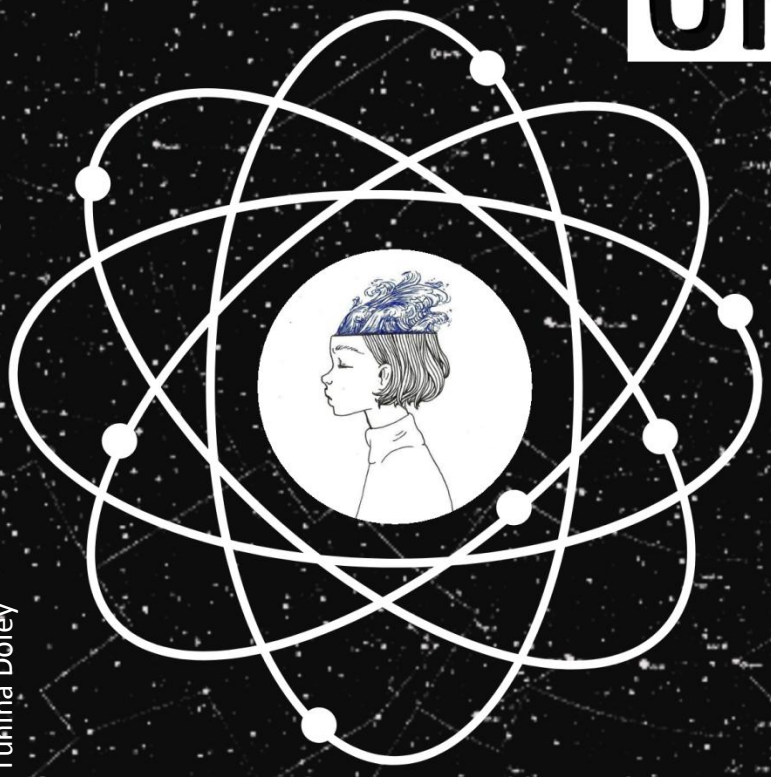
DIMENSIONS '20

UNDERSTANDING UNCERTAINTY



VIDYUT,
THE PHYSICS SOCIETY

MIRANDA HOUSE,
UNIVERSITY OF DELHI

Designed By: Tuhina Doley

From the desk of Head of the Department

Vidyut, is like a strong tree which has the soil of Miranda House to grow. Students, the branches of this tree, work very hard in all fields all through the year for the multi-faceted growth of this tree. Editorial board of Vidyut is one of the strongest branches of this tree. The students involved with this magazine have made the tree grow in the direction where scientific ideas have met literary finesse. I am confident that this magazine will not only entertain the readers but also ignite their minds and attract them towards newer realms of the beautiful world of Physics. In the uncertain year that we live in, the magazine endeavors to shine the light on the path of certainty.

I take this opportunity to congratulate the editorial board for bringing out this magazine in these difficult times, which in itself is an achievement considering the effort and time required. May all our students soar high in uncharted skies and bring glory to the world and their profession with the wings of education!

- **Dr. Mallika Verma**
-

Editor's Note

This edition of Dimensions holds a special place in history, it is carved in an uncertain period, under the pretext of understanding it. Uncertainty is an umbrella term that we have used to describe what challenges, we the students, part of the scientific community face. This magazine is peppered with articles voicing student opinions, to the articles helping you understand the newest scientific talk in town, without which you might feel uncertain in the community. We have carefully curated the magazine for you – the reader, and filled it with artworks, poems, memes, academic gallery, and also the internship experiences of our peers. The magazine truly represents the vibrant nature of our department that encompasses students from all walks of life, who have different perspectives about the uncertainty in their lives. I and my team want to express our heartfelt gratitude for the precious time that you are about to invest in this creative piece, created by our hard work. Lastly, I would like to say that from now on, this magazine seizes to be mine, the ownership passes on to you. So, feel free to appreciate, give suggestions, or question your magazine anytime. I will be happy to address your queries at all odd hours, just email me and connect.

Also, I would like to bring to your notice, that the views and opinions expressed in this magazine are those of the author and don't reflect the view of the Department of Physics, nor of the Miranda House.

- **Prachi Misra (EDITOR)**
prachi.rashmi71@gmail.com

Table of Contents

Heisenbergs' of Vidyut (The Back-stage Crew)

PRACHI MISRA

"She believes herself to be "A riddle, wrapped in a mystery, inside an enigma", but in reality she is quite opposite ;). You can never get a cup of coffee large enough or a book long enough to suit her. If you meet her anywhere around, be sure to have a lot of time on your hands before you say hi to her, as she can talk for hours at length, with the conversation ranging from a plethora of topics "

Editor

MANSI DAGAR

" She prefers to live in the silences between the thousand thoughts. Far from full she is a wild spirit with a sweet soul looking for some "space" and "time". She believes perhaps we are made for this macrocosm: the key to the whole universe may well be hidden in the microcosm of our minds "

Co-Editor

Graphic Designing Team

Palak Awasthi

" 90% of people call her 'Paalak', the other 10% call her 'Plak', pronounced as 'pluck' :-/ No one's gonna read this bio so she feels she can write any gibberish here. So it's okay if your actions don't have equal reactions sometimes even Gods have a hard time recalling Newton's laws :) Also Mitochondria is the powerhouse of the cell "

Tuhina Doley

" With her head buried in fan-fictions and reddit theories, she prefers being stuck in any universe but her own. She also prefers spending most of her time sketching characters, writing random poems and reading weird mythical tales and dreams to one day write an epic sci-fi fantasy "

D.Yeka Priya

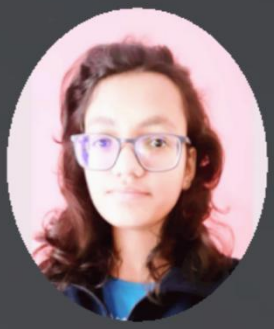
" Everything is a miracle, is her motto. She likes to make things more realistic in her frame of reference, she loves to do work in minimum distance but maximum speed. Being passionate, she likes to make things more realistic and is dedicated to spreading light "

Content Creation Team

Rashi Wadhwa

" Five D's define her- Dedication, Devotion, Diligence, Discipline and Determination "

Neha Yadav



" An enthusiastic, adventurous and an optimistic person. She has keen interest in searching and learning about new things "

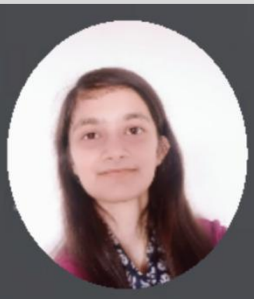
Roopal Bansal

" She has always been a seeker and a mindful observer. She believes in general in dualism between facts and the ideas of those facts in human heads "

Manasvi Gautam

" Has galaxy in her eyes and a universe in her head. She believes that "shoot for the moon even if you'll miss, you'll land among the stars "

Anusha Pandey



" Hobbyist writer and voracious reader. Always curious and eager for the pursuit of knowledge "

Women In STEM : an Overview

By- Saloni Singla, 2H2 and Mansi Dagar, 2H2

Here's the thing: STEM fields are still dominated by men. Given the omnipresent gendered imbalances in every part of the global society, this shouldn't come as a surprise. Except that scientists pride themselves on their objectivity, lack of bias, on theories based on empirical validation. And, as we hope to show you ahead, all evidence points to women being at least as capable as men at science and academics generally. Then why the contradiction, a question we raise by supporting statistics.

We conducted a small survey within our own Department of Physics at Miranda House, to get a feel of what students, at the best college (according to NIRF rankings) in the country thought about certain sub-issues related to the obstacles faced by women practicing science under a patriarchal societal regime. The way the article proceeds is the following: we present the results of this survey one by one, each followed by a summary of the situation and, where required, our humble opinion on the situation. While we cannot claim to be unbiased, we are presenting statistics from reliable sources (cited wherever relevant) to help you evaluate the argument yourself, and maybe even consult the sources directly to form your own.
The results presented ahead are based on the 24 people survey. [1] Most of the questions are answered on a scale of 1 (not at all) to 5 (all the time).

Q1: If you hear the word "scientist", do you usually picture a male figure?

More than 50% of our respondents answered 4 or 5! More than 50% of the respondents at an all-women college, studying physics, are still imprinted with the image of a scientist being male.
They say history repeats itself, but for our situation, it might as well just have continued. In India today, only 14% of our 280,000 scientists, engineers, and technologists in research development institutes, are women. Globally, Fewer than 30 percent of the world's scientific researchers are women. According to the UN Educational, Scientific and Cultural Organization (UNESCO), women in science, technology, engineering, and mathematics (STEM) are published less, paid less for their research, and do not advance as far as men in their careers.
UNESCO data from 2014-2016 shows that globally, female students' enrolment is particularly low in information and communications technology (ICT), where women represent only three percent, and natural science, mathematics, and statistics, where the figure is five percent.

Q2. Do you remember reading about female scientists/mathematicians in the "biography" sections in NCERT textbooks?

This was a Yes-No question. 79% of the respondents answered "No".
While unsettling, this doesn't come as a surprise. What's more, it may not completely be the NCERT's fault. Gender-based discrimination in science academia, (as everywhere else) runs wide and deep, well into history: while men (great scientists, no doubt) were encouraged and supported in their discoveries, women faced myths and ideologies which have lead to their contributions go unnoticed and their scientific ability to be demeaned, even to the extent of being considered non-existent. Take a look at

[1]https://docs.google.com/forms/d/1Yzkq6HUtlmF_M1XU48tMmkfK_QpgvKpzFJrUYbgwrg/edit#responses[2]https://royalsocietypublishing.org/doi/pdf/10.1098/rsnr.1992.0027[3]https://www.nationalgeographic.com/science/2018/12/women-science-sexism-research/

some snippets of modern history showing just how (un)welcoming science and academia has been to women.

Let's look at some of the oldest academies of science: institutions that support and encourage scientists, providing them with a community, an intellectual space for discussion, and in more concrete terms, funding for their research. The French National Academy of Science: admitted its first woman member in1979. The Academy was created in 1666! The U.S. National Academy of Sciences elected Florence Sabin in 1925, (62 years after it was formed), Margaret Washburn in 1931, and then Barbara McClintock in 1944. The Soviet Academy of Sciences elected Lina Stem to full membership in 1939 and further women scientists in 1958, 1970, and 1981. Canada elected Helen Hogg in 1946, and other academies of science followed gradually. [2]

Women were not to become members of these societies for over 300 years; this is surprising since their participation in sciences is not a modern phenomenon but well-rooted in the past; an ancient Egyptian, Merit-Ptah from 2700 BC, described in an inscription as "chief physician", is the earliest known female scientist. Another early female scientist very well-known in her field was an astronomer and philosopher Hypatia from the 4th century, who authored many mathematical texts, mostly lost to the dark of history. We could go on, but you get the point.

When women did get the chance to work, in many instances, the men were credited for work done by them: Take the case of Rosalind Franklin by uncovering the double helix formation when she produced the groundbreaking images. But this subject of disputed credit famously names Cambridge University Scientists D. Watson and Francis H.C.Crick. There is also evidence that men's scientific achievements were more likely to be attributed to capability, while that of women were attributed to luck. (The last line paraphrased from Handbook of Research on Gender and Leadership edited by Susan R. Madsen). According to the UN Educational, Scientific and Cultural Organization (UNESCO), women in science, technology, engineering, and mathematics (STEM) are published less, paid less for their research, and do not advance as far as men in their careers.

Q3. Are you inclined to believe that men are inherently better than are women, at technical and mechanical tasks?

This was a scale based answer. A third of the respondents gave it a "4": They were strongly inclined to believe this. Another third was somewhat inclined to believe this, while only the remaining third answered, "1" (not at all). This, in a physics department where most of the wonderful faculty members are female. Many theories try to explain and sustain this belief in a sex-based hierarchy of mental ability. The biological aspect of patriarchal ideology relies on exaggerating the biological differences between the two sexes, and then uses these differences, to mark the male sex as superior to the female. It seems that the scientific community, even in relatively recent times, has become entangled the poisonous tentacles of patriarchy:

In the late eighteenth and nineteenth centuries, craniologists tried to account for, sexual differences in intellectual achievement by measuring the skull size. Researchers first endeavored to demonstrate empirically that female cranial capacity was smaller, and then that brain capacity was related to intelligence (Van Valen, 1974:417-423). Women were believed to excel in fickleness, inconsistency, absence of thought and logic, and incapacity to reason (Gustave Le Bon, 1979). Question: Can we say that a gorilla's thinking is more developed than a man's because "size matters"?

Darwin observed women in Victorian England and concluded that since women didn't achieve as much as men did, they were simply inferior to men.[3] Despite his scientific brilliance, he some-how overlooked the restrictions and oppression faced by these women; one cannot compare players in uneven playing

fields and expect reliable results, yet that is precisely the fallacy behind this great scientist's argument about women's intellectual inferiority.

Reproductive Role: The burden of child care most commonly falls on the woman; motherhood has always been glorified and for a long time, it had been assumed that those in the scientific society are not from among those involved in reproduction. Professors at the Universities of Oxford and Cambridge were not allowed to marry until late into the nineteenth century.

In the late 1800s Doctor Edward Clark, in a carefully worked out scientific study, showed that women's intellectual development would proceed only at great cost to their reproductive development. With the emphasis historically placed on childbearing as a woman's primary role, one can imagine how this must have discouraged young girls from entering science.

Let's step back and look at the facts: Among the great women scientists of the past, a large proportion were mathematicians. Sophie Germain, Madame du Chatelet, and Maria Winkelmann were all women, working in math-based sciences in the 1700s. Newtonian physicist Laura Bassi was appointed to professorships in both anatomy and experimental philosophy (physics), making her the first woman in the world to hold such posts. This was despite her 12-children household; we can safely say that Bassi alone is enough to completely dismantle any belief one may have had in Point 3 above.

Even in the current national scenario, females appear at least as capable as males in academics. Looking at an MHRD report, one finds that in Class X and XII exams, while fewer female students appeared, a higher percentage of females passed (for Central/state boards). They also have a school-level indicator called the "Mean Achievement Score of Students at National level", which showed that females performed as well as their male counterparts (Class X) in mathematics, science, and social science.

From an ideological perspective, we see that conceptions of femininity and science have been socially constructed: the attributes associated with science, those of rationality, and mathematical ability, are usually associated with men, leading science to be seen as "unfeminine", or "not to be done by women". This idea is so stubbornly deep-rooted, that we are forced to acknowledge again the power of patriarchal ideology, albeit begrudgingly: Despite the heartening evidence above, the inclination to believe that men are better at technical tasks, continues to exist among female scientists; A report from NITI Ayog shows that the out of the women working in STEM, the staggering majority continues to be in the "Biology, health and allied science" disciplines[4], leaving the mathematical sciences and engineering to men. UNESCO data from 2014-2016 shows that globally, female students' enrolment is particularly low in information and communications technology (ICT), where women represent only three percent, and natural science, mathematics, and statistics, where the number is a mere five percent.

Even within the fields of "Biology, health and allied science", many women encounter what's called the "little lady syndrome" the assumption that female staff members are support personnel only. To present an instance: we have heard countless anecdotes of patients insisting on addressing female doctors as "nurse".

The burden of the reproductive role and the primary caregiver in a family is heavily borne by women even today. According to the above mentioned NITI Ayog report, among those women scientists that had a career break after marriage, family responsibilities were cited as the most common reason for the break.

The most commonly quoted dream job for the sampled women was that of a 'scientist'. So if women give settle for teaching at lower-level positions, it is not because they want to.

While 43% said that Family Commitments and Household Responsibilities did not affect their achievements, over 30% felt that their careers were somewhat adversely affected by such responsibilities.

1.https://yourstory.com/herstory/2020/01/indian-women scientiststechnology2.https://www.businessinsider.in/careers/news/india-tops-the-world-in-producing-female-graduates-in-stem-but-ranks-19th-in-employing-them/articleshow/74117413.cms3.https://thewire.in/the-sciences/indian-science-women-recognition

Q4. Do you think education and workplace culture is structured in a way that is helpful or encouraging to women succeeding?

54% of the respondents responded with a 4 or 5, indicating that the majority does feel that the education and workplace culture is structured in a way that is helpful or encouraging to women succeeding.

The above mentioned NITI Ayog report also reports that with regard to the attitude of male colleagues and incidents of sexual harassment, the responses were heartening, with most respondents feeling comfortable with male colleagues' attitudes, and also finding sexual harassment to be uncommon.

While such overt discrimination has reduced at the workplace, feminist scientists still believe that more opaque thought patterns, which may not be intentional or even noticeable, continue to occur, leading to small incidences of unintended discrimination, which adds up to cause the gender gap we see in pay/responsibility at the work-place; omen more often work in lower-prestige jobs than men with identical education and work experience:

"The sorts of mechanisms reported in these studies include, for example, the patterns of exclusion of women from informal mentoring and communication networks within the profession and the workplace; gender-normative work assignments that channel women into heavy advising, undergraduate teaching, and into administrative positions that carry substantial organizational responsibility but little decision-making power; gendered patterns of evaluation bias by which, for example, the accomplishments of women are more readily attributed to luck or external factors while those of men are treated as evidence of talent, training, and hard work (for an overview, see Wylie 1995; Wylie, Jakobsen, Fosado 2008)." (Quote from the Stanford Encyclopedia of Philosophy)[5].

Q5. How often are you reminded in one way or another that, being a girl you are privileged to be able to study?

Only about 25% respond with a 4 or a 5, which is heartening. This means that 75% of them can take their education, not as a privilege, but as a right accorded equally to both them and their male counterparts.

This is a trend seen in national education overall: In primary school, enrolment of girls exceeds that of boys. Looking at time-series data from the MHRD report, one sees that even though female literacy rates have remained lower than males, they have nevertheless consistently risen over the decades from 1951. Same for secondary and higher education. At the territory level, as many as 40% of Indians who graduate in STEM are women.

However, there are anomalies. According to another recent MHRD report, the share of female students is lowest in Institutions of National Importance followed by State Private Open Universities, Deemed Universities-Government. The biggest gap is at the undergraduate level where there are 26,736 females as compared to 96,724 males. Margaret Rossiter calls this hierarchical discrimination: as one moves up the ladder of power and prestige, the female faces disappear, what women in sciences suffer from. Even though the influx of female students at lower levels of education is increasing, this does not translate to greater representation at higher levels of education, leading to a pyramid-like structure of the number of women at every level of education.

As a glimpse of the situation abroad, only 35% of researchers at France's National Centre for Scientific Research are women. We could also recount countless anecdotes from many articles, and even our alumni, about being the only women in their respective classes (in physics courses).

The next 3-part question addresses one particular aspect of patriarchal ideology: self-grooming and gender.

Q. 6a. Do you believe that women are required to put in more effort into their looks than men are?

4.https://thewire.in/the-sciences/chandrima-shaha-first-female-president-indian-national-science-academy5.https://aip.scitation.org/doi/pdf/10.1063/1.1505176.https://www.stsci.edu/stsci/meetings/WiA/schieb.pdf7.https://www.discovermagazine.com/the-sciences/the-50-most-important-women-in-science

While 30% responded with "1, not at all", over 50% responded with a 3, 4, or 5, indicating that a majority of them do feel societal pressure to put comparatively more effort into how they look.

Q. 6b. Do you feel compelled to confirm to this societal norm?

Over 63% felt compelled to confirm.

Q6. c. Do you believe that such a focus on looks takes away from time/effort resources that could be spent on work?

75% believed that such a focus on looks takes away from time/effort resources that could be spent on work.

These answers reflect one of the many ways in which a patriarchal setup can affect women in academics. It shows how certain ideological beliefs, or norms, can affect seemingly unrelated aspects of a person's life.

While we still have a long way to go, we shouldn't forget to acknowledge how far we have come. In our survey, over 70% of the respondents felt that their opinions are heard with the same respect and attention as their male counterparts, and over 80% felt equally comfortable opposing male and female opinions in classroom/informal settings, in discussions related to coursework. We are witnesses to a slow, but very visible, ideological shift.

To recount some recent achievements for Indian scientists, Dr. Ritu Kridhal is the mission director of the Chandrayan-II mission, Dr. Gagandeep Kang became the first Indian woman to be elected to the Fellow of the Royal Society of London in 2019; mathematician Neena Gupta became the youngest winner of India's top science prize last year. The 35-year-old is only the 17th female winner of the Shanti Swarup Bhatnagar Prize for Science and Technology of the nearly 550 who have received the award over the years; Chandrima Shaha has been elected as the first woman president of the reputed Indian National Science Academy (INSA); Kamakshi Sivaramakrishnan, responsible for building the algorithm and chip, onboard NASA's New Horizon mission that is responsible for bringing information from Pluto, just to name a few. The number of women Nobel laureates in science is also increasing: "By 2001, a century after the presentation of the first Nobel Prizes, only 10 of the prestigious awards in the sciences had been bestowed upon women. But the first decade of the 21st century proved a watershed for women scientists. In 2009 alone three women captured the award—Australian-born American molecular biologist and biochemist Elizabeth H. Blackburn and American molecular biologist Carol Greider for Physiology or Medicine and Israeli protein crystallographer Ada Yonath for Chemistry—bringing, at the end of the decade, the total number of science Nobel Prizes awarded to women to 16. The Nobel for Physiology or Medicine was later awarded to Norwegian neuroscientist May-Britt Moser (2014) and Chinese scientist and phytochemist Tu Youyou (2015). The year 2018 was especially notable as Canadian physicist Donna Strickland became the third woman to win the Nobel Prize for Physics and American chemical engineer Frances Arnold became the fifth woman to receive the prize for Chemistry." (Britannica Encyclopedia)[6]. It is heartening that most of our readers will probably be familiar with Katie Bouman, the MIT scientist who built the algorithm that imaged a black hole for the first time.

So, one can see that we have a lot going for us, many female role models to look up to. As with any feminist movement these pioneers too, have built a foundation upon which we can continue to create, discover, and of course, continue to learn. While structural changes, policy measures, institutional changes are taking place (and need to go a lot further too), the most important change that has begun, and is our responsibility to keep up, is the tenacity and awareness, within us. It is gathering momentum, and the only way now is forward.

8.https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6087017/9.http://archive.mu.ac.in/myweb_test/TYBA%20study%20material/Gender%20&%20Soc..pdf10.https://research.swe.org/2018/07/india-undergraduate-education/11.https://www.rsc.org/news-events/community/2016/may/women-in-science/12.https://www.visionlearning.com/en/library/Process-of-Science/49/Scientific-Institutions-and-Societies/16213. https://obamawhitehouse.archives.gov/women-in-stem

SHATTEERD HOPE

By – Sochannao Machinao, 3H2

You grow up with hope as vast as the ocean. Nothing in the world seems impossible to you. Everything appears to be within your grasp. No mountain seems too high nor any ocean too deep for you. The word 'impossible' sounds strange. Desperate to reach the destination that awaits you in many of your dreams, you embark on your life journey. The genesis of your journey looks smooth without any bumps and ridges.

At the very start, you think, it would be a matter of few years before you reach the awaited destination. But little do you know that the path will be shrouded with uncertainties of life, danger lurking all around with dreadful storms of life ready to swallow you up. No sooner do you step further into your path than the shaking of the enormous foundation of your robust hope begins. Slowly one by one, pieces of your hope start to crumble. As you struggle to forge your way through the perils, you find your zeal and enthusiasm for the unseen future constantly wearing away. You find yourself placed in a state completely devoid of the meaning of life. All those great hopes, which led you to undertake this path, vanish into thin air. Your hopes are slowly replaced by despair. The flame of hope, which was once burning brightly inside you, starts growing dimmer and dimmer. Now you are at a point where even a slow wind could snuff out completely the remaining glimmer of hope. You try to turn back only to realize that there's no going back once you begin.

What can be more torturous than living a life devoid of any hope? But one should always keep in mind that: everyone in life goes through this phase when your dreams and hopes are completely shattered. A moment in life when you cannot spot even a ray of hope but still don't bother to search for one. Like a ship, with no rudder in the middle of the sea waiting for the wave of the sea to direct its path, you too wait for time to decide your life. What we need to know at such a moment of our life is that: the ravage of time is inevitable in life. We just need to venture through that stormy phase of our life. We should let the fire inside us burn no matter how dim it becomes. Never let that flame of hope completely blow out in life. Time will bring you better and more realistic hope just after the stormy period of your life. Your new hope will be an unwavering one, a hope that will take you to the destination destined for you. Always remember there's a calm before and after the storm.

Oil of the 21st century and how to mine it?

By- Anusha Pandey, 2H1

In the past two decades, we have entered an era where the most valuable currency in any field has become data. Furthermore, Data Science has become one of the fad words of our time, teeming with many career opportunities and is anticipated to be one of the most in-demand jobs producers of the future. Data, defined as the set of values of qualitative or quantitative variables about one or more persons or objects, is rightly known as the 'Oil of the 21st century' It gives an edge unlike any other commodity in all industries, be it Business, Science or Technology. The availability and efficient use of data has led to many advancements in recent years. Our feed on social media platforms, which gives us suggestions according to our likes and inclinations as well as the speech recognition features on our devices are some of its many achievements.

The collection of data is known as data mining. Data mining has become such a prevalent practice that it is visible in all walks of life nowadays. Surveys that we fill regarding our favorite cafes, about our stance on a political issue, or the observations we take from every physics experiment, all give us a wealth of mined data. With this access to data, we also get the responsibility to use it prudently and to the maximum. Leading to the rise of data science to keep a better check and extract the most out of this data.

Data, in its core essence, is unfiltered and unstructured. Data Science is a combination of various tools, principles, and algorithms to process and analyze data. Analyzed data can be further used for finding patterns, in a predictive and prescriptive manner. Some of the extensive uses of data analysis are, 1) Anomaly detection- in fraud, crime, or disease. In these cases, the previous data gives the conditions that affect the occurrence of the crime, disease, etc. and can be used to predict the same in the future. 2) Forecasting- weather or sales. In the cases of forecasting, the collected data is analyzed and decomposed into three parts - the general trends, the seasonal deflections, and the random changes. These are taken into consideration to create models that have the ability to predict the same for subsequent time. 3) Recommendations- from our daily internet searches to the algorithm of self-driving cars. In these cases, the past data is used to find similar patterns in the required information and then suggestions are made based on them.

Illustration : depositphotos.com

One in-depth example of its use can be described as follows- By taking the database of heart patients in a city, some common data that is obtained are the name, age, gender, cholesterol level, etc. From this, the most dependent variables- age, gender, and cholesterol level are extracted while the rest unwanted data- name of the patient, is filtered out. A logistic regression model, which gives a binary response, is formed on these variables. This model, when applied to the data of any new patient, can predict if (s)he has the affinity to be susceptible to the same ailment.

Physics too, lately, has seen a huge rise in the application of Data Science in all its glory. CERN is one of the notable organizations to use these methodologies to parse their data and arrive at conclusions more effectively. Events like the Higgs Machine Learning Challenge, held by Kaggle and sponsored by CERN, Google, etc., which provided a platform to develop machine-learning techniques to improve analysis of data that led to the discovery of properties of the Higgs boson particle, have also given an insight on how Machine Learning can be used to improve the discovery significance of such experiments.

Although data science is a multi-disciplinary field, a huge advantage for us Physics students who wish to engage with analytics is, that we are already much acclimated to its methodology. It follows the familiar steps of collection of data from a database (from conducting experiments, in our case), analysis of the collected data (analyzing experimental values), building models on the data, and arriving at reasonable conclusions(calculating a constant or proving a law).

It also uses aspects of coding, which already plays a significant role in our studies. The further requirement is honing of these skills and a self-driven attitude. India, at the present moment, is suffering from an unfortunate dearth of Data Science degrees. There is, however, still an abundance of opportunities to get started on this path. Online courses and Bootcamps organized by Coursera, Udemy, IBM, etc. are one of the most effective ways to kick start this journey. Once the required knowledge is gained, self-initiated projects provide the next stepping-stone. Sites like FiveThirtyEight and Kaggle are the ultimate sources of datasets of all kinds which are available to the public, to be utilized and applied to their convenience. These can be then uploaded to repositories like GitHub, which gives further credibility to the knowledge. Kick-starting our journey to become a data scientist, with a strong addition to our work profile.

Data now has a big hand in the progress and innovation of various fields today. Being a relatively easy skill to learn, it is time that we too take the opportunity to use this tool and apply our own creativity to derive new conclusions and give our contributions to society. So gather the dataset of your choice and load up your programs and enter the world of analytics today!

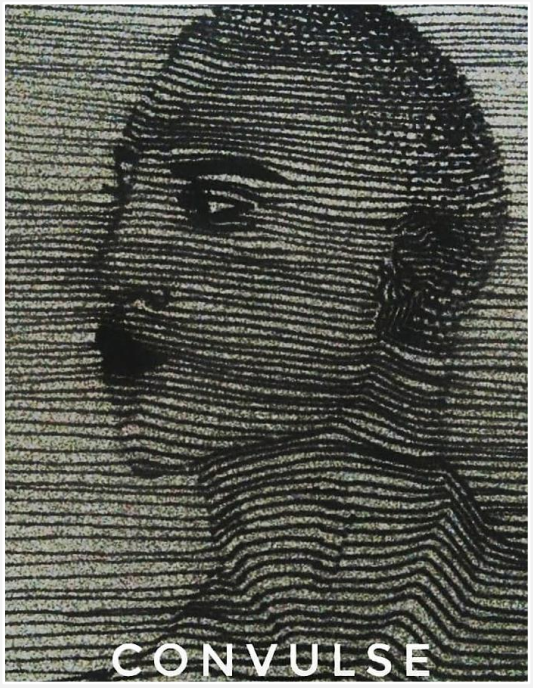
Illustration : datafloq.com

THE ART SECTION

"...After all, the object is not to make art, but to be in the wonderful state which makes art inevitable."

- ROBERT HENRI, "The Art Spirit"

- MEENAKSHI HARI, 1H1

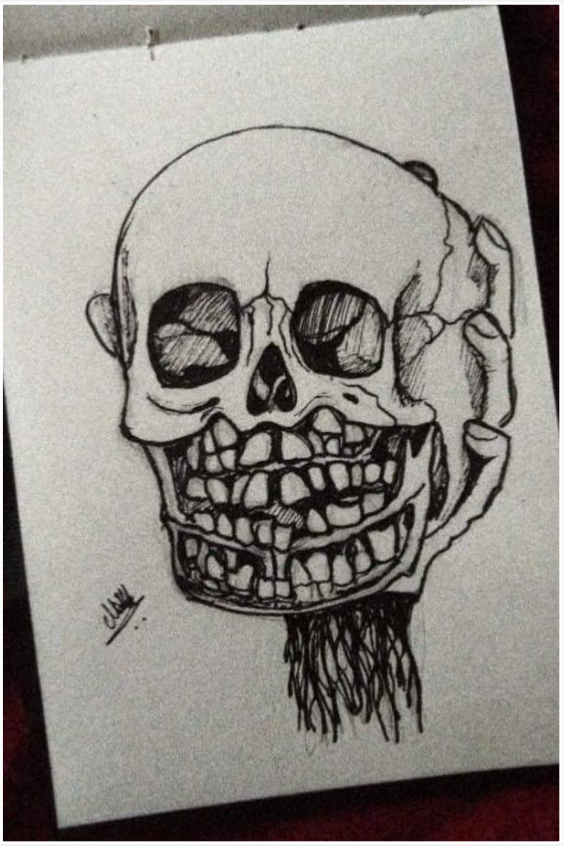


- MEENAKSHI HARI , 1H1

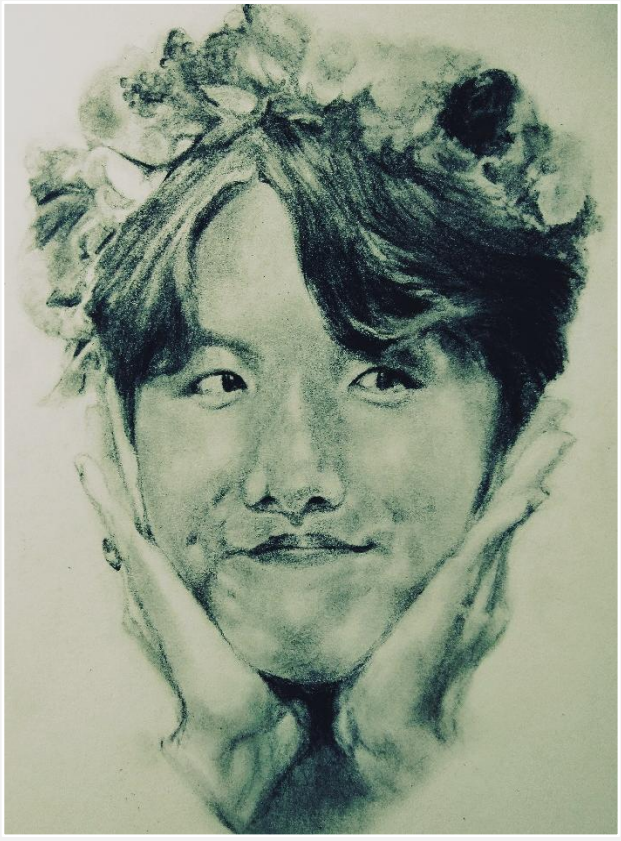
- MEENAKSHI HARI, 1H1

- TUHINA DOLEY, 2H2

- MEENAKSHI HARI, 1H1

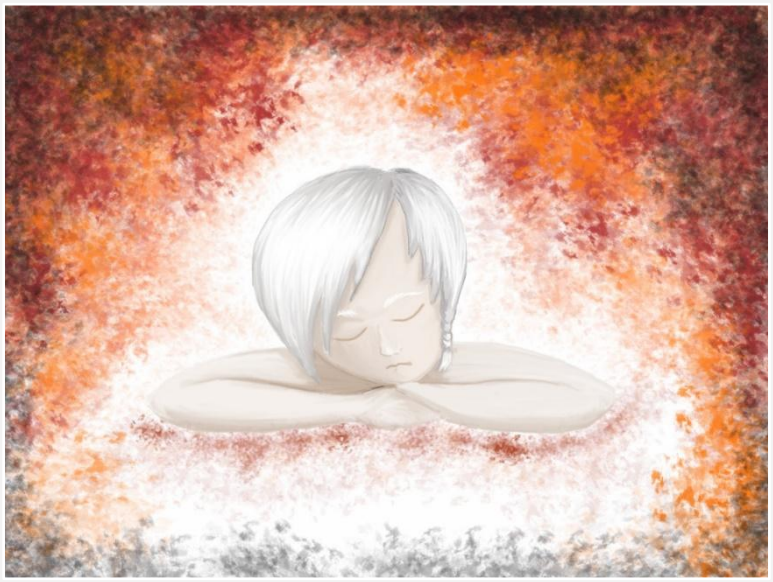


- MEENAKSHI HARI, 1H1

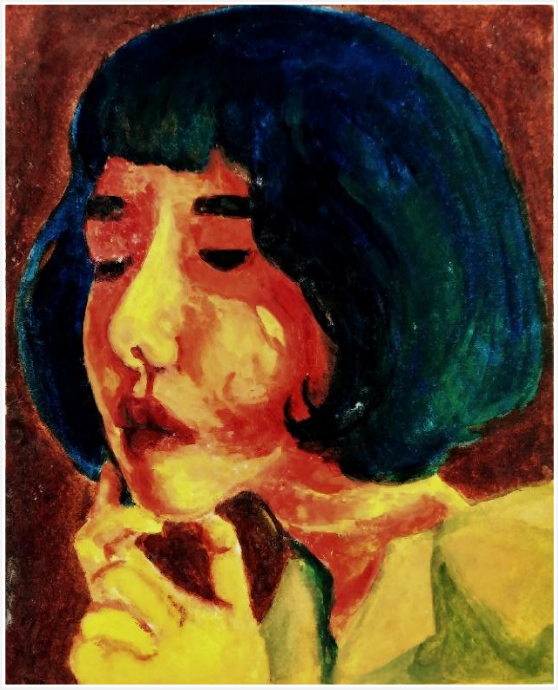


- TUHINA DOLEY , 2H2

- SAKSHI ARORA, 1H2



- KOUSHIKI POHIT , 2H1



– TUHINA DOLEY, 2H2

-TUHINA DOLEY, 2H2

- KOUSHIKI POHIT, 2H1

– *KOUSHIKI POHIT, 2H1*

- MANSI DAGAR, 2H2

"...It was in this hope that the arts were invented. Sign-posts on the way to what may be. Sign-posts toward greater knowledge."

-ROBERT HENRI,

"The Art Spirit"

Innocent Human Activities: A Silent Killer of Environment

By- Manasvi Gautam, 1H1 and Prachi Misra, 3H2

Human activities have been affecting the environment for thousands of years, from the time of our very earliest ancestors. Since Homo sapiens first walked the earth, we have been modifying the environment through agriculture, the industrial revolution, and eventually through urbanization and industrialization. Homo sapiens are considered to be the most destructive animal species ever to walk on Earth. They have led to the extinction of more animal species than the number alive today. Author Yuval Noah Harari in his book titled "Homo-Sapiens" has argued that human growth can be analogous to a virus spreading, devouring everything in its path. Today scientists believe that "pristine nature" or ecosystem untouched by human intervention, no longer exists. Human activities can be directly attributed to the cause of hundreds of extinctions in the last two centuries, versus the millions of years that extinctions naturally occurs. As we progress, humans have changed the world in unprecedented ways.

Human impact on the environment has become one of the most discussed topics all over the world. With the inclusion of Environmental Science in the syllabus at both school as well as higher education, the government is trying to imbibe the value of Mother Nature in young kids and to teach them to mend ways at the earlier stage of life. But can the textbook knowledge be enough to make students learn about the precious natural resources available freely to them? Does the mere learning of definitions guarantee that the child will understand the problematic approach of modern lifestyle s/he has been introduced since birth? That is a debate for another time, this article is not for that. This article is to shock you into believing, how real the problems being taught to us are. How harmful are some of the seemingly innocent parts of our lifestyle to the environment? How we are contributing to climate change without knowing because the concepts in those EVS books are just written and memorized by us. How we don't even pause to wonder whether the activity being performed by us now is related to any carbon footprint and whether it will work towards bringing the impending doom near. We all have studied that things like overconsumption, overfishing, deforestation are dramatically impacting our environment, but have possibly not given a thought about what does this means in the real world. So without further ado let me shock you by describing some of the largest contributors to climate change in the modern world, and no you are wrong it is not vehicular emission or fossil fuel burning for electricity production.

Streaming: Imagine being stuck at home for months on end, with no luxury of stepping out, but with lots of data on your hand, what do you turn towards for entertainment, definitely online streaming services for original and new content. The internet has turned our existence upside down and has become embedded in every aspect of our day to day lives. Year by year web-based traffic is increasing. But this ease of streaming services comes with a hefty environmental price tag. Most of the online traffic (34%) is related to streaming videos, on Netflix, Amazon Prime Videos, and Hulu. **Watching a half-hour show would lead to an emission of 1.6 kg of CO2 equivalent to driving 6.28 km. Last year online streaming produced emission equivalent to Spain and estimated to increase 6 times in the future.** [1]

Online Surfing and Social Media: Till yesteryear, each search on Google also emitted greenhouse gases that contribute to climate change. Despite our notion that the Internet is a wireless technology, it depends on data centers spread around the world connected with kilometers of undersea cables, switches, and routers all requiring energy to run which in most cases comes from burning fossil fuels. **One study from 2015 suggests internet activity results in as much CO2 emissions as the global aviation industry**. CO2GLE was created by Joana Moll, an artist-researcher to create a data visualization. According, to the 2015 internet traffic data, CO2GLE makes an assumption that 47,000 requests are made every second, which represents **an estimated 500 kg of CO2**

[1]https://www.livemint.com/companies/news/half-hour-of-netflix-leads-to-emissions-of-1-6kg-of-co2-equivalent-climate-experts/amp-11572240109579.html

emissions per second. 'A spokesperson also tells that **providing one user with one month of Google services generates about the same amount of greenhouse gas emissions as driving a car for one mile. For every second spent on Google, 23 trees have to use up their CO2-sucking abilities**. Not just Google, Facebook is also a great contributor to CO2 emission. Facebook, for instance, reports that its data centers and business operations resulted in **718,000 metric tons of CO2 emissions in 2016, which is comparable to the annual CO2 output of about 77,500 US homes running on electricity.**'[2]
So next time when you want to search 1+2 on the internet, try using your brain, as it will not only sharpen your wit, prevent Alzheimer's but also save the environment. Let me end this point by reiterating Moll, "What I'm really trying to do is to trigger thoughts and reflections on the materiality of data and materiality of our direct usage of the internet," Moll says. "To calculate the CO2 of the internet is really complicated. It's the biggest infrastructure ever been built by humanity and it involves too many actors…. [But they are] numbers that can serve to raise awareness."[2]

Food: Food is not only important for our survival but it forms an important part of our culture. According to an estimate, **one-third of the food produced for consumption globally is wasted**. This means that all the natural resources like land, water, etc. used for growing processing, transporting, and marketing for this food is also wasted. **22% of material dumped food emits 3.3 gigatons of greenhouse gases**. When food rots it produces methane which is more harmful than CO2. This all is making climate change even worse. Meat and dairy products form a large part of our diet and contribute a huge amount to wasted food. Do you know, **the livestock area is responsible for almost 15% of global greenhouse gas emissions**. Methane is the byproduct of cattle digestion is 25 times more potent than CO2 and even their feed often involves the large application of nitrogen-based fertilizers. [3]

Fashion: Fashion has been the focus of a lot of attention recently, from teenagers to adults everyone wants to look appealing in this first impression based world. Fast fashion has thus proved to be a boon for everyone, it is described by fashion retailers for the cheap and quick equivalent of the catwalk designs. Something like use and throw culture in clothes. Nevertheless "fast fashion" is having a considerable impact on the environment. **The fashion industry produces 10% of all humanity's carbon emissions and is the second-largest consumer of the world's water supply**. What's more, 85% of all textiles go to the dump each year, and washing some types of clothes sends thousands of bits of plastic into the ocean. For example, jeans are a clothing choice of millions because they look good and are comfortable to wear. **But more than 37 hundred liters of water are used in a life cycle of a single pair of jeans**. Imagine the huge strain the fashion industry put on our environment. [4]

Cosmetic products: They are used all over the world to enhance appearance but the range of these cosmetics microbeads. Microbeads are small, solid plastic particles that are less than 1mm in size, that don't degrade or dissolve in water. They are not captured even by wastewater treatment systems. These microbeads in oceans are often mistaken for food, being ingested by zooplankton which is further consumed by fishes, mussels, and ultimately by humans. These tiny plastic particles persist in the environment as they are almost impossible to remove. The best way to reduce their impact is to prevent them from entering the environment. [5] Sunscreen is touted as a protective cover of our skin from harmful ultraviolet rays that causes skin cancer. But research has revealed that chemicals commonly found in sunscreen cause significant damage to coral reefs which are very important for the ecosystem. Going by the numbers the problem is daunting: **14000 tons of sunscreen are thought to wash into oceans every year.** Chemicals like oxybenzone in sunscreen can seep into the water where they are absorbed by corals. These substances contain nanoparticles that can disrupt coral's reproduction and growth cycles, as a result, the mature corals become sterile and this causes younger corals to encase themselves in their skeletons where they starve and die. [6]
If you have reached the end of the article, I am sure one or the other points might have been surprising for you. So, next time when you are going to commit one such innocent mistake, think and weigh out your options, whether this can lead to a much graver future for us. Keep yourself and others informed so that we don't suffer in the future.

Illustration : pxfuel.com

[2] https://qz.com/1267709/every-google-search-results-in-co2-emissions-this-real-time-dataviz-shows-how-much/ [3] https://youtu.be/1MpfEeSem_4 [4] https://youtu.be/xGF3ObOBbac

Space Junk!!

By - Neha Yadav, 1H2

Our imagination

Reality

Be it the launch of Perseverance or Chandrayan, we all watch in awe as humans prove time and time again that sky is not the limit. But have you ever given a thought where the waste produced by these goes? Space junk or space debris is the term used for waste in space such as meteoroids, dust, and the objects, which are no longer in functioning or damaged, left in space by humans. This space debris includes any piece of machinery or leftover dead satellites, non-functional spacecraft, the leftover of launch vehicles stages, paint flecks by erosion or collision from rocket or the crashed rocket pieces, not completely burnt particles from solid rocket's motor, and many mission-related small and large debris.[1]

Around 2,000 active satellites are orbiting the earth and much more than these numbers are dead and are leftover in space as debris or space junk. [1]

This space junk is mostly caused by launched objects from the earth and which get damaged over time and their residue is left in the orbit. A lot of debris is there at an altitude of around 36,000 kilometers in geostationary orbit where the communication and weather satellites are placed, here the debris revolves around the earth in an orbit for several thousands of years, as there is no getting rid of it courtesy Earth's gravitational field.[1] Some space junks are also a result for testing of anti-satellite(this is done by countries to blow their satellites using missiles to test the missile) in the orbits, due to this collision with the satellites both are broken in several thousand pieces and separate apart and create a lot of big as well as small debris in space.

This junk is not only left in space or earth's orbit but also on some of the planets where exploration projects were conducted. **On the moon, the trash left weighs about 190,000 kilograms** includes more than 70 spacecraft and crashed orbiters, urine-collection kits, golf balls, a golden olive branch, flags, a falcon feather and a photograph of astronaut Charles Duke family, and many more things.[1]

As we have established that there is space junk present. Let's get to know, what are some of the problems caused by this waste, generated by humans mindlessly.

[1]https://www.nhm.ac.uk/discover/what-is-space-junk-and-why-is-it-a-problem.html

Problems due to space junk

Due to the increasing space junk, the problems in exploring space is also increasing. These space junks are moving at a very high speed, almost thousands of miles per hour. Due to their speed and volume, they pose a great possibility of colliding, disrupting the path of other satellites, especially to the space station, space shuttles, and other spacecraft where astronauts are present, causing a life-threatening situation for them and can also create a barrier in current and future space projects. [2] These small-sized materials have the potential to damage a satellite to a great extent. [1]

Many space companies have planned to launch a vast group of satellites that beam the internet down to earth to have global coverage of the internet. This will add a large number of satellites to the earth's orbit. [1] So, if there is debris in their path it would lead to fallacies in the data being received by these satellites.

'NASA scientist Donald Kessler said that if there was too much space junk in orbit, it could result in a chain reaction where more and more objects collide and create new space junk in the process, to the point where Earth's orbit became unusable. This situation would be extreme, but some experts worry that a variant of this could be a problem one day, and steps should be taken to avoid it ever happening.'[1]

This problem is not something that will happen in the future, there are many examples where debris collides with spacecraft or satellite and causes damages and increases debris in space as: 'In 1996, a French satellite was hit and damaged by debris from a French rocket that had exploded a decade earlier.'[3]

'On Feb. 10, 2009, a defunct Russian satellite collided with and destroyed a functioning U.S. Iridium commercial satellite. The collision added more than 2,000 pieces of trackable debris to the inventory of space junk.'[4]

'On January 11, 2007, **China** launched a ballistic missile from Xichang Space Launch Center. The payload was a kinetic kill vehicle (KKV) that collided with a non-operational **Chinese** weather **satellite and** added more than 3000 pieces of debris in space.'[5]

The gravity of the situation is real, you might be wondering what the scientists are doing to avert this problem. Let's take a look,

Measures to control space debris

Many missions are launched by several space agencies and governments to control and reduce the space debris with concern for the environment and a safer and prideful take for astronauts.

"The United Nations (U.N.) asked all companies to remove their satellite from the orbit within 25 years after the end of their mission."[1] This task is very difficult as many satellites stop functioning or get damaged leaving their debris behind, which is almost impossible to collect. To do these, several companies suggested solutions such as removing satellites from their orbit using a harpoon to grab satellite or catching it in a huge net or by using magnets to grab it and drag them back into the atmosphere where they burn up. However, these methods are suitable for large-sized debris and not applicable to smaller ones. For smaller debris, one has to wait for them to re-enter the earth's atmosphere and get burned.

NASA has taken the collision with debris in space as a very serious concern and implemented a set of guidelines to combat with each collision threat. These include rules known as flight rules for the precautions to be taken for the safety of the crew in spacecraft from each possible collision**. NASA Orbital Debris Program officially began in 1979 at the Johnson Space**

[2]https://scx1.b-cdn.net/csz/news/800/2020/solvingthesp.jpg[3]https://insidegnss.com/solutions-to-space-debris-problems-addressed-at-european-conference/

Center to look for the methods to reduce the production of earth's orbital debris in space missions and to track and remove the debris which is already present in space. [6]

'NASA and the Department of Defense (DoD) co-operate and share responsibilities for characterizing the satellite (including orbital debris) environment. DoD's Space Surveillance Network tracks discrete objects as small as 2 inches (5 centimeters) in diameter in low Earth orbit and about 1 yard (1 meter) in geosynchronous orbit. Currently, about 15,000 officially cataloged objects are still in orbit. The total number of tracked objects exceeds 21,000. Using special ground-based sensors and inspections of returned satellite surfaces, NASA statistically determines the extent of the population for objects less than 4 inches (10 centimeters) in diameter. Collision risks are divided into three categories depending upon the size of the threat. For objects, 4 inches (10 centimeters) and larger, conjunction assessments and collision avoidance maneuvers are effective in countering objects which can be tracked by the Space Surveillance Network. Objects smaller than this usually are too small to track and too large to shield against. Debris shields can be effective in withstanding impacts of particles smaller than half an inch (1 centimeter).'[6]

'One approach advocated by the Henry L. Stimson Center's Space Security Project is the negotiation of a code of conduct between space-faring nations to prevent incidents and dangerous military activities in space. Key activities to be covered under such a code of conduct would include avoiding collisions and simulated attacks; creating special caution and safety areas around satellites; developing safer traffic management practices; prohibiting anti-satellite tests in space; providing reassurance through information exchanges, transparency and notification measures; and adopting more stringent space debris mitigation measures.'[7] This measure has been adopted in some form. Inter-Agency Space Debris Coordination (IADC) Committee is an inter-governmental committee formed in 1993 whose aim is to coordinate efforts to deal with the debris. It has 11 countries as its members.

Not just the USA, but other countries are also putting in efforts by either developing technologies or participating in treaties to clean up our space. 'JAXA, Japan's space agency, is testing an electronic space whip that stretches six football fields long, known as the electrodynamic tether (EDT). The electrified line, nearly 2,300 feet long, is capped with a 44-pound weight. When deployed, it's intended to knock debris out of orbit, sending it to burn up in Earth's atmosphere.'[7]

India is also tracking space debris using a multi-object tracking system(MOTR) developed by Satish Dhawan Space Station. This allows ISRO to track 10 objects simultaneously and ISRO is also a part of the IADC committee and coordinates with global efforts to reduce man-made debris by sharing research and identifying debris mitigation options. [9]

Whether these measures will bear fruit in the future is what needs to be seen, for now, let's cross our fingers and hope that the junk dumped by us in space, will not be a cause of death of an astronaut.

[7]http://web.mit.edu/stgs/pdfs/Orbital%20Debris%20Convention%20Thierry%20Senechal%2011%20May%202007.pdf[8]https://www.nasa.gov/mission_pages/station/news/orbital_debris.html[9]https://www.hindustantimes.com/india-news/space-debris-is-a-problem-but-don-t-blame-it-on-isro/story-ASKajnnw40Rigu4allSUCJ.html

"A poem begins as a lump in the throat, a sense of wrong, a homesickness, a lovesickness."

– ROBERT FROST

PAUSE
By Amrutha V. Devan , 1H1

I forgot to run the machine.
Pause.
Wind stuck in the twist bough.
Forgot to whip.
Past midnight,
Staring at the ceiling,
Before the jerking of alarm,
Skipped the nightmare and failed to boo.
Between the smoke,
Chimneys deterred.
Wheels went for a holiday.
Roamed around the forsaken places.
Brushed the memories.
Recalled and surrendered.
What happened?
I forgot to run the machine.
Pause.

@lollalette

CHEMISTRY
By Tanya Wadhwa, 2H2

What's going on? I am unaware
The effervescence – I don't give a care
Hydrocarbons, chemical formulae oops, I can't recall
Please give me some perfect alchemy that I can control
I'm not supposed to suffer with such tediousness
My experiences don't recall such dourness
Robert Boyle, the guy who started it all
Totally deserves to be damned in lochness

THE SHOW MUST GO ON
By Chhavi, 1H1

There is a need,
There is a need to understand who tries to instigate and who tries to motivate.

The world is very fake,
where people beat about the bush.
They will try to prevaricate,
in order to hide the truth.

The people here aren't trustworthy,
but deeds of some are noteworthy.
many try to degrade,
only some think to upgrade.

It's just a game of carrot and stick,
life isn't harder, the rules are rather strict.

One has to face rebukes,
one has to fight.
Also it's needed to know,
barking dogs seldom bite.

Sabotage the fear,
The fear of losing,
the fear of the defeat or not being admired.
or either wield it
to set the Thames on fire.

At times the future may appear bleak,
you may be sluggish, but you are not weak.

Vent out the anger,
shed out some tears.
If people do satire,
you have the weapon too.

Be a philocalist,
laud the nature's grace.
The world is atrocious,
people try to embarrass.

Let the heart glare,
and the mind be on lease.
Let the real you come out,
leaving behind the tease.

@miles_art · Miles Johnston

It's high time to take up arms,
to encapsulate the terror,
to neglect the incendiary thoughts
and brawl the unseen ghost.

Don't procrastinate,
else it would be too late.
Disparage the myths, quell the taboos,
and let the people rejuvenate.

NOTHING is immaculate, everything has loopholes.
O' the lord almighty save our innocent souls.

"Poetry is thoughts that breathe and words that burn."

- THOMAS GRAY

@miles_art

Miles
Johnston

UNLIT LOCALE
By Mansi Dagar, 2H2

It is a perilous journey
Into the unknown, with no guidance,
Mental affliction and physical pain at every curve,
and an uncertain outcome!

Isolated in my own compound,
my forces being shred,
I feel a stab of agonising anxiety.
But that is nothing compared to what I usually feel.
Unexpected tears prick my eyes,
and a lump swells in my throat.

The cell surfaces pocked with pores,
I run harder,
but war cry rings in my ears,
taking a firm grasp of my arm,
pulling me in a rather strong headlock.
They seem to writhe in place as bulbous nodules
and spiky protuberances rupture someone's skin.

Have I made a heck of a mistake,
that caused untold misery?
Haven't I opposed this bondage,
this pulverization of a human life?
Those who do not have a peaceful conscience,
dread death even though means nothing,
but physical torment.
Ostensibly sympathetic to those on the raft,
same as mine,
descrying a ship barely visible over the skyline.

ALMIGHTY
By Vanshika, 2H2

Unique is his identity
In every moment, in every jiffy
He couldn’t be seen
But he is, even in the place which is lean
Exists in you and in me
Trust him if you want anything to be
He’ll resolve, he’ll sort out
In his house there is no place of doubt
He’ll give whatever you wish

By him, even a single thing can’t be missed
On this huge Earth
Things by him have eternal worth
There is justice in his court
At every phase he’ll support
Have a faith, have a loyalty in him
And then see, he’ll lift you upto the brim

GROWING UP AND OTHER THINGS
By Tuhina Doley, 2H2

When I was a kid I'd pray for unicorns and princess dress-ups
The stars far beyond this solar system and alien spaceships

But then I'd end up settling for colouring books to paint unicorns in rainbows
Blank sheets to sketch a princess from another galaxy
And plastic neon glow-in-the-dark stars that burnt an alien-green when you switched the lights off.

It's alright - God is busy.

When I became a teenager
I heard the word "atheist" for the first time.
Atheist: Someone who lacks belief in the existence of God

How do you make a thirteen-year-old understand God and Religion and Belief and Faith?
You don't.

So, I just put the word under my list of cool-words-that'd-make-you-sound-unique

I reach eighteen
It's been five years since God has turned from a full-time Santa to a part-time (examination period only) charity-case help

It's alright - God is tired.

I'm twenty now
Two years since I've realized God cannot provide two things:
1. Things that do not exist
2. Things that do exist

So, I recheck my wish list again:
Unicorns exist as much as you do
Princess dress-ups are faces you wear for different people
The shooting stars you wished on are just dust and rocks-People you looked up to can't save you anymore
And aliens?
You treat your own as such.

I cross my shit-list off.

@tatitheoverlord
Tatiana Bonin-Giust

HOME
By Tuhina Doley, 2H2

Home was pain
The pain of arguing
And not talking at all or talking way too much but not quite understanding anything
Or understanding everything but pretending not to.

Home was hard
Hard like a seed coat
It was suffocating at times and cut you off often-but was necessary.

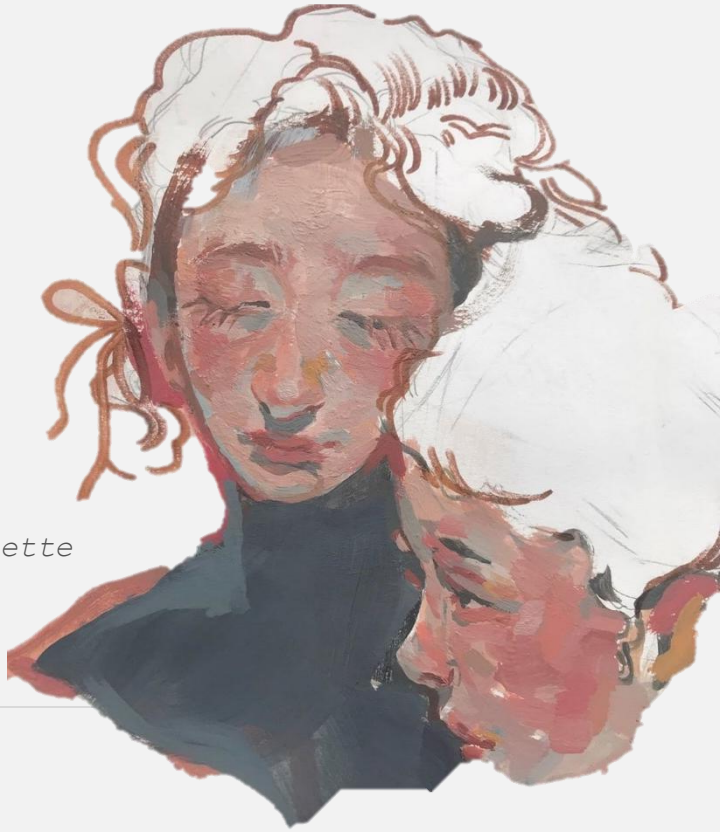
Home was music
Music that was ever-present
And made you teeter between insanity and comfort
You could never shut it down; it was too quiet otherwise.

Home is obsession
(What else would it be?)
You keep on failing yet they only see you trying
You keep on drowning over and over again in the same puddle of self-deprecating tears
Yet they tell you-"You're doing good, sweetie."
You play like a broken record the same song on loop
And they listen to it for the 100th time
As patiently as they had the 1st time
You never understand why
They don't try to make you understand either
They just remind you to eat on time and drink water and tell you to be proud of yourself.

Home is words you will never quite understand
Yet the only ones that will mean so much.

"We are writers, my love.
We don't cry, we bleed on paper."

- ALI Y.



@lollalette

Current Status of Science Education in India

By - Prachi Misra, 3H2

Essay selected amongst the top five entries for the scientific essay writing competition 2018, organized by National Academy of Sciences India.

"The scientist is not a person who gives the right answers; he is the one who asks the right question"

\- Claude Levi Strauss
(French Anthropologist)

You must be surprised why did I start the essay on "Current Status of Science Education in India" by a quote explaining how to be a good scientist but don't be as this is exactly where the answer to this central and vital question lies. Yeah, according to me the current status of science education in India is not as good as we want it to be with our best science-based institutions like IIT's, IISc's not even being able to carve a notch for themselves in the elite 200 of THE World University Rankings 2018. Moreover, no Indian scientist has been able to procure the most prestigious award "THE NOBEL PRIZE" since 1930. Poor graphics for a country known for exporting tech geeks to the world ranging from Satya Nadella to Sundar Pichai leading multinational pioneers of IT industries namely Microsoft and Google. Then what went wrong, are we short of great minds or ideas or we have still not learned the right way to teach science, a subject which runs in our veins as evident from the technological advancements made by us during Indus Valley Civilization. I think the last option is the right answer to the question being asked here. Yes,we have still not mastered the way to teach budding scientists, not understanding how to expand the limits of science to incorporate their new and fiery ideas. So how did we reach here, from being World's teacher during our Golden Era of Taxila and Nalanda, is a question we have whence we have to ask ourselves. Let's rewind a little and go back to the time of our Independence and dig the roots of this menacing problem.

When the British left India with bittersweet memories, they didn't forget to give us parting presents. Yes, they gave us roads, rails, English, and more importantly our education system which produced some of the greatest minds like CV Raman, Jagdish Chandra Bose, and many more. We inherited their system with some minor changes not giving importance to Gandhi's and Tagore's alternative models. Then with passing time we became more and more aware of the advancements happening in Science throughout the World, and felt that they needed to be known to the students studying the subject and hence ended up cramming the textbooks with factual knowledge forgetting the basic fundamental pillar of science that "Science is a way of thinking much more than it is a body of knowledge"

-Carl Segan

Thereby making the blunder of rendering it boring and uninteresting for the students and dissuading them from taking it up. But society said otherwise and started to rate the student's IQ on the subject s/he took. Science was for students with a high IQ, Commerce for a slightly lower group and Arts was for someone who just needed to earn a degree in some subject or other. Here I should also stress the fact that in this process of making more scientific youths for a prosperous and bright India of our dreams we forgot to offer them vocational education which even the father of our nation- Gandhiji wanted to introduce in our education policy. Thereby setting up a perilous trend by hands of which the vocational studies are murdered even today leading us to a situation where we are short of institutes offering vocational courses and industries employing them who have the courage to do so.

Let's not forget our journey of reaching the root of the problem and after this phase came, the phase of engineering as I would like to call it, whence everybody on seeing scope and jobs in that particular field started pursuing it with or without interest. Sometimes for a stable job or at others due to the pressure of our beloved society. Hence science became synonymous with engineering for mathematics and medical for biology students, totally forgetting the purpose behind which it was taught to them. B.Sc. courses were taken up by those who didn't want to pursue either of the abovementioned courses and did thus found a way out of it by condescending to do B.Sc. wherein they could get a good job of teaching it to a whole other lot of uninterested group alike to them. Well, I have not painted the full picture of this interesting scenario as I have forgotten to tell you about the group of students who did like the subject and wanted to do something big in it and bring laurels to our country. You must be thinking yes what happened to them, where are they hiding in this gloomy picture. Don't worry I have not forgotten them so as to stress upon my point that the present scenario of science is a little bit worse than our contemporaries like China, Singapore amongst others. So those students, who are genuinely interested in science and have taken it up to nurture their interest are subjected to an overload of factual information giving almost no importance to the experimental side of it, making them lose interest by and by in this awesome subject.

While talking about the trends surrounding science amongst those who were studying it, we should also talk about the positive initiatives taken by the government to promote scientific education. The first that comes to my mind is the Hoshangabad Science Teaching Programme (HTSP) which was started in 1972 as an effort by the Madhya Pradesh Government to promote the experimentation side of science by teaching middle school science through experiments, in just 16 schools of Hoshangabad district in Madhya Pradesh. But was abruptly closed in 2002 the time when it had spread its roots to 1000 schools in 16 districts.[1] Next in line are government-funded programs like INSPIRE which stands for "Innovation in Science Pursuit for Inspired Research" is an innovative program sponsored and managed by the Department of Science and Technology for the attraction of talent to Science. 'The basic objective of INSPIRE is to communicate to the youth of the country the excitements of creative pursuit of science, attract talent to the study of science at an early age and thus build the required critical human resource pool for strengthening and expanding the Science and technology system and Research and Development base' as claimed by their very own website.[2] INSPIRE provides undergraduate and postgraduate students with scholarships and internships to pursue its above-mentioned goal. But the problem of this kind of approach is that the basis of selection for these prestigious fellowships is the ever prevailing board results or in other words marks, which as accepted by some of the greatest minds is a faulty one although not completely unreliable. It can't be explained better than the words of Albert Einstein which goes like this

"If you judge a fish on its ability to climb a tree, it will live its whole life believing it is stupid"

Illustration : GoGraph.com

1]https://www.indiatoday.in/magazine/education/story/19840715-hoshangabad-science-teaching-programme-makes-science-fun-for-school-students-803149-1984-07-15 [2] https://www.india.gov.in/official-website-department-science-and-technology

No, I am not saying that marks or credits don't reflect a person's scientific aptitude, they do but sadly not completely. Hence the process of selection needs to be more evaluative in terms of experimenting wherein, a certain weightage should be given how a student is able to perform in laboratories and whether s/he tries to implement all the factual information that has been spoon-fed to her/him since the beginning of her/his education.

This leads me to another problem holding back our advancements in science, which is a lack of understanding of real science i.e. our faulty definition of science. Let's make sure you understand the point I am making here and we are on the same page. Rewinding a little and going back to the place from where we started that quote in which I told you, lies the real solution to this current degrading status of science in India. Yes, according to Claude Levi Strauss the real scientist is the one who asks the right questions, but does our mentality comply with this definition, can we believe our budding scientist for once not answering in board examinations or IIT entrance exam and asking questions in their class. For once not mugging up facts and works of great scientists and wondering in awe of their discoveries but finding fault in their logic. Painting this kind of picture in front of your eyes is difficult right. And herein lies the fundamental fault in our reasoning of being a good scientist. We imagine a good scientist to be knowledgeable in all the fields and working hard to expand its limits but no, science is also about testing our fundamentals, questioning our basics, and making our foundations strong. Another problem with our definition of a scientist is the presumption of her/him excelling in her/his studies and having a lot of degrees with all A+'s on it. Not believing in those who are self-learned or self-taught, a presumption on which people like Arunachalam Murugananth and Thomas Alva Edison don't fit as both had to drop out of school due to different circumstances.

But look what they became – legends, one a person on whom India is proud because of his path-breaking invention of low-cost sanitary pads making machinery and another one of the greatest scientists of all times.

But no my list of "all things wrong" doesn't end here. Last but not the least is the problem of the end product churned by this machinery, a product of scientist who believes that they are scientific and have the ability to transform the world but forget to transform themselves. The problem of lack of scientific temperament, yes it does exist. These scientific personas forget that by just learning and memorizing some formulas, working out difficult problems, and performing experiments in laboratories aren't the only key ingredients of becoming a scientist. The salt of this delicious dish is nothing but scientific temperament – a process of rationalizing any situation with the help of logical thinking and hence finding out of the box solution or in some cases just the solution out of a difficult problem. It is the art of believing that nothing is impossible and having absolute faith in oneself, which we are still in the process of developing and understanding. Science is not an island the road to which is full of boring formulas, experiments and requires a high IQ, it is like an ocean consisting of all of mankind and is there in their life one way or another and a subject anybody can study if s/he wants to.

Lastly, not all is bad in the current status of science education in our country we still have ISRO's scientist to be proud of. They have proved that India is still and will be a hub of great minds but we just need to weed out certain problems in our education system and voila we have one of the best education systems in the world and will start churning out not just good scientist but also great artists, musicians, dancers, economist, orators and best in all fields as we have the potential in 1.324 billion citizens.

ENTREPRENEURSHIP AND SCIENCE

By – Palak Awasthi, 3H2

Figure 1)Tesla Roadster in space (could this BE any cooler)

Entrepreneurship in Science is not unheard of, but if you actually pose this question to a common person, the most received answer will include SpaceX in some form. The journey of SpaceX has been an interesting one culminating into it being an internet sensation one whose name is easily found amongst people no matter which walk of life they belong to.

On February 6, 2018, the first picture of Musk's cherry-red Tesla roadster and its mannequin driver, Starman, which was sent as a dummy payload for falcon heavy, surfaced online. Everyone was surprised but it was not the first time something extraordinary was done by SpaceX, or the person behind it, Elon Musk. If we look back and trace its journey we can see that there's a lot more we can learn from the company, even after 18 years of its existence.

SpaceX was founded on 6 May 2002. It started out as a vision, as far off as it may seem even now, to send humans to Mars and maybe one day successfully colonialize it. Elon Musk as we know him today has a fair share of achievements in his name be it Tesla Corporation, PayPal, or our very own, eBay. Currently, the market value of SpaceX stands at around 36B USD and Tesla around 286B USD, which are only 2 of the major projects endorsed by Mr. Musk.[1] The other notable investments include Hyperloop (to make traveling easier and faster using air pressure variation technology), the boring company (a tunneling unit started off as a subsidiary of SpaceX but is now a fully grown independent company), Neuralink (a neuro-technology based company that is developing the implantable brain-machine interfaces: BMI) and OpenAI (has the 'stated goal of promoting and developing friendly AI in a way that benefits humanity as a whole')[2]With all these investments under his belt, Elon Musk has undisputedly become the "father of entrepreneurship" in USA.

All these units are totally different from each other and yet they are similar in a way that all of them are based on innovation in science and have some larger objective than what their tagline might say and are now giving a tough competition to the mainstream big Corporation. For example, OpenAI is now in a race with Google's Deepmind which has somewhat similar goals but is backed up by the tech giant Google. Tesla just threw out Toyota from the highest valued automaker's chart-topper and SpaceX, well it doesn't have a competition.....YET
Looking at all this you might think that Musk is arguably the closest thing we have to Tony stark :)
So how did it actually happen and could we do something similar??

Illustration : wikipedia.org

[1] https://en.wikipedia.org/wiki/SpaceX[2] https://en.wikipedia.org/wiki/OpenAI

Figure 2 - Falcon 9 landing safely back on Earth, ready for reuse.

So here comes the reality check, SpaceX as we know it, is the only private company capable of returning a spacecraft from low-Earth orbit and in recent days have been collaborating with NASA, by sending their scientists to the International Space Station. While most rockets are designed to burn up on reentry, SpaceX rockets can not only withstand reentry but can also successfully land back on Earth and re-fly again. But it didn't go as easy as it sounds. His first two attempts failed brutally. And since making a fully working rocket isn't a cheap deal, he had only one attempt left and if it didn't work...well, then the company could have gone bankrupt. But they took the risk and we all did witness history being created. The success was phenomenal but so was the risk involved.

Coming to the situation in India, we're currently witnessing hot debates on how we need to make India "atmanirbhar" which translates to self-sufficient, synonymous to entrepreneurship in business lingo. But as cool as the word 'entrepreneurship' sounds, it's not all gold and rainbows. Indian market currently depends on foreign products more than you'd ever know. Take an example of the electronics industry- according to statistics "In FY 2019, India imported electronic products valued at nearly four trillion rupees. This sector of imports accounted for nearly 11 percent of all imports into the country that year. Products include computer hardware, consumer electronics, electronic components and instruments, and telecom instruments."[3] And we all know how much electronics are needed in assembling stuff like falcon heavy. So for now unless you're backed up by a really capable venture, assembling rockets is still a distant dream for a budding entrepreneur in Science.

But as always, people come forward and prove that with the right mindset, hurdles will only help you learn more. As of today startups like 'Gridbots' and 'Sastra robotics' have gained phenomenal success in the field of robotics in India and are constantly producing commercial robots. But still, they have a long way to go if they want to be in competition with the other tech giants.

There are also talks going on for the privatization of ISRO and its counterparts. Although ISRO already has strong connections with private individuals for various product developments. 'India has possibly taken its first big step in that direction with the central government setting up New Space India Limited (NSIL) earlier and now IN-SPACe (Indian National Space Promotion and Authorization Centre).'[4] It's true that privatization reduces cost and increases competition but this takes time and effort like nothing else. Since there are no major players in this field in India this is why it becomes a humongous task to bring together small entities and help them grow.

Hence, Science Entrepreneurship in India still continues to be in nascent stages even though we as a country boasts of a high number of software professionals working all over the world. Entrepreneurship in science is a hard nut to crack and therefore, to go on with your idea and make your name in it, is an achievement in itself. But despite all that, it is worth the journey...

Illustration : flickr.com

[3]https://www.statista.com/statistics/625751/import-value-of-electronic-products-india/#:~:text=In%20fiscal%20year%202019%2C%20India,and%20instruments%20and%20telecom%20instruments.
[4]https://www.indiatoday.in/news-analysis/story/india-s-nasa-why-privatisation-of-isro-is-the-right-call-1692576-2020-06-25

AI and ML - The Pillars of the Future

By - Anusha Pandey, 2H1

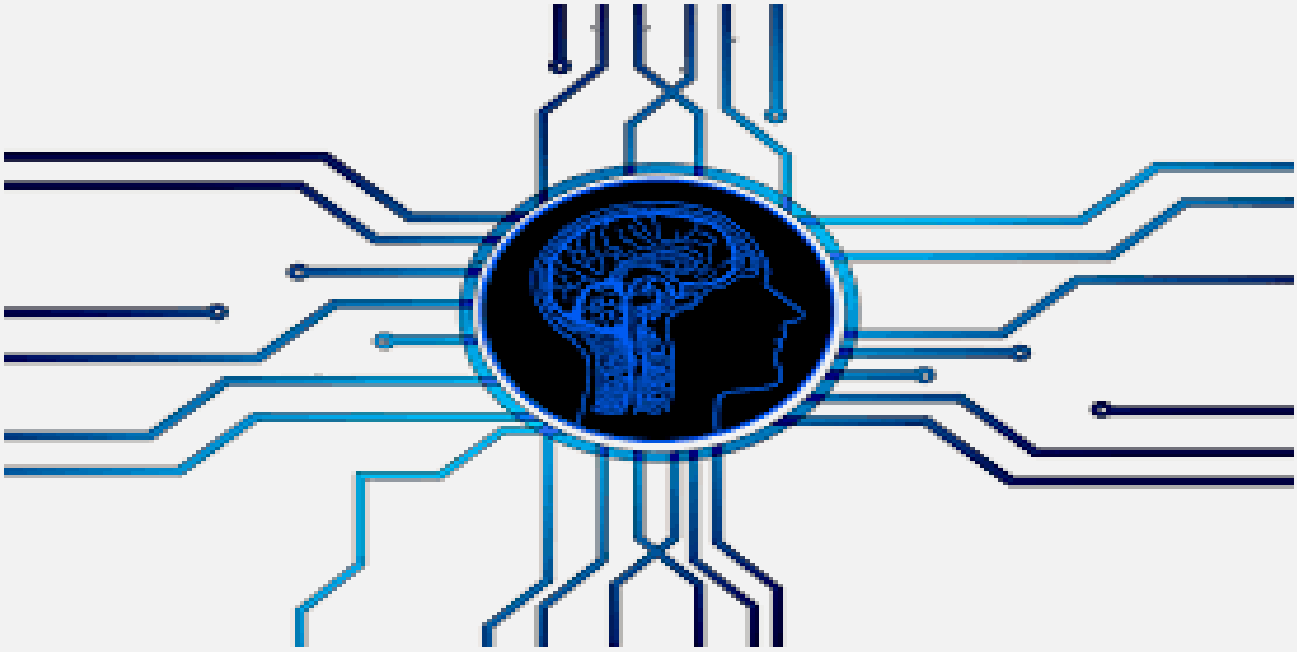


Illustration : pixbay.com

Since ages, books and different media have facilitated us with fantastical images of times at the zenith of technological advancements. These media give us a glimpse of the worlds where machines are capable of anything that man can do, and more- from completing mundane daily chores to finding the answer to the meaning of life, the Universe, and everything in two simple digits. And while reality has yet to achieve the heights of success set by fantasy, we are, by no means, a novice in this field. The mainsprings in all innovation and development in this direction are Artificial Intelligence and Machine Learning.

Intelligence can be summarily defined as the capacity of logic, learning, critical-thinking and problem-solving. Simulation of this human intelligence in machines is called Artificial Intelligence. It is based on the idea that human intelligence can be broken down and explicated in ways that can be understood and mimicked by machines. While the idea sounds complicated in theory, the progress in the applications of this field is so fast that benchmarks are crossed and renewed every single day. A calculator, for example, which in its time was deemed to be a milestone, is now taken for granted as an inherent part of any device.

AI has made some major breakthroughs in the past few years. ELIZA, in 1966, was the world's first chatbot which can be seen as the ancestor of voice recognition software like Siri and Alexa today. It showed the implementation of Natural Language Processing- the ability in machines to understand and communicate with us in human languages.[1] In 1997, IBM's supercomputer Deep Blue defeated the chess champion of that time in a single game, showing the competency of machines in learning such complex skills.[2]

[1]https://en.wikipedia.org/wiki/ELIZA[2]https://en.wikipedia.org/wiki/Deep_Blue_(chess_computer)[

2012 saw the publishing of a paper by researchers from Stanford and Google which elucidated a machine's capability of recognising images of cats without any external labelling of the data. The paper was monumental as it also set out a sketch of an artificial network to be built consisting of 1 billion connections, a significant advancement towards building an 'artificial brain'.[3] In 2015, the ImageNet challenge- a platform that evaluates the proficiency of different algorithms in recognising and describing a library of 1000 images- saw the machines outperforming humans in image recognition.[4] In 2018, another precedent was set when Google parented company Waymo launched 'Waymo One', the first commercial self-driving car service.[5] Even today, when the world is plagued with the coronavirus, numerous researches are already underway on how to use AI to effectively fight it.

The successes achieved by AI are many and the methodology behind them is known as Machine Learning. Machine Learning can be understood as the study of algorithms that enable a machine to learn on its own through its experiences. While in programming, the inputs, parameters, conditions, etc. have to be manually given, ML algorithm provide the data and enable the machine to get its own inferences. This can be done in broadly two ways- Supervised Learning and Unsupervised Learning. In Supervised Learning, for example, labelled pictures of cats and some other animals are provided to the computer. The machines segregate the images by these labels and study them, finding patterns that are responsible for the pictures to be categorized under a certain label. Thus, by studying all the pictures labeled 'Cat', the machines find the similarities and arrive at a model which can find if any new image given to it is that of a cat. Unsupervised Learning, on the other hand, provides a database of pictures without any labels and lets the machine do the pattern recognition without any outside input. In this case, the machine segregates the images based on its own recognized patterns instead of labeled directives and arrives at a model on their basis. These techniques allow the computer to draw its own conclusions in the future, based on its past experiences.

Artificial Intelligence, with the help of Machine Learning, has the potential to automate a majority of work today and making it more efficient. But this advantage comes with its own set of drawbacks. The advent of AI is looked at with fear that it will make human work obsolete, lowering the job opportunities and in the long run, bring more harm than good. But as Satya Nadella, CEO of Microsoft, rightly said, 'AI should augment human workers, not replace them'. Ultimately, the creation and enhancement of AI are in our hands, and by using it judiciously, we can ensure that it does minimum harm while providing maximum improvement to our futures.

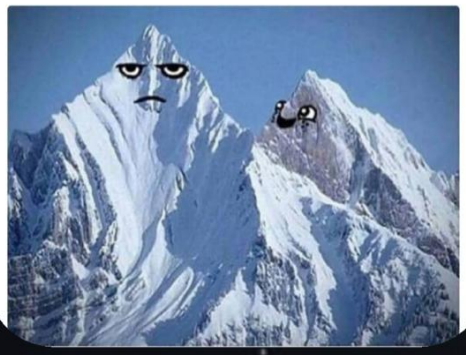
Illustration : pixhere.com

3] https://bernardmarr.com/default.asp?contentID=1770 [4] https://en.wikipedia.org/wiki/ImageNet [5] https://en.wikipedia.org/wiki/Waymo

Wacky Talks

By – Palak Awasthi, 3H2

That one annoying lab partner



No amount of words can express how much I love Newton's rings exp.....

but numbers can 0/10

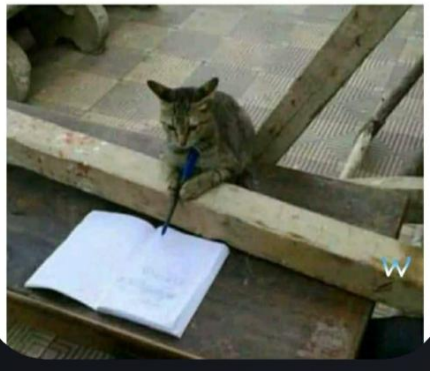
PRO-TIP

If a science student asks to co-author a research paper with you - it means he /she really likes you .....

....but as a FRIEND

Tasting fruitbeer from pam for the first time ;)

Made her study 'cause "Miranda me ho to padhna to padega"

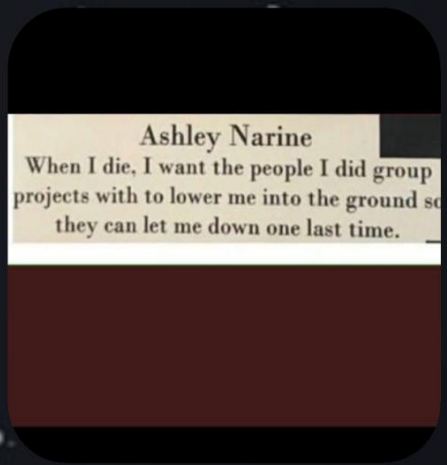


science nibba after speaking about gravitational waves in the middle of anything

My one braincell at the math test:

स्वर्ग लोक	SEC Lab (play chair race in AC)
धरती लोक	LT1,2
पाताल लोक	PC2 (in scorching heat)

MH cat as soon as I open my pack of bhujia -



HUNTING THE GHOST PARTICLES: NEUTRINOS

By - Rashi Wadhwa, 3H2 and Roopal Bansal, 1H2

Neutrinos are teeny, tiny, elusive but fundamental particles. We are engulfed in neutrinos. “More than 100 billion neutrinos pass through our thumbnail every second." They keep rushing through everywhere, from outlying galaxies, from exploding stars and also big chunks of neutrinos are produced in the core of the sun. Traveling at nearly the speed of light, nothing stops them; they keep going straight through the Earth, all the time, day and night, in copious amounts.

As nothing, apparently stops these subatomic particles, it becomes very difficult to detect them. For a neutrino, every detector, every instrument, or simply everything is mostly space, as empty as cosmic space is for an asteroid. Being neutral and light-weight (or even no weight) adds up to the trouble furthermore as we can’t even use electric and magnetic forces to capture them. They do not interact at all, hence get the name “ghost particles."

The story of neutrinos started with the puzzling aspects of beta decay: the conservation principles of energy, linear momentum, and angular momentum were, apparently violated. The electron energies observed in the beta decay of a particular nuclide were found to vary continuously from 0 to a maximum value KE, characteristic of the nuclide. The direction of the emitted electrons and the recoiling nuclei was seldom exactly opposite as required for linear momentum to be conserved. The spins of the neutron, proton, and electron are all (½). If beta decay involved just a neutron becoming a proton and an electron, spin (and hence angular momentum) was not found to be conserved. And for a moment all seemed lost, as the validity of the foundation stones of Physics was in question.

In 1930, Wolfgang Pauli proposed a ‘desperate remedy’: if an uncharged particle of small or zero rest mass and spin ½ is emitted in beta decay together with the electron, the above discrepancies would not occur. This particle was called a neutrino, a “little neutral one” by Fermi. And hence the search of these elusive ghost particles began.

In 1956, neutrinos were detected for the first time in history. Fred Reins and George Cowen exhibited how neutrino and electrons were emitted during beta decay of the nucleus. The experiment was carried out near a nuclear reactor with a tiny detector. It detected around 3 neutrinos per hour when the nuclear reactor (according to their calculations) was creating nearly ten trillion neutrinos per second. Although the number of neutrinos spotted sounds minute now, but this small number changed the course of history forever for physicists. They examine neutrinos to learn more about the events and processes from which these subatomic particles have their origins.The Standard Model states that neutrinos are nearly massless and have no electric charge. And so, unlike all the other particles, they can only interact using the weak nuclear force. Weak Force involves the exchange of W and Z bosons. W boson has an electric charge but Z boson is electrically neutral. Both are heavy particles, each having a mass about 100 times the proton's mass. Neutrinos emit W or Z bosons, which further break apart atomic nuclei. This debris then smashes into atoms and those interactions are detected. Presently, we know of only three types of neutrinos: electron neutrino, muon neutrino, and tau neutrino. The name of each "flavor" of a neutrino is derived from its corresponding charged

They also have corresponding antiparticles, collectively called antineutrinos.
Rather than roaming around in a singular state, neutrinos travel as a mixture of the three flavor states which are known as the mass eigenstates.

Fig 1: The types of neutrino

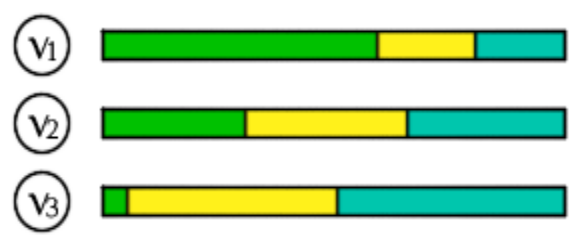


Fig 2: The three mass eigenstates.

The three currently known mass eigenstates are called ν1, ν2, and ν3, and their proportion of mixing is shown in *fig 2*. As the neutrinos travel, this "neutrino mixing" causes them to oscillate between the three flavor states.
Fermilab explains oscillation by imagining a sports car, changing into a bus or minivan as it goes down the highway, then changing back to a sports car. Through neutrino oscillations, all three flavors of neutrinos can change into one another. [1]
The 2015 Nobel Prize in Physics was awarded to two physicists- Takaaki Kajita and Arthur B McDonald, whose teams discovered that neutrinos, which come in three flavors, change from one flavor to another. This discovery provides a conclusive answer to the assumption that there is physics beyond the Standard Model and thereby is a major milestone in particle physics. Hence, neutrino oscillation is a quantum mechanical phenomenon, the result of which is the creation of a neutron with a different lepton flavor than the one it previously had.

Scientists worldwide believe that after the Big Bang, there was an equal amount of matter and antimatter. But this contradicts our view of the universe, as had this been the case then there should be no matter or energy due to the annihilation of matter and anti-matter. The answer to this puzzle seems to lie in neutrino oscillations. These oscillations violate CP symmetry – which tells us that for every matter particle there is an antimatter particle with opposite charges. The CP violation measured in neutrinos might be the reason why we are surrounded by matter.

'Federico Sanchez and his colleagues at Tokai to Kamioka (T2K) collaboration examined data on muon neutrinos and antineutrinos changing flavor from 2009 to 2018, looking for differences between the oscillations of the neutrino and antineutrino beams. They ruled out CP symmetry with 95 percent confidence – in fact, the data favored the maximum possible amount of CP violation.' [2]
Such flavor changes also require that neutrino flavors have 9 different masses with significant mixing. The implication of which is that neutrinos are not massless and, hence, can participate in gravitational forces as well.
These discoveries and subsequent developments have opened a vast new program of research that seeks to answer questions regarding neutrino flavor and masses and their role in the universe. These include:

- Do neutrinos and antineutrinos oscillate in the same way?
- Is there a pattern in the fundamental parameters which relate the neutrino flavor and mass states that point to new symmetries or physics?
- What is the pattern of neutrino masses and why are they so small, more than a million times smaller than the electron? Do they get masses from a different source than other particles (e.g. the Higgs mechanism)?
- Are there additional species of neutrons than those we know about? Do they have exotic properties
- What role do neutrinos have in the evolution of the Universe? [3]

[1] https://www.nevis.columbia.edu/daedalus/motiv/neutrinos.html [3] https://sites.slac.stanford.edu/neutrino/research/neutrino-oscillations

LIGO-India

By – Rashi Wadhwa, 3H2

Fig 1 Engineering concept design of LIGO-India at one of the shortlisted sites in India.[3]

The most interesting discovery made during our teenage years is the detection of gravitational waves. Their detection opened up a new avenue in Physics, a path that allowed us to witness catastrophic events in space without actually seeing them. All this was possible due to a very sensitive instrument called Laser Interferometer Gravitational-Wave Observatory or LIGO in short.

Nowadays, India has taken the forefront of this conversation with LIGO-India taking forward this rich legacy. Yes, you heard it right LIGO is being established in our very own country. Many scientists from India are working within the area of gravitational wave detection as a part of the LIGO international collaboration. The Indian Union Cabinet approved the LIGO-India mega-science proposal on Feb 17, 2016. This formally embarks a group of determined scientists of the pan-Indian gravitational wave physicist consortium (IndIGO) and therefore the LIGO-India teams on an incredible adventure during a blossoming big-science frontier. What lies ahead for LIGO-India may be a tough and challenging path of multi-institutional scientific collaboration alongside major industries in India to create a complicated LIGO on Indian soil over the subsequent 8 years then operate it at its design sensitivity for the subsequent decade, or two. The direct detection of gravitational waves has opened a replacement door to the core of astrophysical phenomena within the universe and allows an experimental probe of gravitation theory in extreme situations like two merging black holes (one such resulting gravitational wave was the first to be detected),supernova exploration, and gamma-ray bursts from coalescing neutron stars.

Gravitational waves as predicted by Einstein's General Theory of Relativity were detected by the Laser Interferometer Gravitational-Wave Observatory (LIGO). 'LIGO's multi-kilometer-scale gravitational wave detectors use laser interferometry to live the minute ripples in space-time caused by passing gravitational waves. LIGO's interferometers are Michelson Interferometers.'[1] They're L-shaped and have mirrors at the ends of the arms which reflect light so as to make an interference pattern called 'fringes'. But this is often where the similarities end. The dimensions and added complexity of LIGO's interferometers are far beyond anything the world's first interferometers could have achieved. The difference between a typical Michelson interferometer and LIGO's interferometers is its scale. LIGO is quite huge in size with arms 4km (2.5 mi.) long. The size of LIGO's instruments is crucial for its foray into

[1] https://www.ligo.caltech.edu/page/about[2] https://www.ligo.caltech.edu/page/what-are-gw[

gravitational wave detection. The longer the arms of an interferometer, the smaller the measurements they will make.

And having to live a change in distance 10,000 times smaller than a proton means LIGO has got to be larger and more sensitive than any interferometer ever before constructed. Hence, they need to be 4 km long, a distance that seems incredulously large to most of us. And in fact, there are practical limitations of building such a precision instrument, with these huge dimensions. So how will LIGO make the measurements? The problem was solved by altering the planning of the Michelson to incorporate something called "Fabry Perot cavities". A further mirror is placed in each arm near the beam splitter (the box on the 45-degree angle), 4km from the mirror at the top of that arm. This 4km-long space comprises the Fabry Perot cavity. After entering the instrument via the beam splitter, the laser in each arm bounces between its two mirrors about 300 times before being merged with the beam from the opposite arm. These reflections serve two functions: It builds up the laser Inner Light the interferometer, which increases LIGO's sensitivity (more photons also makes LIGO more sensitive) and it increases the space traveled by each laser from 4km to 1200km thereby solving our length problem![2]

On September 14, 2015, the 2 LIGO detectors within the U.S., at Livingston in Louisiana, and Hanford in Washington, experienced a disturbance that was just like the chirp of a bird. At that point, two massive black holes with masses 29 and 36 times that of the sun had merged to offer off gravitational wave disturbances. The gravitational waves were traveling from, to some extent 1.3 billion light-years far away from the world. When objects like black holes with such an immense gravity merge, the disturbance is felt by the very fabric of space-time and travels outwards from the merger, not unlike ripples on a pond surface. Thus, gravitational waves are described as “ripples within the fabric of space-time”. Following the 2015 detection, which later won the Physics Nobel (2017), the two LIGO detectors detected seven such binary region merger events before they were joined by the Virgo detector in 2017. The 2 facilities have till now detected 10 such events.

Talking about the newest member to be added to this prestigious group of instruments. LIGO India will come up in Maharashtra, near Aundha in the Hingoli district. The LIGO-India proposal is for the development and operation (for 10 years) of a complicated LIGO observatory in India together with the LIGO Laboratories, USA. With design displacement sensitivity of $4 * 10^{-20}$ m, the LIGO detectors are the foremost precise physics apparatus. Figure 1 shows the layout of this enormous scientific apparatus. The 4 km beam tube along each arm holding about 10 million liters of ultra-high vacuum (nano-torr^2) would make it a powerful tribute to the technological prowess of Indian science and technology. LIGO-India is predicted to enhance the angular resolution within the location of the gravitational-wave source by the LIGO global network. Indeed, a startling attestation to the promise of LIGO-India comes from the forecast that, for the precise event detected, in Sept 2015 by the 2 Advanced LIGO detectors, a hypothetical LIGO-India operational would have made a hundred-fold improvement within the angular resolution.

The construction, commissioning and therefore the scientific operations of the planned LIGO-India observatory will involve three Indian lead institutions, the Institute for Plasma Research (IPR), Gandhinagar, the Inter-University Centre for Astronomy and Astrophysics (IUCAA), Pune, and therefore the Raja Ramanna Centre for Advanced Technology (RRCAT), Indore, working in close collaboration with LIGO Laboratories, USA. Broader Indian participation during this mega-science initiative is going to be made possible through the IndIGO consortium. ‘The entire hardware components of the third

3] https://www.ligo-india.in/about/introduction/

advanced LIGO interferometer that are already manufactured by USA UK, Germany, and Australian partners are to be provided to India by LIGO, USA. The entire infrastructure including the two 4 km ultra-high vacuum (UHV) beam tubes and its controls, also well as the team to line up the interferometer and operate the observatory is going to be the Indian responsibility.'[4]

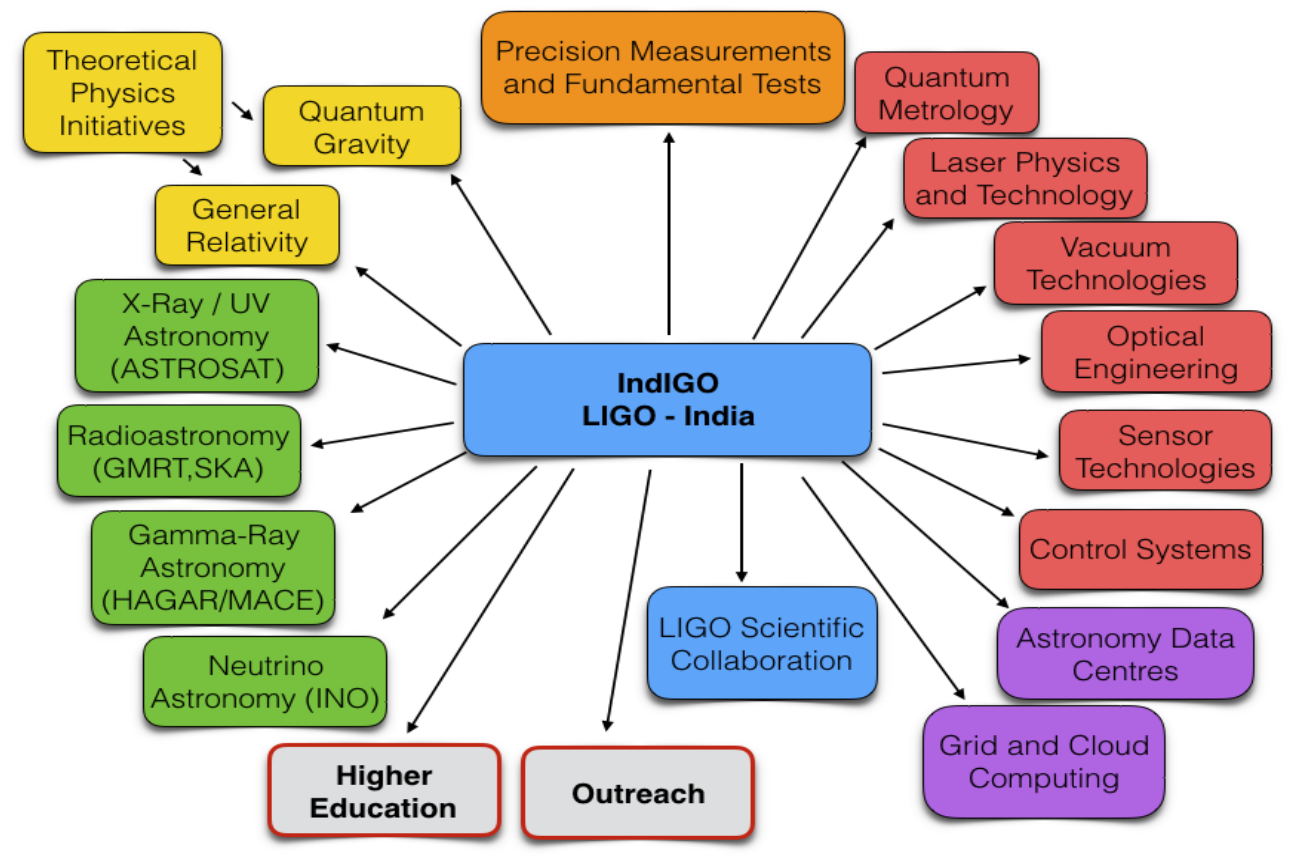


Fig 2 The impact of LIGO- India is multi-faceted and would push the frontiers along each direction. [4]

LIGO-India has the potential to impact precision experiments and cutting-edge technology within the country. The project has interfaces with quantum metrology, laser physics, and technology, vacuum technologies, optical engineering, sensor technologies, control systems, grid, and cloud computing to list a couple of. Figure 2 adapted from the LIGO-India proposal depicts the multifaceted impact of this project. LIGO-India has been a dream nurtured and sustained by wonderful courageous colleagues in India. IndIGO looks forward to enthusiastic participation by a generation of young scientists and engineers during this adventure of exploring the sky using the newest probe – gravitational waves. [4] This is an interesting time to be a young budding Physicist as a lot is happening on the forefronts of research in not just in the world but also in India, testimony of which is provided by LIGO-India.

[4] https://www.ias.ac.in/article/fulltext/reso/021/03/0225-0231
Tarun SouraLdeep, LIGO-India, An Indian Mega-Project for Gravitational-Wave Science.

DSKC Summer Internship – Miranda House

- **Year - 2018**

Student Name	Project Name	Supervisor
G. Vishnupriya, Rashi Wadhwa[1], Shivani Yadav, Sakshi[2], Shambhvi[3], Sonal, Sochannao Machinao [1] rwadhwa10001@gmail.com [2]sakshilohan2000@gmail.com [3]shambhvinigam10@gmail.com	Cosmic Ray Muon Detector	Dr Mallika Verma, Dr SN Sandhya
Shikha Singh[1], Simran Meena [1] shikhasingh7095@gmail.com	Hearing Aid Machine	Dr Mallika Verma, Dr. Monika Tomar
Sanjana Yadav[1], Sudarshana[2], Shikha Yadav[3] [1]sanjana.yadav@mirandahouse.ac.in [2] sudarashnayadav11@gmail.com [3] shikhanikum189@gmail.com	Law of Classical Mechanics (Kepler's law) using Tracker Software	Dr Divakar Pathak
Anmolreet Kaur[1], Garima Choudhary [1] anmolreetkaur31@gmail.com	Particle physics- Cloud Chamber	Dr. Sunita Singh
Harsha[1] [1] harshay3110@gmail.com	Proximity sensor-theremin	Dr Mallika Verma, Dr. Monika Tomar
Aditi Singh, Komal[1], Monika[2] [1] komal28012000@gmail.com [2] monika.physics@mirandahouse.ac.in	Automated Waste Segregator	Dr. Mallika Verma, Dr. Monika Tomar
Krishna Chaudhary[1], Krishnananda C P, Manshi Rani[2] [1] chaudharykrishna76@gmail.com [2] manshirani1999@gmail.com	Fabrication of PM 2.5 sensor	Dr. Mallika Verma, Dr. Monika Tomar, Dr.Geeta Rani, Dr. Nirmala Saini
Mukta Rajput[1] [1] mukta.kaj22@gmail.com	Nanotechnology and its application	Dr. Monika Tomar, Dr. Geeta Rani

- **Year - 2019**

Student Name	Project Name	Supervisor
Divya[1], Jasmine Chhikara[2] [1] divya.gaur@mirandahouse.ac.in [2] chhikarajasmine75@gmail.com	Cosmic Ray Muon Detector	Dr. S.N. Sandhya, Dr. Mallika Verma
Pallavi[1], Tanu Swami[2], Seema Sahu[3] [1] pallavi.phy@mirandahouse.ac.in [2] tanu.swami@mirandahouse.ac.in [3] Seema.sahu@mirandahouse.ac.in	Accident Alert System	Dr Mallika Verma, Dr.Monika Tomar
Charu[1], Eeshita[2], Aditi choudhary[3] [1] mittalcharu.59@gmail.com [2] eeshita2001@gmail.com [3]aditi.choudhary@mirandahouse.ac.in	Hand gesture control car	Dr.Geeta Rani, Dr.Nisha Rani ,Dr.Mallika Verma
Gauri Meena, Kajal[1] [1] 22kajal.khosa@gmail.com	Smart Glass	Dr. Geeta Rani
Tanya wadhwa[1] [1]tanya99wadhwa@outlook.com	Fourier Analysis using op-amp	Dr.Mallika Verma
Aditi Singh, Komal[1] [1] komal28012000@gmail.com	Raspberry based Speaking system for Deaf and Dumb	Dr. Mallika Verma, Dr. Monika Tomar

NIUS - HBCSE

The National Initiative on Undergraduate Science (NIUS), a major initiative of Homi Bhabha Centre for Science Education-Tata Institute of Fundamental Research (HBCSE-TIFR), Mumbai, India concerning tertiary science education in India was launched in the summer of 2004.The program includes initiating and guiding students over an extended period for proto-research, preparing and editing lecture notes, and promoting undergraduate research. Introducing innovative experiments and rejuvenating the Undergraduate selected students attend camp 1, there students are short listed on the basis of their calibre and assigned projects based on their interests. Laboratory is an important component of NIUS. This program is conducted in a total of 4 camps, for which selected students attend camp 1, there students are short listed on the basis of their calibre and assigned projects based on their interests .

Students who attended Camp – 1

- **Year – 2019** Seema**,** Neha Sharma**,** Tanya Wadhwa, Saloni Singla**,** Vanshika
- **Year – 2018** Kirti Bhatia**,** Kritika Bansal**,** Hanan Lateef P**,** Rashi Wadhwa**,** Sonal

Students who attended Camp – 2

- **Student name:** Sonal
- **Project allotted:** Asteroseismology of Solar type Oscillators
- **Mentor**: Prof. Anwesh Mazumdar

I in total attended 4 NIUS camps for two years during my academic holidays. The second camp I attended was for a week only. I worked on: Asteroseismology of Solar type Oscillators under Anwesh sir. We started from learning the very basics and did detailed reports for the project.

- **Student names:** Seema, Neha Sharma
- **Project allotted:** Experimental Problem Solving Specific experimental problem – Ferrite Core Transformer
- **Mentors**: Rajesh B. Khaparde, HBCSE, Mumbai

I was allotted project related to Experimental Problem Solving based on my performance in the test and my preferences given for project topics. I and my project partner Neha Sharma spent almost a week on the specific problem**- Ferrite Core Transformer** in which we did a detailed study of it by performing experiments and the interesting part was we put in place the complete experimental set-up by our own. We learnt from our mistakes, explored new things and touched the boundaries of experience how actual experiments for research work are performed, how minute changes in the surroundings can affect the true readings and then you have to perform the whole experiment again with the prerequisite cautions. We worked in the lab till late evenings and had long discussions after the work with Rajesh Sir.

- **Student name:** Tanya Wadhwa
- **Project allotted:** Radio galaxy and its interaction with the hot gas environment
- **Mentors:** Dr. Dharam Vir Lal, NCRA

The best part of doing a project in your Undergraduate studies, it gives you a sense of flavor of research. I have predominantly worked in analyzing galaxies clusters and making RGB images for the same. I have analyzed cooling flows and shock fronts of Hydra –A (A galaxy cluster) in detail in my project. The life at a research institute is very different, the frequent talks and seminars by renowned astronomers and scientists around the world, the dinner table conversations with the professors are very enlightening and hits different. One of the instances, I would like to mention is one of the prof. there used noodles to explain the very idea of string theory. There is no bound on time, the labs are open 24/7 and the research work is organized in a sense that there is no limit to explore more and more. I had the chance to work on the data collected by GMRT- The

largest Radio Telescope of India in Kohdad, Pune. There is always a lot to learn and gain from every opportunity and this definitely is a "NEW-HORIZON" in my future career goals.

- **Student name:** Saloni Singla
- **Project allotted:** Investigating learning hurdles in quantum mechanics
- **Mentors:** Dr Arvind Kumar, HBCSE, Dr Anwesh Mazumdar, HBCSE.

I was allotted the project-Investigating learning hurdles in Quantum mechanics under the mentorship of Dr. Arvind Kumar and Dr. Anwesh Mazumdar. The second camp, being based on PER for me, personally really encouraged me to think independently and not be afraid to make mistakes. Arvind sir often talked about the history of Physics, and how it's is not as linear as it seems when we look at it now. Since we were researching misconceptions in Quantum Mechanics, we were also introduced to Physics Education Research and were provided few papers to read. It helped me appreciate even more how much work must have gone into, to make us reach where we are right now. My mentors' enthusiasm and energy inspired me to work hard by showing me what true dedication to your work looks like. If any kind of hard work is fun, it's the kind you put into learning Physics!

- **Student name:** Vanshika
- **Project allotted:** Real time detections and analysis of FAST RADIO BURSTS with the help of GMRT
- **Mentors:** Dr Jayanta Roy, NCRA, Pune

Student who attended Camp – 3,4 - Sonal

UGA, SSP - SINP

Saha Institute of Nuclear Physics (SINP), is one of the premier research institutes, situated in Kolkata, India, established in 1949, named after the famous physicist Meghnad Saha. It is affiliated to Homi Bhabha National Institute, Department of Atomic Energy. It is an institution of basic research and training in physical and biophysical sciences and hence remains committed to nurturing research from an undergraduate level. It offers two types of internships for students, to achieve this commitment. Both the internships involve a monthly stipend with travel expenses covered separately. The institute also provides housing facilities for outstation candidates. The two internships are as follows:

1. **Summer Student Programme (SSP)** - The duration of this internship is 8 weeks in total. Eligibility of this internship ranges from students of the second year pursuing Bachelors to first-year students pursuing their Masters.

- **Student Name** - G. Vishnupriya **Year** -2019
- **Supervisor** – Dr. Mala Das
- **Project allotted** - Background study for Dark Matter Search

2. **Undergraduate Associateship (UGA)** - This is a special research internship provided for the students of the first year in their undergraduate studies. The basic motto behind this internship is to familiarize the student with the atmosphere of research and then to mentor them to pursue intensive research. This internship covers a duration of 90 paid days and can be completed as per the convenience of the student in the span of three years of their under-graduation.

Student Name	Project Allotted	Supervisor	Year
Prachi Misra[1] [1] prachi.rashmi71@gmail.com	Origin of cosmic rays with gamma ray detectors, multi-wavelength study of astrophysical sources.	Dr. Pratik Majumdar	2018
Anusha Pandey[1] [1]pandey.anusha2017@gmail.com	Binding Energy and Magic Number of Atomic Nuclei	Dr. Ushasi Dutta	2019
Koushiki Pohit	Green's Functions and its application to electrostatic problems	Dr. Munshi Golam Mustafa	2019

The day I received the confirmation letter from the institute regarding my selection for the internship, I was thrilled. I started my internship in the month of June and took the plunge into the field of research. I had one on one interaction with my mentor from the first day wherein he guided me on how to go ahead on this new path and also solved my doubts if any. Apart from the grill of five working days, my weekends were taken up by roaming freely in the city of Joy-Kolkata. I became adept at using broken Bengali to address my many queries from the people on the streets so that I can savour the local cuisines consisting of "mishtis"(sweets), phucka (golgappa), and rolls. I made so many new friends during the visit as a result of late-night walks, with whom I am still in contact. In all my internship experience was very wholesome, and sharpened not only my academic skills but also my life skills.

-Prachi Misra

VSRP-TIFR

For any student interested in research in basic sciences in India, the Tata Institute of Fundamental Research (TIFR) remains their top choice. TIFR is considered as one of the outstanding research institutes in India. It is a Deemed University and works under the umbrella of the Department of Atomic Energy of the Government of India. It is situated in Mumbai, India. Tata Institute of Fundamental Research (TIFR) conducts an annual summer programme in which talented students are introduced to research activities in the areas of Astronomy, Biology, Chemistry, Computer Science, Mathematics, and Physics. The selected students are expected to work on a research project under the supervision of a TIFR researcher and submit a report and give a presentation at the completion of the same. **The name of the program is the Visiting Students' Research Programme (VSRP).** The students are given a stipend of Rs. 14,000 for a duration of two months ranging from May to June. In addition, the travel and accommodation expenses are also covered.

- **Student Name :** Prachi Misra , **E-mail** : prachi.rashmi71@gmail.com
- **Supervisor :** Prof. Manoj Purvankara
- **Project Allotted :** Mass-Radius Relationship of Exoplanets: How does it matter

When I think of TIFR, the one image that doesn't leave my eyes is the seashore. The campus of TIFR is situated right next to the sea. It feels as if we have our very own sea, right in our pockets. No, don't think that the only thing worth remembering provided by the institute is the sea, the institute brims with academic brilliance and doesn't hesitate to give you a taste of it. During, my stay there I didn't only attend sessions with my supervisor but also was a part of a number of talks given by esteemed professors of the institute, colloquiums by visiting faculties, and an astronomy excursion. I visited almost all the labs situated in the institute and was free to barge in on anyone, to witness science being studied at all levels in the labs. There were many nights when I didn't sleep even a blink on account of the interesting work being done by me. To their credit, TIFR has a student canteen open till 3 A.M, a time when it is crowded by people eating and discussing mind-boggling facts. You have to visit the campus, to get a taste of how it feels like to sit on the seashore, sipping your coffee, and doing work on your laptop.

SN Bose Scholar Program

- **Student Name** : Rashi Wadhwa, **E-mail -** rwadhwa10001@gmail.com
- **Internship at**: Pennsylvania State University under SN Bose Scholar Program
- **Mentor:** Dr Stephane Coutu
- **Project Name**: High Energy Light Isotope eXperiment (HELIX)

Research has unquestionably proven to be a fantastic supplement to my undergraduate coursework. It allows me to strengthen my conceptual understanding of the material taught in my science classes and lead an improvement in my academic performance as I become more involved in research outside of the classroom. All of this was again possible because of **SN Bose Scholar Program 2019**. It is a joint venture of the Science & Engineering Board (SERB), Department of Science and Technology (DST), Govt. of India, the Indo-U.S. Science and Technology Forum (IUSSTF) and WINStep Forward. It is an exchange program between premier institutions in India and the United States. I believe that this internship program has helped me a lot. It has enhanced confidence and passion in me. The program has also made me mentally and emotionally strong. Staying alone in a new country was one of the biggest challenges for me. I interacted with people from different lands. State College is a beautiful place and people are always ready to help. SN Bose Scholar Program is a fully funded program that covers your airfare, health insurance and gives you a stipend to cover your living expenses. Applications open in early July. Applying for this program was one of the best decisions of my life. Staying in the US was the most beautiful phase of my life and I thank my teachers for their support.

Other Internships

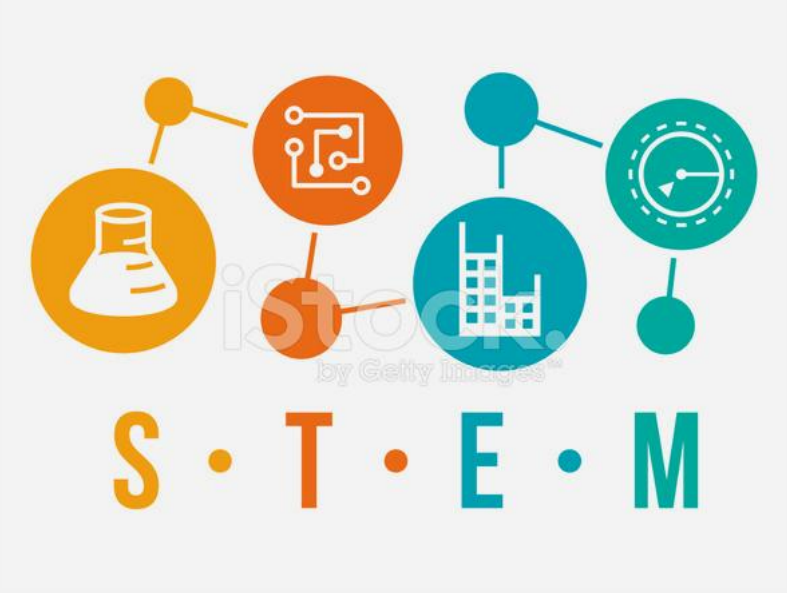
Student Name	Internship At	Project Allotted	Supervisor
Najidha	The Campus Connect	Company HR	
Annanya	Students Undergraduate Research Graduate Excellence (SURGE-2019), IIT Kanpur	Role of reflection and interference in optical devices	
Devika Bhatnagar	IISER Bhopal	Content development in Mechanics for the CREATES application	Dr. Ambar Jain
Devika Bhatnagar	Shiv Nadar University	Research in Random Matrix Theory	Dr. Santosh Kumar

I worked as an Intern at THE CAMPUS CONNECT for one and a half month. It was an unpaid internship but I was paid a stipend as a reward later. Mainly at there I took telephonic interviews, coordinated an event, lead a team of volunteers and also did some small works too. I was able to sync with the organizational culture and I managed it pretty well. I had received a LOR for the same. It was great to be a part of the organization because it worked in collaboration with the UN. It was wonderful to be working with them as I gained a lot of new experiences and got new contacts. The internship boosted my confidence and also I could use my time effectively.

- Najidha

STEM Jobs Amid Covid-19

By - Tapur Jain, 1H2 and Neha Yadav, 1H2



STEM (Science, Technology, Engineering, and Mathematics) jobs include a wide range of occupations from data scientists to geologists, astronomers, physicists, chemists, economists, and sociologists. They are vital in the growth of a country in economic, scientific, and innovative fields. STEM jobs are defined as careers where "*STEM workers use their knowledge of science, technology, engineering, or math to try to understand how the world works and to solve problems.*"[1] **So, to have advancement and development every country needs a strong STEM job system.**

In India, the focus on the STEM jobs has been increased significantly as the number of STEM jobs has increased 44 percent from November 2016 to November 2019, and according to Economic times, **'Delhi is leading the way for STEM jobs with 31% of postings among metros, followed by Mumbai (21%), Bengaluru (14%), Pune (12%), Hyderabad (12%) and Chennai (10%). However, in terms of regions, the West has beaten the rest of the country to the top spot, with 34% of all postings from this region. The North and South of India come in at a close second with 31% of postings from each of these regions. The East accounted for only 4% of all STEM job postings'**. [2]

Everything seemed rose and merry for STEM jobs, until on 11 March 2020, WHO declared a new virus named Covid-19 belonging to the coronavirus family which is related to RNA viruses, a pandemic. To prevent the spread of this contagious virus many governments decided to implement the strategy of lockdown in their countries. This lockdown period came out to be very unpleasant for countries as it destroyed the livelihood of people and created a disturbance in governmental, educational, scientific, and industrial works. A two way hit for the people in STEM concerning jobs. A growing uncertainty is witnessed in not only the people pursuing STEM jobs but also in people planning to take them up as their livelihood.

According to an international labor organization report, '**the proportion of workers in the countries with the recommended workplace decreased by 81-68%. Workplace closure has an immediate impact on enterprises and their current operations and leaves them at a high risk of insolvency. Workers and enterprises in the informal economy are the most vulnerable ones.'**[3]

Illustration : freeimages.com

[1]https://www.jobmonkey.com/what-are-stem-jobs/[2]https://economictimes.indiatimes.com/jobs/stem-jobs-in-india-increase-44-in-2016-2019-shows-data/articleshow/[3]https://www.ilo.org/wcmsp5/groups/public/@dgreports/@dcomm/documents/briefingnote/wcms_743146.pdf[

This lockdown disrupted the student-teaching method all over the world, it became particularly difficult to teach practical subjects as required by STEM due to the lack of laboratory resources. This lockdown adversely affected the life of scientists as it made them stuck in their research because of their inability to carry out complex experiments at home without proper equipment. Some students and scientists will be required to kick start their experiments again from scratch, as their unavailability might lead to error-prone conditions for their experiments. This problem is a double fold in nature as they not only have to invest their time and energy into these experiments but also might not get enough funding for the restart of these experiments. **Hence, the short-term contracted scientists are facing an extreme situation at present due to a cloud of uncertainty ion their jobs**. Some of them might have to lose their jobs due to the company shut down or any other such problem. So, this becomes a stressful situation for people involved in STEM research. One such example includes:

'Amol Pohane, a postdoc at the University of Massachusetts (UMass), Amherst learned that he is no longer in the running of several faculty jobs because 4 universities informed him that they were canceling or postponing jobs because of COVID-19 disruption. Universities told him that his application will be reviewed next year, but that's little comfort for Pohane. As a citizen of India, his visa is set to expire in September, but if he can't find a job by August, he will have to leave the country and bring the rest of his family with him. Also, Pohane can't complete his ongoing experiments, because UMass started to ramp down all non-essential research in mid-March. He was a few short experiments away from wrapping up a manuscript for submission, but the closure will impact his publication record.'[4]

Lisa Feldman Barret, a psychology professor, said that these disruptions will likely have the greatest impact on early-career scientists. According to her, the problem will begin at the undergraduate level, when students begin to build their toolbox of skills at a summer internship, many of which are getting canceled this year. Closures might force the trainees, who are in grad school. So, if any of you wants to work in a STEM-related job, brace up for a bumpy ride ahead.

As we have established that STEM-related jobs are getting affected by this pandemic, you must be wondering what steps are being taken by the governments throughout the world to prevent this onslaught of disaster. Although the priority of all countries is to save their people's lives from the disease, they also have to ensure their livelihoods don't get affected due to the lockdown period. Here are some of the measures taken by countries:

INDIA

The Central Government of India advised all the employers of public and private establishments to continue their coordination by not terminating their employees, particularly contractual and casual workers during this lockdown period. [5]Amendments were made in Employees' Provident Funds and Miscellaneous Provision Act to give individuals and companies, the financial and regulatory reliefs. [6] Postponement of EMI installments, interest payment, term-loan, and other measures for one year to improve their working capital was introduced to maintain the condition of small businesses as they may not be able to re-employ workers or give them their payroll after the lockdown period.

UNITED STATES

US Congress authorized roughly $3 trillion in coronavirus relief in four separate measures.[7] Around 22 million Americans got unemployment benefits in the four weeks of lockdown, almost wiping out all the jobs gain as it was recorded the biggest decline in the factory output since 1946. The Care Act by the government provided fast

and direct economic assistance for American workers, families, small businesses and tried to preserve jobs for American Industry. In a surprising move, the US President **decided to suspend the immigration to the country due to the coronavirus crisis, to protect the jobs of American Citizens. This would impact a large number of migrant employees from different countries based on STEM jobs, as the USA is considered to be a hub of scientific and technological industries.** [8]

AUSTRALIA

The Australian Government responded to support their employees who had lost their job or got reduced payroll because of the pandemic with access to the amount of income support payments and increased the superannuation amount. "The individuals receiving an income support payment (such as the JobSeeker Payment) received an additional fortnightly Coronavirus Supplement of $550 on top of what they already received. This additional amount was automatically paid, with no applications required."[9] The Australian Government also announced to give wage subsidies to eligible businesses and also encouraged cash flow for employers in order to help businesses.

UNITED KINGDOM

The United Kingdom's government had supported the businesses and workers by new schemes so as to secure 6.3 million jobs. The Coronavirus Job Retention Scheme was applied by around 800,000 employers to seek help in paying the wages of 6.3 million jobs. Direct cash grants worth £10,000 or £25,000 for small businesses including in the retail, hospitality, or leisure sectors, worth over £12bn in total and **£1.25bn support for innovative firms**. A rebate scheme was also introduced to reimburse SMEs for part of their SSP costs worth up to £2bn for up to two million businesses. The Government also supported the NHS and other public services in the fight against the virus, so far more than £16bn from the COVID-19 Response Fund has gone towards the effort. Teachers in the UK worked with Google to create the Oak National Academy - a virtual school - in just two weeks which delivered 2.2 million lessons in its first week of operation. [10]

This lockdown has introduced a new pattern for exchanging thought and international cooperation through remote learning. Some of the new practices that are used now can be favorable and useful for future use as well. The ability to work efficiently from home, and to collaborate productively with the scientists and clinicians nationally and internationally, without extensive travel (and the associated carbon footprint) might, ultimately, even result in benefits for scientific communities and society as a whole. Change is indeed a universal law and with change one experiences uncertainty, but now we need to accept these changing patterns and we should focus on tackling these very issues by going for some alternatives and by proper planning.

Governments all around the world are trying their best to tackle this unprecedented situation, but they still have a long way to go from STEM perspective. STEM fields have traditionally been ignored with respect to their much lucrative counterparts, this situation proves the same, with no particular help being provided by the governments to STEM-related jobs. The situation is grim, where the gravity of the problem will be hitting us in the upcoming years. But don't lose hope, if not anything this situation has blessed us with extra time on our hands, which we can use to sharpen our skill set so that we remain relevant for the upcoming newer variations of STEM jobs.

[8]https://economictimes.indiatimes.com/news/international/world-news/donald-trump-says-will-sign-order-to-temporarily-suspend-immigration-into-u-s-articleshow/75263005.cms?from=mdr[9]https://www.mondaq.com/australia/employment-and-workforce-wellbeing/916298/covid-19-new-government-support-measures-what-employers-and-employees-need-to-know[10]https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/884760/Our_plan_to_rebuild_The_UK_Government_s_COVID-19_recovery_strategy.pdf

Future Circular Collider: Is it worth investing billions in larger collider?

By – Roopal Bansal, 1H2

Main Ring and Main Injector as seen from the air. The circular ponds dissipate waste heat from the equipment.

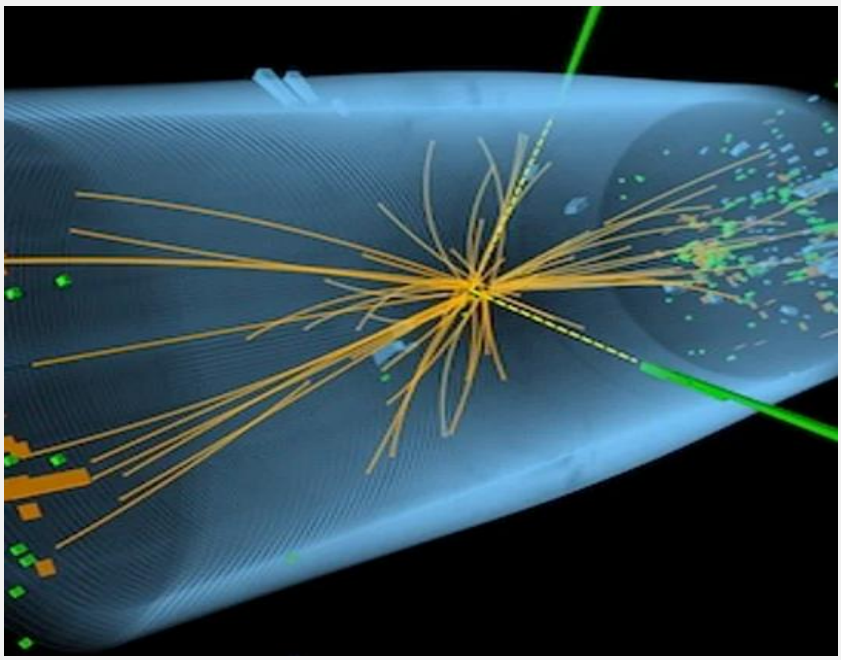
CERN, the physics laboratory near Geneva, Switzerland, is well known as the home of the world's largest smasher – Large Hadron Collider (LHC). LHC is a 27km circular tunnel buried about 100m underground on the border of Geneva and Switzerland. It uses superconducting magnets which are kept colder than the outer space, to accelerate protons to almost the speed of light and be precise it collides 120 billion protons per second. It is noteworthy that CERN is only able to store about 1% of the data generated, because of space crunch. [1] During one such famous sprint in 2012, protons collided and the Higgs Boson was officially discovered. The Higgs Boson is a special particle. 'Its presence confirmed the existence of an invisible quantum field that's responsible for giving particles their mass.'[2] This field permeates the universe, leading some to suspect that it may play an important role in everything.

But at this point in present, the LHC and the community that built it are at a crossroads. Physicists haven't found the super-symmetry they were hoping to see. If they did, it would have solved some open mysteries about the Higgs and the inner working of the early universe. Also, the much coveted standard

Illustration : Wikimedia.org

[1]https://www.sciencealert.com/over-99-percent-of-large-hadron-collider-particle-collision-data-is lost[2]https://www.facebook.com/116924571984658 3/videos/434350200720451/

model of Physics remains incomplete, falling short of being a complete theory of fundamental interactions.This created a huge international debate among the particle physicist over what to do next.



CREDITS : CERN/CMS

To answer this question of what next, last year in January CERN revealed a design study for a future circular collider (FCC). It will be a 100 km tunnel (which is about four times the size of LHC) to be dug where the current collider LHC is. It will reach about 100 TeV (which is six times the energy LHC can reach). This project is going to cost around $ 20 billion. [3] "95% of the universe is still unknown," Fabiola Gianotti, the Director-General of CERN, explained in a presentation to staff at the World Economic Forum. "We are all driven by a shared passion for knowledge."[4]

But the question that still plagues the scientific community still is – is FCC a waste of money? Is this massive investment in particle collider worth it? There's no clear answer to this. Since this news came out, physicists have parted opinions. On one side are theorists, who continuously say that we will need a larger collider in future when we will have our theories better established while on the other side are experimentalists and particle physicists who emphasize on the point that, a discovery is around the corner as this will allow them to explore the super-symmetry at higher energy.

James Beacham, an experimental high energy particle physicist working with the ATLAS collaboration at CERN's Large Hadron Collider, supports the idea of building a larger collider. According to him, "the experimentalists' job is not to demonstrate if theorists are guessing correctly, their job is to explore the unknown like a cartographer to map out all the possible places in data and parameters, where ever discoveries are hiding. Particle colliders are the logical continuation of microscopes, build to see new structures. Higher energy means higher resolution.

That's why we build particle colliders that reach higher and higher energies, which allow us to test what happens at shorter and shorter distances." Particle physics was theory-driven from the past few decades, because of a lack of proper resources. Now if probing short distances is what we want to do, then particle colliders are presently our best bet. There are other ways like cosmic rays and high precision measurements, but they have disadvantages.

There are scientist who are equally vocal in their critique of FCC. One such physicist is Sabine Hossenfelder, a theoretical physicist and researcher of quantum gravity. On Dec 13; 2018, she stated, "I am not opposed to building a larger collider. Particle Colliders that reach higher energies than we probed before are the cleanest and most reliable way to

[3]https://www.scientificamerican.com/article/what-exactly-is-the-higgs/[4]https://www.weforum.org/agenda/2016/09/7-things-you-didn-t-know-about-cern-and-the-strange-world-of-particle-physics-c362a466-43a1-449d-9719-9e9d97e6a293/5

search for new physics. But I am strongly opposed to misleading the public about the prospects of such costly experiments. We presently have no reliable prediction for new physics at any energy below the Planck energy. A next larger collider may find nothing new. That may be depressing but true."

According to her, there are other research directions in the foundations of physics which are more promising like dark matter. It makes more sense to collect more information about the astrophysical situation first, which is equivalent to building better telescopes and thus having better sky coverage, better redshift resolution, better frequency coverage, and so on. There are lots of problems in the theories that do require solutions. Physicists should have honest debates about the evident lack of progress in the foundations of physics and what to do about it. In the past 40 years, physicists have made lots of predictions beyond the standard model, and those were all wrong, which is bad scientific methodology. This bad scientific methodology has flourished because the experiments have only delivered null results. It has become a vicious cycle: Bad predictions motivate experiments that find only null results. Null results do not help in theory progress leading to bad predictions that motivate experiments, which deliver null results, and so on. We have to break this cycle. [5]

Before the Hadron Collider, CERN had a Large Electron-Positron Collider (LEP) where it has LHC now. LEP was looking very closely at a bunch of things. Physicists started to see a hint of the Higgs Boson. But it was nothing conclusive. It was just a sort of suggestion from theory, calculations combined with experimental measurements. So, CERN built LHC colliding protons instead of electron-positron and the reward for this was the discovery of Higgs Boson, a particle so important that it has been given the name of "God Particle".

For many, spending billions on this project doesn't seem justified. Many individuals have suggested investing in other fields like health and upliftment of poor, or other research directions like dark matter which is more promising. But things with massive impacts aren't as uncommon as it may sound, nor is $20 billion as large a fraction of the global economy as you seem to think. This is a global project, not a local one, so the scale of investment is likewise global. $20 billion isn't a massive amount of money in the grand scheme - especially for an international collaboration spread over many years. We also need to remember - this money doesn't just get poured into a black hole. A big chunk of the money is spent giving people jobs, buying equipment and materials, funding research, etc. all of which feeds back into the economies of the respective countries.

Although lots of great discoveries were serendipity, Higgs had almost established theory before its discovery. Counting on serendipity is often too risky for experimentalists. Does FCC have a specific target? The answer is yes! Although LHC measured quantities to quite high precision, if you think in terms of discovery, it discovered only its primary target – "Higgs Boson" but it was unsuccessful to find evidence of dark matter would be a light bearer into the world of super-symmetry. The Higgs has been discovered but is not completely understood, FCC might be helpful in that too. The possibilities are endless, with a big enough collider no one knows what we might discover next. A huge spectrum of energy remains unapproachable to us till now, with FCC we can further prod into the smallest of spaces and maybe find answers to the most elusive questions.

5] https://uncommondescent.com/physics/theoretical-physicist-contrary-to-hype-a-larger-collider-will-not-answer-the-big-questions/

How will the Universe Die?

By - Manasvi Gautam, 1H1

"Are we a part of a dying reality or a blip in eternity."[1]

Cosmology deals with many mind-boggling questions of the Universe that keep Physicists up at night. How did the Universe begin? What is the composition of dark matter? Is there any other planet on which life survives? How is the Universe going to end etc. etc. But the question "Will the Universe end if yes then how?" is the biggest and the most fascinating among all. What can be more dramatic than the annihilation of Earth, the solar system, our galaxy, and the Universe, and our deaths?

Since ancient times astrologers have predicted many dates for the end of the world, but all of these dates set for the end of the world have passed without any dramatic incident and we continue to exist, a testimony of the unscientific basis of these predictions. Scientifically it is a game of equal probability either the Universe will continue to exist or it will collapse. But as the time slips away our impending doom comes closer, making us question the different possibilities of the death of the Universe. 'Before turning to the very distant future, we will mention another relevant survey: GAMA. Using that survey, scientists found that the universe is slowly "dying". Put another way: the peak era of star formation is well behind us, and the universe is already fading.'[2]

By piecing together an increasing number of clues, cosmologists are trying to get closer and closer to solve this mystery. But before we consider events in the very far future, let's start with what we know about the past and the present. Astronomy is analogous to archaeology, as we try to excavate information from light, the greatest time machine. **Explicitly, the further we peer away from our home planet, the further back in time we see in the Universe. And when we look for back in time, we observe that galaxies are closer together than they are at present**. These distant galaxies move away from us, with farther ones moving the fastest. The only way it makes sense is if the Universe is expanding ever since. Nobody knows what's driving this acceleration, so cosmologists have clubbed that mystery dark energy. This dark energy forms 69% of the total content of the entire cosmos. Dark Energy always becomes a part of any discussion about the end of the Universe. And while there are no definite answers yet scientists have come up with four interesting possibilities, as you will see every one of them starts from the word BIG, because what can be bigger than seeing the whole Earth die.

THE BIG FREEZE – The first clue we can get to solve this infamous question is "thermodynamics." As we know that for life to survive there needs to be temperature difference, yes we are talking about the difference of temperature between the rest of the Universe and the Sun. But with the advent of the big

Illustration : Wikipedia.org

[1]https://aeon.co/essays/how-they-pinned-a-single-momentous-number-on-the-universe[2]https://theconversation.com/the-fate-of-the-universe-heat-death-big-rip-or-cosmic-consciousness-46157

freeze, everything will eventually be at the same temperature and all the energy will be sucked out. 'Every star will die, nearly all matter will decay, and eventually, all that will be left is a sparse soup of particles and radiation. Even the energy of that soup will be sapped away over time by the expansion of the universe, leaving everything just a fraction of a degree above absolute zero. In this "Big Freeze", the universe ends up uniformly cold, dead and empty.'[3]

THE BIG CRUNCH – If you don't, like the cold option we also have a hot and fiery answer to this question. We all know that our Universe is expanding, but for how long will it keep on expanding, a pragmatic person's answer will be till it runs out of material to keep expanding. But our Universe is different, it is governed by gravity, the more it keeps expanding the more powerful is the inner tug of this gravity. At some point, gravity might win the game and the Universe will begin to contract, leading to a reverse "Big Bang." This will make the universe hotter and denser and we will be burnt to a crisp in this scenario. [3]

THE BIG RIP – Scientists with much confidence can claim that dark energy is responsible for the accelerating Universe. So the relative strength of dark energy and how it might vary over time becomes important. 'The stronger and faster the repulsive force of dark energy is, the more likely it is that the universe will experience a Big Rip. Put bluntly: the Big Rip is what happens when the repulsive force of dark energy can overcome gravitation (and everything else). Bodies that are gravitationally bound (such as our local supercluster, our own Milky Way galaxy, our solar system, and eventually ourselves) become ripped apart and all that is left is (probably) lonesome patches of vacuum.' [2]

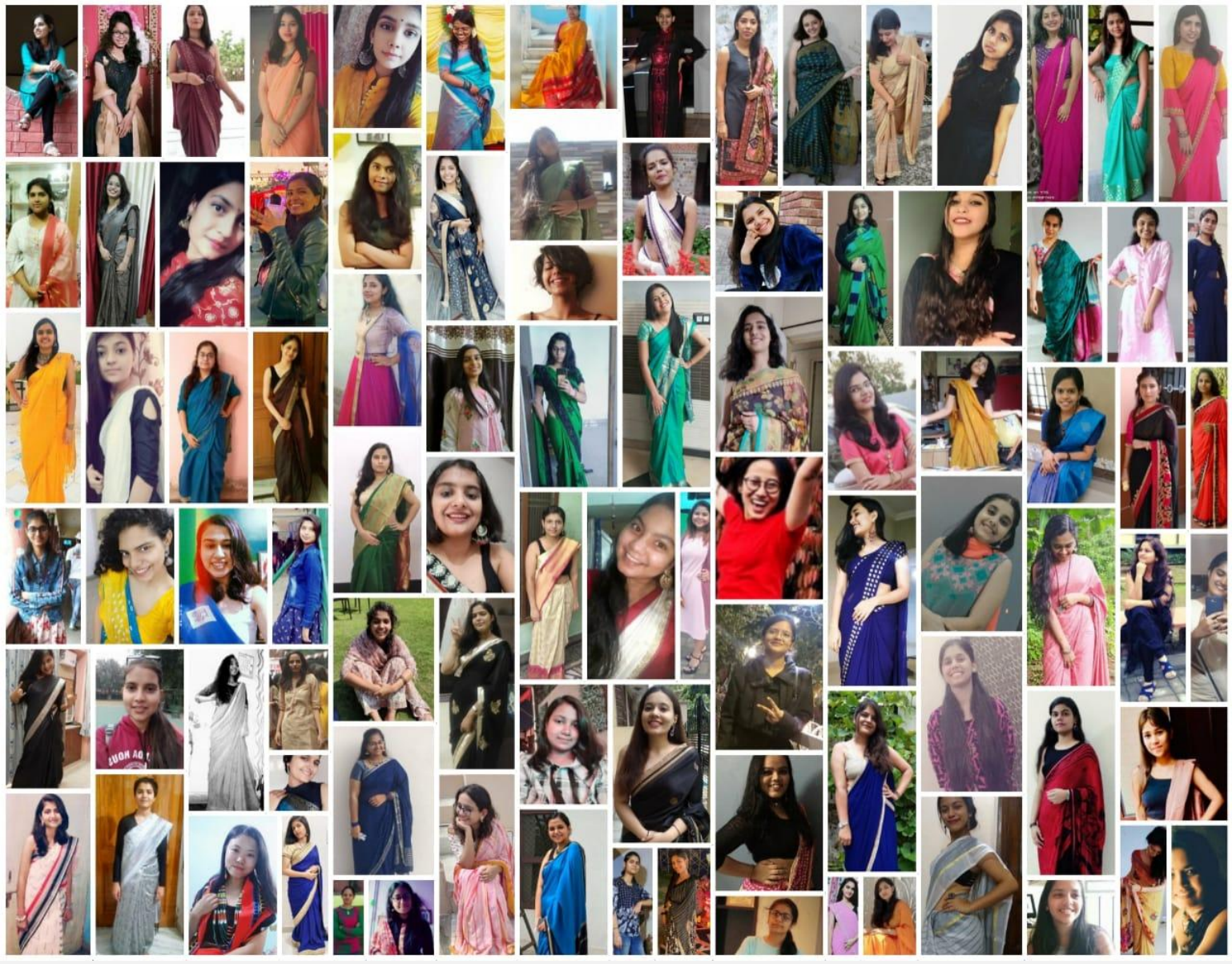
THE BIG CHANGE – 'Of course, there's always the chance that dark energy won't matter. The other scenarios we've considered assume that our universe is all there is. But what if there's more out there, and our universe is but a small part of a multiverse? Could these other universes affect the ultimate fate of our own? The short answer is yes. "Imagine you go to a very, very large scale — much larger than our current observable universe," explains Jonathan Braden, a cosmologist at University College London. While our universe is homogenous and roughly the same everywhere, taking such a large view might reveal that it's just a tiny pocket with its physical parameters and laws, different from the larger multiverse. If so, our universe would exist in a state known as a false vacuum, where we wrongly suppose that we exist in the most stable state, but it's still possible to drop to another one suddenly. Braden explains this would result in a phase transition, a change similar to how water changes from liquid to gas at its boiling point — only for the entire universe. Our cosmos might be like one of the bubbles boiling in a pot of water, he says, just one of many with their own sets of laws and constants. "Eventually these bubbles can run into each other, and from our viewpoint, it would be like our universe … collided with another universe.'[4] Resulting in its annihilation without any warning whatsoever.

This morbid article is not to make you panic and worry about our future as a planet, but to provide you with answers to the questions which you never asked. It is to satiate your 2 a.m queries when you think how all of this will come to an end. It is to make you wonder about the transient nature of life that seems so certain. At last, this article is to make you understand the uncertainty even in the certain future of the Earth. ;)

The development of new theories and models will give us other interesting predictions. Until then this mind-blowing question "Will the Universe end, if yes then how?" will continue to be debated and will make us ponder.

Life beyond Academia

The Class of 2020



Class of 2020 – A tussle of power

By – Prachi Misra, 3H2

For this article, you all have to take out your imaginary time machines and have to travel back in time to precisely 20 July 2017. Surrounded by drizzling rain, can you see a girl rushing through the gates of Miranda in blue Kurti. Let me introduce you all to her, that my friends, is Prachi Misra your humble writer, late even on the first day of orientation! Can you all look how calm that girl is on face value as she is stepping into unfamiliar territory because, for her, Miranda House was home from the first day itself!

Fast-forward to April 2018 when she attended the farewell of her super seniors dreaming constantly what it would be like to be on the other end, receiving all the love from juniors and teachers and then chiding herself for thinking about the future that was almost two years away. But call it relativity or not, time flew attending classes, labs, internships, fests, and everything in between till it was two months to bid adieu. Everyone around her was excited about the upcoming farewell and were even discussing what to wear on one of the most coveted days of college life. It was time to say a short goodbye to all her friends and wish them well for the festival of colors. Everyone was sure that this is their last mid-semester break in these premises but nobody had a clue that it would be their final goodbye.

All hell broke loose when this information started to sink in. She felt cheated, deceived by the circumstances, that took away from her the last memories of her college life, shattering her dream that she dreamt about two years earlier. It felt as those precious hours of loitering in the college campus, the chilled laid back hours in the canteen, the peaceful sleep-inducing hours in the library, the exciting hours full of casual chit chats in the labs, the fun hours spend at the back of the class all were taken away with no promise of return in a single stroke of luck. As if somehow her shelf life of college expired before the expiry date. The plans she had made with her friends on how to spend the few last days in college now seemed fruitless, even meeting them one last time seemed out of question. Life turned a new leaf, and classes were resumed online but those airy rooms, those actual faces, the connection between teacher and students, was somehow missing. Our teachers tried best to not just educate us but also bring in the same sense of an offline class, at the same time getting used to this new method of imparting education. But even they were not fully successful in replicating their full of life self in these rectangular boxes. The feel of sharing a common education inducing environment, that not only stimulates the brain but also all other sensations, was missing in these lifeless screens through which we all were connected. The idiosyncrasies of students were not visible through the chat boxes or their prompts, as everything seemed far off even being right in front of us. One more tangible aspect missing from her life was her notes and library books, an integral part of any students' education journey. But the show must go on and it did, with increasing lockdown period, adapting to the new normal of online classes and staring at these screens more than her surroundings, being connected to her friends not with a fist bump or hugs but with group video calls. Man is a social animal, the actual meaning of this seeped into her life because of this pandemic. She could understand not only the proverb but also its implication in a much clearer light.

The day of 29 April 2020 brought its share of experiences, that my friends, is the day when the first set of University Grants Commission (UGC) guidelines were released. The count of Covid-19 stood at a mere 32,774, which was way below the

worst-hit European countries and USA, and people were optimistic about India's fate in one of the most fear striking situations anybody has witnessed in their lifetimes. The same optimism was reflected in the guidelines which canceled exams for the intermediate semesters (students of first and second years) based on their previous performance and internal assessment. For the final year/semester students the exams were to be held in July. The start of the next session was delayed up till August. **The guidelines were welcomed largely by the student community, a testament that students were not afraid to give exams or being tested.**

The month of May started slipping away preparing for the internal assessments, but on 12 May 2020 a bombshell exploded in her life wherein the last years were informed by a circular dated 11 May 2020 that suggestions from stakeholders were invited on the plan of the University of Delhi (DU) to conduct Online Open Book Examinations (OBE). The suddenness of the plan with no proper intimation, the shifting mode of examinations from the traditional way for which education was imparted made this information seem untrue at first. But when the information got confirmed, students started sending in their **viable concerns regarding not only the discriminatory nature of such assessment but also their inability to perform well without any books (as they didn't have these!) to open during these so-called "open book" examinations**. But all was not lost, we still have the power to speak up and let the good sense prevail over the authorities was the resounding sentiment felt not only by her but also by student circles she was part of. As students started emailing their suggestions and voicing their opinions, a circular dated 14 May 2020 informed them that OBE was not a futuristic proposal but was very much real with its commencement from 1 July 2020. She felt cheated, felt that even being the part of the system she was not audible, felt like she was screaming but it was falling on deaf ears. Amongst all the chaos the students instantly turned towards their guides, the people who knew them most closely, and could understand their pain the best – their teachers. Teachers in their turn not only stood in solidarity with students but also wrote to the authorities within their capacity to competent authorities. Support started pouring in for the students from all quarters. But time passed, with no positive results, no attempt by the university to reply to the concerns of the students. Two separate cases were filed in the honorable High Court of Delhi challenging the university's decision to conduct OBE, that the decision was unfavorable to the students. Hope seemed bleak at this point and student's started preparing for the upcoming examinations.

By 25 June everybody realized that the mock tests promised by the University to get familiarised with this new examination process were nowhere in sight and rumors of cancellation started flowing in the air. On 27 June, the postponement of the examination was declared by the University with no proper reason given for such a move to be taken. At this time, there were at least four cases filed in the court, against the university's move, their arguments ranging from issues about the validity of the decision, because of non-involvement of the academic and executive council, to the move being against student interest. The fresh dates of the examinations were announced to be from 10 July. Later in the court, the University's counsel admitted that the reason for the postponement was that the Deputy Registrar's mother tested positive for Covid-19. [1] **Even the court in its hearing on the matter commented that the repeated postponement of the examinations for the student is "nerve-wracking."** It also didn't mince words when commenting that the University is "turning turtle" and changing its stand on the examinations frequently, as it didn't inform the court regarding the postponement on 26 June when it was in session.[2]

She breathed a sigh of relief as she was hardly ready for an entirely new process of exams and also around the same time a tweet by the Minister of Education, Dr. Ramesh Pokhriyal Nishank was doing the rounds in which he had asked UGC to revisit their earlier guidelines because of the present worsening situation. The tweet read "I have advised the @ugc_india to revisit the guidelines issued earlier for intermediate and

Illustration : freesvg.com

[1]https://www.thequint.com/news/education/delhi-high-court-slams-delhi-university-for-withholding-information-regarding-postponement-of-obe[2]https://www.telegraphindia.com/india/delhi-high-court-to-du-exams-nerve-wracking-why-are-you-delaying

Terminal Semester examinations and academic calendar. The foundation for revisited guidelines shall be health and safety students, teachers, and staff."[3] The interpretation of this tweet by almost all the media outlets was that the exams of the final semester/year students would be canceled, some even going on paper to report this with much confidence. She waited with bated breath, amongst the upcoming exams and ongoing court cases, for the canceling of exams. Every morning she would spend hours scrolling her phone to search even the slightest progress in this direction. Meanwhile, DU announced the date of mock tests to be from 4-8 July. On 4 July, she woke up at 7:00 a.m. to appear for the first mock test so that she can get a sense of what it would feel like to attempt a two-hour paper, consisting of six questions with no parts out of which four had to be attempted, and submitting it online. But, she was in for a shock, as none of the paper uploaded on the portal belonged to Physics, she scrolled unbelievingly through the pile of 75-100 papers, panicking, thinking that she must have made a fault while searching, by 8:00 a.m., half an hour after the supposed start of the examination messages start pouring in her WhatsApp account confirming the nightmare, there was no uploaded paper of Physics. By evening all the media outlets declared the mock test to be a "mockery", in which no student was able to achieve or learn anything. Students started panicking, getting anxious, thinking that if the university can't handle the meager inflow of students during the mock tests, what will happen on the D-day when exams are conducted.

Speculation regarding the revised UGC guidelines started growing louder making the court pass an instruction to UGC to release their guidelines in front of the court by tomorrow i.e. 7 July. This felt like a small victory for students as everybody was convinced about the content of the guidelines due to botched media reports. But voila, the victory was short-lived as on the fateful evening of 6 July, revised UGC guidelines got released. **The guidelines made it "mandatory" for the conduction of final semester/year exams by citing "academic credibility" to justify their stand.** At the same time, MHA (Ministry of Health Affairs) also released a circular stating the same. In its guidelines, UGC argues that certain top-ranking universities have opted to conduct exams amidst the ongoing pandemic.

Citing from their examples, let's take the example of Imperial College of London where exams are supposed to happen, but at the same time, colleges of Scotland have decided to let go of their fascination with exams to grant degrees to their students based on their previous performances. Aren't London and Scotland part of the same country? **[4] But both are free to make their own decisions because they have "academic autonomy", a term that remains a dream for universities in India**. Isn't the decision of UGC to conduct examinations "compulsorily" in direct contradiction to this? As with everything this situation of crisis sheds light on the loopholes in the system, in this case, we realized how fragile the autonomy of universities is, in our country, where they don't even have the luxury to listen to the "stakeholders", the students who make or break the institution, where they have to turn a blind eye to their problems, their tears, their cries of anguish. Will there ever come a day when universities in India will become as bold as MIT or Harvard, such that they can question the unjustified decisions of their government in court without any fear of retribution, in the form of getting a slash in their funds? Let me end this article with a question

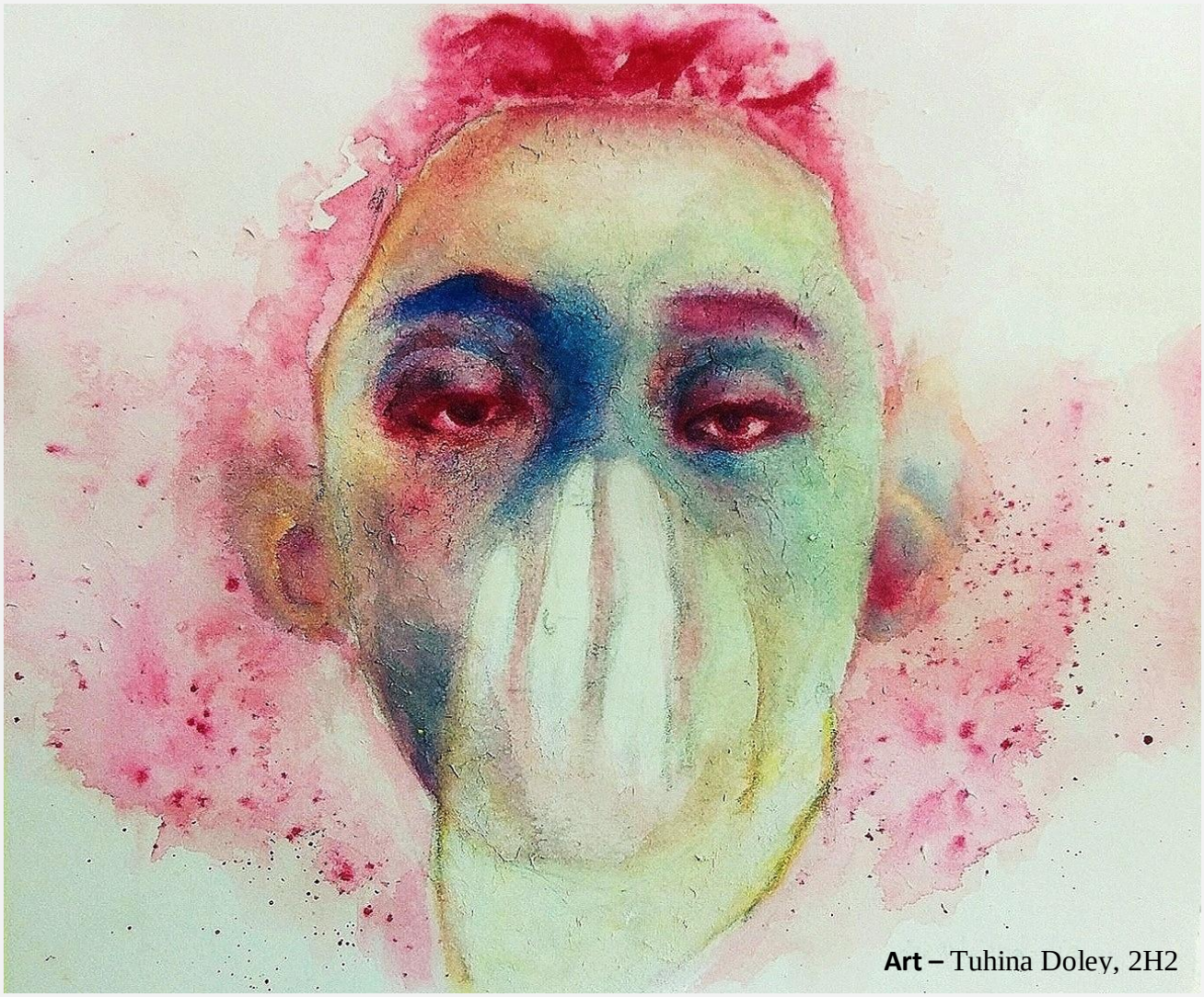
"Will there ever come a day when politics and education separate their ways in our country?**"**

The resilient class of 2020, is a testament to the fact that today the tussle of power is real between the rulemaking authority (UGC), academic institutions, and government. It is my sincere hope that the fate witnessed by the class of 2020 may never be repeated in anybody's academic career, as it makes you lose hope in everything the education system, the justice system, and the political system. It forces you to vent out your feelings in some sort of an article like this ;)

[3]https://www.hindustantimes.com/education/hrd-minister-asks-ugc-to-revise-guidelines-onexams-academic-calendar[4] https://www.bbc.com/news/uk-scotland-53580888

Students, Mental Health and the Slipping Silence Surrounding it

By – Mansi Dagar, 2H2



Art – Tuhina Doley, 2H2

If I ask you to list the most challenging aspect of being a student or a youth in current times, the answers may vary, but the most probable answer would be some or other mental health problems. We all have experienced them, at some or the other point of time.

Year by year we see a tremendous increase in the diverse challenges faced by the youth, with mental health illness taking the top spot. As if that wasn't enough, contributing to it, we have a broad and extensive list including the highly competitive nature of academics, adversity in adjusting to social life, peer pressure, parental expectations, poor study-life balance, uncertainty in career prospects, to mention a few. Still, most of the people in this country refuse to acknowledge the existence of all these problems. A painful silence continues to exist around mental health disorders.

'Mental health issues substantiated in young adults are likely to be lifelong with issues ranging from depression, anxiety, suicidal behavior to substance dependence, schizophrenia, and bipolar disorder.'[1]

According to 2018-2019 Student surveys from ACHA(American College Health Association), about 60% of respondents felt "overwhelming" anxiety, while 40% experienced depression so severe they had difficulty functioning. 'Studies suggests that one-third of Ph.D. students in Flanders, Belgium are at risk of having or developing a common psychiatric disorder like depression and that depression afflicts almost half of STEM graduate students at University of California, Berkeley.'[1]

The National Mental Health Survey-2016, India reported 'that the prevalence of mental health disorders is 7.3% among children aged 13–17 years and it is similar in both genders, which counts >50 million.'[2] Every hour one student commits suicide in India, with about 28 such suicides reported every day as suggested by the data compiled by NCRB(National Crime Record Bureau). 'Suicide is the third leading cause of death in students aged 10–24, with 90 percent of those dying by suicide having an underlying mental illness. 37 percent of students aged 14 or older with a mental health issue drop out of school.'[3] Mental health in our country is a public health crisis and yet we've managed to ignore it for decades. It is noteworthy, 'India with a population of around 1.236 billion, less than 4,000 experts are available' [4] and it speaks volumes on the affordability and accessibility of mental health care in the country. Honestly in India, getting help professionally is a luxury for the majority of us.

These are just the reported numbers. It is believed that the real nationwide estimations are beyond the scope of these surveys and the actual numbers can be horrifying. It takes an immense amount of mental distress to inflict self-pain and it's not easy to do so in our conscious mind. The stigma of simply having a mental health issue is enough for people to pigeonhole themselves in a "problematic" category.

With only acknowledging the problem, can the community start to address it with the attention it needs to be dealt with and overcome with? Being conscious of the issue only is no easy solution! We as a society add up to the fundamental health traumas and act as a major catalyst that pushes people undergoing all this alone through the most heinous of voids. Empathy is non-existent and mental health is scattered in our society. And guess what, it's not surprising! No wonder mental health still is a dark domain in our country.

Why do we have to look depressed, why do we have to look like we have a mental illness for people to believe we have an illness. Mental illnesses, having dysfunctional emotional, cognitive, and/or behavioral experiences are the result of malfunctioning of the organ responsible for these actions and processes, which just happens to be the brain in this case. No one will question a disease of the kidneys, the intestine, or skin but somehow the brain is never expected to malfunction? Not all illnesses are visible. Just because you can't see it doesn't mean it's not there. Seeing is not believing always. Our brains can play tricks on us! Mental health illness can be severe as other serious illnesses of other systems, sometimes even more. And their risk factor increases with negligence, which tends to happen most of the time.

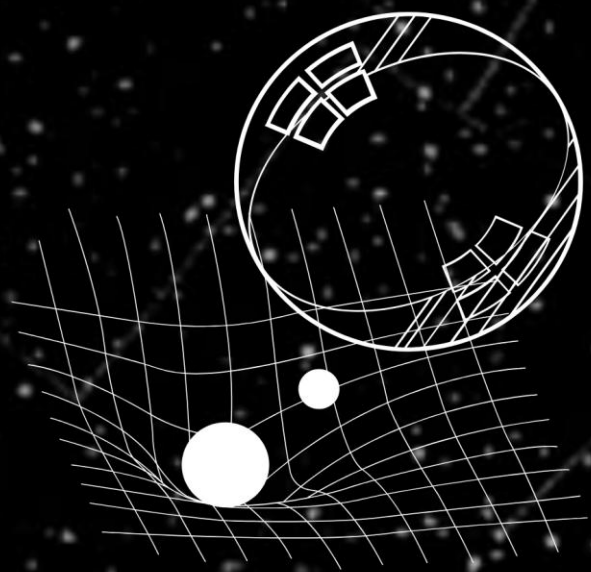
[1]https://www.sciencemag.org/careers/2018/10/why-world-mental-health-day-matters-scientists[2]http://indianmhs.nimhans.ac.in/Docs/Summary.pdf[3]https://www.accreditedschoolsonline.org/resources/student-mental-health-resources/[4]https://economictimes.indiatimes.com/magazines/panache/mental-health-in-india-7-5-of-country-affected-less-than-4000-experts-available/articleshow/71500130.cms?from=mdr

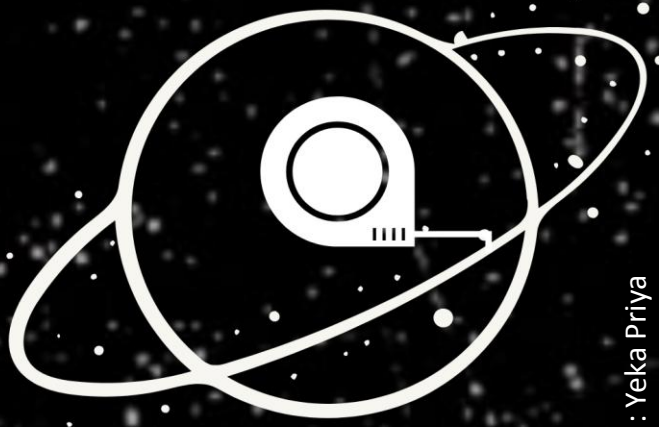
The lack of self-awareness is a defense mechanism of the mind, clinically known as "anosognosia" which often restricts the recognition, discussion, and disclosure of mental health issues but people take it one notch higher by declaring that it doesn't exist, it is just "dimag ka veham"-a figment of our imagination. The sensitivity and criticality one needs while talking about mental health requires a lot of work more than we can imagine. People can talk about such things on the surface so that they don't miss the current trend but leave it for you to deal by yourself believing it's "just a phase" or "it doesn't happen to happy people" and sometimes even "you are acting to seek attention". We frequently demean such people by calling them, cowards. Calling someone a coward is the easiest thing we can do when we don't have the flexibility to stand in their shoes for a moment. In all this, we forget they are human too. They need help and affection instead of unnecessary judgments and taunts. It is so convenient for people to overlook the things happening as all they have to say is we are here, and in case they let you open up, they don't know what to do afterward. All they end up is being indifferent because of their lack of knowledge, with you as if you've got some disease. All of us are raised in a culture where mental health is like a foreign language and it all puts us over a cycle of not being adequate all over again. Implying that people with mental health disorders are a burden and can be contagious. Sometimes even accusing those of using use their mental health issues to harass others or that it is all made up.

The current circumstances are horrifying and we know how mental health has taken a toll. Keeping in mind how access to mental health is not just a financial privilege but social and emotional too, academicians and celebrities have come forward with personal manifestations and experiences to dispel the taboo and stigma surrounding mental health challenges and to help other recognize and tackle with potential signs of distress in themselves.
The stigma around it is real which is often seen as an "extension of the real problems" and all focus and efforts are put in a direction on fixing that rather than taking the person to a psychiatrist or counselor and it needs to spelled out loud. And even if somebody tries to contact someone who has a medical degree to help the person out, the unavailability and cost of this approach make them turn around. Societies' point is why to spend money to fix something which looks alright from outside.

I doubt the world will become "nice" or the people will become empathetic overnight. But so far one thing is clear: the conversation has just begun, there is much more yet to be done. What we need is to stop trying to fit hard to the stereotypes and assumptions of people around us and start seeking therapy, rejecting the unprocessed trauma stored in our bodies. We often see how to help others and the least we can try is to provide a support system to those who need it, The depressed people need the help which goes beyond "Chal tere ko party deta hu"-Come on, I'll give you a party, kind of cheering up tactics. It's important to understand that not all of us are professionals and reaching out for a counselor's help is pivotal. Many people wait a long time before seeking help, but it is best not to delay. The sooner you see a doctor, the sooner you can be on the way to recovery. Therapy is very important to pinpoint the exact cause of the malfunction and correct it through diet, medicines, or change in the environment so that one can cope up better.

UNCERTAINITY IS THE ONLY CERTAINTY





Designed By : Yeka Priya