the classroom for the entirety of the day, an important realization dawned upon her – No matter how advanced the world becomes, escaping hard work shall always remain beyond one.

BY YUVRAJ SHARMA



fight or flight

-Swastika Thakur

Our conversations puncture my soul,
You say I'm moving too fast,
But I think you are.
The speed of light is our enemy,
And I'm too tired to wage a war against it,
You feel older by the second and I, younger.
I think I might be ageing backwards;
From adulthood to infancy.
I crave the little things,
That hold no value to you,
I pull at the thread of our interconnection,
And you pull it back until it snaps.
What feels like pulling,
Often pushes you through the edge.
Falling in love can feel like flying,
And while I rise above lonesome,
My grit crumbles down.
I act, and you react,
And there's nothing more left in our world,
And at some point this was enough.
When the time stood still,
And everything around us spun into oblivion,
The inertia in our lives,
Rots like a putrid fruit.
I crave change and you stand still.
Maybe that is why it looks like I am rushing,
Because you haven't moved an inch in ten years,
While I have run for decades on end,
Chasing after the lost sparks,
Pursuing the landmarks,
Of the love we built from the ground up.



Can We SEE

Cymatics, originating from the Ancient Greek word: κῦμα, meaning, “wave”, is the science revolving around visualisation of music in a more tangible form. It is the study of the effects that waves and vibration may have on matter. Ernst Florens Friedrich Chladni, a German physicist and musician was titled the Father of Acoustics for his extensive research in the field of musicology and acoustical physics. Chladni, in his book, “Discoveries in the Theory of Sound”, writes about the patterns observed when we scatter sand on metal plates and vibrate them by stroking the edge of the plate with a bow.

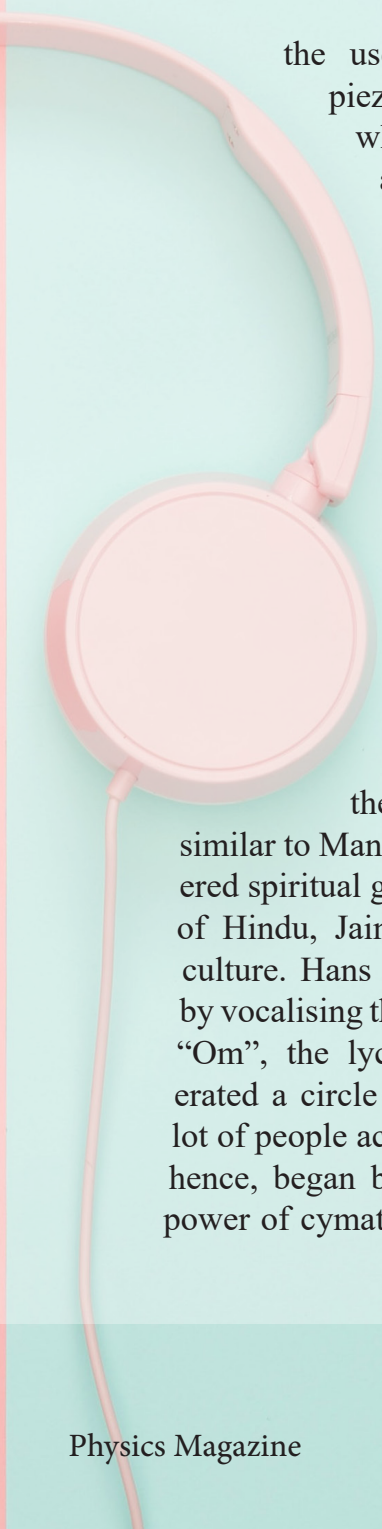
Chladni found that when the bow stroked the plate, certain areas of the plate would not vibrate while some other areas would. The sand would naturally move from the vibrating areas to the areas which were standing still, and in turn, form strange, almost geometrical patterns. Different sounds would produce different patterns. The shape, thickness, density, and rigidity of the plate would also affect

the patterns formed. Low frequency waves would produce simplistic geometric shapes.

As the frequency was increased, the sand would get more excited and turbulent and in turn, form complex patterns. There was no change in cymatic patterns when the frequency used was below or above the audible range (audible range is between 20-20,000 Hz).

Hans Jenny was the first to develop the term “cymatics” in 1967, and he also conducted considerable research on the phenomena until his death. Hans Jenny was a physician, a fine artist, pianist and philosopher. He was powerfully inspired by the work of Ernst Chladni and deeply investigated the phenomenon of visually replicating music. He pioneered

MUSIC?



the use of laboratory-grown piezoelectric crystals, which were quite costly at that time. Hooking them up to amplifiers and frequency generators, the crystals functioned as transducers, converting the frequencies into vibrations that were strong enough to cause resonance between the steel plates.

Interestingly, many of the cymatic patterns are similar to Mandalas, which are considered spiritual geometric configurations of Hindu, Jain, Buddhist and Shinto culture. Hans Jenny also noticed that by vocalising the ancient Sanskrit word “Om”, the lycopodium powder generated a circle with a central point. A lot of people acquainted with his work, hence, began believing in the healing power of cymatics. As our body is ma-

jorly made up of water, some therapeutic scientists strongly believe that certain cymatic frequencies could have a restorative effect on the human body. Since all our tissues are said to vibrate at separate frequencies, cymatics could help in healing injured tissues or cells by bringing them back in unison, such that they start vibrating at their original frequencies and in turn, heal and rejuvenate on their own.

Just as the development of Braille was revolutionary for the blind community, a thorough research on cymatics could help the deaf to visualise and feel the music just like the rest of us. Although the science of cymatics has been majorly limited to art and recreation, the world of cymatics may reveal an entirely new perspective to the very existence of music.

BY SWASTIKA THAKUR

Unknown

- Priyansh Agarwal

There was once,
A land amidst the mist
Far within the reaches
Of a small town,
On the edge of Oklahoma,
A little tunnel at the end of the road,
That protected the wonders within
Dungeon and dragons,
They would play - the little children,
And fantasies they would make,
Of how Newton's gravity,
Poiseuille's viscosity,
Were a hoax, a lie
For the dragons flying high
Of how Einstein said
"Nothing can travel faster than the speed of light"
And yet their dragons would be lost in a blink of an eye,
Of how time travel wasn't possible,
But who's to stop them from creating paradox undefined,

For their Grand Unified theory,
Was inclusive of gravity,
Their dark matter was already found,
How their time isn't linear,
And forms its own loops
Round and round, overlapping into a helix
Till their annihilation, their little chaos theory,
Of matter and antimatter is combined,
Of how Heisenberg was uncertain,
But only about if he should make meth?
They'd be told that absolute zero is impossible,
Yet they find lands, where temperature isn't defined,
Oh how the outside world thinks,
That molecular spaces can't be reduced,
Whilst here, they are lilliputs and giants,
Little did they know about Kepler's laws,
For their planet is flat
And tosses around like a coin
For their stories of creation didn't begin
With the big bang,
But only the time their fantasies were alive,
Who's to say they aren't from an alternate dimension,
A parallel Earth or a different point in time,
I think they are straight from a star wars movie,
Or who's to say,
They are interstellar beings,
Just shag and scooby
Unknown;
All I know is
We're stuck in a matrix,
And we're lagging behind.



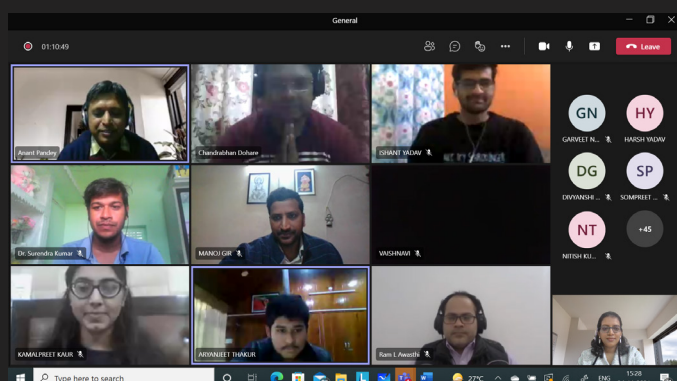
03

**EVENT
REPORTS**

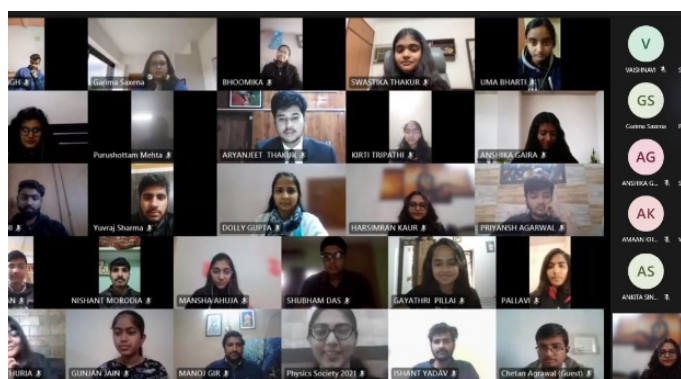
An online orientation program was organized on 24th November 2021, at 2:30pm on Microsoft Teams by the Department of Physics. This was initiated in order to introduce the new students to the department. Prof. Anant Pandey hosted the event and informed the students about departmental achievements, ongoing research projects and eminent alumni of the department. All professors from the department joined and spoke kind words introducing themselves, and welcoming the freshers. The students were informed about the course structure, college and departmental activities. A few senior students of the department also interacted with the freshers. Kamalpreet Kaur, the

President of Principia
- The

Physics Society also spoke a few words about the department. This was followed by a short address by Ishant Yadav, The Vice- President of Principia. Finally the juniors were provided time to introduce themselves and clear any doubts in their minds. The orientation was held successfully and proved to be very helpful to the newly admitted students.



Orientation Ceremony INVESTITURE CEREMONY



To introduce the council for the session 2021-22, Principia conducted its Investiture Ceremony virtually on January 25, 2022. Gracing the occasion as the chief guest was Dr. Prasanta K. Panigrahi, faculty at the Department of Physical Sciences at IISER Kolkata. The ceremony was kick-started by the Head of Department, Dr. Narender Kumar with his address. Thereafter, the President for the session, Kamalpreet Kaur introduced the audience to her hardworking and ever-enthusiastic team of office bearers. It was

followed by an introduction to the Editorial Team and the Social Media Team by Bhumika Taneja, Editor-in-Chief and Hritika Kathuria, Social Media Head respectively.

Moving forward, Dr. Prasanta K. Panigrahi enlightened the attendees with a highly insightful lecture on “Quantum Technology: The Technology of the 21st Century”. He talked about the advancements in quantum computing and technology and discussed future aspects of the same. After the lecture, a QnA round was conducted in which Dr. Panigrahi patiently cleared the doubts of the students. The event was wrapped up by our Convenor, Dr. Garima Saxena with a vote of thanks.

THE ESSAY WRITING COMPETITION

To unleash the literary genius hidden in each one of us, Principia - the Physics Society of Sri Venkateswara College, organised an essay writing competition titled 'Exagium'. The competition was open for participants to submit their entries from 11 August 2021 to 21 August 2021. The students were provided with two interesting topics and had an option to write an essay on the same in not more than 500 words. Participants had the liberty to pick one topic out of the given two i.e. Physics in Art or Philosophies of Physicists. The event proved to be a tremendous success and witnessed huge participation from colleges across Delhi University.

All the participants penned down their ideas in a coherent and interesting manner, making their essay a delight for the reader. Following a fair round of judgement, Shivangi Joshi of Sri Venkateswara College secured the first position. She was followed by Shreeja Dwivedi from Gargi College and Vaishnavi Iyer from Sri Venkateswara College, who secured the second and third position respectively. The judgement panel consisted of Dr. Garima Saxena, the convenor of Principia, along with a few members of the editorial team of the society. The winners were felicitated with cash rewards and certificates. The winning entry by Shivangi Joshi, which is a poignant essay on Physics in Art, has also been included in this edition of the magazine.

CONFLUENCE

The Science Conference



On 25th February 2022, Principia – The Physics Society of Sri Venkateswara College conducted an online science conference for undergraduate and school students on Microsoft Teams. The event consisted of two committees with separate topics. One of the topics was a discussion about how ‘Space exploration helps in improving life on earth’ and the second topic was ‘Are there benefits of colonisation of Mars’.

The participants were initially explained the rules and regulations of the conference. Confluence began with an Opinion Round where the speakers gave their opening statements, followed by the Discussion Round where intense dialogue pursued. A QnA session was a part of the Discussion Round where the judging panel also cross questioned the speakers. Finally, the speakers drafted a Working Paper expressing their final stand on the topic. The event was successfully undertaken with fruitful discussions and debates between the enthusiastic participants. Aryanjeet Thakur and Khushpreet Kaur won Best Speaker for Topic 1: Space Exploration and Rachit Kapoor and Kunal Prasad won Best Speaker for Topic 2: Colonisation of Mars.

The winners were awarded with cash prizes. The conference was engaging and exceedingly informative for all the participants.

SCI-TALES

a science fiction storytelling competition

PRINCIPIA- the Physics Society of Sri Venkateswara College successfully conducted Scitales, a science fiction storytelling competition on 12 March 2022. The event was held virtually on Microsoft Teams and undergraduate students from different colleges enthusiastically took part in it. The event commenced with the extension of a warm welcome by the host, Aarathi, to everyone in the meeting. Then a prompt was given to each participant along with a stipulated time of 5 minutes to come up with a story that started, ended or revolved around it. “Gravity is a repulsive force and yet, the world exists”, “A solar storm has hit the Earth hard. Every digital electronics is fried and the world has been shifted to analog in a jiffy”; “You are a crazy scientist who, determined to discover how the universe began, rigs up a malfunctioning time machine, goes to the ‘beginning’ of universe and ends up in the reason for the big bang”, are some examples of prompts that were given. These stories were judged based on four criterias: accuracy, creativity, narration and scientific content. Participants moulded their thoughts in a very compelling way. There were 24 participants in total and all the stories were very intriguing. At the end, four participants were chosen as winners. First prize was given to Rachit Kapoor, second prize to Shubham Kumar Pandey, and third prize to Muskan Singh and Priyansh Agarwal. With the presence of all the ingenious brains, the event turned out to be a triumph.



A hand holding a lens in front of a sunset over a landscape. The sun is low on the horizon, creating a bright lens flare through the lens held by the hand. The background shows a hazy, golden landscape under a blue and white sky.

The Photography Competition

LUMIÈRE

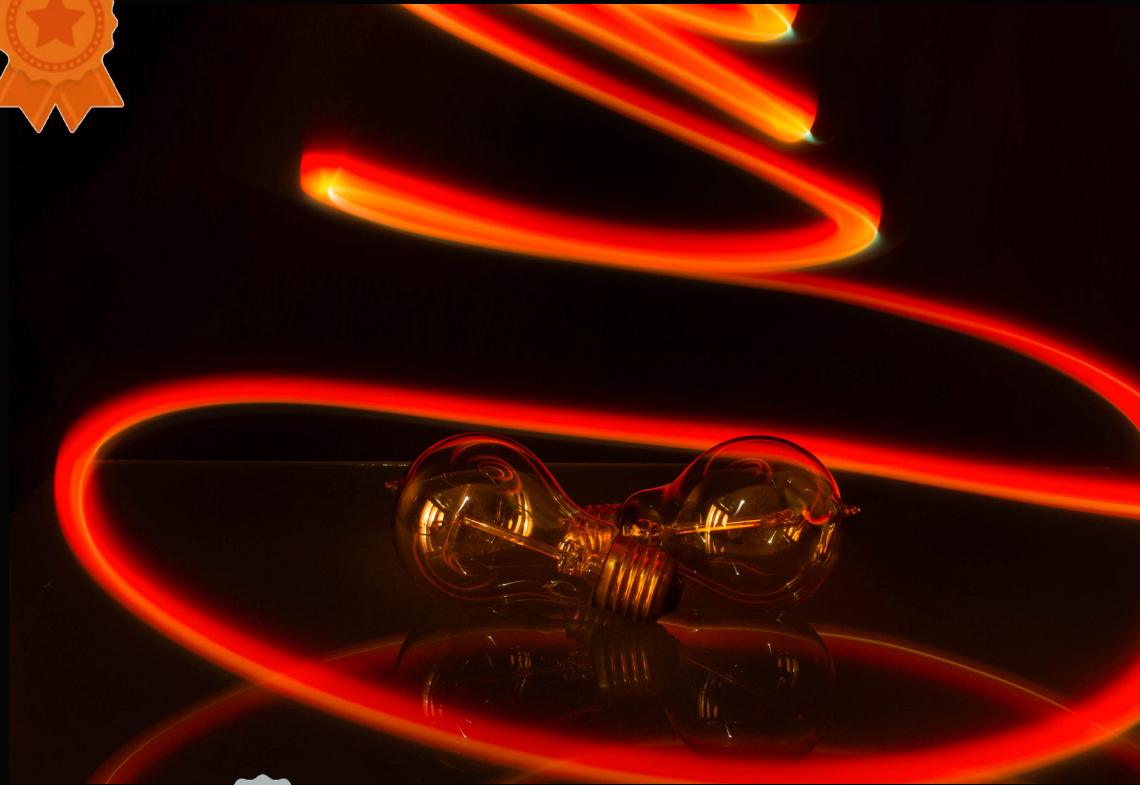
Principia - the Physics Society of Sri Venkateswara College organized Lumière - the photography competition from 11th March to 15th March, 2022, to blend creativity and physics all together in one frame. It was open to all undergraduate students.

The participants were asked to submit a photograph clicked by them, involving some physics phenomenon and further explaining it in the caption within 50- 200 words. The rules and the regulations for the competition were demonstrated on the official handles of Principia along with some sample pictures. The competition was a creative and innovative approach to learn about some complex concepts of physics. It concluded with three winning entries. The first position was awarded to Gunisha Sethi from Maitreyi College (DU), second position to Satyam Kumar from Dyal Singh College (DU), and Shruti Vohra from Sri Venkateswara College (DU) grabbed the third position.

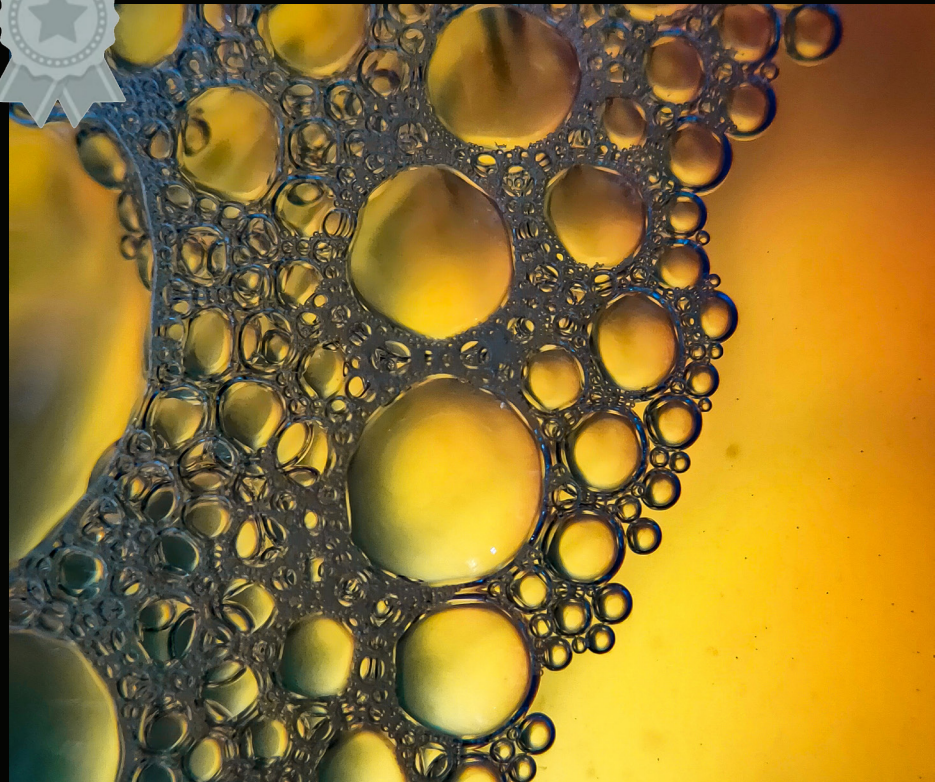
The top three winning entries were awarded with amazing cash prizes. These winning entries have also been included in this edition of our annual magazine Quintessence which are featured here only to give a glimpse of this amazing and instructive competition.



LUMIERE WINNERS



Honorable Mention



AND HONORABLE MENTIONS

04

**REFRESH
THYSELF**

BREAK THROUGHS

in science

European scientists have achieved major success on the road to energy production through fusion plasmas. The team used the fuel of future fusion power plants and produced stable plasmas with 59 megajoules of energy output at the world's largest fusion facility, Joint European Torus, in Culham near Oxford, UK. These were the first experiments of their kind in the world in more than 20 years. Following the example of the sun, fusion power plants aim to fuse the hydrogen isotopes deuterium and tritium and release large amounts of energy in the process.

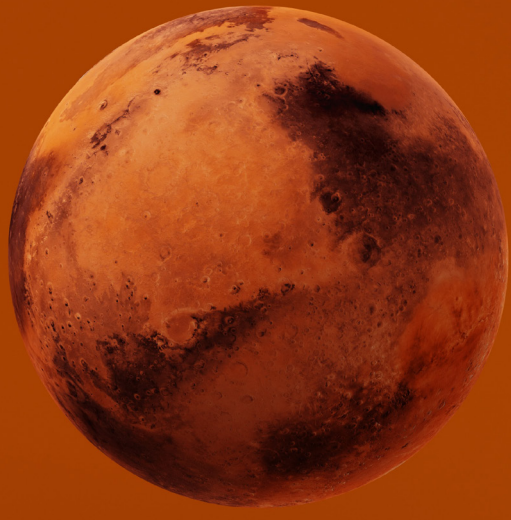
FUSION FACILITY SETS NEW WORLD RECORD

NOBEL PRIZE IN PHYSICS

Three Laureates, Syukuro Manabe, Klaus Hasselmann and Giorgio Parisi, share this year's Nobel Prize in Physics for their studies of chaotic and apparently random phenomena. Syukuro Manabe and Klaus Hasselmann laid the foundation of our knowledge of the Earth's climate and how humanity influences it. Giorgio Parisi is rewarded for his revolutionary contributions to the theory of disordered materials and random processes.

PRESERVING QUANTUM STATES FOR MORE THAN FIVE SECONDS

A team of researchers at the Argonne National Laboratory, US and the University of Chicago have successfully figured out ways to read information held in quantum qubits and to preserve short memory time qubits. They were able to read out their qubit on demand and keep the quantum state intact for over five seconds, which is a huge deal for this class of devices. These qubits are made from an easy-to-use material called silicon carbide, which is commonly found in lightbulbs, electric vehicles and high-voltage electronics.



PERSEVERANCE AND INGENUITY ON MARS

NASA's Perseverance rover touched down on Mars on March 5, 2021. The rover continues to study conditions on Mars and send data back to Earth. Ingenuity, the helicopter which is aiding Perseverance study Mars created history on April 19, 2021 by making the first-ever powered flight of a man-made craft on a different planet. Flying a helicopter on Mars is an extremely difficult task due to its very thin atmosphere. But the success prompted NASA to extend its mission which was initially supposed to be just a flight achievement. Ingenuity carried out several flights after it first took off from the Martian surface.

TIME CRYSTAL FINALLY MADE REAL


NASA's Parker Solar Probe has finally reached the atmosphere of the sun after spending more than three years of gradually creeping closer to our star. Observations from Parker's April 28 flyby, which was the eighth time the spacecraft whizzed by the sun, show that the spacecraft managed to get inside the sun's atmosphere, or the corona, for the first time. Parker found the critical surface to be flowing with "spikes and valleys" (as NASA termed it) in which the surface protrudes higher or lower from the centre of the sun. The surface also likely varies with solar wind activity, which in turn depends on the sun's 11-year solar cycle.

PRIVATE SPACEFLIGHT BUSINESS BATTLE PAVES WAY TO POTENTIAL SPACE TOURISM

In July, Virgin Galactic founder Richard Branson faced off against Blue Origin's Jeff Bezos to be the first non-professional astronaut to complete a suborbital spaceflight. While the British tycoon won that battle by a few days, it was Blue Origin that raced ahead, launching three more flights with paying customers and celebrity guests. Elon Musk's SpaceX entered the fray in September with a three-day orbital mission around the Earth featuring an all-civilian crew on Inspiration 4.

Quintessence





Researchers at Google in collaboration with physicists at Stanford, Princeton and other universities claim that they have used Google's quantum computer to demonstrate a genuine "time crystal", an object whose parts move in a regular, repeating cycle, sustaining a constant change without burning any energy. Google's quantum computing team made headlines in 2019 when they performed the first-ever computation that ordinary computers weren't thought to be able to do in a practical amount of time. The new time crystal demo marks one of the first times a quantum computer has found gainful employment.



AMATEUR ASTRONOMER DISCOVERED JUPITER'S NEW MOON

The amateur astronomer Kai Ly has become the first amateur to discover a previously unknown moon reporting the discovery on June 30th. Ly's quest was a spin-off of the pre-recovery images, which were used to discover 23 new moons in 2003, of their earlier identification of recently discovered Jovian moons. Ly examined three survey images covering the same region of the sky at different times and was able to find a potential moon, temporarily designated EJc0061. While it hasn't received official designation yet, it would bring the tally of Jovian satellites from 79 to 80.



NASA'S PARKER SOLAR PROBE HAS TOUCHED THE SUN IN A DARING MISSION MILESTONE

NASA's James Webb Space Telescope, product of an impressive international collaboration between NASA, ESA (European Space Agency) and the Canadian Space Agency, launched on Dec. 25, 2021. The Webb observatory is NASA's revolutionary flagship mission to seek the light from the first galaxies in the early universe, explore every phase of cosmic history, and to delve into our own solar system as well as planets orbiting other stars in order to reveal new and unexpected discoveries to help us

understand the origin of universe and our place in it.



JAMES WEBB SPACE TELESCOPE

kweez

A SCIENCE
FOR EVERYONE

1. WHAT WAS THE FAULT MADE BY RAMANUJAN TO PROVE HIS FAMOUS SUMMATION SERIES, THOUGH HE WAS LUCKY ENOUGH SINCE IT TURNED OUT CORRECT?

- A. Multiplying both the sides for a divergent series
- B. Multiplying both the sides for a convergent series
- C. Not taking into consideration the negative numbers
- D. None of the above

3. IN FROBENIUS METHOD, THE EQUATION FORMED FROM THE COEFFICIENT OF THE HIGHEST POWERS OF X IS CALLED ____.

- A. Recurrence equation
- B. Indicial equation
- C. Frobenius equation
- D. None of the above

2. WHAT ARE HADRONS HAVING AT LEAST 3 QUARKS CALLED?

- A. Mesons
- B. Baryons
- C. Muons
- D. Electrons

4. WHICH OF THE FOLLOWING IS *NOT* A VALID SQL TYPE?

- A. FLOAT
- B. VARCHAR
- C. DECIMAL
- D. NUMERIC

5. WHAT TYPE OF SOUND CAN FLIES HEAR?

6. WHAT IS THE NAME OF THE SUPERMASSIVE BLACK HOLE PRESENT AT THE CENTRE OF THE MILKY WAY GALAXY?

- A. M87
- B. Cygnus X-1
- C. Cygnus X-3
- D. Sagittarius A*

7. WHO AMONG THE FOLLOWING DIDN'T SHARE THE NOBEL PRIZE IN PHYSICS IN THE YEAR 2021?

- A. Syukuro Manabe
- B. Klaus Hasselmann
- C. Giorgio Parisi
- D. Benjamin List

8. WHICH OF THE FOLLOWING TECHNOLOGICAL INNOVATIONS WAS INVENTED AT CERN?

- A. Teleporter
- B. World wide web
- C. Mp3 format
- D. All of the above

options for Q5

- A. Infrasonics
- B. Ultrasonics
- C. Both a and b
- D. They are deaf,

ANSWERS

1. A 2. B 3. A 4. C 5. D 6. D 7. D 8. B

FACTS



YOU PROBABLY DIDN'T KNOW

1. WE'VE GOT SPACECRAFT HURTLING TOWARDS THE EDGE OF OUR SOLAR SYSTEM REALLY, REALLY FAST

We all know rockets are fast, and space is big. But sometimes when we are talking about how long it takes for us to get to distant parts of the Solar System (eight months to get to Mars, are you kidding me?) it can feel like our spacecraft are just crawling along out there.



2. CATS ALWAYS LAND ON THEIR FEET, THANKS TO PHYSICS

Cats actually use the two halves of their bodies separately to ensure rapid rotation (PS: don't try this at home).

3. AN EGG LOOKS LIKE A CRAZY JELLYFISH UNDERWATER

A cracked egg on land might make a big mess, but 18 metres (60 feet) below the surface of the ocean, the pressure on the egg is 2.8 times the atmospheric pressure, and it holds it all together like an invisible egg shell.

4. YOU CAN SEE WITHOUT YOUR GLASSES



All you need to do is make a pinhole with your hand, which will help you focus the light coming into your retina. Sure, it won't give you 20/20 vision, but it's a good start if you've left your glasses at home.

5. IF YOU SPIN A BALL AS YOU DROP IT, IT FLIES

I mean, it really flies. Thanks to the Magnus effect, which occurs when the air on the front side of a spinning object is going the same direction as its spin, which means it gets dragged along with the object and deflected back.

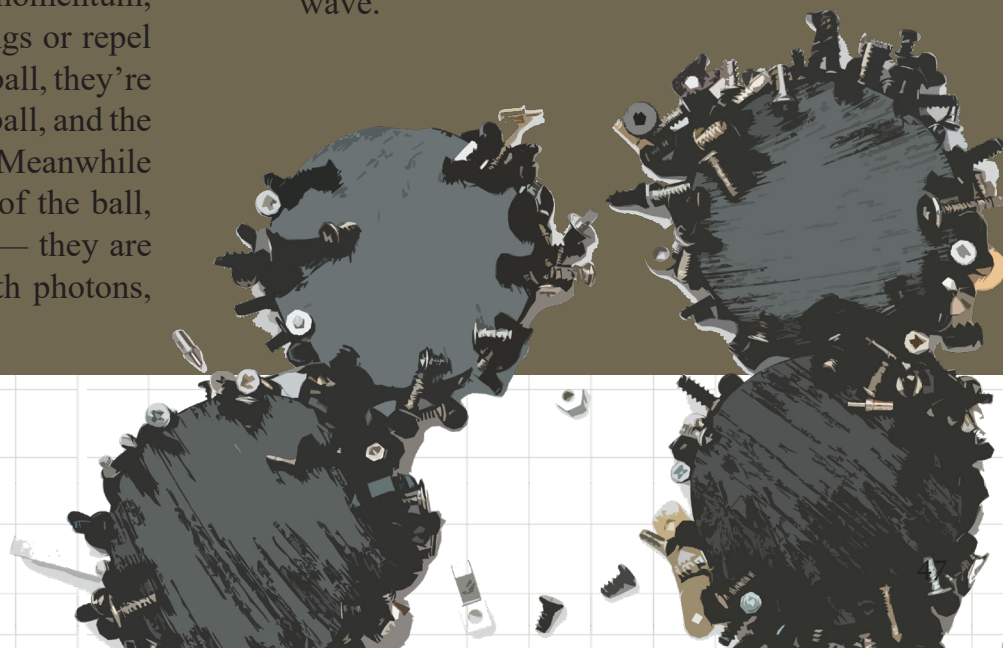
Meanwhile, the air on the other side of the ball is moving in the opposite direction, so the airflow separates.



6. MAGNETISM IS LIGHT

Why do magnets stick? Magnets attract each other because they exchange photons, or the particles that make up light. But unlike the photons streaming out of a desk lamp or reflecting off of everything you see around you, these photons are virtual, and your eyes (or any particle detector) can't "see" them. They can, however, exchange momentum, and this is why they stick to things or repel them. When a kid throws a dodgeball, they're exchanging momentum with the ball, and the thrower feels a slight push back. Meanwhile the target person feels the force of the ball, and (maybe) gets knocked over — they are "repelled" from the thrower. With photons,

the process can also happen in reverse, as though one kid reached out and grabbed the ball while the other was still hanging on to it, which would look like an attractive force. Photons are the force carriers not only for magnets but also for electrostatic phenomena like static electricity, and it's why electromagnetism is the term we use for effects produced by these phenomena — including light, which is an electromagnetic wave.



7. A LONG TRIP

The last time our solar system was in its current position around the Milky Way, the earliest dinosaurs were first roaming the Earth. That is because it takes a whopping 230 million years for our solar system to complete one single orbit around the Milky Way. That really puts that long-day feeling into perspective.



8. IT'S IMPOSSIBLE TO BURP IN SPACE

When you burp on Earth, gravity keeps down the solids and liquid from the food you just ate, so only the gas escapes from your mouth. In the absence of gravity, the gas cannot separate from the liquids and solids, so burping essentially turns into puking.



10. HELIUM CAN ALSO WORK AGAINST GRAVITY

We all know helium as a gas for blowing up balloons and making people talk like chipmunks, but what most people don't know is that it comes in two distinct liquid states — one of which is borderline creepy. When helium is cooled to extreme temperatures, just a few degrees away from absolute zero

9. HOT WATER FREEZES FASTER THAN COLD WATER

In certain conditions, hot water can freeze faster than cold water — a counter-intuitive phenomenon known as the Mpemba effect. There are a number of proposed explanations for the Mpemba effect, including faster evaporation of hot water that reduces the volume left to freeze, the formation of a frost layer on cold water that insulates it, or different concentrations of solutes such as CO₂. The phenomenon is named after schoolboy Erasto Mpemba from Tanzania, who in the 1960s claimed in his science class that ice cream would freeze faster if it was heated first before being put in the freezer.



(-460°F or -273°C), it turns into a superfluid, meaning it can flow without friction. It can climb up and over the sides of a glass. It can leak through molecule-thick cracks in a container. If it starts flowing like a fountain, it will never stop.



Q&A

**RESEARCH
ARTICLES**



SEARCH FOR VARIABLE STARS IN THE I-BAND NAINITAL MICROLENSING SURVEY DATA

This short term research project was carried out under the supervision of Dr. Yogesh C. Joshi, Scientist-E at Aryabhata Institute of Observational Sciences (ARIES) in Nainital as part of the Summer Research Fellowship jointly granted by IASc, Bangalore, INSA, Delhi and NASI, Prayagraj.

Variable stars are those stars which show a fluctuation in their apparent magnitude over time. These changes can occur over years or just fractions of a second, and can range from one-thousandth of a magnitude to 20 magnitudes. These stars show variability at different stages of their evolution with varying brightness. This variability may arise due to several factors that might be extrinsic or intrinsic to the star. The characteristics of variable stars at different stages of their evolution can be used to extract various stellar parameters such as their masses, radii, luminosities, and nature of variability that provide crucial constraints of stellar pulsation models. This information can then be used to understand other stars. Hence, the study of change of stellar brightness over measurable timescales can help us verify the stellar evolution theory and provide a better understanding of the universe.


This project focused on the analysis of the I band Nainital Microlensing Survey data which was taken for ~ 4 years from 1998 - 2002, with follow-up observations executed until 2011. During this period, observations were obtained on 169 nights spanning about 5000 days to detect gravitational microlensing events in the direction of M31 using the 1.04 m Sampurnanand Telescope at ARIES, Nainital. Since search for microlensing events requires monitoring of numerous stars over a few years, it produces a massive multiband database that can be used to detect

stellar variability. A total of 593 frames were obtained in the I band, each containing the image coordinates, observed magnitude and associated error in magnitude of stars. A master file containing 22067 stars was used for reference.

To perform meaningful analysis, stars showing large errors with relatively lower magnitude values were discarded. An increasing trend was observed between the photometric precision and magnitude of stars. In order to cancel out airmass effect, sky variation and instrumental signatures, differential photometry was performed in which stars were divided into different magnitude bins. Stars showing minimum standard deviation in magnitudes were selected as comparison stars and differential magnitude (T- C) of each target star was determined.

Stars exhibiting standard deviation of differential magnitude greater than three times the standard deviation of differential magnitude of comparison stars were identified as potential variable candidates. Periods of each of these stars were determined using the Lomb-Scargle algorithm.

Based on the analysis of photometric light curves of 227 potential variable candidates, a total of 20 periodic variables were detected. Variability in these stars was further inspected by studying their phase folded light curves. Out of 20 variables, 6 were found to be short period variables ($P < 1$ day) and 14 were long period variables ($P > 1$ day). The mean magnitude of variables ranges from $I = 14.96$ to 19.05 mag. and the period of these stars was found to be between 3 hours and 451 days. Further study of these periodic variables can lead to classification of these



stars in different variability types on the basis of observation properties such as shape of the light curves, periods, amplitudes as well as by examining their positions in the H-R diagram.

BY BHUMIKA TANEJA

PREDICTION OF HELIOSPHERIC PRESSURE OF SOLAR CYCLE 25

This research is being carried out as part of the National Initiative on Undergraduate Sciences (NIUS) Physics Batch 17 under the guidance of Dr. Dipankar Banerjee, director of the Aryabhata Institute of Observational Sciences (ARIES) in Nainital, India.

Solar eruptive phenomena are associated with solar flares, solar energetic particles, and radio bursts. This study concentrates on Coronal Mass Ejections (CMEs) observations since the vast majority of eruptive phenomena are related to the eruption, development, and evolution of CMEs. A coronal mass ejection (CME) is a large eruption of plasma and magnetic field from the Sun. It can contain a mass larger than 10^{13} kg and may achieve a speed of several thousand kilometers per second. Thus, CMEs are an important part of coronal and interplanetary dynamics. They cause massive transient disturbances by injecting large amounts of mass and magnetic flux into the heliosphere.

CMEs are recognized to be a major contributor to severe space weather on Earth. They are

affected not only by what happens on the solar surface or underneath it, but also by the status of the heliosphere. This also controls the course of the solar cycle and its impact on the Earth. The goal of this research is to estimate the heliospheric condition of Solar Cycle 25 using two methods: the speed-width relationship of CMEs and in-situ data and comparing it with 1.5 years of rising phase of Solar Cycles 23 and 24. The speed-width data was collected using CACTus CME Catalog. JHelioviewer software was then used for the analysis of collected data. For conclusions, the plots are best fitted. OMNI Web Services data is used for the in-situ measurements. The collected data included the plasma temperature, proton density, magnetic field and sunspot number on 27 days average period. To find the total pressure, magnetic pressure $[B^2/8\pi]$ was added to the plasma pressure.

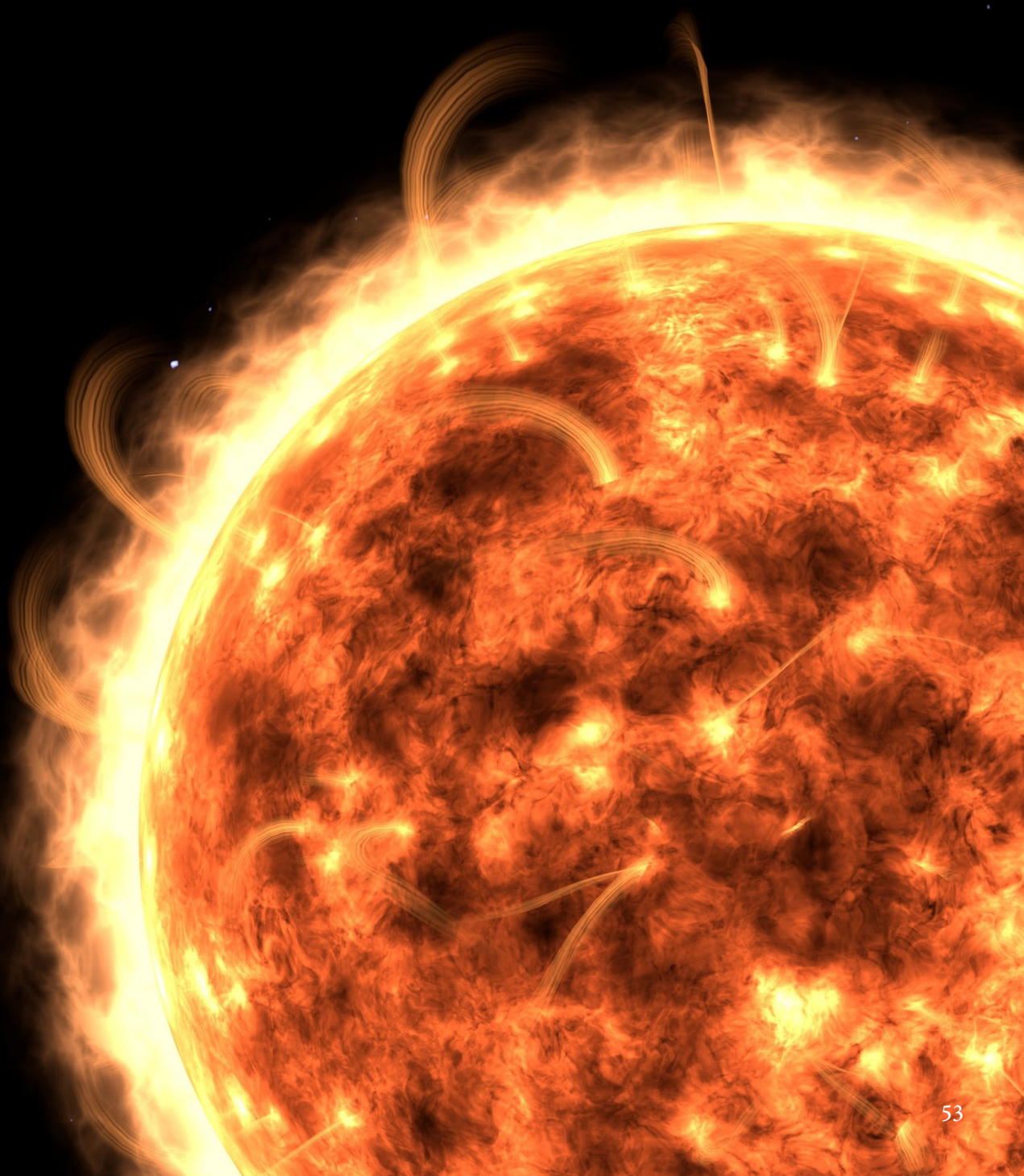
The results of both methodologies are found to be complementary. In comparison to solar cycles 23 and 25, the speed width relationship revealed that the heliospheric pressure is lowest

in solar cycle 25, whereas in-situ measurements revealed that it is lowest in solar cycle 24. This provides an intriguing perspective on considering the projection impacts of CMEs and including more data for observation and study.

The research is significant because it will not only aid in forecasting the status of the heliosphere in the coming years, but it will also aid in forecasting the state of geomagnetic storms in Solar Cycle 25, which are harmful to humanity. The amount of data analysed is limited (1.5 years) because of which conclusive conclusions and forecasts cannot be made

at this time. Though JHelioviewer played a significant part in data analysis, it occasionally fails to display information for certain cases due to technological limitations resulting in data loss. Further, the differences in the results between the nature of Solar Cycles 23, 24, and 25, as determined by the speed-width relation and in-situ measurements, will be examined in greater depth in order to fix any errors and draw appropriate conclusions.

BY KAMALPREET KAUR



LANGUAGE IDENTIFICATION USING NATURAL LANGUAGE PROCESSING

This research project was carried out under Dr. Lalita Josyula and Dr. Basant Saini, Department of Electronics as a part of SRI-VIPRA, the Summer Internship programme conducted by Sri Venkateswara College. Language identification is a crucial step in any Natural Language Processing (NLP) problem. It involves trying to predict the natural language of a piece of text. It is important to know the language of any text before other actions (i.e. translation/ sentiment analysis) can be undertaken. If the language of a document is misidentified, all subsequent language specific models will produce inaccurate results. To accomplish this task, Ishant and Mansha worked on a dataset consisting of 22,000 sentences from 22 different languages and Meemik combined different datasets obtaining a dataset consisting of 47,789 sentences from 4 different languages to work upon. Mansha and Meemik adopted the machine learning approach for the same while Ishant chose to work using deep learning. Python was the programming language used.

The machine learning approach adopted by Mansha required cleaning of data at the initial stages by first breaking the sentences down into tokens (words/characters/subwords) using Natural Language Toolkit or NLTK followed by removal of stopwords. Stop words are the words which do not add much meaning to a sentence. For example, words like 'the', 'is',

'have' etc. are stopwords. Meemik made use of Pipeline which implements all these steps at a later stage. The data was split into training data (80%) which is used to train the model and testing data (20%) which is used to test the efficiency of the model. The next step was vectorization. Vectorization is a methodology in NLP to map words or phrases from vocabulary to a corresponding vector of real numbers which is used to find word predictions, word similarities/semantics. Vectorization plays a key role in building the machine learning model. There are different types of vectorizers available in the scikit-learn library. Meemik used Tfidfvectorizer which considers overall document weightage of a word while Mansha used CountVectorizer which counts the number of times a word appears in the document. Then the model was trained using a machine learning algorithm. Mansha chose Naive Bayes algorithm as the model. Naive Bayes algorithm is based on Bayes theorem and is a probabilistic classifier, which means it predicts on the basis of the probability of an object. Meemik used Logistic Regression which is a predictive analysis algorithm, also based on the concept of probability. The model was trained using the training data and was then applied to the test data to produce significant results.

Ishant made use of Multi-Layer Perceptron (MLP). A MLP is a combination of input layer,

hidden layers and an output layer where each layer is a collection of many nodes. This way a node, which is essentially an equation of line, achieves desirable curves for classification or regression problems. The Sequential model from Keras library was used. The process involved creation of an input layer of size 2,77,720 which transfers the output to 128 nodes of the hidden layer. The outputs then again get passed to the output layer of 22 nodes which ultimately act as classifiers and match the prediction with the actual language of the text. The training data is divided into a number of batches of some size. The way training is done is that the model selects at random a given quantity of a batch and exhausts the training data. This marks completion of an epoch. This looping of training grants better training and hence weights are manipulated correctly. For any given number of epochs, callback makes sure the loss is always decreasing. If not, it interrupts the training and saves the weights for the model when the validation loss is minimum. This ensures that the model does not overfit the training data. All of fitting and testing history can then be retrieved. The model was then applied on the test data.

When the model was applied on the test data, all the methods were able to produce appreciable results i.e. and accuracy of over 95%. At their best, Meemik was able to achieve an accuracy of 99.72%, Mansha of 98.02% and Ishant of 97.48%. The project is a very good example as to how data science is a powerful tool that can be used to simplify many complex real world problems and provide promising results.

BY ISHANT YADAV, MANSHA AHUJA AND MEEMIK ROY



MESSAGES FROM THE ALUMNI

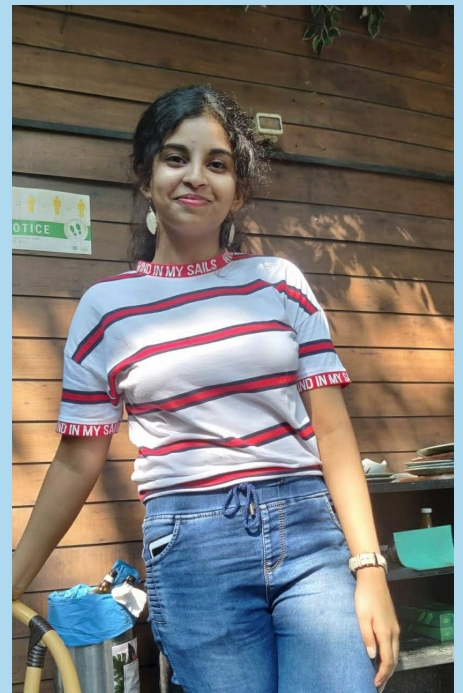


Aarushi Rawat

Pursuing a Masters in Physics from University of Delhi

My Pre-Covid three semester experience at Venky was quite enriching and wholesome. I had lovely, super helpful and fun classmates, my seniors as well as juniors were no short of gems. The canteen, sneaking out of labs, roaming in the campus, FAA, attending so many seminars and events throughout DU, my whole experience being in the student council. All of it was just perfect.

The time in B.Sc, specially starting from first year is the time you can explore the most. Learn languages, join societies, participate, do internships and build your character and CV. This is the time for immense growth for you guys so don't let it go to waste. All the best!



Srishti Kunwar

Pursuing a Master's in Physics from IIT Delhi

My life at Venky has been the most prominent checkpoint of my life so far. It has helped me build my personality, learn about my responsibilities, grow, and become a full fledged adult from an adolescent who had just come out of school. Had it not been for Venky, I wouldn't have been the person I am right now. I'm genuinely thankful for everything it has given me, including a lot of good friends.

Set yourselves free and do not stick to just academics, there's a lot more to explore, which is actually way more important than scores. Try societies, manage your time, work on your passions, try searching for your passions, get into management and extra curriculars; and do not worry if your scores go a bit here and there because of all this, that'd be worth it.



Yashvardhan Shukla

Currently on a gap year, aiming to pursue a degree in screenwriting/ film-making

Oh boy, where do I begin? I think I owe a good chunk of my personality to the college, especially the wide variety of talented people from different courses and societies.

As a first year student I was very intimidated by the whole idea of going to college but some really kind seniors took me under their wing and changed my perspective on a lot of things. I became more thoughtful and less judgemental.

The pandemic has served as a reality check for me. Life is short and unpredictable and with the constant threat of a global war looming, it's best to live life one day at a time. Do one thing that makes you happy everyday without fail.

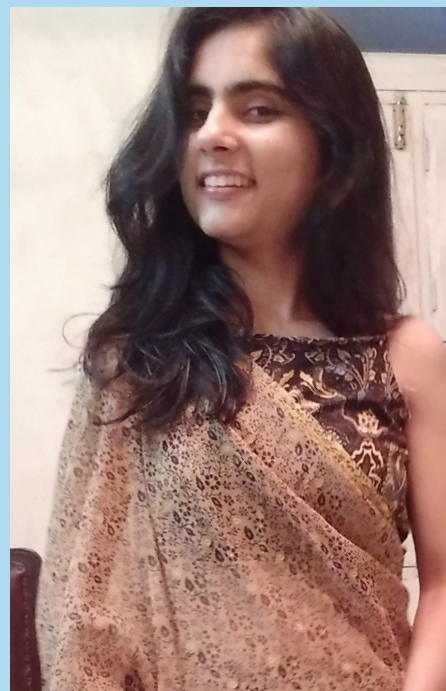


Manish Kumar

Pursuing IPhd in Condensed Matter Physics from TIFR

When I first came to college I was a hosteler and an introvert. As a hosteler I have enjoyed my college life to its fullest even though we didn't spend much time on campus. As far as point of shaping is, Venky has brought a major change in my personality from being introvert to an outgoing person.

During my college time I hadn't interacted much with my seniors and teachers, but I will advice the upcoming batches to be in touch with their's and take advantage of their experience.



Lakshita Bageja

Pursuing an IPhD in Physics from IISER

Venky was indeed a life changing experience for me. It taught me the power of loving what you do, and doing what you love, thanks to the teachers who made me feel proud of what I was doing and encouraging me to pursue it to the fullest. I would like to thank AKC sir for inculcating a physicist amongst all of us, since very beginning.

Every minute in a physicist's life counts. It indeed does as correctly said by Dr. AKC Sir.

And your life must be driven by one amongst the following either a great aim or a fiery passion.



Garima Anand

Working as a junior associate in State Bank of India.

My overall college life has transformed me completely, and I just love this new version of myself. It has taught me how to deal with unprecedented situations and made me realise my potential, my true worth.

It is important to enjoy college life but don't forget that it is equally important for you to stay focussed in your studies, because that is what you're here for. Don't just be swayed away by what others tell you, do what you feel is right for you.



Aiswarya N S

Pursuing a Masters in Physics

In those two years that I spent on the college campus, my college life was splendid with physics, dance, and hostel.

Don't hesitate to join any society as they give you a wonderful college experience be it physics society or any other arts society. And study hard. Do not allow anything to hold you back from pursuing your dream career.



Jasmine Kaur

Working as an Analyst in a Fin-tech startup, Better.com

My three years at Venky had been super fun and smooth. Life in campus was full of interesting experiences and everyday was a new day with more energy and vigour. It has shaped me as a more tough individual. It'd helped me to take on any challenge that life throws at me. It served as a great platform for me to explore, learn and grow.

Don't hesitate to take part in social and cultural activities at college. Join atleast one society to explore the campus life.



PHYSICS DEPARTMENT 2021-22



QUINTESSENCE

*Designed by
Muskan Singh*

Pictures from Unsplash