

NERD NEWSLETTER

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Notes On Engineering, Research and Development

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EDITORIAL

The NERD Team brings out this semester's last issue covering the events that occured this semester, highlighting the most awaited Walter Lewin Talk in Techkriti -14. NERD aims to enthuse, create and communicate, and as always looks forward to the continuing active support of its readers.

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Dr. Walter H.G. Lewin, eminent astrophysicist and Professor Emeritus of Physics at MIT, was the Chief Guest for Techkriti 2014, IIT Kanpur. Dr. Lewin, regarded as a childhood hero by so many students all over the world for a better part of their high school, has captured everyone's minds with his unique style of teaching. His *whoosh*ing chalk marks, his loud & clear "AHA!", his swinging over as a pendulum, his explanation of the simplest of phenomena with a sonorous "Physics works, I tell you" these are legendary in the field of physics teaching. He began his talk with the same picture of the swinging pendulum on the slideshow with some additional remarkable words - "What counts is not what you cover, but what counts is what you uncover."

After charming the entire campus with his friendly and open attitude with the students, Walter Lewin also mesmerized all with his talk on astrophysics. A packed auditorium got to know about the births and deaths of stars, and the life cycles of various kinds of stars depending on their masses - the final fate of stars destined to become white dwarfs, neutron stars or black holes. The explanation of Doppler shifts using a tuning fork had the audience at the edge of their seats! He also talked about the discoveries of radio pulsars by Jocelyn Bell and the subsequent surreptitious removal of her name from the Nobel

Prize. Overall, the late night talk was the most popular news in the campus for days to come.

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By Sharbatanu NERD

Your comments and contribution are always welcome. Please send them to the Editor at nerd@iitk.ac.in

Concept of Parallel Universe - Multiverse

Te always think that there are billions of stars in a galaxy and there are billions of galaxies but we believe the universe is one. It seems however that actually the universe is not one, but rather in billion numbers. In recent years, the multiverse theory is accepted by most of the astrophysicists across the globe. Multiverse are the parallel universes which exist and are defined to be infinite in number. A theory which was accepted recently delineates the continuous formation of universe when stars collapse and black holes are formed. Inside each black hole there is a new point of 'singularity' where all physical laws cease to exist and probably after that singularity various basic forces such as gravity, nuclear forces and electromagnetic force may be absent and if this seems true or if any of the single forces mentioned are missing then one can say that it is a different universe. A famous astrophysicist Martin Rees of Britain in 1998 quoted -

"Our universe may be just one element - one atom, as it were in an infinite ensemble: a cosmic archipelago. Each universe created with its own big bang, acquiring a distinctive imprint and its own physical laws as it cooled, and tracing out its own cosmic cycle. The big bang which triggered our universe is, in this larger perspective, an infinitesimal part of a complicated structure that extends far beyond the range of any telescopes."

To most of us the concept of a parallel universe may sound mind-boggling but a recent book from an Oxford physicist David Deutsch titled - "The Fabric of Reality: The Science of Parallel Universes - And Its Implications" reads the potential of knocking in on multiverse. He proposed that one computer through a parallel universe would be able to find an identical corresponding computer from the other universe and could collaborate with that computer to increase information & knowledge of the other universe. This further involves the alliance of many theories that have not much proof. Nevertheless, it is another division

> of the Multiverse theory that has become much more accepted in recent years and that could possibly give way to positive benefits for society.

The Multiverse theory of parallel universes has many implications and among it is the unique and complex process by which our own universe was born, and further how easily it could have been different from others. It may appear that of all the possible millions or billions of universes, ours is unique enough to develop and support life and this can be special. But maybe life in another universe has got some different meaning, while we know that our universe is special in that as it houses various kinds of life forms. If just one physical law of our universe would have been slightly different, then there would be nobody to realize the beauty that we can view on an everyday basis. This raises one crucial question - if every universe was born from another universe, where did it all begin? Such questions remain debatable in the present world scenario.

> By Manoj Jhawar NERD

Corrupting Nature - The ultimate sin

While human civilizations have advanced hand in hand beginning from pagans to the modern corporate world, we have also induced a significant change in the world surrounding us, but not that which consists of humans, rather that which was originally given to us by nature. In this article, I shall simply brief and discuss some experiences, coincidental observations and conclusions that I derived from these.

I shall begin from an instance when I was travelling on the Intercity Express from Bhopal to Jabalpur. Until the last decade there was no direct way of getting to get to Jabalpur from the capital city of Madhya Pradesh, but the Indian railways has done a terrific job of laying out the lines in a brief period and to even make it operational within months afterwards. There is still no electrical supply for the engines to run, so diesel engines are used here, as they are on several other routes in our country. While an electric engine can pull 16 coaches on an average, a diesel engine is well capable of pulling 25 if not more. While I travelled on one of these trains pulled by a diesel engine, I saw bunches of bugs falling down from the sky like rain drops in monsoon. How did this happen?

I realized it's the exhaust that makes the surroundings destitute of air, which even the bugs need to survive. If all that is detrimental to bugs, tell me how it would be for us? Consider the fact that mostly the lines on which such trains run are located on the boundaries of farms producing the grain that feeds a large portion of the population. Well I don't need to stress on the fact that its effect is in billion for us. Imagine the amount of carbon we are consuming and the detrimental gases we are breathing. There is not much research into the deposits, and if you ask me, the way the Government operates, I am convinced it would be decades before they look into this matter. There have been talks that diesel exhausts can't kill, they can only damage the senses of bugs like honey bees. However I believe what I saw, and the only thing I can conclude is that the above is true only when the diesel is not tampered with. Does that mean there is tampering or contamination of the diesel that is being supplied to the Indian Railways or are they doing it themselves? A plethora of such questions remain unasked and unanswered. Now where is the media and the newspapers which we have in abundance in our country? Well, I guess they are too busy with 'important' news such as Yuvraj's house getting stoned a few days back.

If there is an imbalance at one end of this chain, it protrudes automatically to another link in the chain.

Now let us think, about the impact that such incidents bring into our lives as we scurry around this world like cockroaches thinking about nothing but our comfort. I have already discussed the contamination in the grains we consume. Let us ponder on the impact that could occur with respect to the ecological balance. In a farm there are hundreds of species thriving which consume one another and maintain the balance of the ecological system nature has devised. Now if there is an imbalance at one end of this chain, it protrudes automatically to another link in the chain. And the process continues until the last link in the chain is affected. Let us suppose if it wasn't the case. For example at the first instance the lizards and frogs etc. which consumed these bugs survived somehow, but would they be able to reproduce like they would have otherwise? The answer is no. And even if they did, would their offspring survive the contamination? Rather unlikely, if you ask me. Such pollution even has a large effect on the next generations in the ecosystem.

In the Bible the seven sins of man which consign him to hell are defined. Now wouldn't you say that tampering with nature should be the ultimate sin? While the seven sins lead to the demise of one man or those he associated with, the tampering with nature and its affairs is slowly leading to the damnation of every race on the planet. And yet we remain blind and ignorant about this, even though we see everything with our own eyes.

> By Divyesh Varade NERD

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SPEAKER : Prof. H.C. Verma TOPIC : Understanding Nature through SCIENCE

Here, we explain the answers to the questions posed by Prof. H.C. Verma during his talk. He demonstrated two popular experiments from our daily lives, as described in our newsletter, V6N1.

The first experiment was the classic water-filledglass-supporting-a-coaster experiment, where it is known that the pressure reduction due to volume extension of air inside the glass causes the pressure outside to support the coaster. The audience was quizzed on the exact moment when the air pressure inside is going to decrease. The air pressure inside is going to decrease on turning the cup upside down as this causes water to seep out onto perhaps the rim and causes air volume trapped inside to increase, thus decreasing the pressure and causing the atmosphere to do its work and hold the coaster together.

As for the second experiment regarding the rising of water inside a glass jar overturned over a burning candle, we were asked the reason for the flame extinguishing and the water rising inside the jar. Though the consumption of oxygen during combustion and the production of carbon dioxide might be a reason for the volume change, but there is no guarantee of the entire 21% oxygen being used up. which would cause the significant rise in the water level inside the jar. The more plausible reason is that the heated air in the candle-burning atmosphere causes some of the air inside to escape the jar and the candle extinguishes due to lack of oxygen as the carbon dioxide produced chemically displaces oxygen required for the combustion to occur. As the air inside cools, it contracts, causes the pressure to fall and this causes water to rise. This also explains why the water rises in a rush when the flame extinguishes and not at a steady rate.

SPEAKER : Prof. Jayanta K. Bhattacharjee TOPIC : Pattern Formation in NATURE

National Science day, February 28, the birth anniversary of Sir C.V. Raman saw a wonderful talk on the intricacies of pattern formations in nature by Prof. Jayanta K. Bhattacharjee, Director of Harishchandra Research Institute, Allahabad. Lamenting on the sorry state of affairs in the nation that makes it earmark a day separately to celebrate science (when the cultivation of scientific temper is supposed to be a fundamental duty of Indians) Prof. Bhattacharjee started off with his talk on pattern formation in nature. By the end of the lecture, he had the entire audience enthralled with the captivating patterns that go unseen in front of our very eyes.

The summary of the talk is as follows:

Patterns are ubiquitous – they abound in nature and in everyday lives. They can be temporal (yearly season changes) or spatial (the stripes on the skin of a zebra). They form on every scale – in the visible world, they range from the kitchen sink to the distant skies. They exist too at scales as small as molecular dimensions and at scales large enough to take us to the edge of the universe. Prof. Bhattacharjee's talk focused on spatial patterns in the visible world. The central point was that patterns emerge as a result of competition between opposing forces. The talk emphasized on how trying to understand patterns in everyday observations can lead to insight into scientific truths.

By Sharbatanu NERD

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