Lumen | Department of Physics and Electronics | Hansraj College

Phyonics '23

Annual Magazine Featuring a Sneak Peak Into the Department

THE MOST SIZZLING INSIGHTS OF US

"IMAGINATION IS THE BEGINNING OF CREATION. YOU IMAGINE WHAT YOU DESIRE, YOU WILL WHAT YOU IMAGINE, AND AT LAST, YOU CREATE WHAT YOU WILL." - GEORGE BERNARD SHAW

Featuring

JAMES WEBB SPACE TELESCOPE

"A peek into the past, from the begginning of time"

PHYONICS 2022-23

THE ANNUAL MAGAZINE
DEPARTMENT OF PHYSICS AND ELECTRONICS
HANSRAJ COLLEGE , UNIVERSITY OF DELHI

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Acknowledgement

LUMEN : The Physics and Electronics Society of Hansraj college is a community of students who are passionate about exploring the fascinating world of science and technology. Our society is committed to providing students with hands-on experience and opportunities to apply their knowledge in practical ways fostering a sense of camaraderie and collaboration.

It gives us immense pleasure to extend heartfelt gratitude and appreciation to every member of our society for their commitment and hard work in publishing this year's annual magazine **PHYONICS'23** . The dedication and commitment shown by each and every individual involved in the production of this magazine have truly been exemplary. From the authors and editors to the designers and photographers, each individual has played a significant role in making this magazine a success. We could not have produced this magazine without their dedication, skill, and imagination.

We take great pride in the achievements of our department, and we believe that this magazine will be a fitting tribute to the hard work and commitment of our team LUMEN

Umesh Kumar
B.Sc.(H) Physics | 3rd Year

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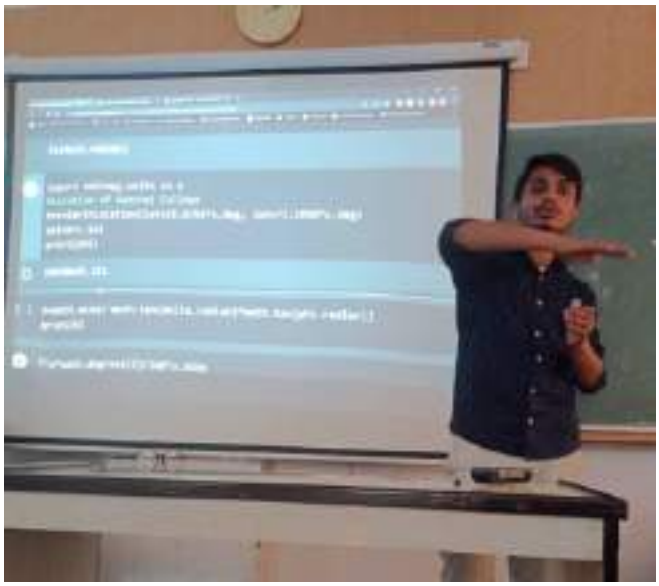

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MESSAGE FROM ESTEEMED PRICIPAL

Dr. Rama Verma
Principal, Hansraj College

भौतिकी विज्ञान की वार्षिक पुस्तिका के चतुर्थ संस्करण के प्रकाशित होने पर समस्त अध्यापक गणों एंव विद्यार्थियों को हार्दिक बधाईया |

जब मुझसे कहा गया कि, मैम हमारे डिपार्टमेंट की वार्षिक पुस्तिका प्रकाशित होने जा रही है और हमे आपका संदेश प्रेषित करना है तो यद्यपि मै हिन्दी आनर्स की छात्रा रही हूँ, पर विज्ञान मे मेरा व्यक्ति गत मत रहा है, कि विज्ञान मे मनुष्य को प्रकृति के बारे मे गहन अध्ययन करने में बढावा दिया गया, तकनीक को और बेहतर बनाने का मूलभूत ज्ञान प्रदान किया गया, और अन्य क्षेत्रों मे भी हमारा ज्ञान विकसित किया है।

इसमें कोई संशय नहीं है कि दिल्ली विश्वविद्यालय देश का श्रेष्ठ तम विश्व विद्यालय है, तथापि हम प्रयास रत है बेहतर को बेहतरीन बनाने में, इसे सिर्फ देश नहीं विश्व के श्रेष्ठतम विश्वविद्यालयों में शुमार करने का। पूरे भारत वर्ष की प्रतिभाएं दिल्ली विश्वविद्यालय के विभिन्न महाविद्यालयों मे मे अध्ययन रत है।

मै चाहती हूँ कि हंसराज महाविद्यालय की भौतिक विज्ञान कोर्स में अध्ययन रत यह क्रीम हंसराज महाविद्यालय की प्रसिद्ध पूर्व छात्र छात्राओं की गिनती में शुमार हो और **द वाल आफ हंसराज** को अपनी मुस्कराती हुई तस्वीर से अवकृत करे। सभी छात्र छात्राओं को शुभकामनाएं और आशीर्वाद |

डा रमा
प्राचार्य, हंसराज कालेज, दिल्ली

ABOUT LUMEN

LUMEN: The Physics and Electronics society of Hansraj college has always been an eye opening, promoting and supporting front that has given great opportunities and knowledge for all the students around the college who have keen interest in Physics and related subjects. They have always worked for the betterment of the department and have always been updated of science thus reaching out to a lot of students in the most advanced manner. For the academic year 2022-23, LUMEN worked under the mentorship of respected Prof (Dr.) Amit Sehgal and Dr. Pradeep Kumar .
LUMEN consists of 37 students.

Our society is dedicated to promoting interest and understanding of Physics among the student body, and providing opportunities for members to explore the subject outside of the classroom. We organize a range of events and activities throughout the year, including talks by guest speakers, lab tours and a lot more activities . This academic year we arranged the events which were celebrating the beauty of science, exploring the various realms of Physics, appreciating the wide applications of Electronics and at the same time keeping the students abreast with the advancements and demand of the recent times and making them aware of the various fields they could explore that could help them build a better career.

Like every year LUMEN proving themselves better, this year also marked great achievements and events that saw high hand success. The society has many times also marked the integrity between students led by heads that showcase amazing leadership qualities and have worked with the students to get everybody involved.

Swapnil Gupta
President

Umesh Kumar
Chief Executive Head

Akriti Vishwas
Vice President

Taurn Gularia
Vice President

Vardhman Yadav
Secretary

Kartikey Siwach
Secretary

Vikalp Sharma
Joint Secretary

Gautam Kumar
Joint Secretary

Aditya Kumar
Technical Head

LUMEN COUNCIL MEMBERS

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Technical Head

Kartikha
Editorial Head

Sana Fatima
Editorial Head

Pallavi Chauhan
Editorial Head

Ashutosh Pratap
PR Head & Treasurer

Keshav Kumar
PR Head

LUMEN COUNCIL MEMBERS

MESSAGE FROM TEACHER-IN-CHARGE

Dr. Davuluri Srikala
Teacher-In-Charge

As we celebrate our platinum jubilee year I would like to recognize and express my gratitude to all our previous faculty, non-teaching staff and alumni who through their dedicated efforts have carved out a special name & recognition for the Department of Physics and Electronics. In that great tradition the current LUMEN team also tread the path of hard work and dedication.

Hearty congratulations to LUMEN team!, for a successful academic year 2022 – 2023. The team worked very hard throughout the year to accomplish the objectives of the society. It was possible only due to your indefatigable efforts and unwavering commitment. You successfully organized inaugural lecture, workshops and field trips to explore new horizons of knowledge. This reflects on the value you attach for continuous improvement. In addition, the events like orientation program and fresher's party were also conducted successfully. This is a reflection of the team's capabilities, tremendous energy and zeal to excel at everything they own.

The team worked very hard throughout the year to accomplish the objectives of the society.

With this famous quote:
"If I have seen further it is by standing on the shoulders of giants." –Sir Isaac Newton (1642 – 1727).

I am sure the team would scale new heights, set new benchmarks and would inspire everyone.
I wish you all the very best for all of your future endeavours!

MESSAGE FROM SOCIETY CONVENERS

Dr. Pradeep Kumar
Convener, Lumen

Greetings dear readers !!

It gives me immense pleasure to extend my warmest wishes and blessing to all of you on the publication of our department magazine “PHYONICS-2023”. This magazine is a reflection of the hard work, creativity, and dedication that our students have put in over the year, and I am proud to see the final product.

I believe that the magazine is a platform that allows students to showcase their talents, creativity, passion and ideas. Our magazine has always been a source of inspiration and a window into the diverse interests and passions of our students. I am confident that this magazine will serve as an inspiration to future generations of students.

I encourage all of you to take the time to read through the magazine and appreciate the efforts of students. I also hope that you find it entertaining, informative, and thought-provoking.

I would like to take this opportunity to thank all the students and faculty members who have contributed to this incredible magazine. Finally, I would like to congratulate each and every member of “LUMEN” society especially editorial team and technical team for their hard work in bringing the magazine to fruition. It is no easy task to compile and publish a magazine, and they have done an excellent job. They have demonstrated leadership, teamwork, and a commitment to quality.

Congratulations and best wishes for the future.

MESSAGE FROM SOCIETY CONVENERS

Prof.(Dr) Amit Sehgal
Convener, Lumen

Hansraj College is one of the premier institutes of academic excellence in India. It has made significant contribution to the society in terms of producing numerous and standing scholars and professionals. The main aim of educational institution is to build-up young minds into rational and enlightened human beings.

The twenty first century has been as a century of new scientific advancements. Our country is rapidly progressing in the field of scientific improvements and therefore a demand of learned human resource is huge.

This progress is making new opportunities for students in the field of Research and Development as well as in scientific industry.

The science department of our esteem college has made a significant contribution to the same. Over the year, there is a skewed progress in the field of science and experimentation in our college. The department of Physics and Electronics, is amongst the best departments of the college and is producing well trained and well-groomed personalities.

It gives me immense pleasure that LUMEN society of Physics and Electronics is continuing the legacy of bringing out departmental magazine "PHYONICS" next edition. The scope of magazine engages the minds to think out of the box and bring out inter-personal and creative skills. These type of activities as participation and management groom students towards stepping in the professional world.

I would like to thank our Principal, Research and Development Cell (RDC) and Internal Quality Assurance Cell (IQAC) and college administration for their constant support towards success of our programmes and events in their respective domains. I appreciate the editorial board for their hard work in bringing out this edition of the PHYONICS. I also congratulate the staff and students of the department of physics and electronics for maintaining the high standard of academic achievements.

My blessings and wishes to all.

MESSAGE FROM CORE COUNCIL MEMBERS

Swapnil Gupta
President, Lumen

As the President of LUMEN : The Physics and Electronics Society, I am thrilled to address you all through this magazine. It has been an honour to serve as the leader of this vibrant community.

Lumen is dedicated to bring out the beauty of Physics and the applicability of Electronics through varieties of events and activities and over the past year, we have faced numerous challenges and uncertainties which sometimes made it difficult for us organize events that imbibe the virtues of Physics and Electronics among our Students.

However, we have remained resilient and adaptable, continuing to engage with each other and foster a sense of belonging. I am proud of the incredible work that our members have accomplished, from organizing different events and at different levels. All the wings such as Technical, Editorial and Public Relations had put their efforts to the utmost limit for making this year a success for our society. Looking forward, I am excited to see what we will achieve together in the upcoming year. We have a fantastic team in place, and I am confident that we will continue to thrive as a society. I encourage all of you to get involved, attend our events, and share your ideas with us. Together, we can create an even more dynamic and inclusive community. If I had to describe this year in the words of Atal ji.
I would simply say :

"क्या हार में क्या जीत में
किंचित नही भयभीत मैं
संघर्ष पथ पर जो मिला
ये भी सही वो भी सही।"

MESSAGE FROM CORE COUNCIL MEMBERS

“Coming together is a beginning, staying together is progress, and working together is success."

- Henry Ford.

I, Umesh Kumar served as the chief executive head of Lumen: The Physics and Electronics Society of Hansraj College, and It gives me immense pleasure to express my appreciation for the hardworking and lovable team that we have. It is said that success is not an overnight accomplishment, but rather the result of tireless effort and dedication. Our team has exemplified this notion through their unwavering commitment to excellence and their willingness to go above and beyond the call of duty.

Umesh Kumar
Chief Executive Head, Lumen

In my first year of undergraduation , I joined Lumen as a member of Editorial wing and what inspired me were my seniors who worked tirelessly so that Lumen can reach heights. I adapted their way of working and became the Deputy Secretary in my second year which was a position of responsibility.
This year team membershave spent countless hours organizing and executing events, managing finances, and promoting the society. Their efforts have helped us to build a vibrant community of individuals who are passionate about Physics and Electronics. It is heart-warming to see the love and camaraderie that exists within our team. Despite the challenges and obstacles that we have faced, they have remained steadfast in their support and encouragement of one another. This sense of unity and teamwork has been instrumental in our success, and I am proud to lead such a dedicated and caring group of individuals.
In conclusion, I would like to express my sincere gratitude to the hardworking and lovable team of Lumen .Your dedication, passion, and commitment to excellence have made our society a success, and I am confident that we will continue to achieve great things together.

“Vive La Lumen !"

MESSAGE FROM CORE COUNCIL MEMBERS

"Three Years of Lessons ,Growth and Memories : A Reflection"

As I begin to write this message and can see my three years in Lumen coming to an inevitable and beautiful end I cannot help but feel a plethora of emotions. Lumen has been an integral part of my college life and when in a few years time I will look back at the time I spent here these emotions will rush right back.This Academic Session, I served as the Vice President of the society and It was an absolute honour.

Akriti Vishwas
Vice-President, Lumen

I started my journey with Lumen as a volunteer in my freshmen year in the editorial wing. It was a wonderful year filled with articles, corrections and learnings. The sophomore year came with increased responsibilities and indeed more lessons. I was given the responsibility of General Secretary and it was a wonderful experience to work under our beloved seniors who were our guiding light in many ways.

I did not realise when did my passion for writing turned into flare for Technical work and I have not left the Tech wing since then. Editing and designing the posters in meets, preparing the PPTs and making thousands of changes made it exciting as well as draining a few times. I will not deny that in one of the toughest times in my life in 2021, being with LUMEN came as a necessary distraction and helped me in more ways than one.

Finally reflecting on this last year, It was like the final piece of data that confirms the hypothesis. The offline exposure came with its own challenges and lessons but I would not imagine it any other way. The best thing about this year was working with my excellent team.Their dedication and creativity motivated us to make this year what it was. All the long meetings and extra hours , organizing the freshers and the farewell,managing the finances for events, meeting our senior batch from 50 years back and working behind the scenes for each event and so on and so forth all this became more beautiful with our extraordinary team. The growth curve in the society for me has been monotonically increasing and the learnings abundant like dark matter.

I am grateful for the bonds I have made in the society and I will cherish these days forever.

The editing and designing of this edition brought back a lot of memories and as I look forward to the coming years, I wish nothing but great things for LUMEN. I believe that the our juniors will carry forward the luminous legacy of the Society with their best efforts just like we tried to do.

With this I conclude my address with these parting words which have always moved me-

“The world is round and the place which may seem like the end may also be the beginning." - Ivy Baker Priest

MESSAGE FROM CORE COUNCIL MEMBERS

Tarun Gularia
Vice-President, Lumen

Hii .. I am Tarun vice president of lumen. To be honest being part of lumen society was one of the biggest opportunity I got in my entire college life I started as an ordinary part of the society later I became the technical head and then the vice president this was an amazing opportunity I got to showcase my skills and the journey of lumen from the beginning till the end is full of memories to cherish even after the college. Being part of this society taught me many things like teamwork, management and forced me to think out of the box to be creative and thoughtful and gave me a chance to push my limit for the good, I never thought that I could do such thing that I did here, it took a lot of effort to do so but all those efforts were completely worth it because completion of any successful event organised by lumen was full of core satisfaction and I never felt forced to do anything as I always knew all the efforts I made will never gonna get wasted because it was never only me, it was my team who took the charge help me out with my stuff and never made felt overburdened. I want to thank all my teams and my seniors who are doing great in their live but helped me out with a lot of stuff in the beginning like many of you who are new to this. All the members of lumen are were very supportive and helpful without them it would have been a lot more tougher. So I want to thank you all for everything and for all the good memories.

Thankyou.

PEER TO PEER MENTORING PROGRAM

"Learning is finding out that you already know. Doing is demonstrating that you know it. Teaching is reminding others that they know just as well as you. You are all learners, doers, and teachers." — Richard Bach

The Peer-to-Peer Mentoring Program was initiated by the Student Learning Centre, Hansraj College under the guidance of Dr. Mona Bhatnagar (IQAC and SLC Director),Dr. Ravikant Prasad being the course coordinator and Dr. Davuluri Srikala the coordinator.

When we learn from our peers like our group members, classmates, parents, seniors and many more people around us then this fact is not of surprise that we take learning as more fun because we are more open to them and not afraid of anything and this was the motive to start Peer to Peer Mentoring Program.

This Program not just proves beneficial to the learners but also to the mentors (our seniors) who gained a lifelong rememberable experience of the most noble profession of teaching. This Program was conducted in an online mode with a proper schedule for the classes which included the almost all the core subjects which helped the students to clear their doubts and learn many more new things. This was a program full of learning, teaching and gaining experience which will be fruitful for every student to make their future brighter.

Our Events

DEPARTMENTAL TRIP

LUMEN organized a Departmental trip on 28th September 2022 on the occasion of Council of Scientific and Industrial Research – National Physics Laboratory Open Day (Jigyasaa). A group of 30 students of Physics and Electronics Department along with the Conveners of LUMEN accompanied by Dr.Ravikant Prasad visited the CSIR-NPL and the National Science Centre, New Delhi.

The students, after reaching the NPL got the opportunity to visit Solar Park where they got to know about the functioning of the park and Solar cells. The students also got an esteemed opportunity to visit the Advanced Carbon Products Lab where they were informed about the various uses of Carbon Fibre to make better, cost-effective and lighter products such as rods for body, body-armours, inflammable fibres, etc.

Next the students visited Liquid Helium Plant where they were explained about the Cryogenics field and then witnessed an exciting demonstration of Liquid Nitrogen and some of its applications. The enthusiastic trip was ended with the visit to National Science Centre where the various exhibits intrigued the curiosity of the group and they appreciated the experience thoroughly.

In this manner the informative excursion was concluded , the day which started with enthusiasm ended with the same but with the life long memorable experience.

CONSCIENTIA

Orientation programs in colleges play the important role of familiarizing the students with their transition to a university life.

On 7th November 2022, 'CONSCIENTIA', the orientation program was organised by Lumen- The Physics and Electronics Society of Hansraj College which intended to provide new students with a chance to learn how things work and showering them with all the necessary information related to their academics and social activities. In this event we briefly introduced the students with their College, department, department faculty and familiarised the students

with the departmental society Lumen, giving them an overview of the past events, introducing the respected Conveners and Student Council. Moving forward the students were informed about their academic syllabus, College societies, scholarships available and hostel facilities giving an insight on how to avail for them.

With this the informative part ended and was time for a fun session. The seniors played games and interacted with their juniors to conclude the event with a hope that first years can start their college career off well.

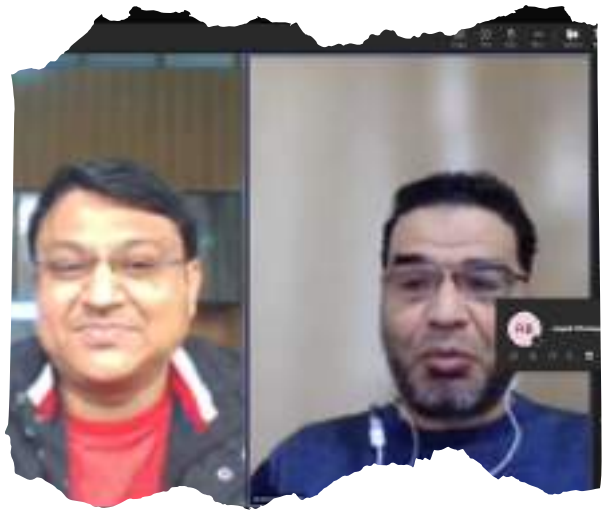
INTERNATIONAL WEBINAR

Title :- Horizons of High – Energy Physics Abstract.
Speaker : Prof. Abdel Naseer Tawfik

We're thrilled to share the success of our international webinar with Professor Abdel Nasser Tawfik on high energy Physics, held via MS Teams on January 7th, 2023. The webinar was introduced by Dr. Yogesh Kumar and included a review by Professor Tawfik of the current status of high-energy physics. This field explores the constituents and forces of the world at the smallest and largest scales, ranging from tiny particles to astrophysical objects. During the session, Professor Tawfik highlighted the latest research tools and technologies, the current status of research in the field, and future horizons.

The webinar also featured a discussion of the four international conferences scheduled for 2023, which will provide a platform for researchers, students, and scientists from around the world to share their research findings and ideas related to high energy physics. Students actively participated in the session, asking questions which Professor Tawfik answered satisfactorily.

The event concluded with a vote of thanks to Professor Tawfik, teachers, and all the students who attended the session and maintained decorum throughout. The webinar provided a great opportunity for students to learn from an expert in the field and gain insights into high energy physics..



SEMINAR ALUMNI CONNECT

Topic : " Spherical Chicken in Vacuum : An Unconventional Path To a Scientific Career"

On 5th January 2023, Lumen- the Physics and Electronics Society of Hansraj College conducted an Alumni Connect Seminar with Garima Malik, Alumni(2012 batch) andFounder and Chief of Operations Labrynthe Pvt. Ltd. in the old seminar room under the guidance of Lumen Conveners and department teachers, providing an amazing opportunity for the students to amplify their practical knowledge and understanding of physics.

The program started with the story of a spherical chicken in vacuum, a joke related to big bang. The discussion revolved around the opportunities for startup and gaining practical knowledge in field of physics for which her company is working. After a brief introduction of the company , Miss Garima also interacted with the students about their motivation to explore the subject .This interactive session enhanced the knowledge of students about startup in the field of science and its practical applications.

CONCLAVE '23
(Golden Jubilee)

Alumni Meet Cum Interaction Programme

On 1st March 2023, Lumen organized a Golden Jubilee Alumni Meet cum Interaction Program for the batch of 1973. The event wouldn't have been possible without the constant support by our Teachers and Conveners. The guests arrived and event commenced at 10:30 am with the welcoming speech by the President of Lumen. He was grateful to all the Alumni for taking out time from their busy schedules. The guests were greeted by the Vice Principal back in the seminar room offering them saplings, pots and muds. Ourguests started narrating stories which took us to a 50 years younger Hansraj. The shared stories somehow still could be related by the students sitting at that room. The students didn't spare a single breath asking questions about the secrets of a successful career andmoreover life. A new perception of life was created in everyone's mind that day. Lunch was announced and guests headed there along with the teachers and students. The event concluded with the tour of college recollecting past good memories with every step. After the event, every one of us started to make more memories to cherish them till we happened to be invited to a 50 years old Hansraj from now.

LUMINOUS'23

LUMEN organized a series of exhilarating events instilling the same fervour among the science enthusiasts and they were a huge success.

Hansraj Got Talent

The talent search event "Hansraj Got Talent " hosted by on March 25, 2023 was a major success. The event was held in the amphitheatre inside the college. For all of the students, this was the ideal venue for showcasing and publicising their hidden talents. The event was open to all Hansraj college students, and the program attracted a sizable audience. Huge numbers of people registered for the event, indicating that Hansraj College has no shortage of potential. Students were free to exhibit whatever they desired on the platform, which became open to everyone. The primary events of the gathering were singing, dancing, musical instrument playing, rapping, and other activities. Every person was given the opportunity to demonstrate their talents in a manner that attracts the audience.

Luminous Conventional Debate

"For good ideas and true innovation, you need human interaction, conflict, argument and debate"

This quote aptly describes the spirit of LUMEN, which focuses upon developing a questioning temper among students that encourages them to ask the right questions and eventually learn by finding answers to these questions. In order to fulfil the same motive another successful event 'Luminous Conventional was held on March 29,2023. The topic of the debate was –"The theory of relativity has had a greater impact on modern physics than quantum mechanics." The debating match was raised to a new level as each side shot questions at the other The intriguing topic enabled the students to research more about different avenues of science and holistically present their point of views. The thoughts of the dedicated participants compelled the audience to think differently and made them wonder about some things in awe. The debate competition was graced by participants from various colleges and institutions who participated in pairs having one member speaking in favour of the motion and the other member speaking against the motion .The debate was judged by our respected seniors from Prastav : The Hindi debating society Hansraj College. Questions were asked from the participants which helped the participants to establish and present their views on the topic more firmly.

Python Workshop

Coding continues to be a vital role in defining our future. It is very crucial that everyone learns coding as early as possible. That is why LUMEN ,the physics and electronics society of Hansraj college decided to conduct this fruitful event of workshop based on python for all the enthusiastic learners out there. The workshop on Python that Lumen, the Physics and Electronics Society of Hansraj College, organised took place on March 28, 2023. All of the Hansraj College pupils had the chance to participate.

There was a strong connection between the speaker and the crowd, and each of them was attentively listening.

Students who are interested in coding in big numbers were visible, and the questions segment gave them the chance to ask the speaker any questions they could have.

“Character cannot be developed in ease and quiet. Only through experience of trial and suffering can the soul be strengthened, ambition inspired, and success achieved.”

Intellect Innovations

MY SCIENTIFIC INNOVATIONS

"Physics is something which I can do anywhere and at anytime. "

I strongly believe in the fact that when you see something practically you learn more. For two years in my high school I had been learning concepts theoretically and on paper. One day I decided to do the things learned in school practically at my home using simple tools and things available at my home.

I made an electroscope to study the phenomenon of electric field and how charges are induced by rubbing the material and taking it near the other object. I simply used a plastic container ,attached two aluminium foils with a copper wire. I rubbed a plastic object with wool , the plastic object acquired negative charge and brought near to the wire the aluminium foils repelled because of same charge i.e. negative charge were induced in both foils.

I also made a Youngs double slit experiment setup using a laser light and observed the light and dark fringes formed on the wall. Simply used some stapler pins and created the slits using it and then passed laser lights through it and obtained fringes on the wall. That day I understood the phenomenon of interference more better than previous.

I made a hero's engine at home to understand the concept of newtons third law that is every action has equal and opposite reaction. I took a plastic container and then made three holes and bottom, dipped the container in water and when took out it started to spin as the force with which water was coming out same force was applied by water on the holes and since three holes were made each holes experienced force and it begun to rotate.

Once I made a simple setup to understand the concept of general relativity about universe being a space time fabric and when a massive object is placed on it, it bends the spacetime curvature making other object rotate in elliptical orbit around it. This explains us about the concept of gravity that how does it works and also about the motion of planets around the sun.

These simple experiments performed at home made my concepts more better and also I enjoyed a lot while making of it and when it worked it gave a next level excitement to me. I still continue to make more experiments like this and get the fun and learning from it.

Ayush Gupta
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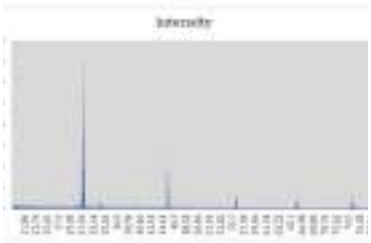
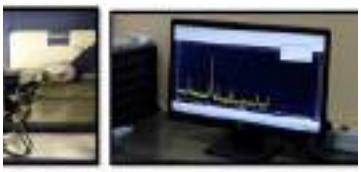
A BRIEF INTRODUCTION OF SUMMER SCHOOL

"THE INTELLIGENT USE OF SCIENCE AND TECHNOLOGY ARE THE TOOLS WITH WHICH TO ACHIEVE A NEW DIRECTION."
~ JACQUE FRESCO





It was an immense pleasure to be taught by Professor A.G. Vedheshwar at the Department of Physics and Astrophysics, University of Delhi in a "Summer School" organized by Hansraj College's Physics Department.

Professor introduced us to what exactly Thin Films are, what are there uses, how and why they are prepared and many more things about it. Here is what we had learnt throughout the lecture.

Thin films are material layers that are placed onto a substrate or surface in thin layers. They are utilized in a range of sectors and tasks, including as electronics, solar cells, optical coatings, and other fields. Metals, semiconductors, polymers, ceramics, and other substances can all be used to create thin films. Depending on the use, thin films can have a thickness of a few nanometres to several micrometres.

Many methods, including physical vapour deposition (PVD), chemical vapour deposition (CVD), and spin coating, are capable of producing thin coatings. Each method has advantages and limitations, and it can be used for various applications.

Applications of Thin Films:

· Thin films are used in the manufacture of microelectronics such as computer chips and transistors. They serve as connectors, insulators, and barriers.

· Thin films are used in the manufacture of solar cells, which convert sunlight into electricity. Solar cells are commonly manufactured using thin films of silicon, CIGS, and CdTe. .

CHARACTERIZATION TECHNIQUES:

UV-Vis spectroscopy is an analytical technique that measures the amount of discrete wavelengths of UV or visible light that are absorbed by or transmitted through a sample in comparison to a reference or blank sample. Before starting with the data collection of UV Visible calibration of the spectrometer was done so for that the glass plate over which thin film was created was taken and placed in both the holders and then the device was started and whatever data was presented on the screen was set to zero since there was no sample. After this the BiI3 sample was taken and was placed in one of the holders. The data and the graph was obtained and thus the session on UV Visible data collecton was completed. Once the data was collected using the UV Visible Spectrometer then the work on data analysis was done later.

WHAT DOES LIGHT ACTUALLY CONSIST OF? WAVE OR PARTICLE?

" LIGHT, MY LIGHT, THE WORLD-FILLING LIGHT, THE EYE-KISSING LIGHT, HEART-SWEETENING LIGHT! "

The Bard of Bengal, Rabindranath Tagore wrote this poetry in his collection, 'Gitanjali', which made him the first Indian to win noble prize. But nobody asked him, "Kobiguru! What is light? How does it look?"

To answer this, we will start from a turning point in history. It was a fine morning in 1865 when James Clerk Maxwell published his paper 'A dynamical theory of the Electromagnetic Field' in which he included four equations. Using these equations, he came up to the idea that there are electric field and magnetic field waves oscillating together, perpendicular to each other. He called them electromagnetic waves.

Using the same equations, he derived that these waves travel with the speed c (299,792,458 m/s). We know that light travels with the same speed. We have seen many coincidences occurring in science. But a coincidence can't be that great. Hence, Maxwell stated that these electromagnetic waves are nothing but light itself, propagating through the ether at speed c.In other words, we can say that light consists of coupled electric field and magnetic field oscillations called electromagnetic waves. However later, with the arrival of Albert Einstein's Special Theory of Relativity, Maxwell's ether was abandoned as an unnecessary concept but this concept of light as electromagnetic wave still remained there.

Many experiments were done to prove that light is an electromagnetic wave i.e. it has wave nature. Two of these experiments were interference and diffraction. But this was not the whole story.

In late 19th century, despite the fact that light is electromagnetic wave, Many experiments couldn't be explained using classical wave theory. Two of them were blackbody experiment and photoelectric experiment. Coming to blackbody radiation experiment. Many attempts were done to explain its spectral density graph, but those were either failure or only applicable on limited frequency range.

However, German physicist Max Planck unveiled the mystery behind blackbody spectral density graph using an adhoc assumption that energy of an oscillator which is emitting blackbody radiation, is quantised. This assumption introduced the world to a new study called Quantum physics. The Swedish Academy of Sciences awarded Planck the Nobel Prize for 1918 in recognition of his epoch-making investigations into the quantum theory.

What was the actual mystery behind blackbody radiation and how Planck solved it using an assumption, is a long story which we will cover in another article. But what is noticeable in this whole saga was Planck's assumption that the energy of an oscillator is quantised. The great Einstein, same as us noticed that revolutionary assumption. Einstein took it to another level by stating that not only oscillator's energy is quantised, but the emitted radiation's energy is also quantised or we can say that energy of electromagnetic radiation spreads in form of packets. In simpler words, light consists of energy packets called photons. Einstein explained photoelectric effect using this theory which won him Nobel prize in 1921. Compton also proved this photon's theory using his experiment.

Now we have seen both theories. One says that energy of light spreads out continuously through wave pattern (wave theory) whereas the other says that light consists of photons (quantum theory). Both views have strong experimental support. Now which theory are we going to believe because either theory can only explain certain effects not all?

We have arrived at the same question where we initially started. What is light? How does it look? Is it wave or particle? But don't go haywire. When we ponder this question, actually we are in good company. The Great, Einstein shortly before his death in 1955, remembered, "All the 50 years of conscious brooding have brought me no closer to the answer to the question, 'What are light quanta?' Of course today every rascal thinks he knows the answer, but he is deluding himself."

Today, in 2023, this question still remains a puzzle. Light remains as fundamentally mysterious as ever.

That is it for today.
Thank You.

~ Tushar Jain

MY EXPERIENCES WITH PHYSICS

~ Rudra Pratap Jha

What is Physics ? If I ask this question ,one may come out with a typical definition that it is the study of laws of nature,while some other person may coin that it is one of the hardest subject ,some may assert that it is the most logical and fascinating subject and even some including me may even proclaim that 'Physics is Love'.So if I ponder upon the reason behind these spectrum of views on this single subject , I realize that these varied views are because of the fact that different people have felt this subject at different to different extent.If you just regard this as a subject with lots of formulae and numericals , you would definitely end up seeing this subject as a tough one having no fun in it.But if you start observing and relating it with your day to day life , you start becoming curious about this subject .Trust me , if you develop this kind of approach towards this subject , then you willfind this subject as one of your love .Similar was the case with me also, before my 11th standard , I was also kind of having just a rote – learning approach for this beautiful subject.But standard 11th was a turning point for me towards Physics , when I started solving the problems of the book 'Concepts of Physics ' by Padma Shri 'H.C. Verma' sir following the previous approach ,I was not able to solve even a mediocre question which required just a bit of analytical thinking rather than simply putting the values in the formula. Those questions literally used to run in my dreams like a horror movie and I used to feel dejected at times that why I couldn't solve the problems even after reading all the concepts .But gradually ,continuing the journey of struggle with the problems ,I realized that my approach was not correct .Just reading the concepts wouldn't work until I feel them , until I understand its application , until I analyse them.Then with changing my approach I started visualizing the questions. Literally I started visualizing the motion discussed in the problems just like a play ,I visualized its trajectories , its intricacies ,and gradually with this approach I started playing with them.Even though I was not able to solve all the problems and my point also here is not solving all the problems just . Rather my point is even though If I could not solve a problem , I started enjoying attempting and playing with it and this was a 180 degrees turn for me in my journey of Physics and I'm still enjoying it .Undoubtedly Physics has many fascinating theories and concepts other than just numericals and derivations like the Black Holes ,The Mystery of Origin of the Universe ,Particle Physics etc which are a part of almost all the discussions or articles on Physics and reasearh work.These theories may fascinate anyone and make anyone interested in the subject but I have confined my discussion here more on numericals and derivations in Physics instead of these theories . The reason behind this is that I feel practically that most of the student give up on this subject because of these lengthy derivations and complicated problems .So , I just want to change the minds of the mass that these may also be fascinating and enjoyable .And believe me these are the stepping stones for all those big discoveries and if one develops a right approach towards these ,then that person will definitely prosper by leaps and bounds in the subject as the person has conquered one of the most patience and skill demanding section of the subject.At last I conclude this article with a message that :

"Start Living Physics and you will slowly realize that you have started Loving Physics".

PARTICLE DETECTOR

-Aditya Aryan Lal & Yash Joshi

When I got to know about Phyonics this year, my instant thought was to submit an article.
Can I write a poem, hell no, I'm well aware of my writing skills, then what about a movie review, God, I don't watch any but what I got is a brilliant and unique idea, PARTICLE DETECTORS. I know, sounds boring but then this is what I have to offer. Although I will make sure that this article is nothing like a scientific research paper with exhausting math and boatload of "essential" references, rather it will be more like a fun monologue(which I'm pretty good at giving by the way) with some useful insights.

"Just as hunters can identify animals from tracks in mud or snow, physicists identify subatomic particles from the traces they leave in detectors"-CERN website.

I don't think there is a much better way of introducing the need for particle detectors than this very statement. Billions if not trillions bombard your body every single second, their existence and interaction make up everything we know, and they are just so goddamn cool.
There are various types of particle detectors butue to time limitations as well as fabrication easiness(a future endeavour hopefully), I have chosen gaseous detectors.

So, what are they? In the most rudimentary form, they are a closed system with at least two separated structures at different electric potentials, this system is normally evacuated of atmospheric air and instead filled with a particular type of gas.
The basic idea is as an energetic particle passes through this gaseous medium; it ionizes the atom of the medium resulting in the creation of electron-ion pair. Due to the presence of an electric potential, an electron would then drift toward the anode, meanwhile, a positive ion will drift toward the cathode.

Due to continuous collision inside the gaseous medium, the electron eventually slows down and loses its kinetic energy. Their mean range is generally too low for an electron to be deposited onto the anode. To offset this an electric potential is applied, which accelerates the electron, to not get reabsorbed and be deposited onto the anode.

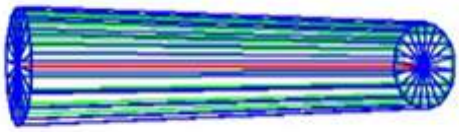
Depositions of these electrons cause a sudden spike of current in the anode, which can be connected to some simple circuits, and lo and behold a signal(the kind you can see on an oscilloscope in the lab).
But hang on a minute, what potential should we use, the answer is rather difficult and involves more physics than I have the space to write in this small article. But in short, there exists this graph.

While divided into many ranges, I would like to bring your attention to two regions, Ionization, and Proportionality. So, what are they?
Ionization as the name would suggest is the region under which, there is just enough electric potential to accelerate the electron to hit the anode.
When the electric field goes over that just enough, what happens is that electrons gain sufficient energy to ionize other electrons. And what results is a beautiful shower of electrons, aptly named an electron shower or Townsend Avalanche. This phenomenon is present in all ranges above ionization but what makes the proportionality range special is that potential is still not enough for too many dense showers to be created, thus creating additional headaches.

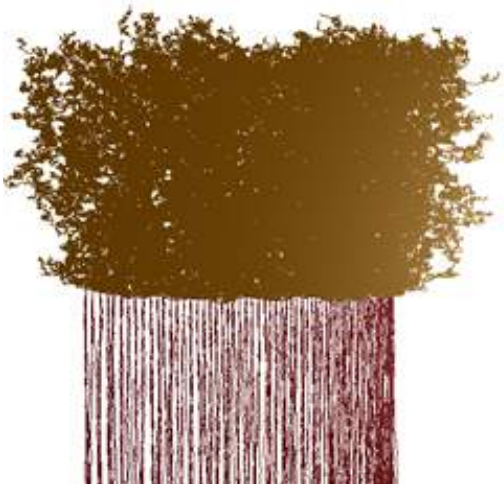
This all may sound superficial, as why would I go over ionization range if I can just use it only, reasons are many, but it all boils down to the noise you are willing to accept and have the capacity to filter in your system. And that's it!

While I was reading about all this, I got to know about Garfield++, not a successor to the Classic Cat, but an ingenious toolkit developed by R. Veenhof and religiously maintained by H. Schindler.
To say, it's just another toolkit one comes across, is frankly an understatement. Just think about it, if I say you can choose any particle(atomic and sub-) moving in some material of choice where you can SEE its track(total path under observation), beautiful avalanches, a real-time signal, some weirdy complicated graphs, what else could one want from life, right? It surely makes up for the lack of experiments in our undergrad and gives us a way to verify our theoretical knowledge, not to mention if one wants to play around with radioactive particles, you won't die, I mean this has to be a pretty good reason to at least give it a shot!

Garfield++ has been particularly developed for a detailed simulation of gaseous and semiconductor detectors. The only catch is it is not compatible directly compatible with DOS but UNIX environment(so get out your Linux machine) and you need to code in C++ for its compilation, "Good things do not come easy". What you'll need is a basic understanding of C++03 or higher and if you know it already, you can do wonders in it.
The detectors you can simulate are Ionization Chambers, Proportional Chambers, MWPCs, GEMs, Micro Strip detectors, and the list goes on.

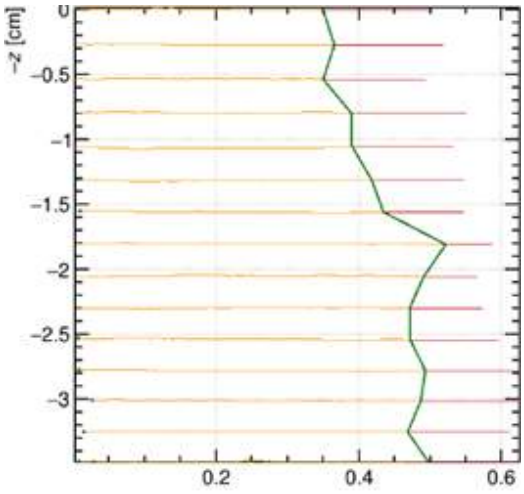


What I've been working on is a parallel plate ionization chamber, an easy detector geometry but widely used in particle detectors. It majorly deals with particle identification and detector calibrations.



As I've already taken you through the physics behind it, now I'll share what I've been waiting for from the start of this article. The two detector geometries that I'll be covering here are Parallel Plate Ionisation Chamber(Fig 1) and Single Wire Proportionality Chamber(Fig 2). The simulations and the visualizations are done using Garfield++ using Root (a framework for large data analysis, ubiquitous in High Energy Physics).

For the needed potential difference, we have 2 plates with different voltages in ionization chambers which are replaced by a wire and an outer cylindrical shell in SWPC.



Till now I have talked a big game, so I gotta show some big results(they are too me, at least).

Alright, I've got here visual results. So, I simulated the behaviour of a 200keV proton as it enters the detector, and the visuals are well nothing less than euphoric.

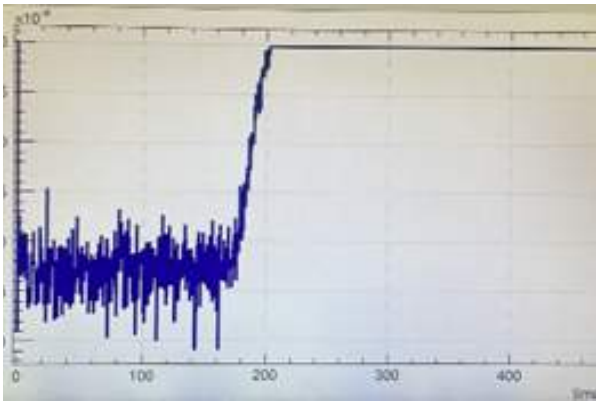
Fig 3 depicts a 2D plot where the green line represents the path of our proton, the yellow the electrons created along the path, and red the corresponding ions.

You might argue that why are these so straight and somewhat less in numbers, basically why is it not more chaotic. If I say I coded it in a way for better visualization, some still won't believe me. For these people who do not believe in physics and me, I've got something for you as well. Fig 4 shows a full blow blown 3D model of an Avalanche, with electrons in brown and ions in red. Now isn't this the definition of Beauty?

Finally, as a bonus I'm adding the signal that I got from the anode plate(Fig 5).

Now, tell me wouldn't you like to give Garfield++ a try!

For those interested in further exploration of the topic, I would recommend checking my website TheEthernalKnot.com (which I will eventually get around building).There, hopefully soon I will list not just recommended literature for novice but also post some of my simulations' result. As a stopgap, I will recommend Radiation Detection and Measurement by G.F.Knoll, almost considered a holy book for experimental Particle and Nuclear physicist.



THE GREATEST STORY EVER TOLD

THE COSMIC CREATION

--By Aditya Kumar
BSc (H) Physics

**"THE UNIVERSE IS UNDER NO OBLIGATION TO MAKE SENSE TO YOU,
YET NONETHELESS SEEK A CONDUIT TO THE COSMOS"**

---- SIR NEIL D'GRASSE TYSON

I am Aditya Kumar, a sophomore of BSc(H) Physics at Hansraj College. I have been on this college journey for two years now, and it has been a wonderful experience. However, my personal story may not be quite interesting enough to share in this magazine. Nevertheless, I would like to share with you the fascinating journey of the universe as described by Neil D'Grasse Tyson in his popular book "*Astrophysics for People in a Hurry*".
In this article, I will present a brief adaptation of his work for your enjoyment.

This isn't a regular story which starts with *"Once upon a time"*, rather it is a reality from which the **"TIME**" itself started.

When there was a single dot in the vast nullness of the universe. The dot was so dense that it could not hold itself together, and at 10^-43 seconds, it exploded, spreading its contents and starting the greatest story ever told.
Gravity and quantum mechanics were like husband and wife in the beginning, but by the end, gravity had separated from unified forces, achieving an independent identity. Electroweak and strong nuclear force also separated, further electroweak force separated into electromagnetic force and weak nuclear force, thus forming the four fundamental forces that we know today.

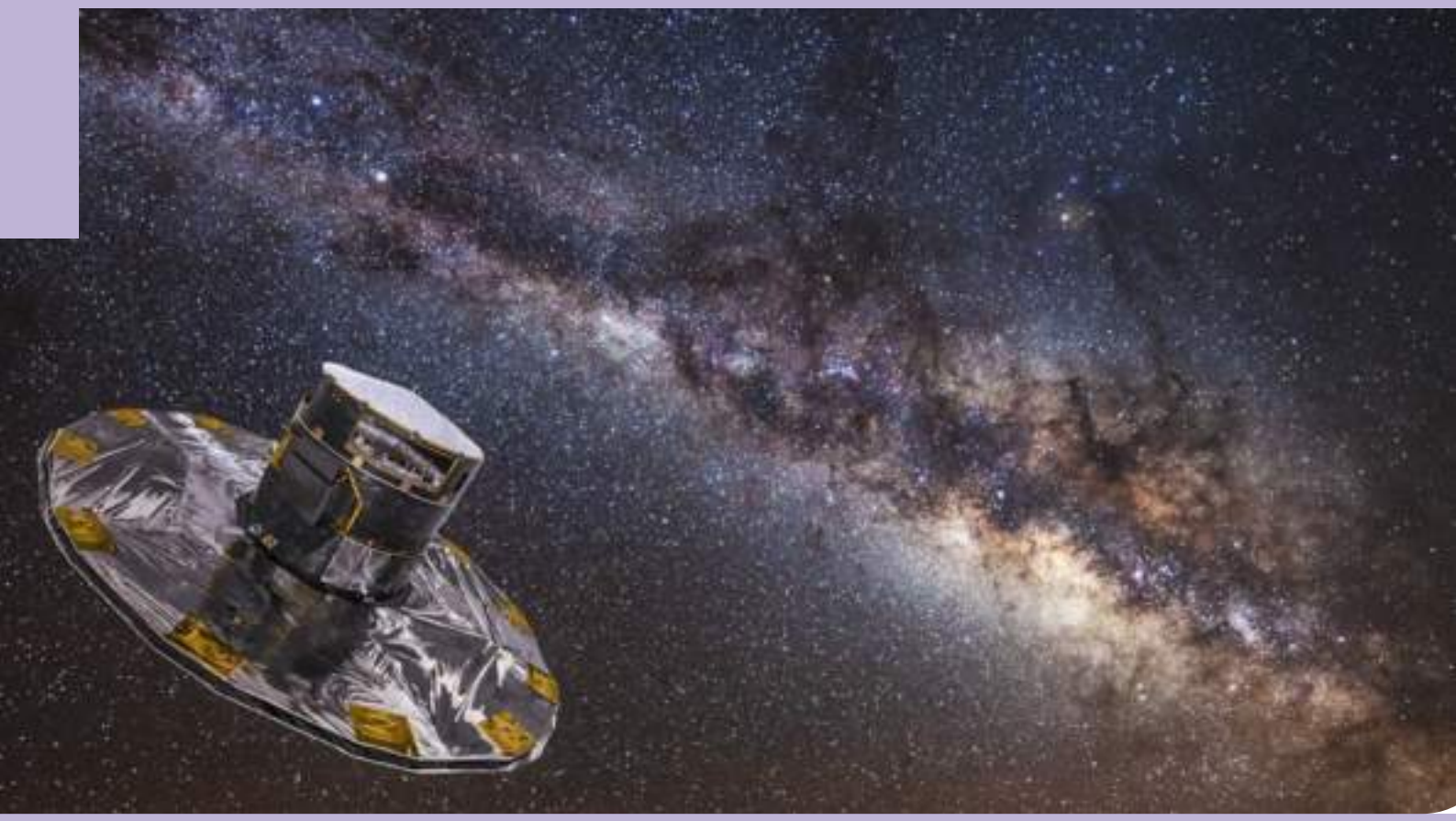
During this play of the universe, subatomic particles and photons were abundant. The extreme temperature of the universe made massless photons form matter and antimatter pairs, which matter annihilated immediately.

There was also a huge thunderstorm of fundamental particles such as quarks, gluons, leptons, and bosons, naming the time as Quark-Lepton Era. As the universe continued to expand, it became cooler and cooler, and quarks fell in love with another particle, forming hadrons and changing the era to the Hadron Era. The excessive release of energy made those hadron-antihadron pairs, and the temperature of the universe dropped to 3000 K, naming this chapter as the Primordial Universe.

As time passed, all the matter under the force of gravity came together to form large galaxies and stars. These stars started fusion inside their nucleus and synthesizing heavier elements. The stars exploded, spreading all the elements across the universe. Such explosions for around 9 billion years led to the formation of our galaxy, "The Milky Way," and thus our Sun was formed.
In this complex system, for the first hundred million years, quantities accreted into larger bodies forming planets which got caught up under the gravitational force of our sun. The Earth remaining in the "Goldilocks Zone" became suitable for the evolution of life. Our universe is still evolving and will continue to do so. The journey of the universe is the greatest story ever told, and it is still unfolding before our very eyes.

We too are the part of that heavenly cosmic dance.

Sir Tyson says:
"We are the stardust brought to life, then empowered by universe to figure itself out- and we have only begun" .



Young Stellar objects and their study in molecular clouds

Vikalp Sharma
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What are "Young Stellar Clouds" ?

Star formation is a process that takes place in multiple stage it starts with a dense region in the molecular clouds and these molecular clouds collapse and form stars. For understanding the process of star formation it is very important to understand the molecular clouds and the interstellar medium and young stellar objects as they are the immediate result of star formation process

Young Stellar Objects(YSO) is the earliest stage of star formation, they are infra-red bright objects. YSO consists of a protostar that is present at the centre and this central protostar is surrounded by a circumstellar disk. YSO radiate infra-red emission as the material in the disk is cooler that the protostar and produces longer wavelengths of light. Now as the material from the disk falls into the protostar the infra-red radiation decreases. YSO are classified on the evolutionary stages based on the slope of spectral energy distribution (plot of energy vs frequency of wavelength of light) in mid infrared.

YSOs have further been classified into sub divisions based on there near and mid-infrered slope of there continuum emission. The sub-divisions on the basis of here increasing ages are Class 0 YSO, Class I YSO, Flat Spectrum YSO, Class II YSO, and Class III YSO. Class 0 YSO evolve into Class I stage and slowly here they become visible on the stellar birthline as pre main sequence stars. Class II YSO relate to T-Tauri stars(they are ablut less than 10 million year old) and they have circumstellar disk later in the Class III stage the disk is lost and they relate to weak T-Tauri stars.

YSOs are also related to some of the phenomenons line jets, bipolar outflows(A bipolar outflow comprises two continuous flows of gas from the poles of a star) and protoplanetary disks. YSOs can also be classified based on there mass. Namely they are Massive YSOs, intermediate-mass YSOs and Brown Dwarfs(these are not very massive stellar objects with mass of around 12-80 times jupiter).

Molecular Clouds

A molecular clouds is a combination of dust and gas in which the molecules can be formed like hydrogen and helium. The study of these molecular clouds started with launch of Hubble space telescope the in depth study of young stellar objects and how they are formed started and we started to know more about these young stellar objects. Stars form by contraction of gaseous nebulae and planets and other bodies form by condensation and accretion as nebulae cool. How times the dust makes it hard for us to study the stellar objects due to extinction and thus we use infra-red range to study these objects and clouds.

$$A\lambda\ AV = a(x) + b(x).R\text{-}1\ v\ ;\ x = \lambda\ \text{-}1 \text{ ----------(1)}$$
$$Rv = Av\ AB\ \text{-}\ AV = AV\ E(B\ \text{-}\ V\ ) \text{ ----------(2)}$$
$$E(\lambda\ \text{-}\ V\ ) = A\lambda\ \text{-}\ Av \text{ ----------(3)}$$
$$E(B\ \text{-}\ V\ ) = (m\lambda\ \text{-}\ mV\ )\ \text{-}\ (m\lambda\ \text{-}\ mV\ )\odot \text{ --------(4)}$$

a(x), b(x) - wavelength dependent coefficient
Rv - Ratio of total to selective extinction
E(B - V) - Color Excess

Using these the value of color criteria 1 and colour criteria 2 has been calculated taking the value of Aλ Av from Wang and Chen, The Astrophysical Journal, 2019 June

$$H\ \text{-}\ W2 = [(0.131 \pm 0.006)\ \text{-}\ (0.026 \pm 0.004)] \times 2 = 0.21 \pm 0.010\ K$$
$$\text{-}\ W2 = [(0.078 \pm 0.004)\ \text{-}\ (0.026 \pm 0.004)] \times 2 = 0.104 \pm 0.008$$

Gaia Satellite

The main aim of the Gaia satellite is to measure three dimensional spatial and the three-dimensional velocity distribution of stars and to determine their astrophysical properties, such as surface gravity and effective temperature and to map and understand the formation structure and past and future evolution of our galaxy.

The data from the GAIA DR1 satellite is released in various data releases for example the first data release was done on 14th September 2016 based on only 14 months of observation. So in the first data release, there were a total of 1,142,679,769 sources.

The data from various data releases can be used from the Gaia archive and till now total 3 data releases have been done with stellar positions of 1.8 billion stars. The number of stars for which there parallax has been measured by Gaia increased in Gaia Data release 3 in the year 2026.

All these data can be used by the researchers and citizen scientists for exploring the space and studying about the stars in detail. There are two main methods for the data retrieval from the archive the first one is to search the object on the archive directly and the other one is to use tools like TOPCAT here we get exposure to other satellites also and we can use the data from Gaia and cross match the results and compare them with other satellites

IRAS(Infrared Astronomical Satellite) Satellite

IRAS was the first Infra-red satellite to do the night sky survey of the entire sky. It was launched in the year 1983. Over 250,000 infrared sources were observed at 12, 25, 60, and 100 micrometer wavelengths. The success of IRAS was realized in the year 1985 and Space Infrared Telescope Facility, SIRTF was formed and it lead to the development of Spitzer space telescope.

The data from IRAS can be used freely for science and the data can be retrieved from IRAS archive or through skyview where you may specify the coordinated of the cloud or name the cloud and specify the search area.

How to study these Young Stellar Objects

Young stellar objects can be used for many applications such as study of molecular clouds through YSO and further more we can estimate the distance to these clouds through the study of YSO's although its quite advance but one can do that if we have knowledge of machine learning algorithms.

Thus the study of these YSO objects lets us know about the molecular clouds and if we know about these concepts they can help us in the study of other fields also like exoplanet science.

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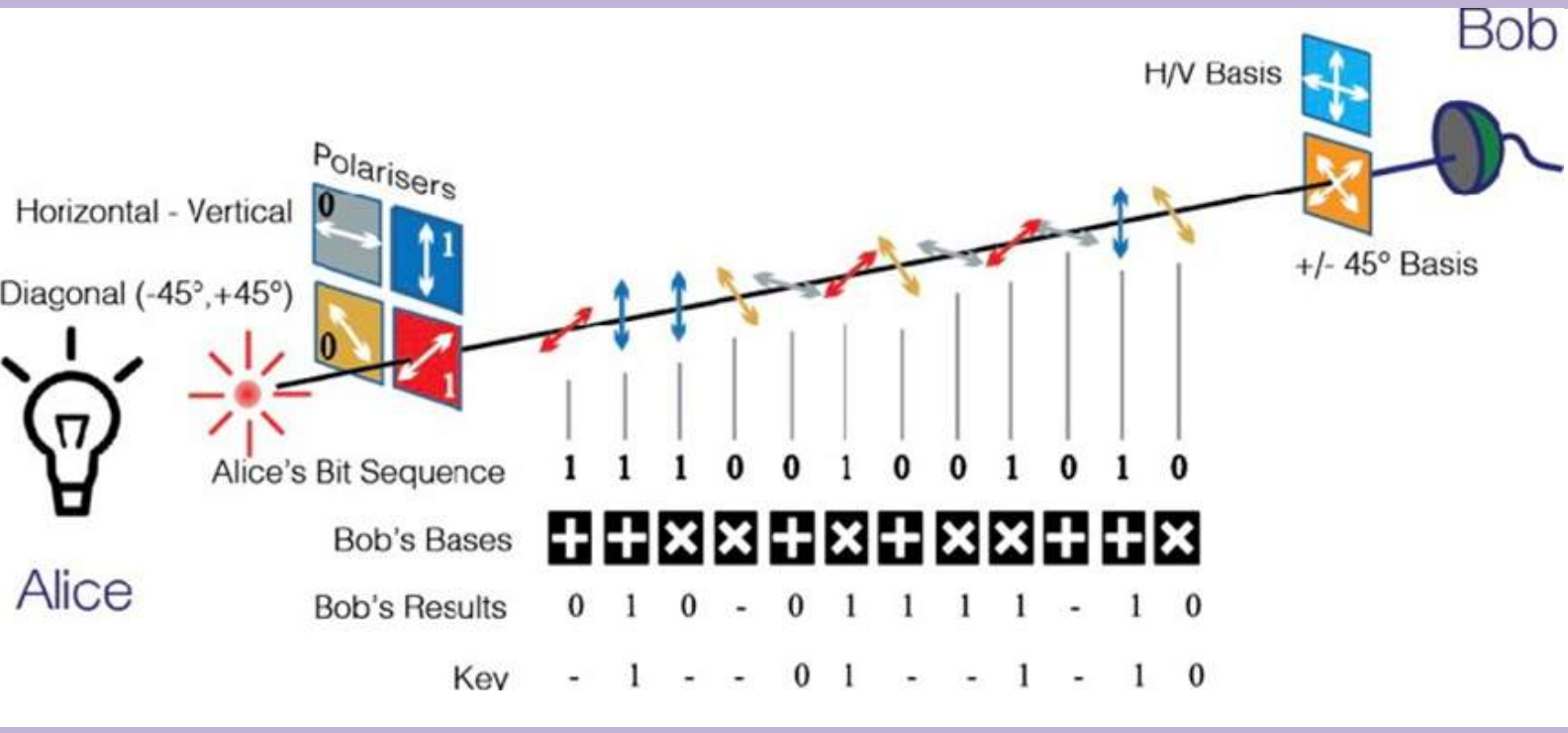
2. Earth as an Evolving Planetary System, Kent C. Condie
3. Gaia, ESA

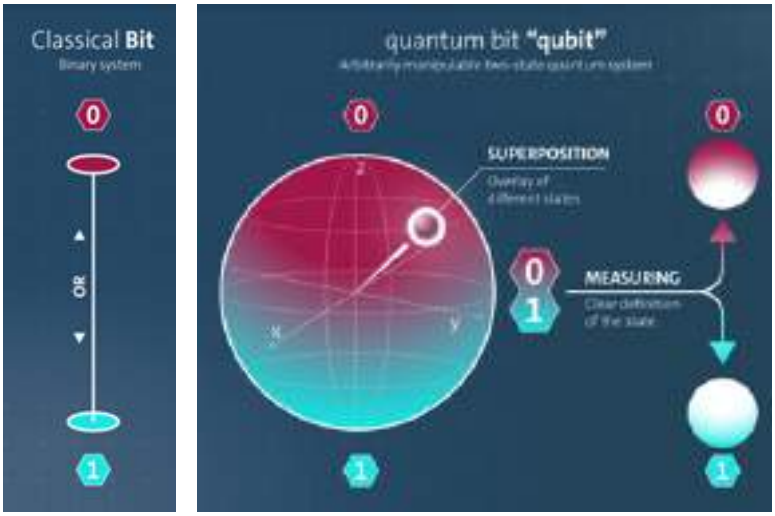


Quantum Cryptography

Nancy Sharma
2nd Year, Physics Department

Modern Cryptography Technique :

Cryptography is the process of hiding or coding information so that only the person a message was intended for can read it.
In Techniques like RSA, maths functions like the product of prime numbers are used. Any receiver, let's say Bob multiplies two large prime numbers and makes the product public. Anyone who wants to send him any message, will encrypt that with the provided product. The message can be decrypted only if the two prime factors are known. Thus the message can easily be decrypted by Bob but for an eavesdropper it's virtually impossible to find the factors of such large numbers using classical computers. Even supercomputers would take years to crack the encryption.
A bit can only be in 2 possible states, so if we want to do any calculation it can be done only with one stable state at a time, that will take a long time for large no. of bits. So it's not easy to break the encryption even with supercomputers. But it can be easily decrypted by a quantum computer.
In classical computers information is computed and represented as bits. A bit can have two states- High 1 or Low 0.



IMG SRC : GOOGLE

Store Now Decrypt Later Practice :

Store Now Decrypt Later or SNDL is practiced by many hackers around the world. They are intercepting and storing lots of encrypted data. Right now they can't open these files but in the future they would be able to decode them using quantum computers.
This poses a serious problem and thus we have to move to encryption that is resistant to quantum computers as soon as possible.
One such encryption technique is BB84 Protocol. It is a quantum key distribution scheme developed by Charles Bennett and Gilles Brassard in 1984 and thus named BB84.

Storing Data Today

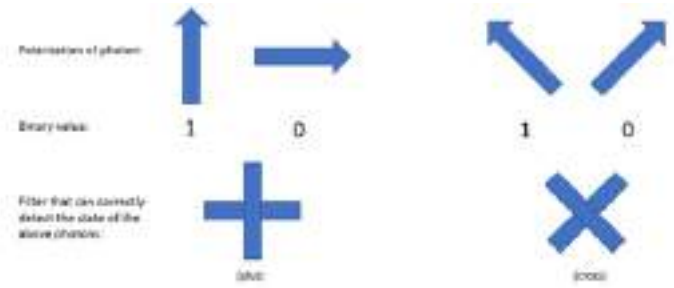
Decrypting When quantum computers become capable of doing so. (~2030's)

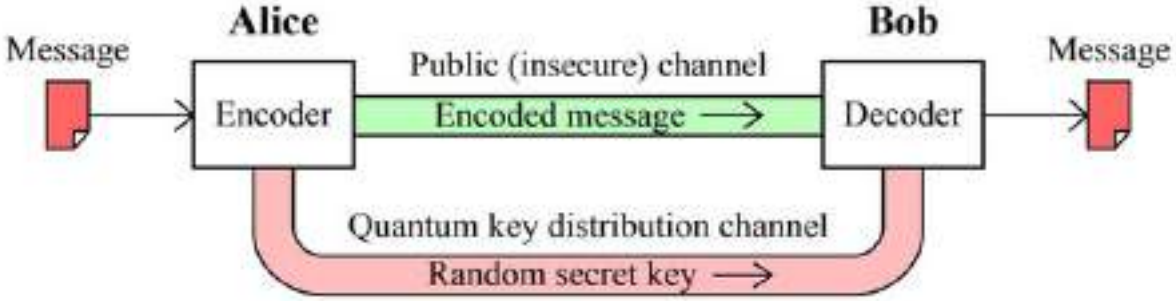
Quantum Computers - Threat to Modern Cryptography :

Quantum computers have cubits that exist in arbitrary combinations of 0 and 1, a superposition of 2 states. So, 2 qubits can simultaneously exist in a superposition of 0,1,2,3. It will perform calculations for all states at the same time, left with superposition of all answers. Increasing no. of qubits can go over a million different states at same time, simultaneously computing over a million different answers. Thus factorising for large prime number products becomes easier with quantum computers.
But all the answers are embedded in a superposition of states, and while making measurements only a random value displays and all other info gets lost.
So to harness the power of quantum computers, a smart way to convert superposition of states into one that contains only the required info is needed, which at the moment is an incredibly difficult task. Which is why quantum computers are useless for most general applications.
At present the quantum computers can only perform very specific tasks for which the ways to extract the answers have been found. But general use supercomputers will soon be the reality and it's not long before they will be useful for breaking encryption.
Quantum computers are a double edged sword. On one hand, the sheer amount of computing power that they possess will be beneficial for our development but on the other hand the online security as we know today would be at a huge risk.
We need a solution for this problem.
So ironically we are going to use quantum mechanics for let's say.... fight quantum.

Quantum Key Distribution :

Quantum computers have cubits that exist in arbitrary combinations of 0 and 1, a superposition of 2 states. So, 2 qubits can simultaneously exist in a superposition of 0,1,2,3.
Let's say Alice wants to send a message to Bob. She uses quantum mechanics to make a key randomly and send it to Bob. To make a random key, she sends polarized photons to Bob, vibrating in 4 different directions - horizontal, vertical, diagonal to left, diagonal to right. Bob measures which direction they are polarized by using random polarizing filters for each photon. Each photon in a particular direction refers to a bit. And eventually, Bob will get the multiplication key from this set of bits.
Now, Alice and Bob will compare their polarising filters for each photon. If Bob has used wrong polarising filter on a photon, he will have a 50% chance of measuring it 0 and 50% chance of measuring it 1. So Bob's filters need to match with that of Alice.
After they go through this check, they discard each bit where Bob guessed the filter incorrectly and now, they are left with a sequence of identically polarised and measured photons. That sequence is the key. Alice can now send the actual encrypted message through a traditional channel and use the quantum key to decrypt it.
If an eavesdropper hacks into the system and tries to copy some of the photons using wrong order of filters, it will change the state of photons and Bob & Alice will get to know that they have been hacked even before sending the message as they can check for errors in a subset of bits in the key. Also, eavesdropper will have the disadvantage of not being able to compare the key with Alice.





Limitations Of BB84 :

- Quantum states are very fragile so hard to transmit large distances. Physicists have only been able to send quantum keys over 200 kms.
- Quantum detectors can be sabotaged even by shining a bright light on them.
- Even if quantum cryptography becomes commercially viable, much of the internet's infrastructure would have to be rebuilt.
- It is impossible to send keys to two or more different locations using a quantum channel as multiplexing is against quantum's principles. This demands separate channels between source and many destinations.

Expansion of the Universe- The Friedmann Equation

Rudrani Mohadikar
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Introduction- A stroke of genius?

Alexander.A.Friedmann was a Soviet mathematician and meteorologist born in Russia. Friedmann was famous for his contributions to cosmology. After Einstein's theory of General relativity, Friedmann introduced 'Friedmann Equa tions' derived from general relativity and was the first person to mathematically predict an expanding universe in 1922. The Friedmann equations are a set of equations in physical cosmology that govern the expansion of space in homogeneous and isotropic models of the uni verse within the context of general relativity.Homogeneity of universe tells us that no matter where you are in the universe , it will look the same i.e it doesn't have a preferred location. Isotropy tells us that there is no preferred direction of universe to expand or evolve. This factors define the Cosmological principle

Cosmological Principle

The Cosmological Principle implies that the metric of the universe must be of the form -ds2 = a(t)2ds2 3 - c2dt2 where ds3 is the three-dimensional metric. This 3-D metric includes flat space(0), a sphere of constant curvature(1) and a hyperbolic space with constant negative curvature(-1) which we will discuss further. This space-time matrix is called as Friedmann-Lemaˆıtre-Robertson-Walker (FLRW) metric.

Cosmic Scale Factor- a(t)

Cosmic scale Factor a(t) represents relative expansion of the universe. Einstein's equations relate the evolution of this scale factor to the pressure and energy of the matter in the universe.The parameter k which will be introduced in the friedmann equations takes the value 0,1,-1. The FLRW metric

Friedmann Equations

Friedmann formulated two independent friedmann equations for modelling a homogeneous, isotropic universe. The first is: ˙ a2 +kc2 a2 The second is: =

8πGp+Λc2 3 2 ¨ a

a = -4πG 3 (p+3p c2) + Λc2 3 where a is the cosmic scale factor, G is the gravitational constant, Λ is the cos mological constant with dimensions l-2 and c is the speed of light in vacuum.ρ and p are the volumetric mass density and pressure, respectively.

The factor k a2 is spatial curvature in any time-slice of the universe. It is equal to one-sixth of the radius of curvature 'R' R= 6 c2a2 (¨aa + ˙a2 + kc2) Using the first Equation, the second equation can be rewritten as ˙ ρ = -3˙a a (ρ+ p where ˙a c2) a = H(t) which is the 'Hubble Parameter' which is defined as the ratio of rate of change of scale factor to the current scale factor. This helps us to know how fast the universe is expanding. Pressure and Volumetric mass density are formulated as:

ρ →ρ- Λc2 8πG
p →p+ Λc4 8πG which gives H(t)2 = 8πGρ 3c2 - kc2 R2a2 (eq1)

Density Parameter-Ω

The density parameter is an important part of the Friedmann equation as it gives the overall geometry of the universe. This is decided by the ratio of the actual and critical density of the Friedmann universe, which is what we call the density parameter. To date, the critical density is estimated to be approximately five atoms (of monatomic hydrogen) per cubic metre, whereas the average density of ordinary matter in the Universe is believed to be 0.2–0.25 atoms per cubic metre. The critical density is:

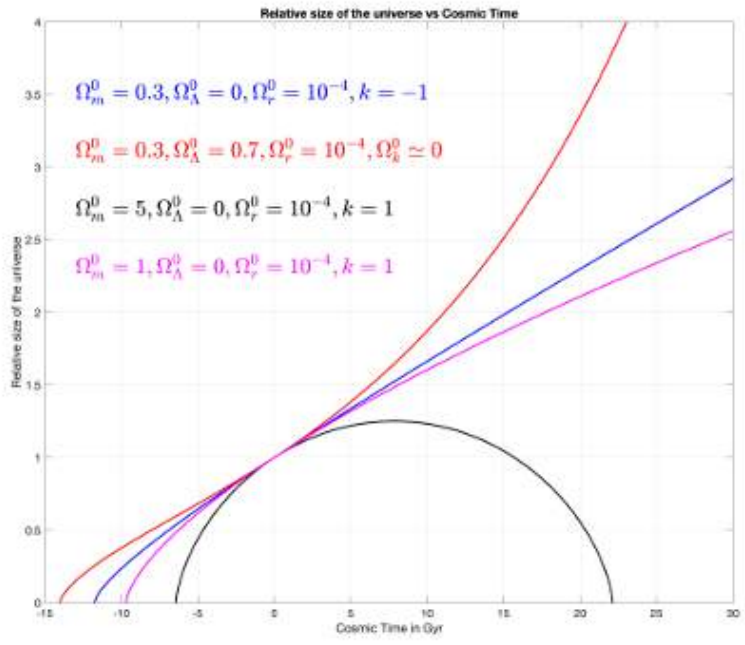
ρc = 3H2 0c2 8πG

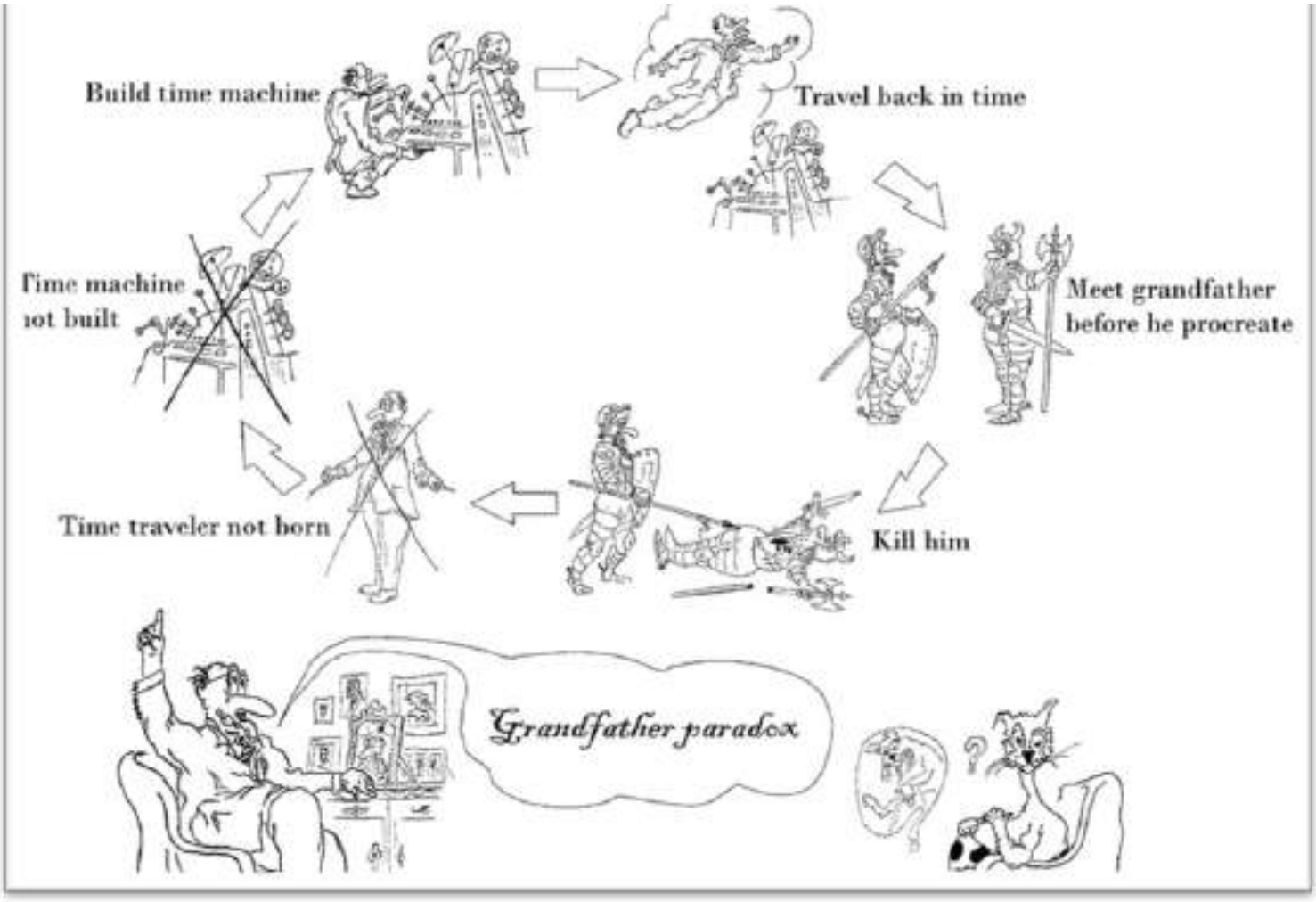
then the density parameter is formulated as:

Ω= ρ ρc = 8πGρ 3H2 0

Conclusion:

In this article, we try to show the complete view of Friedmann equations. For that, we deduced the Friedmann equations and exhibited a solution for it in volving the Hubble parameter. We also calculated the density that needed to yield the flat universe and the age of the universe. Friedmann equations play vital rules to understanding the cosmological models which help us to enrich the knowledge about our expanding universe.To conclude, we have briefly reviewed the Friedmann equations obtained from the Einstein general relativity theory.





GRANDFATHER PARADOX

----**By Sakshi Barue**

The Human Brain is one of the smartest on the planet. But there are some things we just can't wrap our minds around. One of those is the paradox. We have evolved to think of reality in a specific way, but there are paradoxes out there that suggest reality doesn't work the way we think it does. One of those famous paradoxes is
"GRANDFATHER PARADOX".

"Science is simply the word we use to describe a method of organizing our curiosity "

~Tim Minchin

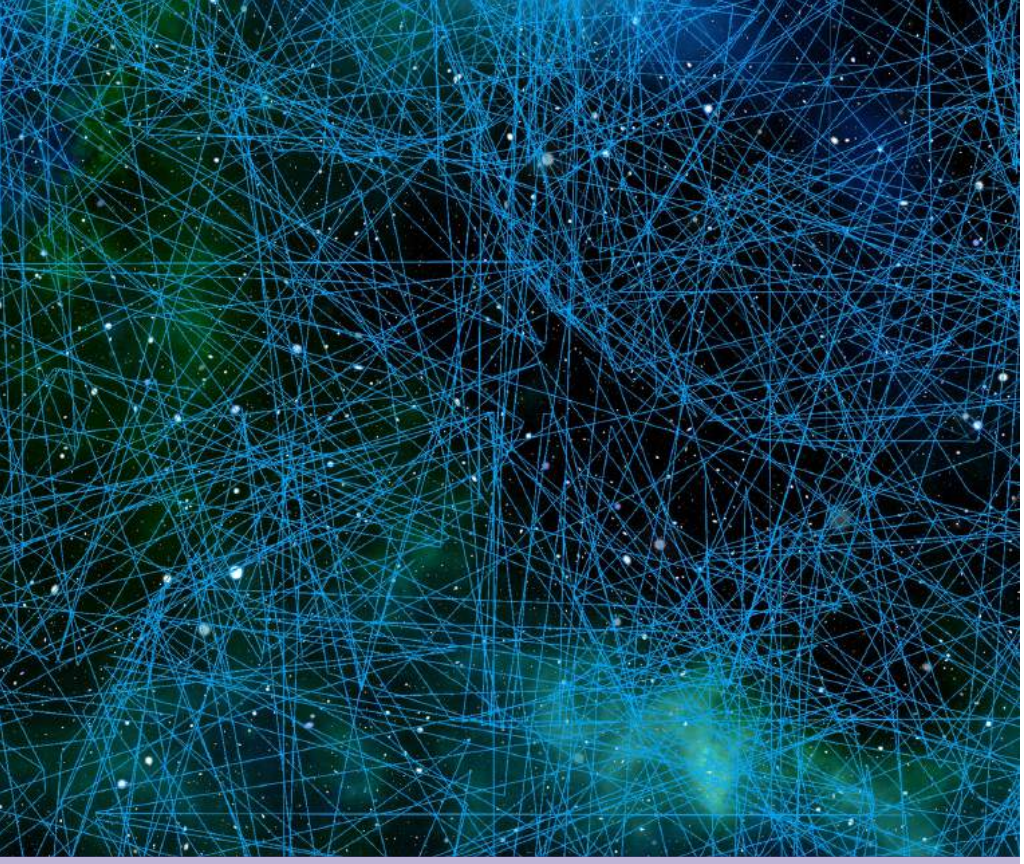
According to this paradox what happen if you kill your grandfather when he was a child? Then your father or mother would not have been born, so you would not have been born, so you would not have been able to go back in time to kill your grandfather in the first place. The paradox suggests that a cause is eliminated by its own effect, thus preventing its own cause and essentially becoming reverse causation.

The simplest resolution to the grandfather paradox is that when you go back in time, you are actually notgoing back into your own history but to a copy, and everything you do there influences the new alternate future of that universe, not your own past. But that's boring because it just avoids the paradox. If what you do when you go back in time actually influences your own past, and the effects of your time travel do loop back to the present, future, past-no problem.

You go back in time, kill your grandfather, thus you are not born so you can't go back in time, thus your grandfather isn't killed, thus you are born, so you go back in time and kill your grandfather, and so on. Then the question arise here is that who killed your grandfather? There is no predicted outcome to this. This is a linear series of events but really it's two entangled histories happening in parallel. Is that even possible?
Subatomic particles regularly do multiple different things in parallel, its called quantum superposition and is responsiblefor the weirdness of the double slit experiment, many properties of atoms and molecules, fusion in the sun's core, and so on. So if the universe were toexist in a superposition of two states,your grandfather is alive and your grandfather is dead, then the natural result is the superposition of two states: youare born and able to go back in time to kill your grandfather, and you are not born.

And the natural result of these is a superposition of two states, your grandfather is dead and your grandfather is alive - and so, at least from a logical perspective, this looping timeline is entirely consistent and there is no paradox.
The grandfather paradox has been a trope of science fiction, appearing in Ray Bradbury's short story "A SOUND OF THUNDER" the classic movie "BLACK TO THE FUTURE" and many more. But the grandfather paradox isn't limited to fiction. Philosophers and Physicists began seriously thinking about the grandfather paradox when Albert Einstein's theories of special and general relativity suggested that time travel may be a theoretical possibility.

Einstein's theory of special relativity purposes that space and time are actually one unified entity called space-time and also introduced a universal speed limit for particles of mass, setting this at the speed of light(c). So no particle with mass could accelerate to the speed of light, as this would take an infinite amount of energy. But scientists following Einstein's work, including Columbia University physicist Gerald Feinberg, suggested the existence of hypothetical particles that could because speeding. Travelling faster than light, these massless particles, which Feinberg dubbed "TACHYONS" in a 1967 paper would travel backward through time travel to Physics that went way beyond idle speculation.



ASHUTOSH PRATAP SINGH
BSC(H) PHYSICS, 3RD YEAR

Quantum Direct Secure Communications

Glossary:- 1.Quantum Teleportation:-Quantum teleportation is closely related to entanglement of quantum systems. It may be defined as a process by which a qubit (the basic unit of quantum information) can be transmitted from one location to another, without the qubit actually being transmitted through space. 2.Quantum cryptography:- Quantum cryptography is a science that applies quantum mechanics principles to data encryption and data transmission so that data cannot be accessed by hackers – even by those malicious actors that have quantum computing of their own 3.Protocol:-In networking, a protocol is a set of rules for formatting and processing data. 4.Superdense Coding:-Superdense coding is a quantum communication protocol that allows a sender to send two classical bits of information to another user by only utilizing one qubit.

Communication is the act of conveying an us intended message to another party through the mutually understood signs and rules. Effective communication has played a pivotal role in development of civilization, and often the ability to communicate effectively distinguishes e of The th e human being from the other living species.

Quantum Direct Secure Communications

With time, we have many techniques of learned Communication, and our dependence on the communication schemes have increased. In fact, in A modern society communication plays a crucial role, and our dependence on the communication increasing continuously with technologies is the rapid development and enhanced uses of e banking, mobile phones, internet, IoT, etc. Motivated by this fact, the present work is focused o n a set of modern techniques of communication.

In classical communication, the security of the transferred information is not unconditional. As the security of the communicated information in every public key cryptography system is ensured via the computational complexity of the task used for creating a key which is used for Encryption of the message. In contrast, in quantum communication, it is possible to attain the unconditional security as the security of the schemes for quantum cryptography are independent of computational complexity of a task and is obtained using the laws of nature. In addition, there exist a few quantum communication tasks such as teleportation and dense coding, which can be realized only in the quantum domain. These communication tasks (teleportation, dense coding and most of their variants) do not require security, but they may be used as primitives for secure quantum communication. Quantum Communication have 2 types of communication method, quantum teleportation and quantum cryptography. But with a greater stress on quantum teleportation. From last 3-4 decades, several cryptographic and non-cryptographic quantum communication tasks have been studied rigorously. The first quantum teleportation scheme was introduced by Bennett in 1993. This scheme was designed for the transmission of an unknown quantum state (a qubit) from Alice (sender) to Bob (receiver) using two bits of classical communication and a pre-shared maxi-mally entangled state .Dense coding (or super dense coding) is a closely related scheme for quantum communication, where two classical bits of information is transferred by using a single qubit and prior shared entanglement. Bennett et al., introduced this scheme in 1992. After these pioneering works, several quantum communication scheme have been proposed which can be classified into following two classes:

Class 1: Quantum communication security: where security is notion protocols without relevant. (e.g., dense coding, teleportation and its variants). Class 2: Quantum communication protocols with security: where security is relevant. All schemes of secure quantum communication, including the protocols for QKD and secure direct quantum communication belong to this class. On the basis of upper mentioned methods, a highly secure communication method can be developed which is widely usable in today's world.

Physics and Environment

------ by Sudeepto Dixit

DO YOU KNOW ???

- Water having maximum density at 277 K breaks conventional currents in cold water.
- Sustains aquatic life, provides then oxygen and warmth in cold conditions.
- Establishes water as a fundamental liquid, depicts power of Physics in nature.

SURVIVAL OF AQUATIC ANIMALS : THE MAGIC OF PHYSICS

Physics in itself is quite fascinating and mysterious. It helps in solving a lot of everyday problems. We find its application in almost all spheres of life. Life is incomplete without Physics and Physics is a way of living. Its one such practical application is the growth of ice on the surface of lakes, ponds etc. that preserves and sustains the aquatic life in these water bodies. In the winter season, the temperature of the surroundings near a lake becomes quite low. So the temperature of water on the surface is less than that in the depth of a lake. As a result of which convectional currents are set up within a lake, and warmer water from the bottom reaches to the top and colder water on the surface goes to the bottom because density of cold water is more than that of hot water.

If this happens then the water temperature at the bottom of the lake would become too less that it can cause the death of aquatic organisms. But here a unique property of water comes into play that the density of water is maximum at 4° C. So the warmer water remains at the bottom due to greater density. The conventional currents are broken and the water at the surface freezes allowing the aquatic organisms to flourish beneath the harder upper layer of ice.

This way Nature provides a magnificent balance for the maintenance of life and this balance is governed by the virtues of PHYSICS.

POETIC PALETTE

बड़ा अच्छा लगता है.....

बड़ा अच्छा लगता है .....
वो खुले आसमां के निचे बिस्तर लगाना,
इस छत से उस दुनिया की छत को निहारना
उसमें भी उन हीरे जैसे तारों का टिमटिमाना
और उनमे उस कोहिनूर को खोज निकलना।
बड़ा अच्छा लगता है |

बड़ा अच्छा लगता है.....
वो उन रंगबिरंगे उजियारे वाई जहाजों का जाना,
वो चाँद के उस दाग पर कहानियां बनाना,
वो पूरनमासी को उसकी शीतल चांदनी में नहाना,
और अमावस तक उसका गायब हो जाना।।

बड़ा अच्छा लगता है।।।

~ अभिषेक बरनवाल

तू खुद की खोज में निकल .....

तू खुद की खोज में निकल
ना जीत के लिए, ना हार के लिए चल ;
चलना जीवन है रुकना मृत्यु है,
तो जीना जीवन है इसलिए तू चल।

हज़ारों - हज़ार आकर्षणों से क्यों तू भटक रहा ,
खुद की खोज में क्यों नहीं तू निकल रहा??

दिमाग की बत्ती कौन जलाने आयेगा ??
तू नहीं न्यूटन जिस पर सेब खुद गिरेगा ;
तुझे सेब के पेड़ को हिलना होगा
तुझे जीवन लक्ष्य खोजना, पाना खुद सीखना होगा।

हार से ना हो तू हताश,
मुश्किलें चाहे तेरे पास हो पचास ;
रख विश्वास खुद पर, कर तू सतत प्रयास
यह आस ही बनाएगी तुझे दुनिया से कुछ खास।

मीठा बनकर राजा बनना, सिख ले तू आम से
जीवन-संग्राम में कर्त्तव्य-पथ पर दृढ रहना,सीख ले तू राम से ;
पानी में आग लगाना सीख ले तू कलाम से,
हार को हार का हार पहनाना, सिखा दे तू अपने काम से।

बहुत हो गया आराम - उपहास, अब चलने की बारी है ;
बहुत रट लिया इतिहास, अब रचने की बारी है।

~ केशव कुमार

A Way To Universe

Usually I sit on the roof of my room
Looking up at the lonely night sky &
Say " Hi" to the beautiful stars & moon.

I just close my eyes a time
lose myself in the mysterious universe,
where a beautiful world of stars, nebulae, planets
all are mine.

I can see the beautiful meteor shower
which make the night sky very gorgeous &,
bring a natural smile on my face as not ever.

Hey! look up at the shooting star
I just smile & make a heart wish
But suddenly it goes somewhere very far.

Meanwhile, I find myself among the beautiful star constellation,
with them I feel like there is always a unbreakable relation.

I have my mobile in my hands
And I take many pictures of my little stars friends.

~ Rakhi Suklan

मैं खुद कोई किरदार नहीं बुनती.....

मैं चुरा लाती हूं कहानियां दूसरों की,
मैं खुद कोई किरदार नहीं बुनती।
कलम बैठी रहती है स्याही के इंतज़ार में,
क्यूं ये कागज़ की पुकार नहीं सुनती।
मैं सबमें छुपी हूं थोड़ा सा,
सब थोड़ा सा मेरे अंदर छुपे हैं।
मैं ठहरी हूं इंतज़ार में शबनम के,
कई महीने मेरे इंतज़ार में रुके हैं।
कुछ कविताएं मेरे ज़हन में समाई हैं,
और कई किस्से अनकहे रहे गए।
ना जाने कैसे कुछ अल्फाज़ आखों से झाक रहे थे,
और निगाहों के तैखाने से हर राज़ कह गए।
मैं चुनती हूं कांटों को,
फूलों को हर कोई संवारता है।
मैं दिन ढले एक शाम चुराती हूं,
भरी दोपहर को कौन पुकारता है।
मैं बूंद बन बहाना चाहती हूं,
नदी की किनारे सर टिकाना चाहती हूं।
एक खत खुद को लिखकर,
खुद से मिलना चाहती हूं।
पर अब सुनसान इन सड़कों पर,
मैं अनजान गलियां नहीं चुनती।
तारों से जड़े इस क़फ़स में,
रात गए मैं संगीत नहीं सुनती।
शायद इसीलिए,
मैं खुद कोई किरदार नहीं बुनती।।

~ पल्लवी

Shaheed-e-Azam "Bhagat Singh"

From dreaming of growing guns in fields
to fight against the British Sheilds,
massacre at Jallianwala Bagh
ignited the fire of rage within his heart.

Hot -blooded person he was
played against the odds,
with the slogan of "Inquilab Zindabad"
furiously opposed the British Raj.

~ Dev Raj

By bombing the Central Assembly
raised the voice against British army,
an explosion to make the deaf listen,
to tremble the Britisher's vision.

No fear, no reluctance on his face
Rajguru, Sukhdev were his mates,
gave the enemies an outrageous blow
even if the world becomes their foe.

Had beliefs in Anarchism
deep-rooted with patriotism,
epitome of courage and revolution
proud even in the last moments of his execution.

Got hanged with a smile
became greatest martyr of all time,
was charged of many conspiracy
embraced the death fearlessly.

Inspiration for the youth
just his name elevates the whole mood,
gun-trotting, moustache-twisting personality he had
fought the British till his last breath.

आत्म -जागरण

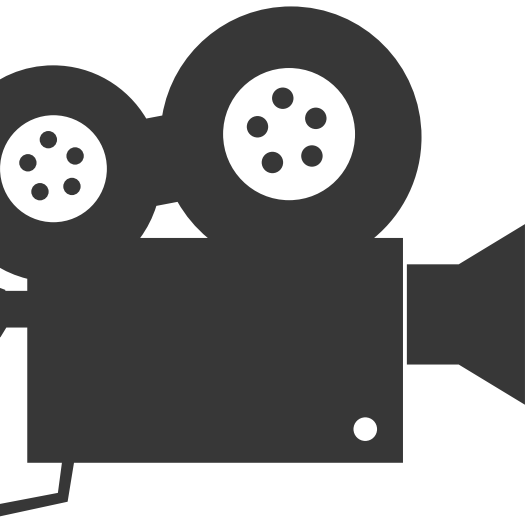
जागे थे , या होजाग रहे
क्या खुद मेंतुम हो झांक रहे।
खामोशी है या उठल -पुथल
क्या तुम होउसको माप रहे ।
जागे थे या होजाग रहे
देखो किसके पीछेतुम भाग रहे ।

संकल्प लियाथा जो कभी
क्यों उसको विकल्पों सेबांध रहे ।
जग जीतने की लालसा में
क्या खुदको खुदसेहार रहे ।
देखो किसके पीछेतुम भाग रहे
जागे थे होया जाग रहे।

जीवन की इस रणभूमिमें
क्यों खुद को दूसरों से माप रहे।
जब रण तेरा हैखुद से ही
तो कृष्ण क्यों उनमें झांक रहे ।
जागे थे या हो जागरहे
देखो तो किसके पीछेभाग रहे ।

है अभी भी लक्ष्यपर आंखे टिकी
या माया की चकाचौंधदेख हो भटक गए।
भटके हो तो ठहरोज़रा,
ना देर हुई हैसमय कह रहा ।
माया की नींद कोतोड़ो तुम
अपनी आंखों को खोलो तुम।
और कह दो खुदसे ये आंख मिलाकर
संघर्ष पथ पर हूं भाग रहा ,
था जागा मैं , हूं जाग रहा ।।

~ रुद्र प्रताप झा



CINEMA MATTERS

INTERSTELLAR

Interstellar by Christopher Nolan is a perfect movie as it deals with all those concepts which exists theoretically in physics. When the movie was made it included real physicists like Kip Thorne and Neil de Grasse Tyson and many more , that is probably the reason why it is very famous among many science students. The scenes which I liked the most in the movie was when the cooper(the lead cast) was on millers planet collecting some data and then the movies famous dialogue come “Those aren’t mountains, Those are waves” which hit their spaceship Endurance and they also loose their one friend. That scene was very amazing when waves hit them and how they rescued themselves. That scene also talked about time dilation that one hour on that planet was equal to seven years on earth.

There is another scene in the movie which was magnificent , that is when they get near to the Gargantua. For shooting that scene Christopher Nolan created a software in real to just get that shot and used in his movie. It showed how endurance was trapped by its gravitational field and what all they experienced over there. They also fell as there was someone with them when they were near Gargantua.

Finally, The scene which stole my heart was when cooper fell inside tesseract. A tesseract is the four-dimensional analogue of the cube. In that particular scene Cooper experience time travel, revives all his memories of past. He send the information to his daughter using morse code. He discovers that tesseract was created by human in future who helped him to send the information and secure their future. That one particular scene is emotional too. The science behind it was also looking very accurate and real.

~ Ayush Gupta
1st Year Physics hons.

There isn't much time for popcorn or a loo break in the science and thriller starring Taapsee Pannu and directed by Anurag Kashyap, which demands a lot of attention.
Consider it fortunate that it has been a while since we've seen a movie that requires your full attention and activates brain cells to focus, sometimes too hard to understand what is happening on the screen.
The 1990s are the setting for Anurag Kashyap's adaptation, which takes place during a storm. Then tragedy strikes when Anay, a young man who witnessed the murder at Raja Ghosh's (Saswata Chatterjee) home, is killed. After 25 years, Antra Awasthi (Taapsee Pannu), her daughter Avanti, and her husband Vikas (Rahul Bhat) are seen living in Anay's home. Antra's song, which coincidentally begins on the night of a storm of a similar intensity, links her to Anay's tale via an antiquated television and a video camera. Dobaaraa looks into how Antra is able to go back in time and save Anay, as well as the effects these developments have on her present-day life.

In the meantime, DCP Chandan (Pavail Gulati) is attempting to assist Antra in solving this case, and even his story is connected to all the incidents. I appreciated that the movie had a few moments of humor to break up the monotony, even though it had a dark and intense story with distinct character cards. When accompanied by strong performances, a good story can accomplish wonders, and Dobaaraa does this successfully most of the time. Rahul ends up being a pleasant surprise; even though there is nothing funny about his character, he manages to pull off all the funny lines and is quite skilled at this type of straight humor. Dobaaraas' convoluted and intricate plot works because there is a lot that is not said or understood. Despite being a scene-for-scene translation of the Spanish movie, it has its own plot and is a fun watch. With this movie, Bollywood successfully explored the concepts of time travel and parallel universes and butterfly effect.

~ Sanidhya Baranwal

The THEORY of EVERYTHING

Reading the title of this article you must be thinking that I'm going to give any kind of theory but I'm not going to give any theory. With this article I'm just going to give you an overview of one of the best movie THEORY OF EVERYTHING.
THE THEORY OF EVERYTHING is a 2014 biographical movie which was directed by James Marsh. This movie details about the life of one of the renowned theoretical Physicist of the era Sir Stephen Hawking.

The plot of this movie starts with life of Sir Stephen Hawking at University of Cambridge where he was an astrophysics student and met a literature student Jane Wilde and fell in love with her. During those days he was in search of a topic to give thesis on. After attending a lecture on BLACK HOLES he decided to give his thesis on BLACK HOLES but soon he also came to know that he has a motor neuron disease and he has approximately 2 years to live. Knowing that he has only 2 years to live he started working hard and presented his thesis on BLACK HOLES. His bad phase of life didn't end here only. Soon he became more ill and due to a surgery, he lost his voice. He faced this phase bravely and continued his research work.

He got a computer with a built-in voice synthesizer with the help of which he was able to communicate and wrote a book- 'A BRIEF HISTORY OF TIME', which became an international best seller. His condition was getting worse day by day and due to some reason he got divorced with his wife. The nature was totally being rude with him. Everything was against him but one thing was in favor that the illness couldn't affect his brain, thought and intelligence. With this hope he continued his research on this universe and tried to give a unified theory known as 'Theory Of Everything'. He also wrote a book by this name.
So, this movie teaches us that along with good phase of life there is always a bad phase so without thinking on what we don't have start thinking on what we have and start doing your work because Sir Stephen Hawking's life is the best example of the quote –

"While there is a life, there is a hope".

So wake up and start living your life as if it's your last day of life.

~ Hariom Pandey
2nd Year Physics hons.

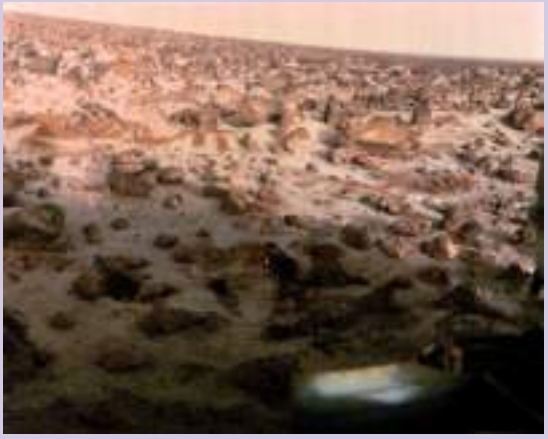
THE MARTIAN

In 2015, director Ridley Scott brought to life the gripping story of an astronaut's fight for survival on the red planet in the critically acclaimed film "The Martian." Based on the novel of the same name by Andy Weir, the movie stars Matt Damon as Mark Watney, an astronaut who is left stranded on Mars after his crew-mates believe he has died during a mission.

The film begins with a catastrophic sandstorm on Mars, forcing the crew of the Ares III mission to abort their mission and evacuate the planet. However, during the evacuation, Mark Watney is struck by debris and disappears, leaving his crew-mates, including Commander Melissa Lewis , with no choice but to leave him behind, assuming he did not survive. But as it turns out, Watney is alive, and now he must figure out how to survive on Mars with limited resources and no way to communicate with Earth.

One of the strengths of "The Martian" is its realistic portrayal of the challenges of living on Mars. Scott and his team of filmmakers paid meticulous attention to scientific accuracy, consulting with NASA experts to ensure that the film was grounded in scientific realism. From the harsh Martian environment to the life-sustaining technologies used by Watney, the film presents a convincing depiction of what it would be like to live on the red planet.

In conclusion, Ridley Scott's "The Martian" is a compelling and visually stunning film that combines scientific realism with human drama. Matt Damon delivers a standout performance as Mark Watney, a determined astronaut fighting for survival on Mars. The film's attention to scientific accuracy, breathtaking visual effects, and its exploration of themes such as resilience, teamwork, and human ingenuity, make it a captivating and thought-provoking viewing experience. "



~ Chirag Tomar
2nd Year Physics hons.

Ambition's Odyssey

TUSHAR JAIN-AIR 6

Hello everyone!

I am Tushar Kumar Jain. I am a final year student of Hansraj College, pursuing B.Sc. in Physics. I got All India Rank 6 in IIT JAM Physics exam 2023.

I owe a huge 'thank you' to Hansraj College for opening doors to so many opportunities and for setting me up for this achievement.

Thank you, Hansraj College for shaping me into the student that I am today and for providing me with professors that truly cared about me and didn't see me as a number.

Thank you for providing me with lifelong mentors who I know I could always go to at any point in my career.

Thank you, Physics & Electronics Department of Hansraj College, for giving me such a good platform to learn and grow as a student.

Thank you for everything, Hansraj College. Coming to my journey, I spent initial half of my college time at home because of the pandemic. But it didn't affect me much. I studied from standard books which helped me in covering the basic concepts. When the classes began to held in physical mode in Feb 2022, I joined an online coaching for the preparation of IIT JAM exam. But I didn't take it seriously and instead, I focused on college studies. I would say that it was a mistake and I should have taken college and coaching parallel without ignoring any one of them. When 5th semester exams ended, it was already first week of December and only 2 months left for the IIT JAM exam. I had only completed half of the coaching lectures till then. But for the next two months, I worked hard. I focused on revising concepts which I had studied so far, completed rest of the topics, solved previous year questions of JAM, JEST & TIFR and took coaching mock tests. It helped me to secure AIR 6 in IIT JAM exam 2023.

For future aspirants, I would suggest - Focus on building basic concepts. Take classes regularly and be serious throughout the preparation. Must read standard books which our professors suggest. Solve PYQs and take mock tests to analyse your preparation.

Sir Henry Ford said, "Whether you think you can or you can't, either way, you are right." So, just believe in yourself. Even if you don't, pretend that you do and at some point, you will.

Thank you for reading this far. Have a nice day.

SHARDA BERA-AIR 38

Hello everyone!
My self Sharda. Right now, I am a student of 3rd B.Sc.(H) Physics at Hansraj College Delhi University. I secured all India rank -38 in IIT Jam 2023 Physics exam. I wanted to thankHansraj College for this achievement. I came know about IIT jam exam from professors and seniors. Before that I don't have too much knowledge about it . After taking the admission here I learnedlot of new things from college and people surrounded in my life .Professors gave me good suggestions about career what I can do further and also from 1st semester they provided the mentors.
Now, I wanted to share my strategy regarding JAM preparation which will help future JAM aspirants.
When I entered in 1st year at that time college was going in online mode due to corona. This time did not affect my study. First I focussed on basic concepts which I learnt from HC Verma book then I moved to standard books. I completed my theory portions semester wise from standard books and parallelly I solved some examples because we know that IIT JAM syllabus is less then the B.Sc.(H) Physics academic syllabus. When I entered in 4th semester then I took coaching from "Optimist Classes Delhi" in online mood. I took regular classes parallelly with college classes and also doing govt. exam preparation, at that time my main focus on govt exam only which was held in June 2022. But in mid of 4th semester college opened in physical mood and then totally I focussed on only college exams and I left my preparation of govt. exam. During 5th semester I started solving assignments questions which were given by coaching and revising concepts from coaching notes regularly. After 5th semester exam I had only two months for JAM exam. In last two months I totally isolated from my college and friends. I gave my percentage for this preparation with out wasting my time in social media and other unwanted activities. At this time I solved PYQs of JAM , JEST and TIFR . I gave all mock test seriously and after giving the test I tried to find out my mistake and worked on them which was helpful in scoring good marks. Also I selected I got in top 25, in National Physics graduate examination.
Future JAM aspirants must focus on – 1. Building the basics concepts 2. Reference standard books 3. Solve examples and PYQs 4. Revision is more important 5. Attempt mock test 6. Take care your health and don't take stress .
A.P.J. Abdul Kalam said ," If you wanted shine like a sun ,first you burn like a sun".
Thankyou for reading this and have a nice day.

HARISH PATEL-AIR 740

I am Harish Kumar .

I studied Physics hons. course from Hansraj College. My three semesters were spent online due to the corona pandemic.I came to Delhi for the first time in February 2022. Became good friends in college within a few days. I wanted to make my career in physics, so I joined coaching in March 2022 for the preparation of IIT JAM. In my college time , I followed standard books to understand Physics better which helped in my preparation. I used to spend 6 hours out of my day in college and then gave some time for coaching preparation.The college professors were very helpful and polite. They helped me a lot in understanding physics. My mentor teachers also helped me in planning my future. Meanwhile, I gave my 4th and 5th semesters exams in which my score was very good. Amidst all this, I continued my IIT JAM preparation. On 12th February 2023 , I wrote my IIT jam exam in which I secured AIR 740.

I am very lucky to be a part of Hansraj college.

My Journey : Priyanshu Shukla

Hi there, I am Priyanshu Shukla, a final year B.Sc (H) Physics student at Hansraj College, University of Delhi.I have done nothing magnificent yet I got this opportunity to write for our departmental magazine. I have been a recipient of Smt. Lajwanti and Rajrani memorial price twice in academics and have secured 264th rank in IIT JAM PH 2023. It has been a very nice journey in physics with University of Delhi. Thankful to all the faculty members who have taught/supervised me and encouraged me to pursue physics ahead. My fellow juniors, I know you people are optimistic and full of enthusiasm. In such a case I don't find any need to guide you but I will share somethings. Let's start with the preparation for the competitive exams, which actually initiated from the day 1 you started learning physics(science- in general). If you have 2-3 years with you, then you should go on with your semester syllabus and learning all concepts with clarity.

. Ask questions, try to know different ways of solving problems and if you have 6-12 months then you should properly orient your preparation with the pattern of the competitive exams . Let yourself open to solve numericals with accuracy and in time. This all comes with practice and revision. Search for an empty classroom and teach/discuss concepts with yourself or with peers , I find it a nice way of understanding the subject matter.

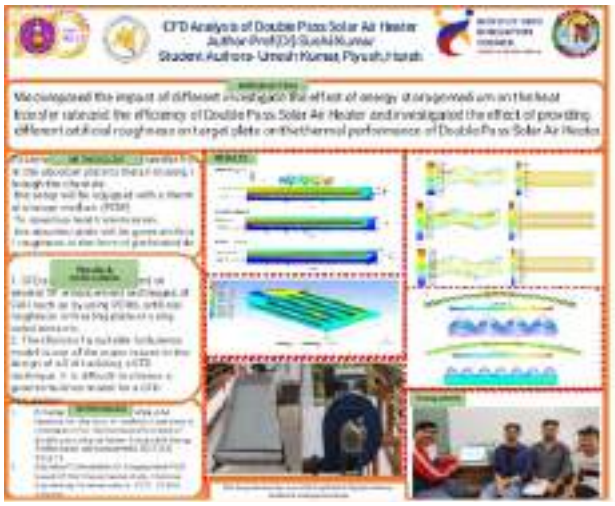
Sometimes, you might not feel the seriousness in your preparation but then you need not to worry so much, just ensure you maintain a simple discipline of going through content everyday also it is often better to recreate somewhere with your family or "real good friends".

During the last months of the preparation, do focus on revising the formulas, concepts and practicing tests so if you see any problem you should be able to retrieve a mental picture which actually helps to derive some formulas because we need not to keep lots of things into memory and it's not about doing just for competitive exams. You are studying physics and everybody has a different perspective of seeing it. I feel may be I am interested more in philosophy of the subject but if you have some different approach that's also fine. The ultimate thing is we have to build (atleast contribute) a society where maximum have a true understanding of science and i feel that's what good for the planet and its people. Don't think a lot about the end result. See.. the planet will continue to revolve and spin-all those exams will happen, their results will come so why not enjoy the learning process which actually serves all. At last, I would say do not ever think that true research will happen only in the higher education. See..whatever you are learning now, it's new to you and whatever codes you generate they are also new to you so try to make maximum on your own rather just copying ,that will surely give you immense joy and also spread the same discipline among your connections, be nice to each other(but for good cause). Keep listening, reading about science ,scientists, philosophers, other great lives and current world affairs!. Thank you for being with me all upto here. Have a worderful Life!

CAMPUS DIARIES





" THANKYOU HANSRAJ !"

-- By Umesh Kumar

College life is an important phase in every student's life, where one experiences a myriad of emotions, makes new friends, and acquires new skills. As a Physics Honours student at Hansraj College, I have had a unique college experience, marked by the sudden transition to online classes due to the COVID-19 pandemic.

The pandemic forced us to adapt to a new way of learning, and my first three semesters were completed entirely online. This meant that I had to adjust to a different mode of instruction and self-learning. Despite the initial challenges, I learned to manage my time efficiently, focus on my studies, and collaborate with my classmates virtually. Well this was a great experience in itself.

However, when the college finally opened, it was a refreshing change. I made some good friends and had a great social life. I discovered that being part of a community with shared interests and passions is an essential aspect of college life. I also realized that it is important to strike a balance between academic and social life to make the most out of college.

Continued...

Teaching has been my favourite hobby from my very childhood so to sharpen this dusted skill , I joined this Peer to peer mentor prog. In which I used to teach my juniors concepts of Mathematical Physics. This was my favourite part of college life.

During my final semester, I had the opportunity to work on a research paper under the guidance of Professor Sushil Kumar. The project was challenging but fulfilling as it allowed me to apply the theoretical concepts I had learned in class to a practical problem. I am grateful to Professor Sushil Kumar for his guidance and support throughout the project.

Although I could not secure a good rank for admission to a Master's program in Physics(JAM), the experience has left me inspired and motivated for the future. I have realized that success is not determined solely by academic achievement, but also by one's perseverance, passion, and hard work.

In conclusion, my college experience at Hansraj College has been unique, challenging, and rewarding. The sudden shift to online classes, the opportunity to make new friends, teach my juniors and the chance to work on a research paper have all contributed to my growth as a student and a person. I am grateful for this experience, and I look forward to the future with optimism and enthusiasm.

Thankyou Hansraj !

“ DIARY NO. 2”

-- By Sana Fatima

I am Sana Fathima doing my third year graduation in Physics hons. from Hansraj College. I have always considered it as a big opportunity to be a part of DU and leave back a mark of my own in the college walls for many more inspirations coming up. The excitement of me joining the college had only little life in the beginning as I felt my dreams were crashed due to the deadly COVID 19 that held us hostage at our homes. Losing three semesters in online mode had its own sorrows and each day me and all my friends dreamt for that day, we knew we could all meet each other at last. And yes I woke up a day to hear this news,

"Delhi University decides to resume their offline classes."

New Delhi, the capital of India. For me being a student from Kerala, Delhi probably only existed in our Social textbooks. But not anymore. I was actually coming to Delhi and seeing my classmates. And yes did I forget to mention I was here for my education?

Well yes I did forget that fact at times too. The faculty we had in the Physics department actually added to making me more comfortable in Delhi. Being independent and having control over life with sincerity and utmost discipline was always something I like any other teenager wanted. Adding to my just 'studying' life came the saviour app 'INTERNSHALA' where I found my biggest passion and comfort zone. I always loved writing and wanted to be a journalist. Ignoring your thought of then why I chose physics I move forward. I also love sports. Combining my two favourite hobbies I found an internship of Football Content Writing at a reputed firm called 'Firstsportz'. Finding time for my passion never felt like a big headache in my schedule adding to the bonus, for the first time in my life I was earning money and feeding myself. Well it is actually cool to chill with your own cash, just a big boost to your confidence level.
And alas, it comes to an end. My college life in Hansraj with a memory worth lifetime and the beginning of a new chapter. With the same suspense level I opt to move forward.

“ DIARY NO. 3”

-- By Harshita

From School to College everything has changed.
Pta h mai apne class ki akeli ladki hu
Heyya I'm Harshita from BSc Electronics 2 nd year. I'm the only girl in my class so yeah I know it feels like 90s or a movie scene, haha, well this is something I tell everyone because, baat hi aisi hai and everyone's like "Awww, seriously maze toh tumhare h."
Getting admission in DU was my dream since class 11.
I still Remember the day when I got into Hansraj. You know it's more exciting when your school friend also got the same college, It was more exciting when I got to know that there's only one girl in my class & that's me. A girl who loves to talk to people and get to know them, came to this college holding lots of dreams eager to explore new things that I had missed in my school and making new friends indeed studying having so much expectations.

But reality hits harder my friend, well I remember my first day in college I was very excited & nervous at the same time because it was the day I was going to meet new people and have had to make good friends whom I never met , lmao , every person belongs to a different city . Fun fact : I thought I'll tell my old good school friends that now I'm going to make new friends humorously, "Bye Bye forever" but that day I didn't even talked anyone because I was scared to see all the boys getting nervous of talking to me and even I was not able to recognize all my classmates and but i was curious about them who they are , that time i didn't even has the courage to ask them . well now when I look back to all those silly things I found it all crazy .

On the second day of the college, I remembered I was sitting alone, my whole row was completely empty, every boy that entered, sat in the next row aka boy's row. Everyone is talking to each other but sadly no one's there for me with whom I can chit chat. Being a chatterbox, it wasn't easy to sit quietly. Everyone made their new friends. but I didn't made a single new friend due to which I started doubting myself, I was anxious to talk to boys, I started becoming streotypical and orthodox and things got worse and worse, I started feeling depressed. those days, I was loosing my inner me and that's the first day I cried after coming back to my pg why I came to this college why? thinking of getting back to home. But when I look back and tell anyone I used to laugh on myself. Always craved for friends the good thing about the college is " the societies " those helped me a lot to explore new things, talking to peoples and With the passage of time everything changed . My inner " care free Harshita " came back. When I look back, one thing comes to my mind friends bnaye nhi jate bas wo ban

jaate h, I was stupid to run after making new friends. college has taught me a lot. I was always scared of doing things alone but now I enjoy time alone , also your friends can't be with you all the time , and this is the best thing I have learnt in my college how to spend time with yourself.
The Best thing I learned in the college is "nobody is gonna judge you " and the thing is why would they?
I am also only now realising the importance of female friends atleast having my best friend with me, not everyone got their school friends with them but I think i was lucky . These college days I will never forget. Finally Going to graduate next year with a tag " pta h class ki akeli ladki thi mai "...haha atleast there's 1 more year to do all those things(otherwise I will always regret) that I am going to miss the most because college days will never come back, also my studies , my college assignment.

“ DIARY NO. 4”

-- By Dinesh

Hey, I'm Dinesh and I'm currently in my 4th semester of a three-year physics major program. I've taken this course because I want to pursue higher studies and research in this field. Thanks to Covid restrictions, my first semester was online, but in the beginning of my second semester, we finally got to attend classes in person. Although sitting in a two-hour class felt like torture at first, my classmates and I quickly adapted to the new routine. We also spent a lot of time exploring Delhi's many tourist attractions and making new friends. I used to walk about 15,000 steps per day, and on one particularly active weekend, I logged 42,000 steps! Adjusting to life in PGs and flats was a bit of a challenge, especially dealing with tricky landlords and managers, but we managed.

In addition to attending classes and exploring Delhi, I participated in various extracurricular activities. I joined online clubs before coming to college, and continued working with them after arriving. Making new friends helped me learn more about myself, but maintaining a regular sleep schedule was definitely a struggle. I took part in many of the normal college activities, including a summer school program on thin film deposition organized by my department after my first year. I also participated in sports tournaments and sprints, sometimes even skipping classes to play. The college library had subscriptions to lots of different magazines, so I enjoyed reading up on various topics during my free time. We also had the opportunity to attend sessions by national level personalities from different fields. Of course, all of this activity could be exhausting at times, especially with semester exams and practicals taking up so much time and energy. But after two years of hard work, I became eligible to apply for research internships at various institutes in India and abroad. It was tough to get the LoRs I needed to apply, but I applied to as many internships as I could, and I was lucky enough to be selected for a two-month program this summer through the SRFP. Overall, it's been an exciting and hectic couple of years, but I'm looking forward to seeing where this degree will take me in the future!

A JOURNEY OF SELF-DISCOVERY AND TRANSFORMATION

-- By Kunwar Upvan

Hello, I'm Kunwar Upvan, and currently in the last semester or living the last few days of a 3 year holiday package of Physics Honors at Hansraj College. As I sit down to reflect on my college journey, I realize that the past three years have been a transformative experience for me. From attending online classes and spamming the official groups to bunking and chilling out in the LP or canteen, from copying assignments to well-organized national level events my college life has been full of challenges, achievements, and invaluable lessons. Despite the challenges and uncertainties, I have learned a great deal about myself, my goals, and what it takes to succeed.

When I joined Delhi University, like every other student, I was eager to learn and grow in a conducive environment. However, due to the pandemic, we had to attend online classes, which limited our opportunities. But as soon as the pandemic ended and the college reopened, I got exposed to the dynamic environment of Delhi University. I had the chance to attend various college fests and events, of which I have a lot of stories to tell. But for the moment, we could skip them, XDDD...
One of the most significant opportunities college offers is to join a society that aligns with your interests and goals. For me, it was the Nishtha, a renowned society at our college which is the Civil Services Society of Hansraj College. As a member of this society, I have had the privilege of interacting with prominent leaders of the country, organizing events, and working alongside like-minded individuals.

Serving as the General Secretary of the society in my final year has been a life-changing experience for me. We conducted a few seminars with speakers such as Dr. Kiran Bedi (Ex-IPS), Ms. Apala Mishra (IFS), and many more. While working in this capacity I learned valuable lessons about leadership, problem-solving and how to manage a team of individuals with diverse personalities and backgrounds, communicate effectively, and motivate them towards our common goals.

However, being a part of the Nishtha Society is just one aspect of my college journey. Over the past three years, I have learned that college is not just about academics. We might be the top students at school, but it’s okay to be an average student in college. What all matters is, are we growing? As I'm writing this article, I’m at my lowest as I got my 5th semester result which was 6.5 SGPA. However, I know my capabilities, I know where I have come from. From not even registering for the placement cell to being one of the five to be shortlisted and reaching up to the last round of a tier 1 company with 19 LPA. Being a dual degree student and a person who’s always set to have fun and hangout with friends, managing all this stuff wasn’t easy but somehow sailed through.

College is a journey of self-discovery, where we learn not only about academic subjects but also about ourselves, our interests, and our passions. It's a time to explore different avenues and discover what truly excites us. It’s a journey of introspection, an experience that challenges us to push beyond our comfort zones. It helps us discover who we are and what we want to achieve in life.

I encourage everyone to take advantage of all that college has to offer. Join societies, take part in extracurricular activities, make connections, and above all, don't be afraid to fail. Failure is part of the learning process, and it's through failure that we grow and improve.
The journey was not a bed of roses; I faced several failures and pressure situations. However, those experiences helped me develop resilience and perseverance. I learned that failure is not the end, but a stepping stone towards success. Moreover, it taught me to handle pressure and prioritize my responsibilities efficiently.

In conclusion, my college life has been a rollercoaster ride, full of incredible experiences that have shaped me into who I am today, and I'm excited to see where it takes me next. I hope that my story inspires you to make the most of your college life, embrace challenges, and never miss out on any opportunity that comes your way, learn from their experiences, and never give up on your dreams.

“ FROM STARTUP DREAMS TO REAL-LIFE SUCCESS: MY ENTREPRENEURIAL JOURNEY IN COLLEGE”

-- **By Yuvraj Jaiswal**

As a student, I had always been passionate about entrepreneurship and the endless possibilities it presented. With a burning desire to create something of my own, I embarked on a journey to start not just one, but two successful startups during my high school and freshman year of college.

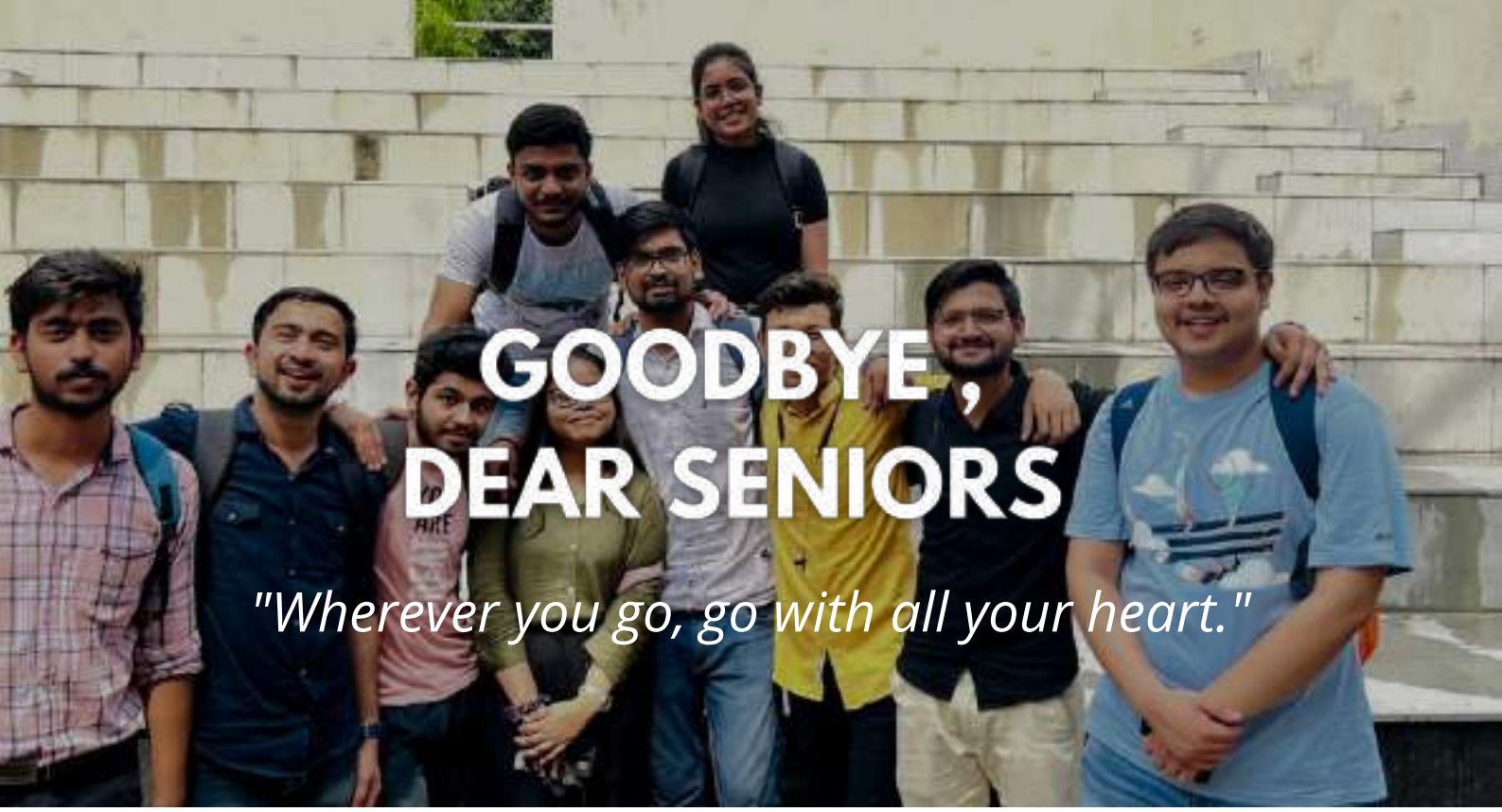
My first venture, ServiceGalaxy.com, was an online platform that provided a range of internet-based services such as content designing, graphic designing, website development, and data entry. In just two months, we were able to serve more than 10 clients, a remarkable feat for a high school startup. It was an exhilarating experience as I learned the intricacies of running a business, from conceptualizing the idea to developing a brand, creating a website, acquiring clients, and managing a team. The challenges were immense, but the sense of accomplishment was equally fulfilling.

Emboldened by the success of my first startup, I ventured into my second startup, Floret Aroma Perfumes, during my freshman year of college. This time, I partnered with an industry expert to private label perfumes. It was a thrilling experience as I delved into the world of product development, branding, and marketing. Through meticulous planning and strategic partnerships, we were able to establish FloretAromaPerfumes as a premium brand in the market.

The journey of entrepreneurship has not only taught me valuable business skills but has also honed my leadership abilities. As the founder and CEO of both startups, I had to inspire and lead teams, set goals, and manage resources efficiently. I learned how to make tough decisions, adapt to changing market dynamics, and persevere through challenges. These experiences have shaped me into a resilient and strategic thinker, equipped with practical knowledge and insights that go beyond the classroom.

Looking back, I am proud of the milestones I have achieved with my startups. They have not only provided me with hands-on experience in entrepreneurship but have also given me a sense of fulfillment and purpose. The entrepreneurial journey has been a rollercoaster ride, but the lessons I have learned along the way have been invaluable. I am grateful for the support and opportunities provided by my college, which have nurtured my entrepreneurial spirit and empowered me to pursue my dreams.

As I continue my journey as an entrepreneur, I am filled with excitement and determination to create a meaningful impact in the business world. I am grateful for the valuable lessons, the friendships, and the memories I have made on this entrepreneurial journey. With a heart full of gratitude and a mind brimming with ideas, I look forward to the next chapter of my entrepreneurial adventure, fueled by the knowledge and experience gained from my startups in college.



DEAR GRADUATING BATCH,

As you are near the end of your under graduation academic journey, we want to take a moment to congratulate you on all of your achievements. You have worked hard, overcome obstacles, and grown in ways that you may not have even realized. Now, as you prepare to embark on the next chapter of your life, Let's cherish the relationships that you have built throughout your time in school. These connections will be invaluable as you navigate the challenges that lie ahead. Take the time to thank those who have supported you along the way, and never forget the friendships that have been formed.

Always stay true to yourself and your passions. As you enter the workforce or continue your education, it can be easy to lose sight of what truly matters. Remember to pursue your dreams, and don't be afraid to take unconventional paths to achieve them.

We want to wish you all the best as you take on the next chapter of your life. Remember to stay true to yourselves, stay connected to your friends and loved ones, and never stop learning and growing.
In last, We would like to say that "Goodbyes are not forever. Goodbyes are not the end. They simply mean we'll miss you until we meet again."

Congratulations and goodbye!

---------- Vatika
B.Sc.(H) Physics, 2nd year

Dr. Sushil Kumar
Professor

Dr. Pradeep Kumar
Associate Professor

Dr. Namrata Soni
Professor

Dr. Maya Verma
Associate Professor

Ms. Bhavna Vidhani
Associate Professor

Dr. Hema Chutani
Associate Professor

Dr. Davuluri Srikala
Assistant Professor

Dr. Chetana Jain
Professor

Dr. Ravikant Prasad
Assistant Professor

FACULTY OF PHYSICS

Dr. Sonia Yogi
Assistant Professor

Dr. Chanchal Yadav
Assiatant Professor

Dr. Neelakshi N.K. Borah
Assistant Professor

Dr. Ganesh Lal
Assiatnt Professor

Dr. Aman Phogat
Assitant Professor

Dr. Yogesh Kumar
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Bella Ciao '22

Big Bang Bash'23

Phyonics '23

" When you change the way you look at things,
The things you look at change "

- Max Planck

IMAGE DESCRIPTION : PLO T OF JULIA SETS ON A PLANE

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