“Do they want to do what everybody is doing or are they doing it for the sake of it?”

-Sai Ghule

Is the Cat Dead or Alive?

Science Day: Another Raman Effect

Feb 28, 2022 #ScienceDay
The winds blow, its science.  
The trees grow, its science.  
We thrive, its science.  
We are alive, its science.

Science is like the Mariana trench of knowledge. The deeper you go, deeper it gets. Even after numerous discoveries, the glass is still half empty. There are many more discoveries to be made, many more fields to be explored, many more truths to be uncovered.

Scientists are the priests in the world of knowledge.

Science is their God,  
Their research, their meditation.  
The development, their salvation.
One such scientist marks the Science Day in India: C V Raman. National Science Day is celebrated throughout Indian institutions, schools and colleges to mark the advancements in Science and contribution of our Indian scientists in their respective fields.

This edition of Wings magazine highlights the reason behind the celebration of Science Day in India with an article on C V Raman and attempts to take you through the complex but inevitable world of Quantum Physics.

To praise all the women who contributed to this field, we have an article on ‘Women in Science’, speaking of which we have the interview of a young soon-to-be-engineer, Sai Ghule. She is currently the Operations Secretary of Cummins and also the candidate to win the IBM Hackathon 2020. She is a mentor, a leader and an amazing student in herself. Be it technology or management, you name it, she’s done it.
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Q. Why did you opt for engineering and specifically computer science?
A. Ok so to be very honest I didn't want to opt for engineering. I wanted to do astrophysics but for some reasons I missed the IISER exam so my second option was engineering and always had interest in technology. I always used to roam with the screwdriver, a pen drive and something and would always see a computer how it is, how it works, see the hard disc, see the IC. So I was always interested in this stuff as a kid. So when astrophysics didn't work out I opted for engineering.
Q. We would love to hear your experience in UET, USA where you work as a management trainee?

A. I was in my second year and that time I used to send requests to many people on LinkedIn. I always wanted to work as a management trainee or on something we don't have that much exposure to through college. So one day I came across a person who was working at the start-up and we had this interview and I was the youngest person to work with them as a management trainee and what I used to do was I attended the weekly leadership meeting. I also had my own team which was called as Brandsmith and my team was responsible for interviewing people, so we interviewed the chairman of SRM University, the chairperson of a Computer Society of India. So we used to interview these people. Secondly, I loved the job as it had an International team like I had two people in my team working from London, some working from Africa, some from US so that give me an idea of how different people from different cultures come and work together at different time zones. I remember distinctly that I would have to wake up at 3-4 a.m. and answer the calls. Also due to the leadership meetings, I got to know how International start-ups work and developed new connections.
Q. How was your experience at Emergetech foundation and at Krishitect?
A. So UET and Emergetech are twin start-up. I joined Emergetech Foundation as a research fellow. They took me into management. Basically I wanted to do research and that’s why I applied for it. So I was as a lead research fellow over there and along with my research I had to take care of 30 other research fellows from over the world and see that their research is also going well. I was researching on cognitive artificial intelligence and how we could make machines conscious but after spending a few months into it, I realised that this was a topic not suitable for undergraduate students, you need to have a PhD and hence I switched my topic to genetic algorithm. I did my research how to reproduce images using genetic algorithm and I also have a paper on it. My topic was nature inspired algorithms and genetic algorithms are inspired by Darwin’s theory of evolution. And it is surprising to see how we can use these algorithms to recreate an image. For example, you have a photograph of your grandfather in black and white and the algorithm converts that into a colour photograph. So I was successful in doing that.
Krishitect, I got from college. I wanted to do masters so I needed a strong research background. So I applied for start-up based internship. Since I was in Emergetech, I didn’t want any corporate role. So Krishitect is basically an agriculture-based start-up. There I was working on ML project which would tell all the information like where to buy etc. about any vegetable that picture has been clicked. The biggest challenge was I had no dataset available so I had to create it from scratch by clicking pictures. It was tough but taught me well.
Q. It was great to know that you were also selected as a mentee for PWC EKA Programme among Top 5 college students, so how was your experience with that programme?

A. This was the best thing that happened to me till date. There were five of us and three were seniors that is we were just two people from third year. So it was third year and fourth year all departments combined and we had to write a essay on leading one self and I remember I finished my essay at 4 am in the morning and I was very nervous because I was in third year and competing with fourth year people made me nervous. But I think the reason I got selected was my essay was very true. There was no buttery language in it. I wrote everything about being ill yet giving CET and eventually landing in Cummins. Also how I developed myself after I won my first hackathon. In the program there were leaders of the company like the Vice-president and everyone and we had interactive sessions with them. So one day, I asked the Managing Director the reason behind selecting me. She told me everybody from computer science background knows how to code but we feel you can lead a bunch of people who can code. You can code and lead people as well and I see myself in you. Her words made me realise that I am better at managing roles than Computer Science.
Q. What was your challenge for NASA’s International Space App Challenge and how did you approach towards the solution?

A. The topic we had was to do something related to environment. It was a common topic in Hackathon that time. So, we found a tyre pad and what the tyre pad does is it absorbs CO2 and CO emissions. We integrated it with an AI app and every time a car travels from say, Karve nagar to Deccan, the app would tell you how much CO2 the tyre pad has absorbed and how much it can absorb in future. Extra features we wanted to add was if somebody is going through a route and the tyre pad has absorbed a certain level of CO2, then it can warn other people that this route has lot of pollution so don’t take your car from this route. We made to the finals of Nasa space app challenge and we were in the top 11.

Q. Congratulations on your win at IBM Hackathon 2020, we would like to know the problem statement given to you and your approach path?

A. IBM hackathon took place when I was in my second year and that was my real first achievement in Cummins. The problem statement was disaster management. We thought of a blockchain based prototype which will track donations. For example, during the Kolhapur flood, people used to send money but money wouldn’t reach the right people. So what blockchain does is that it makes smart contracts and when the contract is done, we used blockchain there and integrated it with a machine learning chatbot. The chatbot tells you how much amount of rice is needed by the particular family, not more or less, the sufficient amount. We also made a website. We integrated the backend blockchain with the website and the chatbot. So that it all worked smoothly, helping the needy people.
Q. Recently you were the winner of Citibridge 2021, we would like to hear about the competition and your experience with it. 

A. Citibridge is a unique, college to corporate training program which our college has every year. You first give an aptitude test and they select 100 girls for the program. They first train you about the corporate stuff. They first taught us springboot, angular and java. Then they made teams of 5 people and they assigned a mentor to us. They expected us to build an entire thing from scratch. So what happens in a regular college project is when we build a website, we only build a website. We don’t know how we connect that to an app. We just code in java, we don’t connect everything. But this was a project in which we had to connect everything and had to make a proper functioning website of nifty stocks. Our problem statement was ‘market capital-based stock recommendation system’ in which we had to fetch the nifty stocks from API and distinguish the stocks between large cap, small cap and mid cap, display the highest stocks. The project duration was 1 month. And during that training period, I was sick with covid. So I could not attend the sessions. Later I had to see the recording and then learn everything. But in the end, we managed to do it. But what extra we did and why we managed to win was because of two reasons- Firstly, we knew that everybody is going to do what they are taught. But we added security to the site. And a few other stuff which I can’t tell because Citibridge will also come this year, and if I tell people will just copy that. Then, the most important thing is the presentation, your confidence, and how clear you are on your thoughts.
Q. What preparations would you suggest to ace in these hackathons and similar competitions apart from the college syllabus?

A. I would suggest self-learning. People just study for a good CGPA or for getting placed in Google or Microsoft. But the one thing that I truly believe in is there’s a lot to CS than hackerrank. There are so many things that one can explore. People just do everything just at a glance. But for a hackathon, you need to go into things deeply. If you’re doing web development, you just cannot google a template and show it to the examiner. You have to know what goes behind it. And secondly, what is important for a hackathon is adaptability. We in Cummins are used to learning the subject for a few months. In a hackathon, we have to learn 2-3 different technologies in a day. You should be that quick to adapt to things. And the most important thing was mentioned in the last interview by Ritvi as well, that googling is important to win any hackathon.

Q. Currently you are working on SCLP Compiler with IIT Bombay as your final year project, would you like to put some light on it?

A. We have been working on it for 4 months now. This project was actually started 10 years ago. Our seniors from Comp department did this final year project last year as well, and we are continuing the research work. The project is a lot complicated and it’s nothing like what we’ve been taught in college. So, the compiler itself is a difficult thing to understand. Because we just write the code, compile it, run it. But the compilation which takes place behind it is very complicated. You need a strong understanding of theory of computation and grammar. We are also working on specifications, translational rules and assembly language and everything.
Q. Now moving onto some extra-curricular part, firstly heartiest congratulations on winning the Position of Operations Secretary in Students Panel of 2021-22, what do you think helped you earned the position?

A. When I was in my FY, we had our general secretary, Ipshita and I used to see her and it felt so great. The power she had, the respect, the kindness. And that was the moment when I thought that I want to be the head of the student panel one day. And from SY I’ve put in efforts for it. It was my long-term goal. In the SY, I became the head PR of AICVS, Cummins. That was the time when some people started to know me. Then I won the IBM hackathon after which many people started to know me. And then in TY, I became the class CR, training and placement cell representative and also started to mentor juniors. I have mentored 50+ juniors to get their dream company, to get into the research work which they wanted. I helped students to write e-mails to professors. After a year of mentoring people, most of the people knew who I am. I always like to help people. Operations secretary is the head of the student panel and this position can be handled only if you actually like to help people.

Q. What would you say you like more, engineering or management? (laughs)

A. We live in an era where no domain is specific. Everybody now-a-days is learning coding, data analysis. What is required in this year is that people should be multi-talented. I think there is no choice between management and technology. I’m a person who acts as a bridge between the two. So in the future I’ll be trying to work in technology but more on the managerial side.
Q. Would you like to mention someone who has always supported and inspired you in your journey till date?
A. My mom. The woman literally gave up everything for me. She is a very important and inspiring for me. She did her MBA, finance when she had me and her full-time job. Yet she topped her college in MBA, finance. In the morning she used to work and in the evening she used to attend college. So my mom is someone who I look up to.

Q. In what activities do you engage yourself as to refresh your mind?
A. Solving Maths or solving any complicated problem gives me peace. I go in a state of meditation when I’m doing something. Maybe reading books as well. In my free time, I mostly mentor people. But when I’m really upset, I actually sit down and solve a few calculus problems. I even learn a new language. I was stressed out during placements so I learnt the German language. So basically I learn something.

Q. What do you plan to accomplish in future?
A. I want to travel the world. This is something I wanted to do since my childhood. Not just travel, I even want to work in technology, management. Whichever field I go, I want to live each day to the fullest. So my next goal would be to go abroad do an MBA/MS.
Q. Any advice for your juniors?

A. Seeing today’s juniors, those people really scare me. They just call me at night at 12am and say “You know what didi? Humne 10 kitaabe padhi hai, will we get this will we get placed in Microsoft?” I am like, you’re just in your SY. The advice here I would like to give is don’t stress so much and don’t run in the rat race. Find out for yourself what you want. When I came into this college, even I wanted to get placed at good companies. But what I realised in these 3-4 years is that I wanted to be a consultant and I don’t want to be a software developer and that’s what everybody should explore. Do they want to do what everybody is doing or are they doing it for the sake of it? So people should self-analyse themselves.
The year was 1921. Chandrasekhara Venkata Raman was on a trip to Europe when he noticed the striking blue color of some icebergs and the Mediterranean Sea. He was inspired to want to understand the reason behind this phenomenon. The only explainable reason behind this was stated by Rayleigh’s Scattering. But Raman found that Rayleigh’s theory was questionable by a simple mode of observation using a Nicol’s prism.

Light consists of particles called photons, whose energy is directly proportional to the frequency with which they travel. When they strike molecules in a medium at high speeds, they bounce back and scatter in different directions depending on the angle with which they hit the molecules. Most of these scatterings are elastic — the photons retain their energy and are deflected with the same speed as they were traveling with.
Raman found that Rayleigh’s Scattering could only clarify the elastic scattering of light but there was some inelastic scattering that could not be explained by Rayleigh. To support his theory, he conducted experiments with transparent blocks of ice and light from a mercury arc lamp and recorded the spectra by shining the light through the ice block. The results he formulated came to be known as the Raman Lines, caused by the Raman Effect. The definition thus followed; the Raman Effect is the process of inelastic scattering of light particles by molecules of a medium. These molecules of the medium through which the light passes, absorb or give energy to the photons that strike them. The light particles then bounce with decreased or increased energy, and thus, frequency.
When frequency shifts, so does wavelength. This means that light refracted from a body, like the Mediterranean Sea or an iceberg, can appear to be of a different color.

The effect is extremely negligible when measured and occurs in very low amounts, but each medium contains a specific molecular scattering signature, related to the particular molecule and its numbers. This gave birth to the field of Raman spectroscopy, which has extensive applications around the globe, and across various fields.

Raman Spectroscopy can help in determining chemical bonding structures, characterize materials, determine temperature, find out crystalline orientation, identify pharmaceutical chemicals, discover counterfeit drugs, identify pigments in old paintings and historical documents and detect explosives using lasers from a distance.
Raman and Krishnan’s work was recognized and rewarded in 1930 by a Nobel prize. Raman was awarded solely; Krishnan didn’t share the award, although his name was given an honorable mention. Soviet physicists Grigory Landsberg and Leonid Mandelstam observed the effect in crystals just a week before Raman did, but Raman published his results first. The duo also ended up citing Raman in their study, and thus weren’t recognized as the original discoverers of the effect.

In 1986, the National Council for Science and Technology Communication (NCSTC) asked the Government of India to designate February 28 as National Science Day to mark the discovery of Raman Effect.
Is the Cat Dead or Alive?

For most of us, quantum physics has long sounded frightening and perplexing. Things operate reasonably well on a broad level, but as we get deeper and deeper into the subatomic realm, the real disaster begins.

Quantum physics is the branch of physics that deals with the tiniest objects in our universe, such as molecules, atoms, and subatomic particles. Things down there don't quite work the same way they work up here. This is fascinating because everything around us rests on quantum physics and this is how the whole universe works. It leads to some unusual conclusions about the physical universe, which may appear strange at first.
Many of the equations of classical mechanics, which describe how things with usual sizes move with usual speeds, are useless at the scale of atoms and electrons. Objects exist in a definite place at a specific moment in classical mechanics.

Objects in quantum mechanics, on the other hand, live in a haze of probability, with a certain chance of existing at point A, at point B, and so on. So with quantum physics we cannot state for sure, but can only predict probabilities that things will happen.
The physical interpretation of some offbeat concepts involved in quantum mechanics makes it weird and difficult to understand, one being Quantum Tunnelling. Assume that you have a bouncing ball with you and you are hitting it against a wall. It keeps coming back to you, and you keep hitting it, but there comes a point when it disappears at the wall and reappears on the other side, creepy right? This is Quantum Tunneling. Technically speaking, a subatomic particle can pass through a potential barrier greater than its energy, this is in fact the reason behind our existence.
Another fascinating theory of Quantum mechanics is wave particle duality, it describes the outcomes of experiment that showed that light and matter have the properties of particles or waves, depending on how they are measured. Today, we understand that these different forms of energy are actually neither particle nor wave. They are distinct quantum objects that we cannot easily conceptualize. Another similar idea is superposition, which states that you can perform exactly opposite things at the same time before someone looks upon you. For example, if you are a quantum particle, you can rotate clockwise and anticlockwise at the same time before any measurement is taken. This principle is related to the famous hypothetical experiment of Schrodinger's cat: at the instant before the box is opened, the cat is equal parts alive and dead at the same time. The only time we observe a single definite state is when the box is opened.
Quantum Physics contains a plethora of fascinating theories that are tough to picture and hence comprehend. However, these theories have paved way for a slew of new discoveries, including computers, digital cameras, LED displays, lasers, and nuclear power plants.

Quantum physics has a mystique for being difficult to grasp; indeed, Richard Feynman, who won the Nobel Prize for his work on quantum electrodynamics, once said, "If you think you understand quantum physics, you don't understand quantum physics".
The presence of women in science spans the earliest of times in the history of science wherein they have made significant contributions.

It is believed that Merit Ptah was the world’s first female scientist who lived during 2700 BC. Though the ‘Women in Science’ concept grabbed many eyes after the first female Nobel laureate, Madame Curie. According to records, 58 women have been awarded the Nobel prize, which is, as it seems, quite a low number.
Despite significant improvements in the last couple of years, women are still outnumbered by men in science and technology, including academic and private sector. This accounts for a variety of reasons, mostly related to the role allocated to women in modern society as well as pre-existing prejudices that form glass ceilings while encouraging male presence in the workplace.

What seems to be missing are ample role models for young females who could act as inspiration and source of guidance, and offer a glimpse into the reality of being a female employed in the field of science and technology.

Until date we have Asima Chatterjee, the first Indian female scientist to be awarded with the doctorate from an Indian university. Despite the hardships and social restrictions of women being exposed to higher studies, Asima chose organic chemistry and excelled at it.
After going through a revolutionary era, women have been entering this field of science and technology continuously and creating wonders. The time isn’t far that the world will soon see women enhancing all the fields with their intellect and creative ideas.