IISER PUNE

# SENTIENCE

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*this issue*



## Peter Schneider Is New J. C. Bose Chair Professor

Dr. Peter Schneider, professor of mathematics at the University of Muenster, Germany has currently joined IISER Pune as the J. C. Bose chair professor from 1st September to 1st October 2011. The first occupant of the chair was Prof. Girish Agarwal in 2010.

**Professor Schneider**

The J. C. Bose Chair Professorship was instituted at IISER Pune by the Ministry of Human Resource Development (MHRD), Govt. of India in 2010 on the occasion of the 150th birth anniversary of the eminent Indian scientist Sir J. C. Bose. The J. C. Bose Chair allows IISER Pune to invite eminent and distinguished scientists to spend time at the institute interacting with faculty and students and to lecture on frontier and emerging research areas. During his stay in IISER Pune, his office will be W311 in the West wing of Sai Trinity Building.

Accordingly, Prof. Schneider is in IISER Pune for the month of September. He is one of the leading mathematicians in the world working with p-adic methods in arithmetic and geometry. He has made major contributions to Iwasawa theory, Langlands' program and p-adic analysis. He has developed a thriving school of younger mathematicians in Germany working in this area, and is widely sought after as a lecturer at conferences around the world. In recognition of his work, he was offered a special Chair at Cambridge University in the year 2000 (which he did not take for family reasons). He is an excellent expositor and his lectures are renowned for their clarity and precision.

During his visit, he is giving a number of lectures, talks and seminars on various topics. He is giving a brief course on 'Local Fields' which consists of 3 lectures per week on Tuesday, Wednesday and Friday from 5 PM to 6 PM aimed at undergraduate students (fourth, fifth and advanced third year students). Local Fields are important objects in Algebra and Number Theory. They are obtained by completing the rational numbers with respect to a different metric than the usual one. The prerequisites for this course are basic linear algebra and some basic knowledge of rings and fields.

He also gave two seminars on 'p-adic Banach space representations' and 'Local Galois representations and the Langlands program'. He also plans to give a colloquium at IISER Pune aimed at a general audience, the details of which would be announced soon.

It's a great opportunity for the IISER Pune mathematics fraternity to interact with him.

## Virtual Bloodshed At IISER!

**'Homicides' - The winning team of the Counter Strike tournament**

Mid-September onwards, sporting spirits are high at IISER Pune as the *Kreeda Jung* is holding a variety of events - from the exhausting volleyball matches to the equally demanding and addictive cyber games like the Age of Empires (AOE), Counter Strike (CS), FIFA and Need For Speed (NFS).

Six teams participated in AOE while eight teams did in CS.

Ultimately, the team comprising of "Lord Borg", "Elpuir", "Necromancer" and "JeeTen" became the emperors by winning the finals of AOE while the 'Homicides' proved that they were ever ready to strike and play as a team countering all other opponents. The events were so popular that some of the well-contested matches were projected on to the big screen for the other members of the IISER community interested in knowing the strategies of the best teams of IISER.

Among other events, Table Tennis and street soccer have already begun while volleyball and basketball tournaments are about to begin soon. The volleyball matches have been scheduled on 24th and 25th September, and the preparation is going on in full swing. The teams have already been decided and the slots fixed. So, Get Set Go!!!

## K. N. Ganesh Named Among Top 25 Indian Scientists

Prof. K. N. Ganesh, Director, IISER Pune added one more feather to his cap (and to the entire IISER Pune community's) when he was named among the top 25 scientists of India by the India Today magazine. His has been an extraordinary journey to become one of the most respected scientists in India, from being an odd chemist in the laboratory at the Centre for Cellular and Molecular Biology, Hyderabad to the Director of IISER Pune to the Vice-President of the International Union of Pure and Applied Chemistry (IUPAC), Biochemistry division.

A true proponent of the IISER Philosophy, he has always stressed on inter-disciplinary research with his own research in the interface between Biology and Chemistry. He strongly believes that the future lies in the field of Chemical Biology.

**Professor Ganesh**

In 1986, he conducted breakthrough research in the area of synthesis, by synthesizing artificial DNA to diagnose diseases with more accuracy. His work has emerged as a global standard in the area of peptide nucleic acids (PNA). In 1987, he researched on how DNA could be modified and used as a drug as such (antisense drugs).

In 1991, he produced artificial collagen (structural protein on the skin) peptides, which is a boon to the medicine world as it could be used to address diseases caused by faulty collagen. He has also explored the interaction of nucleic acids with peptides to help diagnose genetic diseases such as thalassemia and certain cancers.

At IISER Pune, he has given rise to new buzzwords like quantum photonics and glycosciences which, in the future, can revolutionize healthcare. He has inspired many students to take up inter-disciplinary research, especially in the fields of Chemistry and Biology.

**Courtesy:** India Today

## Academic Buzz

**1.** DAAD – Working Internships in Science and Engineering (WISE) for Summer 2012.
**Link:** http://newdelhi.daad.de/mainFrame/home/scholarship.php
**Deadline for applications**: 1st November

**2.** Annual Foundation School (AFS) 2011, IISER Pune.
**Date**: 5th - 31st December 2011
**Link**: http://www.atmschools.org/2011/afs/annual-foundation-school-part-I
**Deadline for applications**: 28th September

**3**. Workshop on Networks: Structure and Function, IISc Bangalore.
**Date**: 4th - 6th November 2011
**Link**: http://math.iisc.ernet.in/~imi/NSFWS.php
**Deadline for applications**: 30th September

**4**. International School and Conference on Quantum Informatics 2011, Institute of Physics, Bhubaneswar
**Date**: 13th - 22nd December 2011
**Link**: http://iscqi2011.iopb.res.in/
**Deadline for applications**: 30th October

**5**. DST-SERC School on Non-linear dynamics, IISER Pune.
**Date**: 4th - 24th December 2011
**Link**: http://www.iiserpune.ac.in/~sercnld/
**Deadline for applications:** 30th September

**6.** Radio Astronomy Winter School, NCRA-IUCAA, Pune.
**Date**: 26th December 2011- 2nd January 2012
**Link**: http://wm.ncra.tifr.res.in:8080/RAWS2011/candidate/welcome.ncra
**Deadline for applications**: 10th October

## SPIC MACAY Concert At IISER Pune



SPIC MACAY IISER Pune - NCL chapter will be hosting a *Hindustani* vocal concert by a renowned artist, Arati Ankalikar-Tikekar, on Tuesday, 27th September. She is a famous Indian Classical vocalist.

Her unique trait is that unlike her contemporaries, she can sing in multiple *gharanas* because of the training she has had under different *gurus*. Not only is she one of the most talented classical vocalists, she is also an extremely popular playback singer in the Marathi and Hindi music industry. She is best known for her albums like 'Tejomay Nadbrahm', 'Raag-Rang' and for her playback for Marathi movies 'Antarnaad', 'De dhakka', 'Savlee' and the hit Hindi movie 'Sardari Begum'. It is a unique opportunity for students of IISER Pune to interact and learn from one of the most popular musicians of the state.

The concert will be held at the Multi-Purpose Hall on 1st Floor, HR4 on Tuesday, 27th September at 10.30 am. All are welcome.

## Editorial

"Hey! What are your plans for *Karavaan*? Anything exciting on your mind?", I enthusiastically asked my friend. "I am going home", he answered casually. I was shocked to hear this and asked him the reason. I shook my head in utter disbelief when I heard the answer, "Just because everyone else is going. Anyway nothing good is going to happen".

How people get influenced by others' opinions, without even giving a thought about it, amazes me. I sometimes wonder, why is *Karavaan* happening at all? Why are the organisers working so hard? For what? For whom? My heart bleeds to see people spending sleepless nights deciding events for *Karavaan* while some of their "friends" ridicule them behind their backs.

The problem with doing or starting any activity at IISER is that there are only a few people who do all the work, while the rest of them do nothing, sometimes to the extent of not even being aware of the existence of such initiatives. The fact that it is a new institute and everything needs to be started from scratch makes the scenario even worse for the people who work. Even if you get past the starting phase driven by a lot of initial motivation, sustaining it is where the difficulty starts. Everyone is enthusiastic at the beginning, but it dies down quickly, and ultimately the same faces end up trying to swim against the tide.

If you look at a few experiences from the past, the situation becomes clear. Barring the initiatives which are supported or promoted directly by the institute (or a faculty member), like MIMAMSA and KALPA, almost every other venture or initiative started by the students has failed to stand the test of time. Perhaps, the most shameful thing is that we, being one of the premier institutes in science education, are not able to sustain a Science Club. Every year, there are attempts to revive the club, but it lasts only for a few weeks. There are similar stories of Astrophysics club, Team Turing, *Jijnasa,* Drama club and others.

Not many take up responsibility and the ones who do, get criticized. In most cases, it becomes an issue of egoistic clashes. Everyone wants things to happen their way. Everyone wants to be a leader. There is no teamwork, no coordination. Every new venture leads to tiny internal groups, blame games and politics, finally leading to its downfall.

This lacklustre attitude needs to be changed. This can happen only if there exists a feeling of belonging to the institution and a longing to see IISER at the level of the IITs or BITS today. It is the time to act. Ask yourself whether you want to contribute to the making of an institute which has the potential to be one of the best in the country. Be the change you want to see.

## Trumpet Sounds For MIMAMSA 2012

MIMAMSA– The annual science 'challenge' of IISER Pune, is a one of its kind competition in India which aims to test the logical and reasoning ability of participants rather than just factual knowledge. The format of the competition (the finals comprise about 14 hours of quizzing!) and the type of questions makes it one of the toughest competitions at the national level.

Last year, MIMAMSA saw participation of 108 teams across 4 centres– Pune, Mumbai, Nagpur and Hyderabad. Like every other thing in IISER, MIMAMSA is also expected to grow multi-fold over the last year. So, ambitious plans are being cooked up for MIMAMSA 2012. Accordingly, the first meeting was held on 9th September, in which various plans of expansion were discussed. The possibility of including Delhi, Kolkata, Bangalore and Ahmedabad in addition to last year's centres as prelim centres was discussed.

But expanding MIMAMSA to these many centres would require a steep increase in quality of the questions and also the manpower to manage the entire event. So, there was a debate as to whether it is feasible to conduct it at these many centres. So, it was decided to start working on the questions first and only then, after a month or so, depending on the quality and quantity of questions, would a final decision be taken. A Google group will act as a discussion forum for the questions.

The next meeting is scheduled on 15th October, to review the work done and to decide on the further strategy. So, start racking your brains and come up with questions! You can post your questions on the MIMAMSA Google group. If you are not added to the group, send an email to Sandesh Bhat(sandeshbhatjr@gmail.com). You are also encouraged to discuss answers to various questions posted in the group.

## *Karavaan* Around The Bend

The countdown has begun. *Karavaan* is just a month away and the work is going on in full swing. For those still clueless and with mouths agape, *Karavaan* is the evolving cultural fest of IISER Pune. The fest is planned to be a two-day event, bigger and better than ever before. It's high time the institute is abuzz with preparations. Dance, Music, Drama and other clubs of IISER Pune have optimistically invited performances and participation in the various events.

The first and second year students are most encouraged to contribute maximally as volunteers and in the cultural side of affairs by generally putting up a good show. The other batches are expected to contribute more along the lines of organisational input of planning and execution and ensuring smooth running of the programme.

For more information and updates, follow the main notice board regularly.

## New Goodies For HR4

**The new washing machines installed in HR4**

Your life at HR4 is getting increasingly more comfortable. No more do you need to do the laborious weekend chore of washing your clothes, as 4 brand new LG washing machines have been installed on the 2nd floor in the Central Wing of HR4. The machines are fully automatic and you just have to bring your detergent and set the program and the machine will do everything for you, except for folding up your clothes and placing them in your cupboard for you. Although rumors have it that a secret intelligent being is under development that aims to do even that! No more the drudgery of being forced to wash your clothes just when your olfactory senses are on the verge of permanent damage!

Moreover, to cater to the needs of the student community, a new stationery store has been opened in a room just above the main lobby of the central wing. The store will hold the answer to all the students' needs, like notebooks, pens, etc. and also items for daily use like soaps, common medicines, that earlier used to send students foraging amongst the shops in the Pashan Market surrounding Sai.

A new computer lab is also going to be operational soon on the second floor, and not to forget the SBI ATM. All these, in addition to the library, the gymnasium and the wi-fi which have already become functional, will truly provide a 3-star living experience to the students, the envy of all college students across the country. All it lacks a gaming zone, at which time it will become redundant for the students to venture out of the comforts of their campus, which is indeed the ultimate aim of the administration.

## Erdös Number

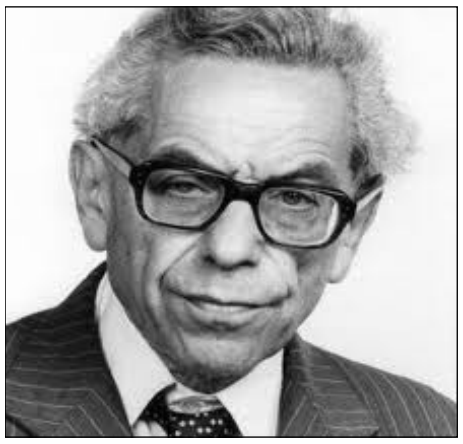
ASHWINI RAMESH

The Erdös number is one of the first of its kind. It's often referred to as the 'collaborative distance' between a person and the mathematician Paul Erdös. Its uniqueness lies in the fact that it relates every other mathematician with the 'God' of Mathematics- Paul Erdös - by a number.

Paul Erdös was a Hungarian mathematician well known for both having held the record for highest number of papers published and also for his eccentric nature.

Erdös was a child prodigy – having learnt to compute, at the age of 3, the number of seconds a person had lived for. Not surprisingly, he grew up to be one of the greatest mathematicians known to mankind.

He lived a rather 'nomadic' life, travelling across the globe and collaborating with a record number of 511 mathematicians. He is profoundly noted for his contributions to the fields of graph theory, combinatorics and number theory besides his bizarre vocabulary – he referred to children as '$\varepsilon_0$' because in calculus an arbitrary small positive quantity is called $\varepsilon_0$!



**Professor Paul Erdös**

To pay tribute to a mathematician of his calibre, the Erdös number was coined where Erdös alone was assigned a number 0 and all his collaborators, 1 and further, their collaborators, 2 and so on. Everyone completely unassociated were assigned $\infty$.

Due to large number of interdisciplinary sciences existing today, scientists of almost all walks of life have been assigned an Erdös number by the American Mathematical Society. Ayan Mahalanobis, Assistant Professor of Mathematics, IISER Pune has an Erdös number of 2. That means, he has collaborated with a collaborator of Paul Erdös himself!

Although the assigning of Erdös number has been subjected to criticism in recent times as it has no direct relation to the mathematics done; it is still considered to be a prestige and honour for those in the numerosphere. So… what is your Erdös number?

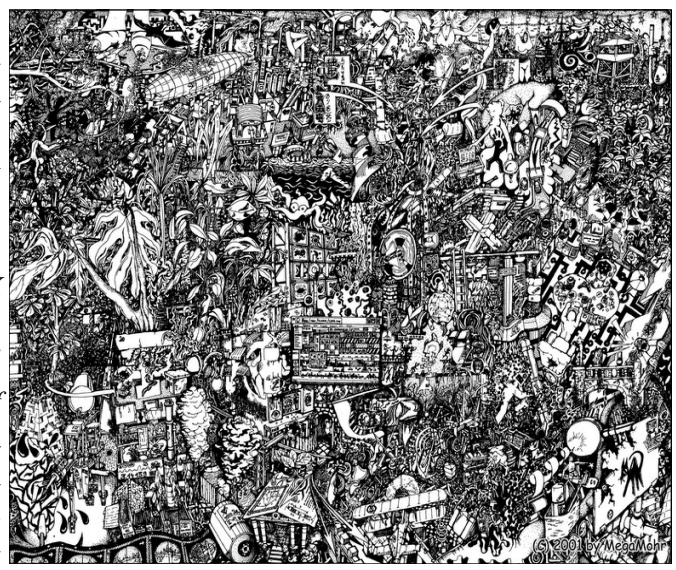
**Reference:** Wikipedia

**Inspired by**: 'A Beautiful Mind'

## Period Three Implies Chaos

SOURAV SARKAR

All those who love mathematics and all those who hate it, have you ever come across a result, say a theorem, and exclaimed silently, "How in the world can this possibly be true?"



Well, try this. Take any continuous function $f$ from $X$ to itself ($X$ being an interval on real numbers), and try to find a point $a$ such that $f^3(a) = a$ (given that it is not so for $f(a)$ and $f^2(a)$). If you do find such a point $a$, then proceed to choose a natural number $n$, any natural number I mean. For whatever number you choose, you will get a point $x$ in $X$, such that $f^n(x) = x$ (even when its true for no number less than $n$). Interesting?? "What is so special about 3?", was my straight response!

The result described above, is a corollary of the celebrated Sharkovski Theorem, a surprising theorem of the 2nd half of the 20th century and a classical result in the theory of dynamical systems. Before we go on to the general theorem (which might not be not too good looking to some), let's look into the history of it, and the story has quite a bit of spice in it indeed.

Alexandr Nicolaevich Sharkovski is the (first) mathematician to come up with this theorem. He was a Ukrainian, and he had published his paper titled "*Coexistence of cycles of a continuous mapping of a line into itself*" in the Ukrainian Mathematical Journal in early 1960s. The article was in Russian and anyway it was published in a Soviet journal at the time of the Cold War. So quite naturally, the article did not become known outside eastern Europe till the 2nd half of 1970s. Probably the topic was also not fashionable at the time. In 1975, American Mathematical Monthly published a famous paper titled *"Period three implies chaos"* by Tien-Yien Li and James A. Yorke. In this paper, Li and Yorke had proved the result described above and also introduced the idea of chaos in the context. Because of the paper, they came to a conference in East Berlin, where they met Sharkovski. This meeting resulted in the global recognition of Sharkovski's work.

Now we come to the Sharkovski theorem. To be on the safe side, I would just inform you that if a function $f$ has a point $x$ in its domain such that $n$ is the least number for which $f^n(x) = x$, then $x$ is called a periodic point of $f$ with prime period $n$. The Sharkovski theorem is based on a certain ordering of the natural numbers, different from the usual $n < n+1$. In this ordering, the natural numbers in "increasing order" are as follows (Here we shall use the notation *a, b* to mean *a* "less than" *b*) :

3, 5, 7, 9, 11, ...,
6, 10, 14, 18, 22, ....,
$3(2^2)$, $5(2^2)$, $7(2^2)$, $9(2^2)$, $11(2^2)$, ...,
...,
$3(2^n)$, $5(2^n)$, $7(2^n)$, $9(2^n)$, $11(2^n)$, ...,
...
..., $2^4$, $2^3$, $2^2$, 2, 1.

You can convince yourself that we have exhausted all the natural numbers in the process.

According to the Sharkovski theorem, a function $f$ (with the given conditions previously described) has a periodic point with prime period $m$, if it has a periodic point with prime period $n$, for all $m$ such that $n,m$. The special case for 3 is now trivial enough as 3 is the first natural number on the ordering described. Similarly, if there is no periodic point of prime period 3, but there is such a point for the prime period 5, then we can say that the function has periodic points with prime period equal to all natural numbers but 3 (notice that this does not necessarily mean that the function does not have a periodic point with prime period 3).

The proof to this theorem heavily relies on the Intermediate Value Theorem and hence the continuity of the function is an important issue. Consider the function 2x(mod 1) defined on [0,1). Though it has a jump discontinuity at 0.5, we can still apply the Sharkovski theorem on it (find out why!). Its easy to see that 1/7 is a periodic point with prime period 3. So there should be periodic points with other prime periods. What are they? You can reach to certain general forms for such points. For example, the points $1/(2^n-1)$ are points with prime period $n$. Finding the others is a petty exercise for you (if you can find a function $g$ such that there is a one-to-one correspondence between (x, f (x)) and (y, g(y)), then solving the problem for $g$ can often be an easier way to do it).

How chaos relates to this result and in what sense, is a non-trivial issue, and requires further analysis. But the existence of points in the domain that initiate orbits with arbitrarily long periods for the function (the case of an infinitely long period corresponds to a non-periodic point), is a significant result in itself.

Significant work has been done on the theorem later on. Attempts have been made to generalise the result for broader class of maps (discontinuous, multi-valued and so on) and for different types of phase spaces (X is the phase space in the terminology of dynamical systems).

## Tomatoes vs Tuberculosis

SHRUTI PARANJAPE

What if there was an elixir of immortality? What if there was a potion that could turn you invisible? What if you could gain immunity against the world's most deadly diseases by just stopping for a burger at the local drugstore? Well, I can't tell you much about the elixir of immortality or the potion of invisibility. But I can tell you that the answer to the last question is, as Bob the Builder would put it, Yes You Can!

The first vaccines made by man weren't mass produced. They were made only on order. Due to lack of storage facilities, all the vaccines had to be made and administered within a week of each other at the most. As technology developed over the

years, these problems were slowly removed.

First came refrigeration. Science breathed a sigh of relief when it was discovered that vaccines have a much longer shelf life when stored in cold storage. This got rid of the one week deadline.

Next came the fermentors. These humungous vessels contained just the right mixture of nutrients, oxygen and micronutrients for the microorganisms to produce the vaccine. This was preceded by a long and drawn out procedure by which they found the perfect strain of microorganism that could produce the perfect vaccine.

And now, we come to this day. We find that despite the high purity vaccines that we are now able to produce, the lack of electricity in most rural areas of India makes storage a problem. Also, the lack of skilled personnel for administration of the vaccines in these areas becomes problematic. And hence, biotechnologists all over stood up and solved all our problems.

Food vaccines are fruits or vegetables which contain the antibodies which are also contained in vaccines. The gene coding for these antibodies is introduced into the fruit/ vegetable plant and so the plant starts producing it in its parts.

Thus, on eating the fruit/vegetable, a person will have given the antibodies a free ticket into his/her bloodstream. This method is a little slower in terms of how quickly the antibodies reach the bloodstreams, but it totally wipes out all problems related to storage and administration of vaccine.

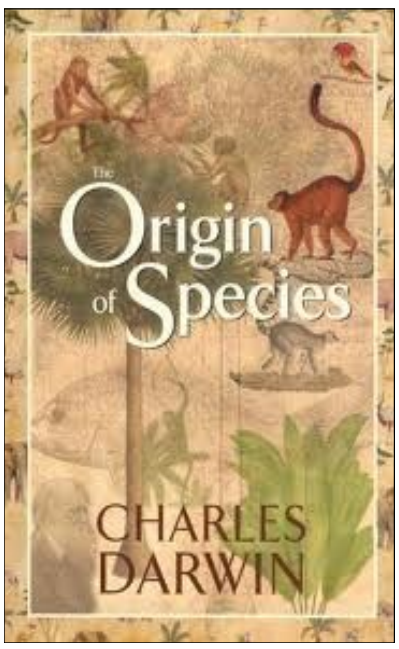
The day is not far when a child's vaccination list will look more like your weekly grocery list! So... Hungry Kya?

# Off The Rack…

## The Origin Of Species

RADHIKA R.

In 'The Origin of Species', the renowned naturalist Charles Darwin gives a detailed account of his famous journey aboard the vessel H. M. S. *Beagle*, the observations he made and the conclusions he drew in due course.



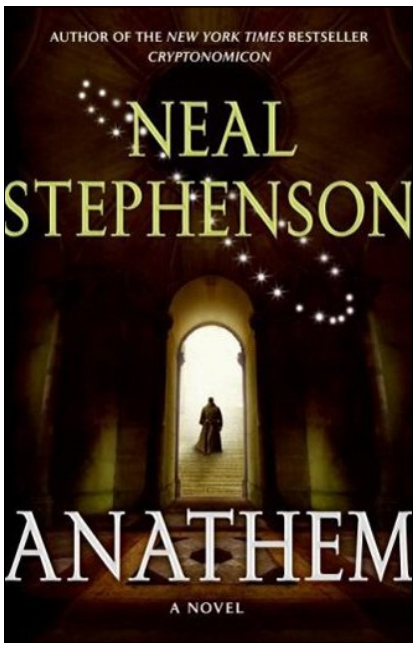

Darwin, himself a staunch disbeliever of evolution, was on the lookout for evidence needed to squash the concept of evolution, which, supported by the then recent theories, seemed to be carrying more and more popularity. Thus, when the captain of H. M. S. *Beagle* offered to accommodate him as a naturalist on the ship, he readily accepted it. The data he collected over years of research and exploration at the newly formed volcanic islands of Galapagos provided him with ample amount of conclusive evidence – but all in support of the theory of evolution. These findings initially shocked him too. Thus, he went ahead to explain this research and conclusion in simple language and format in his book – The Origin of Species – an attempt to make the data more understandable to the layman.

Though Darwin followed a long line of philosophers and naturalists, his work too led him to similar conclusions as theirs, his book was sold out on the very first of its release, owing to the sheer scale of speculation and controversy that surrounded it. Unlike today, wherein just going through the book once would take any of us through an exciting journey of evolution, the book failed to do so then.

## Anathem

SACHIT

Anathem is a work of science fiction that is quite unlike any other that I have read. Set in an alternate earth-like world, the planet Arbre, it has magnificently detailed descriptions of various academic traditions, (the mathematicians and philosophers have been segregated from the rest of humanity for eons), great action and amazing science. The strongest point of the book is that the "fiction" in the science fiction is not flashy magic disguised as technology, but that the author, Neal Stephenson, takes the frontiers (and fringes) of current science and shapes them into beautiful props in his universe.




For science fans it is a treat to see the way the multiverse interpretation of quantum mechanics, string theory and quantum consciousness (yes, he pulls it off) are stitched into the story line. He also takes the time to delve into subjects ranging from orbital mechanics to Plato's Theory of Forms.

On the downside, the book is kind of dense and slow to begin with till it picks up and the ending leaves you looking for more pages. Overall, it is an excellent read for any sci-fi fan.

"Anathem," Stephenson recommends in his acknowledgments, "is best read" as "a fictional framework for exploring ideas that have sprung from the minds of great thinkers of Earth's past and present." Such thinkers include "Thales and Pythagoras, Plato, Saint Augustine, Leibniz, Kant, Mach, Husserl, and Gödel."

# Pashan On Celluloid

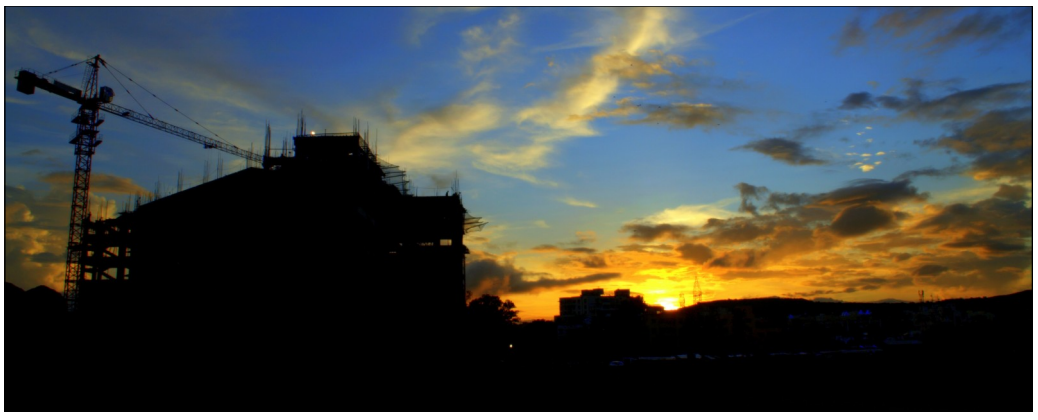


**Photo credits**
(anticlockwise from top-right)

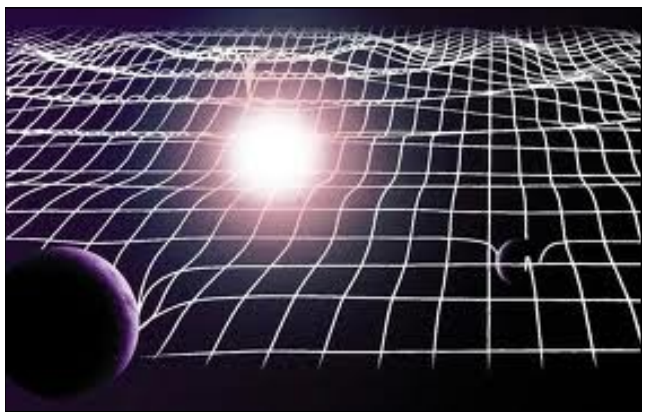
1. Vishnu K. N.
2. Sharvaree Vadgama
3. Chaitanya Afle
4. Ravindra P. N.
5. Harsha K. Kumar
6. Nisarg Desai

This is a collection of selected snaps by the members of the photography club. The photography club meets every Tuesday at 9 PM at HR4 and is open to all those interested in sharing their expertise as well as learning about photography.

## Detecting Gravitational Waves

ANANDITA DE

Gravity - we are some what familiar with (at least we would like to think so), waves - we are familiar with, but how do we see them coming together to form "Gravitational Waves"? Seems crazy right? Well, nature does behave crazily, and its workings are sometimes well beyond our imagination. In case of gravity, nature chose Einstein's theory of general relativity, over the somewhat simpler explanation of gravity given by Newton earlier. General relativity says, that presence of mass and energy (which are essentially the same) warps the space-time around them, and we observe this as gravity. Well, now gravitational waves won't seem such an crazy idea, as they are a direct consequence of this idea!



**Movement of large masses generate ripples in the fabric of space time**

When large masses move they send out ripples in the fabric of space-time. A neutron star, which is a burned-out core of a star, is extremely dense, since it carries the mass of the sun in a few kilometres. When such dense objects move they send out ripples in the fabric of space-time.

Scientists have been trying to detect the presence of waves such as this, which will provide a new insight into the way our universe is. This is done at LIGO - Laser Interferometer Gravitational Wave Observatory in the US. LIGO uses a device called the Laser Interferometer. Its a L-shaped device with two long arms of equal lengths stretched out perpendicular to each other, with two mirrors at the end of each arm. A beam splitter at the corner of the L splits a laser beam and sends it along the two arms. The light is allowed to bounce between the two mirrors before it returns to the beam splitter. If the two arms have equal lengths, the beams would meet at the beam splitter from where it will be directed back to the laser. If the arms do not have identical length, the light will be directed to a photo detector.

If there is a wave, it would cause the space to distort, consequently the length of the arms will not remain the same, and the photo detector will receive a signal. It converts the amount of light falling on it into electrical signals. Three interferometers of this kind were built for LIGO - two near-Richland, Washington and one near Baton rouge, Lousiana. At least two devices widely separated are required to rule out false signals.

The arms of the interferometers are 4 kms each. Such a large length is required to receive a considerable signal because the difference in lengths are as small as one thousandth of the diameter of a proton. The interferometers are housed in one of the world's largest vacuum systems of volume of 30000 cubic feet. The air is evacuated to create pressures as low as one-trillionth of an atmosphere, so that lasers do not get affected by the gas molecules.

The main challenge is to eliminate different kinds of noise, so that the lasers do not get affected by other energy sources and the mirrors which are extremely sensitive to movement. The various kinds of noises include thermal noise, seismic noise, radiation pressure. The suspended mirrors should be so well shielded from vibration that random motion of atoms and suspensions can be detected. Scientists and researchers are coming up with more and more technologically advanced systems to make the control systems which combine software simulations and electronic designs.

**The LIGO site**

Another such endeavour to measure gravitational waves is being carried out by NASA. Its named LISA - Laser Interferometer Space Antenna. The punch line for this mission goes like - "Gravitation is talking. LISA will listen". In this mission the whole equipment is going to be set up in space where some sources of noise will be reduced considerably. It will have three spacecrafts in a triangle with arm lengths of 5 million kms each. Gravitational waves reach LISA warping space and time, stretching and compressing the triangle. The waves are measured by monitoring the separation between the space crafts.

The universe has been observed by different kinds of electromagnetic waves starting from gamma rays to radio waves. But nobody knows how the universe will look in terms of gravitational waves. This new way will help us to probe deep into the universe and know about masses, shining or dark, and events such as collision of stars and vibrations of black holes. Nobody knows what these new observations will lead to. But let us be optimistic, and hope to understand our universe better when the projects become successful!

***References***:

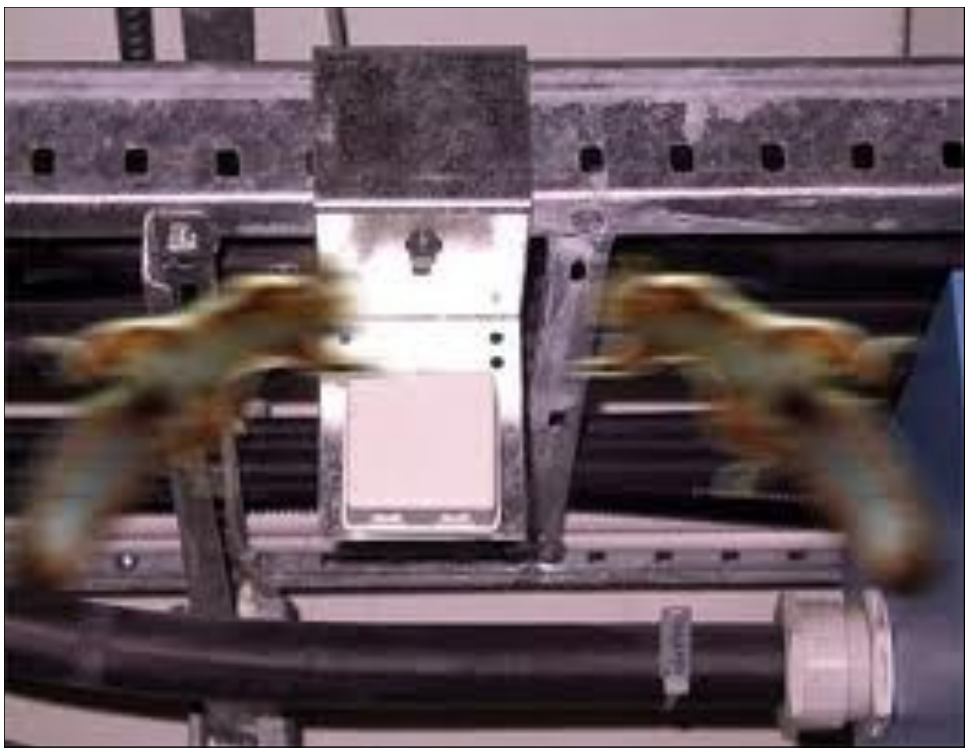
1. LIGO official site.
2. Colloquium By Rana Adhikari, Professor, MIT.

## LHC vs GAS

PUNYA PLABAN SATPATHY

The Large Hadron Collider (LHC) is found ever so often in the news. Everyone knows about it. At least most people can tell that it is a huge ring shaped machine in which particles go round at super-high speeds and then collide with each other which somehow would help scientists unlock the mysteries of nature (most people can't tell what the mystery is, but never mind). There is some Godly particle called the "Higgs Boson" which is supposed to give rise to a property which we call mass. Our great theorists have predicted its existence and the job to verify it now lies on the team of experimentalists and engineers working at the LHC.

While it may take at least a dozen or so years for the LHC to actually discover something significant, that doesn't stop people from using their imagination to use this idea in other fields of research (?). One such marvellous idea is called the 'Giant Animal Smasher (GAS)', developed by the 'scientists' of the Evolutionary Acceleration Research Institute (EARI). Instead of colliding elementary particles, GAS collides animals at large speeds. Apparently the scientists at EARI are jealous of all the attention the LHC is getting and hence, have come up with this amazing idea. And more probably, watching animals collide is much more dramatic and "visual" than "watching" two particles collide, which is another motivation behind the project.



**An artists' impression of a model of animal smasher**

Evolutionary biologists (Darwin will repent this!) believe that the GAS will help unlock many secrets of Evolution and lead to the discovery of the elusive "Darwin Particle". This particle could possibly create new life-forms, or accelerate evolution to unimaginable levels.

Analogous to the LHC, the GAS will collide animals at very high speeds and examine their vital parameters after the collision. The first test runs will only accelerate microscopic life-forms like bacteria and viruses to high speeds, but theoretically the GAS can handle animals as large as squirrels! Much of the early work in animal smashing is anecdotal, and has largely been carried out informally by pickup and semi-trailer trucks on the roadways of the world. However, this important work has been greatly limited by local highway speed limits. Scientists at the EARI are claiming that the GAS, when fully operational, would be able to carry collisions of animals moving at speeds as high as 12 kilometres per second!

Like the LHC, the GAS too is at its infancy now and it will take years for any successful experiment to be conducted. But the scientists are hopeful that the GAS will lead to a revolution in evolution and that they will get their share of limelight on par with the scientists at LHC.

So, keep your fingers crossed. One day you may hear the breaking news of the discovery of the "Darwin Particle" and the huge consequences and implications it will have on the biological world!

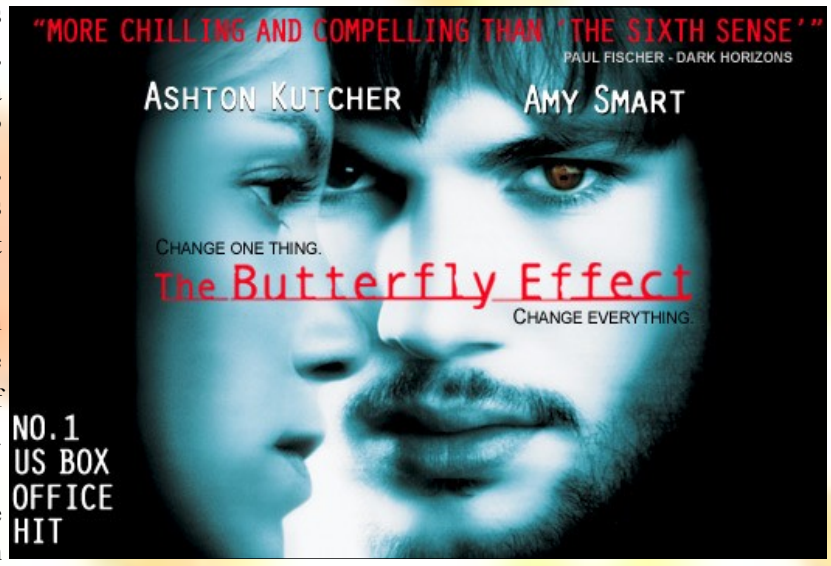
**NOTE:** ***The contents of this article are purely based on crude internet facts and are fictitious. There is no intention of demeaning any particular community or organization.***

# geneEXPRESSION

*the students' corner*

## Movie Review - The Butterfly Effect

ROSHNI BANO




If a butterfly flaps its wings in Brazil, does it set off a tornado in Texas? This simple idea, popularised by James Gleick in his best selling book *Chaos,* is explored through this movie, by the writer-director pair of Eric Bress and J. Mackye Gruber.

The movie is the story of Evan Treborn (played by Ashton Kutcher, among others), who suffers several childhood traumas and as what seems to be a coping mechanism, blacks out unpleasant memories. His physician suggests that Evan maintain a journal, so he remembers things better. This seems to help. By the time he is in college, he has stopped having these blackouts altogether, until one day while he finds one of his journals, starts reading it aloud and has a flashback of sorts. Strangely enough, he is not just an invisible observer, he *is* in the flashback and what he does then and there can change things. Armed with this knowledge, he tries to go back and make things better. But whatever he tries, things in the present end up far from perfect.

In his final effort, Evan tries to change as little as possible, and as soon as he's "back", burns up his journals so that he's not tempted anymore.

The screenplay of the movie is nicely stitched together to show all the could-have-beens. It might be technically incorrect to say that the characters are well etched out, given that each character is quite different in the different versions of Evan's reality, but the entire cast plays its part well. What seems to be missing though, is the attention to detail that the likes of Christopher Nolan and David Fincher bring to their movies. Also, the movie takes a very interesting premise, but doesn't make it intriguing enough, doesn't leave enough open ends to speculate. All in all, it's a decent one time watch, but doesn't give much food for thought.

## Foodie Corner

AASHAY PATIL

For the veggie lovers, the question must have always come to your mind that which is the quintessential vegetarian restaurant in Pune, where you could get tasty veggies, amazing *dosas*, and good desserts, all at an affordable price. **Abhishek** is one such place which will cater to your needs.

This is a normal vegetarian restaurant in Erandawane where you get every variety of food from Maharashtrian to Punjabi to Chinese to South Indian. The *dosas* at this place are simply awesome and even the south Indians like it! Especially try the cheese chilly *dosa* and the set *dosa*. All the Punjabi vegetables too have a very good taste and quality. Also, for those with a sweet tooth, the mango *mastani* of this place is very famous, and is definitely worth a try.

The service and the ambience of the place are good too. A wholesome 3 course meal won't cost you more than 250 bucks. So do visit this place at least once. But the place is mostly crowded so make sure you book your table beforehand or be ready to wait!

**CONTACT**

**Address:** Gulawani Maharaj Road, Near Deenanath Mangeshkar Hospital, Dattavadi, Erandawane, Pune

**Telephone:** 020-25438384

## En Route The Dinning Hall

A DIN(N)ER

An ode to the misspelt word.

The legendary Dinning Hall Route might invoke images of undiscovered paths to long-forgotten mysterious lands which hold promises of ethereal treasure. But the reader is jolted out of this pleasant reverie by the harsh, cold and indescribably ugly truth that this fantasy is merely an A4 sheet of white paper with black print and yellow fluorescent highlighter, lying pinned to insignificant yet noticeable places in the HR4 mess. But do NOT lower your expectations to unspeakable worlds below the crust, mantle and core… this is not an entirely futile document. It holds the key to the regulation of the time you spend splurging in the culinary delights of the technologically superior mess.

If you are a victim of the popular misconception that the mess is a haven only of alternative cooking (or not) methods, prepare to be thrown out of your seats because the sparse literature in the mess also reflects extreme creativity in grammar and spelling. But unbeknownst to these inventive beings, IISER harbours people with extreme OCDs against spelling. So much to the extent that lilting about in the IISER airs are rumors of a much awaited pageant of Misspelling (gender neutral) for Karavaan.

Getting back onto the Route, among the mess-spelt savories is a delightful assortment of delectables. A typical day in the mess begins with a caffeine-deprived scientist turning to a bucket of Samber for refuge, drowning in which are sad white shapes which plead guilty to be idlies. Slightly more appetizing (it could hardly be less) is the Choice (or the illusion of it) in the form of Tossed/Bread. Daring as the prospect of a 'tossed' sounds, it is perennially non-available as the long queue of expectant eaters suggests. The nut cases of IISER are in for tough competition as the mess is hit by a tropical tsunami of parthenocarpic produce… fresh bananas!! Much too fresh for palatability, especially for those not enamoured of raw bananas.

Supplementing the heatstroke by the noon sun, the mess provides oxymoronic (and plain moronic) dishes like the Veg Stri Fried, an insult to Plantae, the female *Homo sapien* and Raja Ram Mohan Roy in a single oily scoop. For those yearning for French cuisine, they have a weekly serving of Palou which might sometimes be supplemented by an unlimited supply of Green Peace, the clash of the *Oryza* and the *Pisum* leaving the unfortunate intermediary immensely *sativa*ted. There's more for the rice-loving scientist in the form of fundamental rice iatoms like Coriwonder rice, Garlice rice and Birainy (a Chinese delicacy of monkey-brain? You wish!). These dishes are complemented by curries like Doohi chana and Veg Bhandi Masala. For those non-Nazis (lovers of juice), The Mess Provides aperitifs like Leamon Juice and Kokam Sabart. In the ETS (which is not a system of fundamental particles being transferred across ion channels, but the Evening Time Snacks) you have bheal and the Rassian sandwich(a recipe developed and put together by Rasputin in his spare time when he was not doing… other stuff).

To wrap up this two course (too coarse! Really? A coincidence?) meal, the conjurors in the kitchen cook up a sandstorm of a Des(s)ert in all existing states of matter, specializing in iridescent plasma. For people who want solid ground to stand on, there exists a Fresh Fruit Disapaly (and no, its not a sleepy town in rural South India). At the culmination of this peristaltically stimulating Route, do not be fooled by the mirage of luscious Gajar ka Halwa, because as evil fortune would have it, it is available only during the Samar months. The messy spellings may bring the mess's standing in your eyes an abyss lower, but the strategic position of the architectural marvel that is the new set of restrooms manages to haul it up a few notches.

P.S. The authors aren't sufficiently original to cook up these spellings. We gracefully bow to the tech-nologically high spelling prowess of the Mess. If any reader wishes to applaud our humble efforts, the authors perpetually crave chocolaty dessert.

**YOUR ARTICLE COULD BE HERE**

*or maybe in a bigger and better spot?*

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