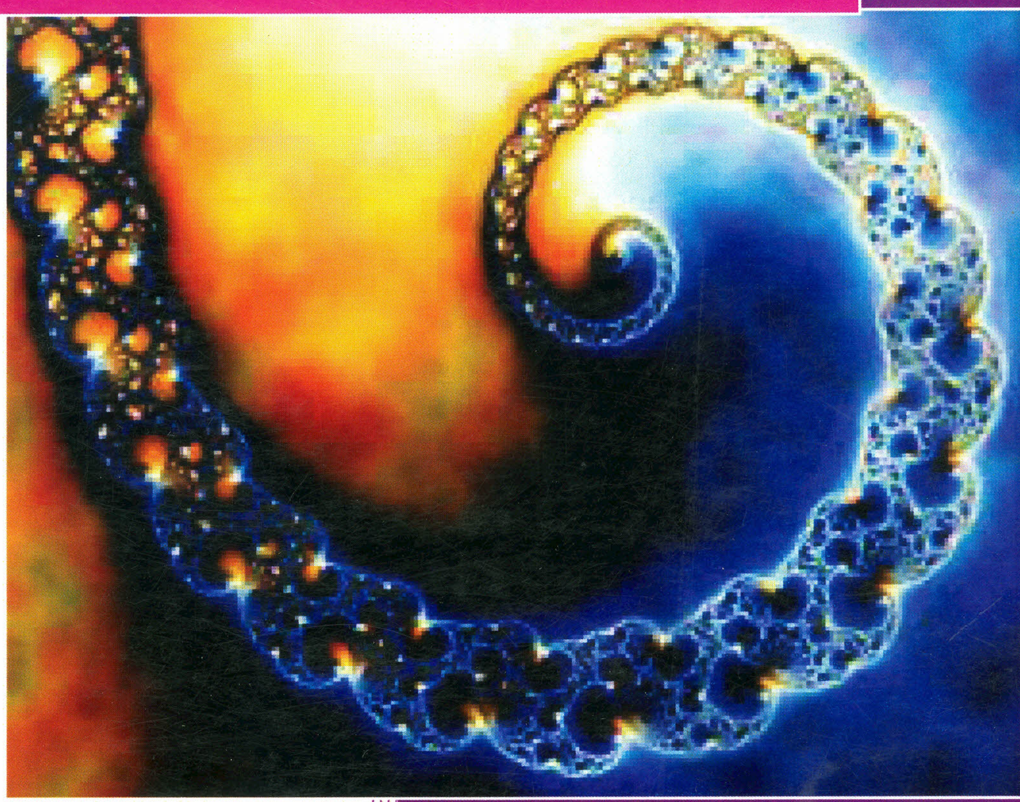
2008

PHYSIK!



DEPARTMENT OF PHYSICS

STELLA MARIS COLLEGE

2008

Wise words from the BIG four…

Dear students your enthusiasm to contribute your mite to the field of physics has invigorated me to be committed to my profession but your enthusiasm alone is not a guarantee of ethical desirability.

However technology had been used down the ages the outcome of it becomes a part of the history only when it is balanced with ethical values. I share the views articulated in the epigraphs from Isaac Asimov and Martin Luther King Junior that our moral and spiritual development lags tragically behind our scientific and technological development. Science and technology allow us to accomplish things that were until recently the stuff of science fiction, we have as yet to live as global community in peace.

Your valuable resources have the potential to leap frog and bridge the technological divide that threatens our society. May the "uncertainty principle" and the "Theory of relativity" that call us to accept that there is a super power beyond our scientific understanding humble us to be human. Your research and higher studies must enable you to develop feasible options to create a better world where there is brotherhood and sisterhood.

I wish all of you success and prosperity in all your endeavors.

\- Ms. A. Suganthi Lark Josephine

Head of the Department

Physics is an exciting and living discipline. An intellectual coherence, linked to the other sciences. Its Greek root means matter, its motion, space and time. According to me Physics is a search for the nature of things, and for an understanding of that from which things grow.

\- Ms. Gigie A. Varghese

Physics is an interesting subject which unravels the mysteries of nature for those who seek adventure. It is challenging and rewarding, also can be fun when the concepts are understood.

- Dr. K.H. Rajini

Memorable quotes:

The purpose of all examples of physics is to calculate, from the knowledge of the present, the state of affairs that will prevail in the future.

- Eugene Paul Wignern

Like the fundamental concept which everyone must learn on his arrival into the world, the newer concepts of physics can be mastered only by long familiarity with their properties and uses.

- Paul Dirac

Physics is a statement on its own.

It is omnipresent.

- Maria Jose & Belinda Peter

CONTENTS

From the Editors: Physics + Fun =??

What are the essential ingredients of a liberal twenty first century physicist and how far can or should its physics department magazine reflect these? Who is going to read it anyways?
Is it an irreplaceable record of the past year, a public relations exercise or just one of those books that gathers the dust?

Another year, another journal, but this time with a little twist. It's not just about the chucks of literature but a little bit of knowledge mixed with a little bit of fun and a pinch of puns to add some flavor!

The title of our journal "PHYSIK" is a pro word that is concerned with the discovery and understanding of the fundamental laws which govern matter, energy, space and time. It contains an interesting mix of articles, jokes and cartoons and our very own farewell page.

We thank our principal Dr. Sr. Annamma Philip, our Head of Department, Ms. A. Suganthi Lark Josephine and all the faculty members of the department for the help rendered.
We would also like to specially thank Ms.Belina and Sr.Nirmala, our chief faculty advisors for their continuous guidance and encouragement. We would like to thank Ms.Gigie A. Varghese for her support and help. We also thank our fellow physicists for their contribution and hard work for the journal.

So with all the formalities out of the way, get geared up and venture into the world of physics! But readers please enter at your own risk....
We hope you enjoy reading this journal, just as much as we had fun making it!
Finally we wish you a very happy and momentous new year!

Keep smiling☺!
Fathima Rufaa Thazyeen
Rajshree Khanikar
R. Akhilandeswari
Sonia H.L. Francisco

Physics Straight up!!

The fascinating world of physics is constantly being changed and edited to keep in track with the changing face of the world. These are some of the latest developments and news in physics.

Contact Lenses with Circuits: Superhuman Vision

We have seen movie characters like the Terminator to the Bionic Woman use bionic eyes to zoom in on far-off scenes, have useful facts pop into their field of view, or create virtual crosshairs. Visual effects that leave us at a loss for words. recently virtual displays have been proposed for more practical purposes like providing aid for vision-impaired people, holographic driving control panels and even as a way to surf the Web. Engineers at the University of Washington have for the first time used manufacturing techniques at microscopic scales to combine a flexible, biologically safe contact lens with an imprinted electronic circuit and lights.

Physicists Create World's Tiniest Trophy, To Be Awarded On Super Bowl Sunday

While the world's biggest football game is under way, someone will be awarded the world's smallest trophy, created by Cornell nanotechnology specialists.
The "Nano Bowl" contest, sponsored by Physics Central, challenges entrants to create short videos explaining some aspect of the physics of football. The trophy is built around a silicon chip on which, football fields nest inside one another, the largest about 12 millimeters long and the smallest only 2 microns (millionths of a meter) long. The chip was designed and fabricated by Philip Waggoner and Benjamin Cipriany, Cornell applied and engineering physics graduate students working in the lab of Harold Craighead. Under an ordinary microscope, the surface of the fingernail-sized chip displays an image of a football field and the words "Physics Central Nano Bowl Champion 2008." In the center of the field, on part of a stylized football helmet, is a tiny rectangle 120 microns long. An electron microscope would reveal that this is another football field, and in its center is yet another, only 2.4 microns long. The smallest image is drawn in lines only 59 nanometers (billionths of a meter) wide.

Large Hadron Collider at CERN Expected To Go Live Summer Of 2008

CERN, the research institute located in Geneva, Switzerland is reporting progress towards the goal of starting physics research at the Large Hadron Collider (LHC) in summer 2008.The LHC is CERN's new research facility, bringing together some 9000 researchers from around the world. Approved by the CERN Council in 1996, it will begin operation this year and has an expected operational lifetime of around 20 years. The experimental collaborations running the LHC's detectors, ALICE, ATLAS, CMS, LHCb, and TOTEM are poised to bring new and profound insights into the workings of our Universe.Another milestone just round the corner!

Mysteries and Surprises in Quantum Physics

"Cavity quantum electrodynamics" is a sub-field of quantum optics. Speaking at a symposium, "Physics In Our Times" at the Fondation Del Duca de l'Institut de France, Paris Professor Serge Haroche from the Collège de France and the École Normale Supérieure in Paris, explained how he and his colleagues manipulate and control single atoms and single photons interacting in a cavity, which is a box made of highly reflecting walls.

By studying the Behaviour of these atoms and photons in this protected environment, the physicists can illustrate fundamental aspects of quantum theory, such as state superpositions, complementarity and decoherence. This research is related to the physics of quantum information, a new domain at the frontier of information science and physics that try to harness the logic of the quantum world to realize tasks in communication and computing that classical devices cannot achieve.

Prof. Haroche and his team have recently succeeded in trapping a single photon in a box on the time scale of seconds and have detected this photon many times without destroying it. The researchers have achieved this by sending atoms across the box and measuring the imprint left on the atoms by the photon. This is a new kind of light detection called 'quantum non-demolition'," explained Prof. Haroche. "Until now, single photons were always destroyed upon detection."

The result means that it is now possible repeatedly to extract information from the same photon. This is important because the major part of all information we get from the universe come from light

Body Heat to Power Cell Phones? Nanowires Enable Recovery of Waste Heat Energy

Energy now lost as heat during the production of electricity could be harnessed through the use of silicon nanowires synthesized via a technique developed cell-powered "Freedom CAR," and personal power-jackets that could use heat from the human body to recharge cell-phones and other electronic devices.

"This is the first demonstration of high performance thermoelectric capability in silicon, an abundant semiconductor for which there already exists a multibillion dollar infrastructure for low-cost and high-yield processing and packaging," said Arun Majumdar, a mechanical engineer and materials scientist, who was one of the principal investigators behind this research.

The technique involves the galvanic displacement of silicon through the reduction of silver ions on a wafer's surface. Unlike other synthesis techniques, which yield smooth-surfaced nanowires, this electroless etching method produces arrays of vertically aligned silicon nanowires that feature exceptionally rough surfaces. The roughness is believed to be critical to the surprisingly high thermoelectric efficiency of the silicon nanowires.

Warp Speed Improves Calculations a Million Times

Thanks to Einstein, physicists know that the world looks different depending on how fast you're moving. A new analysis shows that it a lot prettier (mathematically speaking) if you're moving at just the right speed, leading to an improvement in calculations describing colliding particle beams and lasers by factors of a million or so.

One of the foundations of Einstein's Special Relativity is that no particular frame of reference is better than any other - whether you're sitting on the couch or barreling through space on a rocket, physics doesn't change. On the other hand, as many physics undergrads learn, choosing the right reference frame can simplify your homework problems a lot.

Jean-Luc Vay has found that the same is true for calculations that describe what happens when particles smash together at nearly the speed of light in machines like the forthcoming Large Hadron Collider experiment in Geneva.

But instead of saving a few hours of homework time, Vay's analysis shows a surprising million-fold improvement in calculation speed.

The discovery should allow much higher precision analyses of high energy physics experiments as well as helping physicists to model interactions that were previously just too computationally intensive to consider.

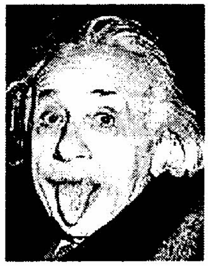
World's Only Ultra fast Electron Microscope Takes 4-D 'Movies' Of Molecules

A unique electron microscope that can help create four-dimensional "movies" of molecules may hold the answers to research questions in a number of fields including chemistry, biology, and physics. The microscope, located at the California Institute of Technology, is a modified transmission electron microscope interfaced with an ultra fast laser. The ultra fast microscope is the only one capable of capturing four-dimensional pictures of molecules — 3-D structural changes over time — as they form and break apart.

These reactions occur at extremely fast rates: one billionth of one millionth of a second, or a "femtosecond" — that can't be seen directly in real-time by other instruments.

Complied by Sonia H.L. Francisco
III Year

PHY - Story



Unforgettable Einstein:

He was one of the greatest scientists the world has ever known, yet if we had to convey the essence of Einstein in a single word; it would be "simplicity"

Einstein was born in 1879 in the German city of Ulm. He was no infant prodigy; indeed he was so late in learning to speak that his parents feared he was a dullard. In school though, his teachers saw no special talent in him the signs were already there. At the age of 16 he asked himself whether a light wave would seem stationary if one ran abreast of it.

Einstein failed his entrance examination at the Swiss federal polytechnic school, in Zurich, but was admitted a year later. There he went beyond his regular work to study the masterworks of physics on his own. Rejected when applied for academic positions, he ultimately found work, in 1902, as a patent examiner in Berne, and there in 1905 his genius burst into a fabulous flower.

Among the extraordinary things he produced in that memorable year were his theory of relativity, with its famous offshoot, $E=mc^2$, and his quantum theory of light. These two theories were not only revolutionary, but seemingly self-contradictory as well: the former was intimately linked to the theory of light as of waves, while the latter said that it consists somehow of particles. Yet this unknown young man boldly proposed both at once – and he was right in both the cases, though how could he possibly have been is far too complex a story to tell here.

Although Einstein felt no need for religious ritual and belonged to no formal religious group, he was the most deeply religious man according to Banesh Hoffmann. Einstein had once said to him "ideas come from God,"- and one could hear the capital "G" in the reverence with which he pronounced the word.

Einstein was an accomplished amateur musician. He used to play the violin.

At a press conference in Princeton in honour of his 70th birthday, one of the speakers, A noble prize- winner, tried to convey the magical quality of Einstein's achievement. Words failed him and with a shrug of helplessness he pointed to his wrist watch and said in tones of awed amazement "it all came from this". His very ineloquence made this the most eloquent tribute to Einstein's genius.

We think of Einstein as one concerned only with the deepest aspects of science. But he saw scientific principles in everyday things which most of could barely give a second thought to.

Political events upset the serenity of his life even more. When the Nazis came to power in Germany, his theories were officially declared false because they had been formulated by a Jew. His property was confiscated, and a price was put on his head.He then moved on to America.

Like the noble prize winner there are no adequate words to sum up Einstein's life. In the last years of his life Einstein tried to formulate the theory of everything but he just ran out of time and died on the 18th of April 1955.

- R.Akilandeswari
  III Year

Max Born:

Max Born was born in Breslau on the 11th December, 1882, to Professor Gustav Born, anatomist and embryologist, and his wife Margarete, who was a member of a Silesian family of industrialists.

Max attended the König Wilhelm's Gymnasium in Breslau and continued his studies at the Universities of Breslau, Heidelberg, Zurich, and Göttingen. In the latter seat of learning he read mathematics, and also studied astronomy and physics. He was awarded the Prize of the Philosophical Faculty of the University of Göttingen for his work on the stability of elastic wires and tapes in 1906, and graduated at this university a year later on the basis of this work.

Born next went to Cambridge for a short time, to study under Larmor and J.J. Thomson. Back in Breslau during the years 1908-1909, he worked with the physicists Lummer and Pringsheim, and also studied the theory of relativity. On the strength of one of his papers, Minkowski invited his collaboration at Göttingen but soon after his return there, in the winter of 1909, Minkowski died. He had then the task of sifting Minkowski's literary works in the field of physics and of publishing some uncompleted papers. Soon he became an academic lecturer at Göttingen in recognition of his work on the relativistic electron. He accepted Michelson's invitation to lecture on relativity in Chicago (1912) and while there he did some experiments with the Michelson grating spectrograph.

An appointment as professor to assist Max Planck at Berlin University came to Born in 1915 but he had to join the German Armed Forces. In a scientific office of the army he worked on the theory of sound ranging. He found time also to study the theory of crystals, and published his first book, Dynamics of Crystal Lattices, which summarized a series of investigations he had started at Göttingen.

At the conclusion of the First World War, in 1919, Born was appointed Professor at the University of Frankfurt-on-Main, where a laboratory was put at his disposal.

Max Born went to Göttingen as Professor in 1921; he remained there for twelve years, interrupted only by a trip to America in 1925. During these years his most important works were created; first a modernized version of his book on crystals, and numerous investigations by him and his pupils on crystal lattices, followed by a series of studies on the quantum theory. During the years 1925 and 1926 he published, with Heisenberg and Jordan, investigations on the principles of quantum mechanics and soon after this, his own studies on the statistical interpretation of quantum mechanics.

During the winter of 1935-1936 Born spent six months in Bangalore at the Indian Institute of Science, where he worked with Sir C.V. Raman and his pupils. In 1936 he was appointed Tait Professor of Natural Philosophy in Edinburgh, where he worked until his retirement in 1953.

In 1953 he was made honorary citizen of the town of Göttingen and a year later was granted the Nobel Prize for Physics. He was awarded the Grand Cross of Merit with Star of the Order of Merit of the German Federal Republic in 1959.

- E.Fathima Rufaa Thazyeen
III Year

Nobel Prize winners for 2007 in Physics

Francis Albert Fert and German Peter Gruenberg won the 2007 Nobel Prize in Physics for a discovery that has shrunk the size of hard drives found in computers, iPods and other digital devices.

The duo discovered a totally new physical effect that has let the computer industry develop sensitive reading tools for information stored on computer hard drives from the tiniest laptop to the feature- rich portable music and video player. The discovery can also be considered as one of the first real applications of the promising field of "nanotechnology". The science dedicated to building materials from the molecular level. Applications of this phenomenon have revolutionized techniques for retrieving data from the hard disk. The discovery also plays a major role in various magnetic sensors as well as for the development of a new generation of electronics.

Fert, 69, is the scientific director of the mixed unit for Physics at CNRS, Thales. While Gruienberg,68, is a professor at the Institute of Solid state research in western Germany. In 1988 the pair independently discovered the physical effect known as "giant magneto resistance" or GMR. In this effect, a very weak change in magnetism generates larger changes in electrical resistance.

This is how information stored magnetically on a hard disk can be converted to electrical signals that the computer reads. Both realized at an early stage that their discoveries would have a huge impact.

Thus now we can see it has made a huge impact and has revolunised the electronics industry.

- Ann Tresa George
II Year

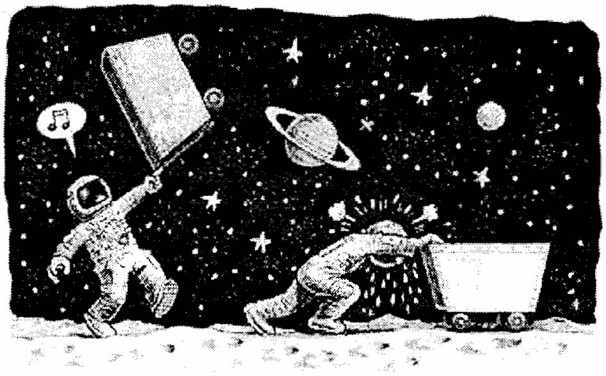
Francis Albert Fert Peter Gruenberg

At the Party with the Physicists

One day, all of the world's famous physicists decided to get together for a party (ok, there were some non-physicists too who crashed the party). Fortunately, the doorman was a grad student, and able to observe some of the guests...

- Everyone gravitated toward Newton, but he just kept moving around at a constant velocity and showed no reaction.
- Einstein thought it was a relatively good time.
- Coulomb got a real charge out of the whole thing.
- Pauli came late, but was mostly excluded from things.
- Pascal was under too much pressure to enjoy himself.
- Ohm spent most of the time resisting ampere's opinions on current events.
- Heisenberg may or may not have been there.
- Feynman got from the door to the buffet table by taking every possible path.
- The Curies were there and just glowed the whole time.
- Van der Waals forced himself to mingle.
- Milikan dropped his Italian oil dressing.
- de Broglie mostly just stood in the corner and waved.
- Everyone was attracted by Tesla's magnetic personality.
- Compton was a little scatter-brained at times.
- Bohr ate too much and got atomic ache.
- Watt turned out to be a powerful speaker.
- Hertz went back to the buffet table several times a minute.
- Faraday had quite a capacity for food.
- For Schrödinger this was more a wave function rather than a social function.
- Born thought the probability of enjoying himself was pretty high.
- Pauling wanted to bond with everyone.
- Shakespeare could not decide whether to be or not to be at the party.
- Pavlov brought his dog; which promptly chased after Schrödinger's cat.
- Bill Gates came to install windows.
- Chadwick was handing out neutrons free of charge.

\- M. Priyadarshini
III Year



BLACK HOLES

All of us have heard of black holes, but how many of us know what exactly it is? I hoped to achieve some sort of clarity when I embarked on a quest to understand one of the mysteries of the universe.

Most of us know that black holes are formed when a star collapses. But why would a perfectly normal star collapse all of a sudden? A star uses its nuclear fuel and produces energy which exerts an outward pressure which counter balances the gravitational force due to the mass of the star. When all its fuel is exhausted, the gravitational force causes the star to contract leading to the formation of a black hole.

When the star collapses during the process of becoming a black hole, the entire mass of a star is compressed to a single point, where space and time ceases. This point in the black hole is called a singularity. The boundary of a black hole is marked as an event horizon. This doesn't provide a physical boundary for the black hole, but it marks the region beyond which the gravitational effects of the black hole are actually felt. If any of us were to go near a black hole while taking care to stay behind the event horizon, we wouldn't feel any different than if we were in any other part of the universe, in that, we would still experience weightlessness. As we get closer, the body starts feeling the gravitational force and the part of the body closer to the centre of the black hole would feel the gravitational force more than the other part and hence the body would begin to rip apart.

Another very strange thing also occurs when we move closer to black hole. It is said that if we move very close to the black hole, we would be able to see the back of our heads, because the gravity is so intense that it pulls the light from the back of our heads and bends it so much that they enter our eyes. This effect is called Einstein's ring.

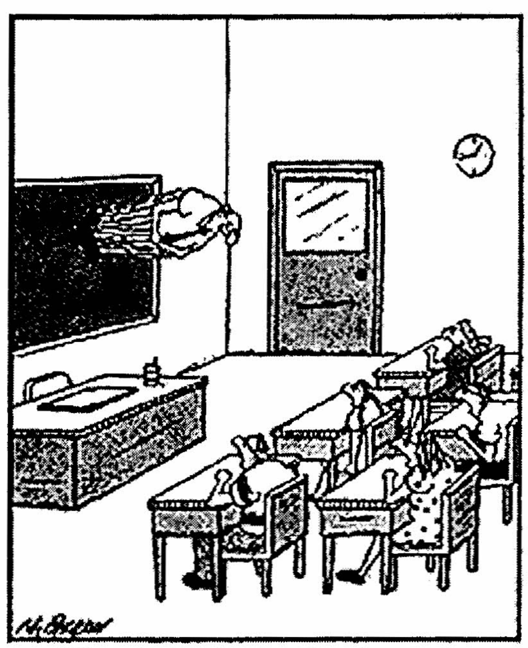
Since these black holes possess such high gravitational forces that even light cannot escape from it, it might seem ridiculous to even suggest that any matter can escape from it. But in the 1970's it was seen that some matter does in fact manage to come out of black holes. This extremely bizarre phenomenon was explained by Stephen Hawking using quantum mechanics. He suggested that the particles are continuously being formed from nowhere in vaccum and since vaccum has no charge, the particles formed are in pairs i.e. particles and antiparticles. Although the creation of these virtual articles and antiparticles from nothing defies the law of conservation of energy, the energy spent in the creation is regenerated when they annihilate each other and hence satisfies the law. He suggested that in the horizon of black holes such virtual particles and antiparticles are created. If one of these particles is sucked in by the black holes and the other has sufficient energy to defy the gravitational pull of the black hole, then that particle is free to move out and the black hole appears to be radiating. The particle sucked in has negative energy and hence negative mass (Einstein's mass energy relation) and thus the mass of the black hole tends to decrease. The black hole is then said to be evaporating. These radiations emitted are called Hawking's radiation.

Hawking however said that these were random radiations and carried no information regarding the matter present inside the black hole. This was opposed and a theory was put forth explaining that the radiations coming out of the black hole did in fact carry some information about the matter inside. The theory takes into account that at singularity, the black hole has infinite density, and space and time cease to exist. At singularity therefore, something (matter) changes into nothing. Also, we have seen that Hawking's radiations are formed from nothing i.e. something is formed from nothing.

When thus something is formed out of nothing, the laws of conservation insist that the matter formed must be entangled, which means that they be particle antiparticle pairs. Assuming that when Hawking's radiations are produced, the particle gets sucked in by the black hole, meets another particle and annihilates to form nothing. But something can turn into nothing only when that particle meets its antiparticle. Hence, this particle that enters black hole can be concerted into nothing when it meets the particle that has escaped the gravitational pull as Hawking's radiation. Thus the fact that the particle sucked in is converted into nothing implies that the particle present inside the black hole and that released as Hawking's radiation are in fact the same. Thus it was shown that the radiations emitted when a black hole evaporates carries information about the matter present in the black hole.

Due to the symmetry in nature, it was suggested that just as a black hole takes in everything, there must be a white hole which gives out matter. These white holes however exist only due to the compulsions of science for no evidence has been shown proving their existence. Since black holes take in materials and white holes ejects matter out, it was speculated that these two could join to form what is called worm hole. A worm hole might seem to be easy getaway for any person bored of the universe, as it was suggested one could enter a black hole and get out through white hole into a whole new universe. Of course, one may wonder how someone would even be able to make it through the black hole and get out into another universe, as black holes have the amazing quality to split us into two. It is to be noted that there is a possibility of not hitting singularity, if one enters black holes that rotate and or possess charges and thus one can manage to stay alive long enough to be roasted by the radiations in the worm hole.

Rajshree khanikar
III Year



"Good morning, and welcome to The Wonders of Physics."

In her shoes...

PHYSICS is a natural philosophy i.e. the science of nature which treats the causes (as gravitation, heat, light...) that modifies the general properties of bodies.
The most interesting factor about physics is, that unlike other subjects physics deals more with quantitative skills and connections or relationships between concepts and this is what motivated me to choose my career in this field. This is a subject where you need to utilize your brain to its maximum capacity. The best way to study physics is by oneself .After the initial grooming from the classes, one should develop the skill to think on one's own. Take any problem in physics, analyse the various concepts involved in that problem and can understand the subject in a better way by yourself than can be taught by anyone else.
Research in physics is characterized into theoretical and experimental work. Theorists seek to develop mathematical models that both agree with existing experiments and successfully predict future results, while experimentalists devise and perform experiments to test theoretical predictions and explore new phenomena. Although theory and experiment are developed separately, they are strongly dependant upon each other. Progress in physics frequently came about when experimentalists make a discovery that existing theories cannot explain, or when new theories generate experimentally testable predictions. Experimental physics is my area of interest because this can bridge the gap between physics and society. From a tough subject involving a lot of mathematical methods, experimentalists can bring physics to the common man's use. Experimental physics is the basis of engineering and technology. Experimental research involves both fundamental researches as in areas of high energy physics, nuclear and particle physics and astrophysics as well as applied research in the fields of condensed matter physics and optics. Condensed matter physics has revolutionized the era of science and technology by giving birth to nanotechnology where as optics has been overtaken by laser physics.
What I mean to say is that despite important discoveries during the last four centuries there are a number of open questions in physics and many areas of active research. I am more interested in the fundamental experimental research in nuclear physics and particle research. The main reason being that unlike other areas in physics, fundamental astrophysics and nuclear physics remain largely ignored by society. Right now I am not interested in anything beyond this earth. So this is how I turned my attention towards nuclear and particle physics. The scope of this subject remains alien to a vast majority of the people even though apart from power production, it has found many applications in the field of medical physics through nuclear medicines and in scanning equipments. These elementary particles, I believe have wonders in store for us. The only barrier in front of us is that we do not know the right way to harness their power. My ambition is to exploit this hidden energy of the universe for the benefit of mankind and I hope I will find success in my endeavour.

- Vidya .k
M.Sc physics, 1st year
IIT, Roorkee
(Alumnae of Stella Maris)

<u>Can the invisible man see?</u>

H.G.Wells novel ***"The invisible man"*** may have inspired a lot of ideas in the new generation, but if we think deeper, the question should arise ***Can an Invisible man see?***

In the novel "The Invisible Man", H.G.Wells demonstrated with wit and logic that an invisible man is omnipotent. He is able to enter any place unnoticed and steal anything with impunity.The invisible man is able to issue to the terrified population of his home town an order of the following content: "Port Burdock is no longer under the Queen, tell your Colonel of Police, and the rest of them; it is under me... this is a day one of year one of the new epoch- the Epoch of the Invisible man. To begin with, the first day there will be one execution for the sake of example- a man named Kemp. Help him not, my people, lest death fall upon you also."
At the outset, the invisible man triumphs.

Are the physical theses on which this science fiction novel is based right? Undoubtly yes. In a transparent medium every transparent object becomes invisible when the difference between refractive indices is less than 0.05. Ten years after H.G.Well's "The Invisible man" was published, a German anatomist, Prof. W. Spalteholtz, put the writer's idea into practice - not on living organisms but in the preparation of dead specimens. The transparent preparations method evolved by Prof. Spalteholtz in 1911 is briefly as follows. After treatment- bleaching and washing- the prepared specimen is soaked in methylsalicylate, a colorless liquid with a bug refractive index. Specimens of rats and fishes, or various human organs thus prepared, are placed in jars containing the same liquid. However, full transparency is not sought as this would cause the specimens to become absolutely invisible and consequently, useless for the anatomist.

This is naturally far from Well's dream of a live man so transparent as to be absolutely invisible. Firstly, because we must know how to treat living tissue with this transparency liquid without violating organic functions. Secondly, because Prof. Spalteholtz's preparations are transparent but not invisible. They are invisible only while immersed in a liquid of corresponding refractivity. They will be invisible in air, only when their refractive index is the same as that of air, which is something we are still unable to achieve.

Can an invisible man see? No ,because every part of his body, including his eyes, was rendered transparent and possesses a refractive index identical to that of air. Since on passing from one medium to another of the same refractivity, light will not change it direction and, consequently, its rays will be unable to concentrate in one point
To sum up: an invisible man sees nothing. He will derive no benefit from all his advantages. This formidable claimant of power to power would have to grope in the darkness begging for alms which nobody will be able to give, as the applicant would be invisible. Instead of the most powerful of mortals we would have before us a helpless cripple doomed to a miserable existence.

In other words, if we desired the cap of invisibility, it would be futile for us to copy Wells. Even a successful result would be a sorry one.

- Complied by E.Fathima Rufaa Thazyeen
III Year

THE QUEST FOR THE QUANTUM COMPUTER

The world of quantum mechanics and quantum computation goes against the grain of everyday experience. It's an "Alice in Wonderland" realm beyond the ones and zeroes of classical computing. Now, a century after the first faltering steps in the development of quantum theory and a half century after the invention of the digital computer, we are witnessing a scientific revolution that could put quantum theory in greater prominence, while transforming our understanding of computing science and physics. For, the realization is that quantum mechanics offers completely new ways to process information which seem to be clearly more powerful than those of classical physics in this regard. Whosoever said "Anything you can do in classical physics, we can do better in quantum physics" got it absolutely right and the quantum computer, even if it is at present more of a concept than a reality, serves testimony to this statement.

Quantum Superposition: A quantum computer will be based on the "strange" principles of quantum mechanics (especially **quantum interference**), in which the smallest particles of light and matter can be in different places at the same time. In today's computers, the fundamental unit of information is the binary **"bit"**. In a quantum computer however, the quantum bit or the **"qubit"**, the fundamental unit of information, can exist not only in a state corresponding to the logical state 0 or 1 as in a classical bit, but also in states which correspond to a blend or **"superposition"** of these classical states. A classical bit can be in any one of the two states $|0\rangle$ and $|1\rangle$. A qubit can exist in all possible superposition states

$$|\Psi\rangle = \alpha\,|0\rangle + \beta\,|1\rangle$$

where α, β are complex numbers with $|\alpha|^2 + |\beta|^2 = 1$. Here $|\alpha|^2$ is the probability for the qubit to be found in state $|0\rangle$ and $|\beta|^2$ is the probability for the qubit to be in state $|1\rangle$. If we represent states by column vectors

$$|0\rangle = \begin{bmatrix}1\\0\end{bmatrix} \quad \text{and} \quad |1\rangle = \begin{bmatrix}0\\1\end{bmatrix},$$

the representation for $|\Psi\rangle$ will be

$$\alpha\,|0\rangle + \beta\,|1\rangle = \begin{bmatrix}\alpha\\\beta\end{bmatrix}.$$

Quantum Parallelism: The existence of such superposed states gives rise to the exciting possibility of **"quantum parallelism"**. In a computer, with three bits, there are eight possible combinations of 1 or 0. But three bits in a digital computer can store only one of those eight combinations at a time. In a quantum computer, one qubit can be both 0 and 1 at the same time. So with three qubits of data, a quantum computer can store eight (2 power 3) combinations of 0 and 1 simultaneously. This means roughly that a three-qubit quantum computer can calculate eight times faster than a three-bit digital computer. Personal computers today calculate 64 bits of data at a time. A quantum computer with 64 qubits would be 2 to the 64^{th} power faster, or about 18 billion billion times faster!

Shor's algorithm: Early investigators in this field were naturally excited by the potential of such immense computing power, and soon after realizing its potential, the hunt was on to find something interesting for a quantum computer to do. In April 1994, Peter Shor, a scientist then at the Bell Laboratories in New Jersey, provided such an application by devising the first spectacular **quantum algorithm.** Shor's algorithm harnesses the power of quantum superposition to rapidly factor very large numbers (on the order ~10^{200} digits and greater) in a matter of seconds. Factorization of an N-digit number using conventional computers is known to take a time which increases exponentially with the number of digits N. Shor demonstrated that a quantum computer can solve the same problem in a much shorter time which varies only as a power or a polynomial of the number of digits N.

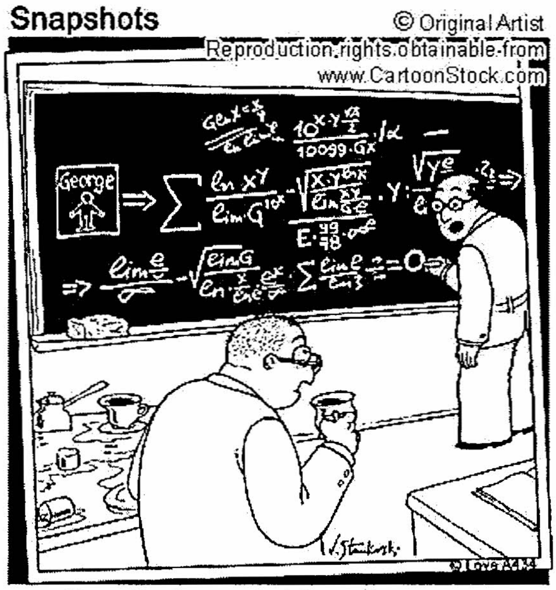
Quantum Cryptography: The premier application of a quantum computer lies in the field of encryption or cryptography. The Shor algorithm has a fantastic application in cracking the common (and best) encryption code, known as RSA code, which relies heavily on the difficulty of factoring very large composite numbers into their primes. Another difficult problem on which cryptographic systems may be based, the discrete logarithm problem, was also found to be solvable in polynomial time in a quantum computer. Most government agencies, industries, banks and private companies still use the RSA code to protect their privacy. Thus if somebody were able to build a quantum computer, all RSA systems would immediately become vulnerable and the security of all data currently protected by the RSA systems would disappear overnight!

The Universal Quantum Simulator: Cracking encrypted codes, however, is only one application of a quantum computer. In addition, Shor has put together a toolbox of mathematical operations that can only be performed on a quantum computer, many of which he used in his factorization algorithm. Even earlier, the renowned theoretical physicist Richard Feynman had envisaged the possibility that a quantum computer could function as a kind of simulator for quantum systems, potentially opening the doors to many discoveries in the field. In 1982, Richard Feynman showed how classical computers had difficulty in simulating quantum systems and conjectured that a machine that worked by quantum means would make a much more efficient simulator than a classical machine. A quantum simulator would, in effect, be a laboratory in which physicists or chemists could study models of quantum phenomena that are too difficult or impossible to simulate classically. Examples of such problems would include dynamical evolution of chemical reactions, lattice-gauge theories, study of ferromagnetic materials and superconductors and even quantum gravity.

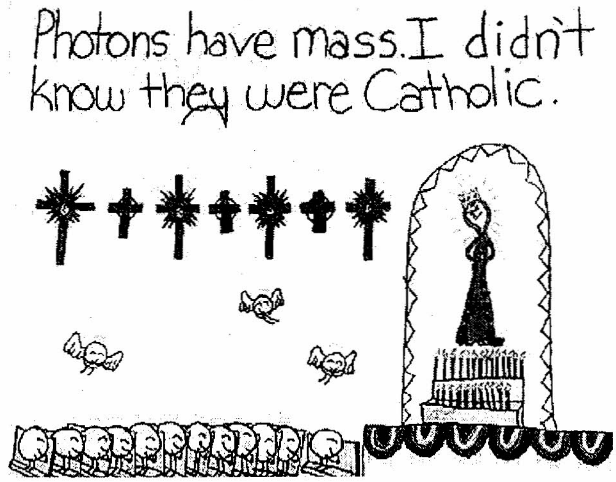
Building a Quantum Computer: The last decade has been witness to a large body of theoretical investigations into the power, capability and applications of a quantum computer and the potentials of quantum theory in information processing. Actual building of a quantum computer involves construction of **quantum gates** and assembling them into **quantum circuits.** We seem to be on the technological frontier of actually constructing such systems thanks to advances in the preparation and handling of single-atom and single-photon systems. The advent of the first fully functional quantum computer will undoubtedly bring forth many new and exciting applications and might indeed be something that we might live to see in our own lifetimes. The quantum age, we can say, has really and truly begun.

"The nineteenth century was known as the machine age, the twentieth century will go down in history as the information age. I believe the twenty-first century will be the quantum age." - Paul Davies

- M.D. Nityasri
II Year

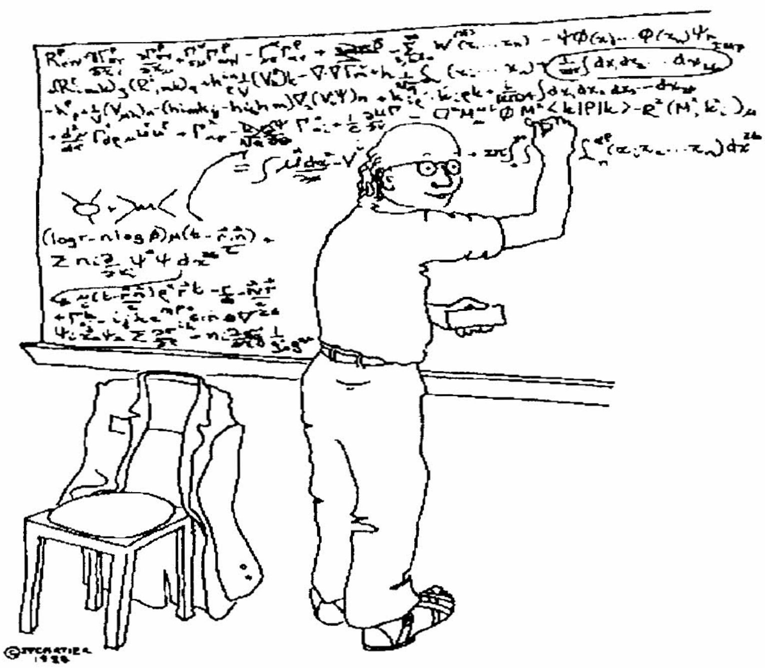


"According to my calculations, George, you don't exist. *You...don't...exist, George.* I'm going to have to ask you to leave."



How does Einstein begin a story?

Once upon a space- time....



"At this point we notice that this equation is beautifully simplified if we assume that space–time has 92 dimensions."

Heisenberg is stopped by a traffic cop who asks " do you know how fat you are going?"
He replied " No, but I know exactly where I am!"

What did the nuclear physicist have for lunch?

- Fission chips

Why do the soccer clubs; club Fermi and club Bose never play a match against each other?

- They can't agree about the spin of the ball.

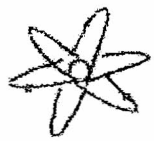
Women matter!!

In today's world we've often heard of the phrase 'it's a man's world'. Some of us would strongly disagree with this statement. An interesting comparison would be that of the evolution of the universe and the relative proportions of men and women in physics. Well, imagine that men are matter and that women are antimatter. And note that equal amounts of matter and antimatter were created in the big bang, just as equal numbers of baby boys and girls are born every year. Yet for reasons that are still not understood, we now live in a universe that is dominated by matter and a world where physics is a male-dominated profession. Particle physicists believe they are close to solving the first of these asymmetries, but despite much talk and some progress, a satisfactory solution to the second inequality is still a long way off. .

One of the key women who first broke the barriers was Marie Curie: a scientific entrepreneur. She is best known for her discovery of radium one hundred years ago, but she also worked closely with industry in developing methods to make and monitor radioactive material. Having arrived in Paris from Poland in 1891, Marie Curie became the first woman in France to obtain a PhD in physics, the first woman to win a Nobel prize and the first woman to teach at the Sorbonne. She also helped to found a new scientific discipline: the study of radioactivity.

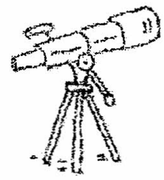
In recent times, women have started to emerge from their shells and prove everyone wrong. Today there are about 83 women have contributed significantly to the physics world. A few examples are Rosalind Franklin,Helen Quinn , Hertha Sponer , Sau Lan Wu, just to name a few.These women have contributed to the 20th centaury history archives of physics. However the low numbers of women holding senior positions in physics results from a combination of two factors: the relatively low numbers of women studying physics in schools and universities, and the effects of the "leaky pipeline" i.e. the proportion of women becomes smaller as you move up through the ranks in both academia and industry. Physics is seen as a male subject, so those recruiting pupils and students into school and university courses must go out of their way to make the subject attractive to young women.Some ways this is done is by conducting guest lectures, physics cultural programs and exhibitions, tours and various competitions like the International Young Physicists Tournament (IYPT) and the physics Olympiads.

Lord Rutherford is often held up as an outstanding role model for young physicists, but it is to be hoped that his famous comment to Lise Meitner on meeting her for the first time - "Oh, I thought you were a man" - belongs to an era that has long past.

"For me, the world has always been full of mysteries. Studying the physical properties of matter allows me to unlock the secrets of the physical world."

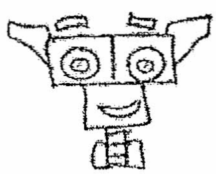
Shirley Ann Jackson
Subatomic Explorer

"The Universe is full of opportunities. Every night offers the possibility of discovering something no one has ever seen."

Heidi Hammel

Outer Planet explorer

" I want robots to share our world with us, to communicate and interact with us, understand and relate to us in a personal way."

Cynthia Breazeal
Robot Designer


"It's the dream of every child to get to play in the dirt. We geologists get to do it for real."

Adriana Ocampo

Space geologist

- Sonia H.L.Francisco
  III Year

WHAT COLOUR ARE ELEMENTARY PARTICLES?

The question is fully within the purview of kinematics. The colour of a body is determined by the frequency of the light waves travelling away from it. If the body is self-luminous, these are waves emitted by the body itself. Otherwise, they are waves reflected by the body. The former case is simpler, and we shell define the colour of a particle as the colour of the light waves spontaneously radiated by it. The colour of an atom is also the colour of the light it emits. Assume for the sake of simplicity that the particle is at rest.

It is known from quantum mechanics that the radiation of light is the flux of photons, or light quanta. The frequency "v" of light is related to the energy E of the photons by the equation:

$$E=hv$$

Where h is Planck's constant (6.63×10^{-34} js)

Hence of we wish to determine the colour of particle X of mass m we should find the energy of the photons it emits and calculate the corresponding frequency. This is, in essence, a problem on the kinematics of decay of one particle into two. Let us imagine for the moment that the particle emits photons one after the other but remains unchanged. We will perceive this flux of photons from the particles as its glow.

$$X \rightarrow X + \gamma$$

The mass m of the initial particle X is not less than the sum of the rest mass (m + 0) of particles X and γ, so that the necessary and sufficient condition for the possibility of decay:

$$m \geq m_1 + m_2$$

Where m is the mass of the original particle and m_1 and m_2 are the masses of the products of decay.

The energy of γ can be found by the equation:

$$E_2 = ((m^2 + m_2^2 - m_1^2) / 2m)\, c^2$$

Since $m_1 = m$ and $m_2 = 0$, $E_2 = 0$: this means that energy of photons and momentum are equal to 0! Our assumed beam of light carries neither energy nor momentum. There will simply be no radiation and therefore the elementary particles have no colour and are hence blank!

- Rajshree khanikar
III Year

MAGMA THE MAGNIFICENT TELLS ALL!

Q: You're magma. What's it like to be so hot?
A: Pretty cool, except for all the pressure. I'm sitting under miles of crust, and it weighs billions of tons. Unbelievable! Sometimes I just can't take it. That's why it's nice to escape to the surface through a volcano. The instant I hit the surface, I turn into lava and flow. Magma, lava, lava, magma- we're the same hot stuff: melted rock with a bunch of gases mixed in.

Q: That's cool!
A: No, hot. Molten. Red-hot. We're talking two thousand degrees Fahrenheit, or eleven hundred degrees Celsius. Hot, hot, hot. Many times as hot as boiling water.

Q: OK, OK, you're hot. So do you only hang around in volcanoes, or are you anywhere else underground?
A: ANYWHERE else? You've got to be kidding. Magma is EVERYWHERE else underground! Except for one thin solid part on top, the earth's mantle is all me, myself and I. you're sitting on magma right now. But don't get up. I'm atleast twenty miles down.

Q: Wait a minute. If you're everywhere underground, why aren't volcanoes everywhere up here?
A: Well, there ARE five hundred active volcanoes in the world. About sixty of them blow up every year. So I do my best. Seriously, volcanoes don't just happen anywhere. I need the right place in the earth's crust before I can surface.

Q: And the right place is...?
A; It's where the crust is so thin it's cracked, or it's got a hole in it. That's when I make my move. Either I blast out or spill out, depending on my type.

Q: What do you mean; your type isn't magma all the same.
A: No way. I come in four different types: andesite, basalt, dacite and rhyolite. It's like having four different personalities. My basalt type is thin. It's weak. It's got no guts. I have to accept that. It makes bubbles and sprays and pretty fountains of lava and stuff when it erupts. My other kinds are thicker. They're strong. They're powerful. They ruile1 they make the best blasts, especially rhyolite, which is the thickest of all.

Q: You mean the type of explosion depends on the type of magma?
A: you got it.

Q: But why should it matter whether magma is thin or thick?
A: Come on figure it out! Think of sipping water through a straw slides right up, doesn't it? Now imagine slurping up a mouthful of ketchup through the same straw. See how it works? It's harder for the thicker stuff to rise. And you know what that means.

Q: No what?
A: It means trouble, and you spell that G-A-S. See, as I rise to Earth's surface, gases down here in the mantle rise too. Because of the pressure, those gases are trying to mix into magma the magnificent. When I'm thin and basaltic, that's no problem. Io let them right in. we mix up, easy as pie .they dissolve , and we all float up the old vent and spray out the top. Then they drift quietly into the air, maybe making a little plop or whoosh or something. It's like popping the top of your can of cola VERY carefully, a little bit at a time. But when I'm thick- whole different story.

Q: What happens when you're thick?
A: I get stubborn. I block up the magma chamber like a big toe caught in your bathtub drain. the gases all crowd together below and around me. They want to get through, and I won't give. Ha ! They bunch up in pockets and sit there fuming and expanding until finally- BLAMMO! This time it's like you shake and shake your cola and then rip off the top and spray it all over the place! We blast out of there quicker than you can say "stratovolcano!"

Q: Strato-huh?
A: Stratovolcano. That's the kind of volcano made by the biggest blasts and the thicker kinds of magma.

Q: If thicker makes stratovolcanoes, what do volcanoes made by basaltic magma – the thinner kind-look like?
A: Kind of round and wide. Sort of like what a giant shield would look like if you laid it flat on the ground. That's what they're called shield volcanoes. Hawaii is full of them. In fact, the Hawaiian Islands are shield volcanoes.

Q: So you can tell just by looking at a volcano what kind of magma was inside? And what kind of explosion made it? Cool!
A: No, hot, I keep telling you. And there's one more way to tell.

Q: What's that?
A: Find a volcano. Wait for it to blow up. See what comes out! Speaking of which- I gotto cool off. I'm outta here.

-E.Fathima Rufaa Thazyeen
III Year

Dark Matter- Myth or Truth?

Astronomy continues to enjoy a golden age of exploration and discovery. The new technologies and novel theoretical insights make the study of cosmos more exciting. As we advanced in this field, we came to know there remain many things undiscovered and many things we have discovered lack clarity or proper theory foundation. Dark matter is such an area.
To study about black matter you first need to know the mass of the galaxy. Since our sun is in the Milky Way galaxy, it will be interesting to measure the mass of our galaxy.

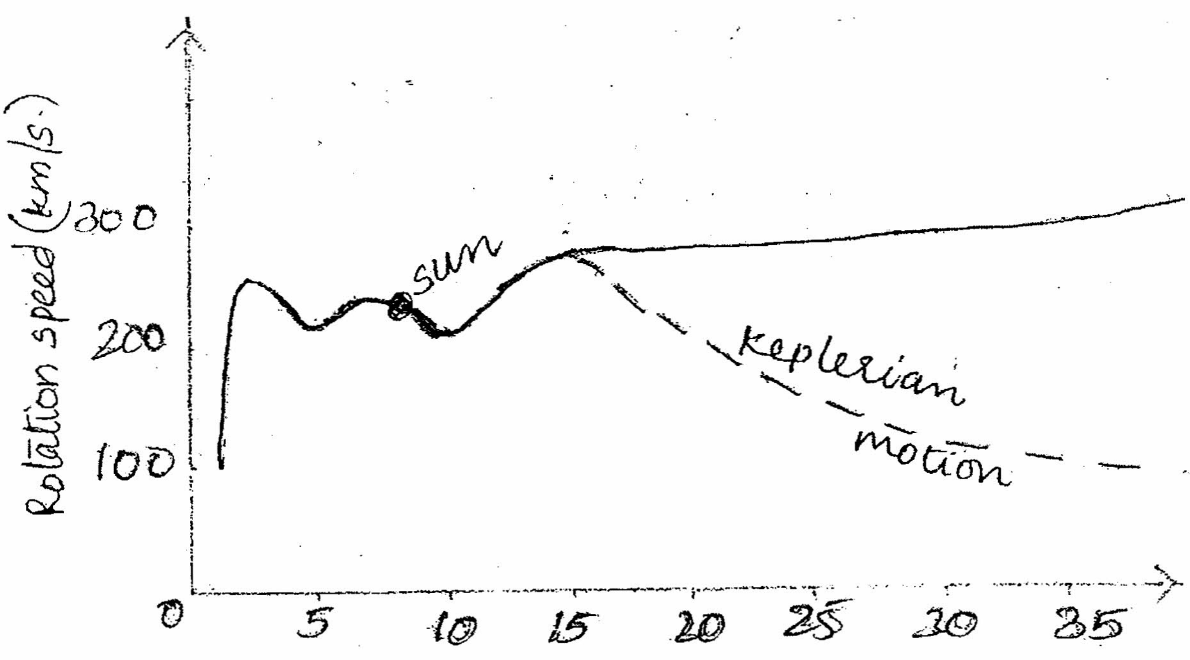
The mass of the Milky Way

We can measure our galaxy's mass by studying the motions of gas clouds and stars in the galactic disk (galactic disk is an immense, circular flattened region. Our sun lies in the galactic disk). Keplers third law, modified by Newton connects the orbital period, orbit size and masses of any two objects in orbit around one another.

$$\text{Total Mass (solar masses)} = \frac{\text{orbital size (A.U)}^3}{\text{Orbital period (years)}^2}$$

The distance from the sun to the galactic centre is about 8 kpc and the suns orbital period is 225 million years. Using this we get a mass of almost 10^{11} solar masses- 100 billion times the mass of the sun.

The galaxy's matter is not concentrated at the galactic center. Instead, galactic matter is distributed over a large volume of space.



Dark Matter

Based on data obtained from radio observations figure shows the galactic rotation curve, which plots the rotation speed of the galactic disk against distance from the galactic center. Using this graph, we can repeat our earlier calculations to compute the total mass that lies within any given distance from the galactic center. We have evidence that the mass within about 15 kpc from the center- the volume defined by the globular clusters and the known spiral structure is roughly 2×10^{11} solar masses, about twice the mass contained within the sun's orbit. Does most of the matter in the galaxy 'cut off' at this point, where the luminosity drops off sharply? Surprisingly the answer is no.

If all of the masses of the galaxy were contained within the edge of the visible structure, Newton's law of motion predict that the orbital speed of star and gas beyond 15 kpc would decrease with increasing distance from the galactic centre, just as the orbital speed of the planets diminish as we move outward from the sun. The dashed line in the figure indicates how the rotation curve should look in that case. However the actual rotation curve is quiet different. Far from declining at the larger distances, it rises slightly out of the limits of our measurement capabilities. This implies that the amount of mass contained within successively larger radii continues to grow beyond the orbit of the sun, apparently out to a distance of least 50 kpc

According to the above equation, the amount of mass within 50 kpc is approximately 6×10^{11} solar mass since 2×10^{11} solar masses lies within 15 kpc of the galactic center we have to conclude that at least twice as much mass lies outside the luminous part of our galaxy- the part made up of stars, star clusters and spiral arms- as lies inside! Based on the observations, astronomers now believe that luminous portion of milkyway galaxy- the region outlined by globular clusters and by the spiral arms- is merely "the tip of the galaxy ice berg". Our galaxy is surrounded by an extensive, invisible dark halo of stars and globular clusters and extends well beyond the 15 kpc radius once thought to represent the limit of our galaxy. But what is this dark halo made of? We do not detect enough stars or instellar matter to account for the mass that Our complications tell us must be there. We are inescapably drawn to the conclusion that most of the mass in our galaxy exists in form of invisible dark matter which we presently simply do not understand!

The term dark here does not refer just to matter undetectable in visible light. The material has so far escaped detection at all electromagnetic wavelengths, from radio to gamma rays. Only by its gravitational pull do we know of its existence. Dark matter is not hydrogen gas nor is it made of ordinary stars. Given the amount of matter that most be accounted for, we would have been able to detect it with present day equipment if it where in either of those forms. Its nature and its consequences for the evolution of galaxies and the universe are among the most important questions in astronomy today.

Many theories have been suggested for this dark matter, although none is proven. Among the strongest "stellar" contenders are brown dwarfs, white dwarfs and faint, low mass red dwarfs. These objects could in principle exist in great numbers throughout the galaxy, yet would be hard to see. A radically different alternative is the dark matter is made up of exotic subatomic particles that pervade the entire universe. Many theoretical astrophysicists believe that these particles could have been produced in abundance during the very earliest moments of our universe. If they survived to the present day, there might be enough of them account for all the dark matter we believe must be out there. This idea is hard to test because such particles would be very difficult to detect. Several detection experiments have been attempted, so far without success.

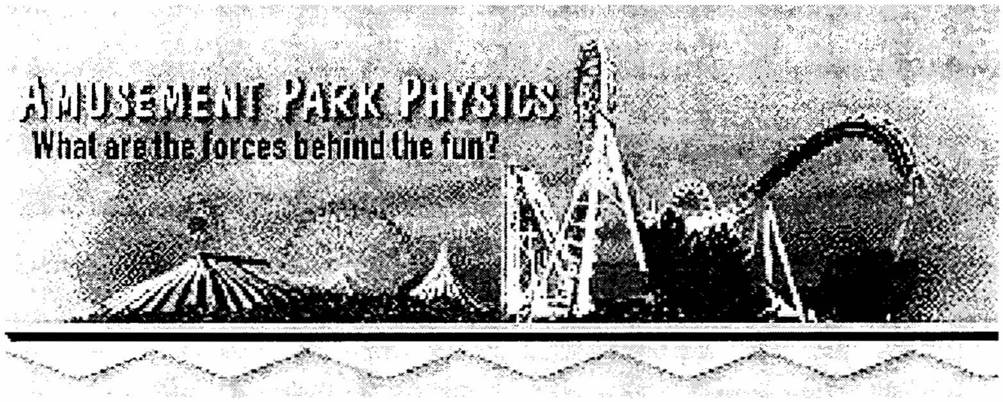
- S. Sameera
III Year

Food for thought

Roller Coaster

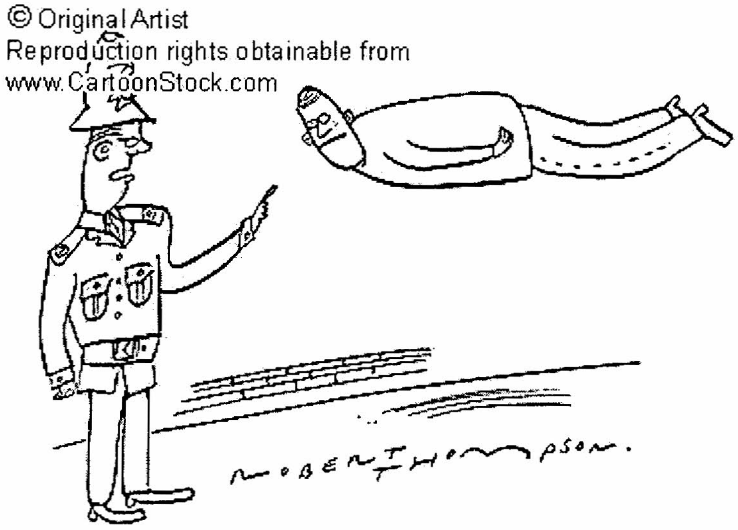
For many people, there is only one reason to go to an amusement park: the roller coaster. Some people call it the "scream machine," with good reason. The history of this ride reflects a constant search for greater and more death-defying thrills.
How does a roller coaster work?
What you may not realize as you're cruising down the track at 60 miles an hour is that the coaster has no engine. The car is pulled to the top of the first hill at the beginning of the ride, but after that the coaster must complete the ride on its own. You aren't being propelled around the track by a motor or pulled by a hitch. The conversion of potential energy to kinetic energy is what drives the roller coaster, and all of the kinetic energy you need for the ride is present once the coaster descends the first hill..
Once you're underway, different types of wheels help keep the ride smooth. Running wheels guide the coaster on the track. Friction wheels control lateral motion (movement to either side of the track). A final set of wheels keeps the coaster on the track even if it's inverted. Compressed air brakes stop the car as the ride ends.
Wooden or steel coaster: Does it make a difference?
Roller coasters can be wooden or steel, and can be looping or nonlooping. You'll notice a big difference in the ride depending on the type of material used. In general, wooden coasters are nonlooping. They're also not as tall and not as fast, and they don't feature very steep hills or as long a track as steel ones do. Wooden coasters do offer one advantage over steel coasters, assuming you're looking for palm-sweating thrills: they sway a lot more. Tubular steel coasters allow more looping, higher and steeper hills, greater drops and rolls, and faster speeds.

- R. Akhilandreshwari
III Year



The world's largest particle accelerator in Geneva was mysteriously in operable for 5 days. Investigators combed the $1 billion facility for clues and found empty beer bottles in one of its vacuums.

Laughter for the mechanical souls



"I'm arresting you for breaking the laws of physics"

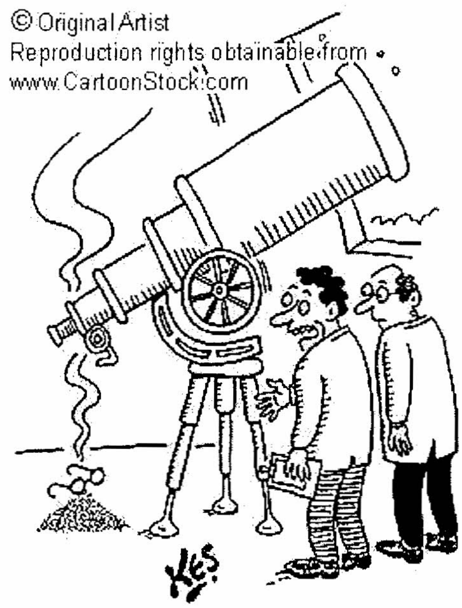
What do you call it when atomic scientists grab their rods and gather around the old watering hole?

- Nuclear Fishing

What did the monk say when he got shocked?

- Ohmmm (Ω)

Dr. McPhee discovers the Embarrassment Particle



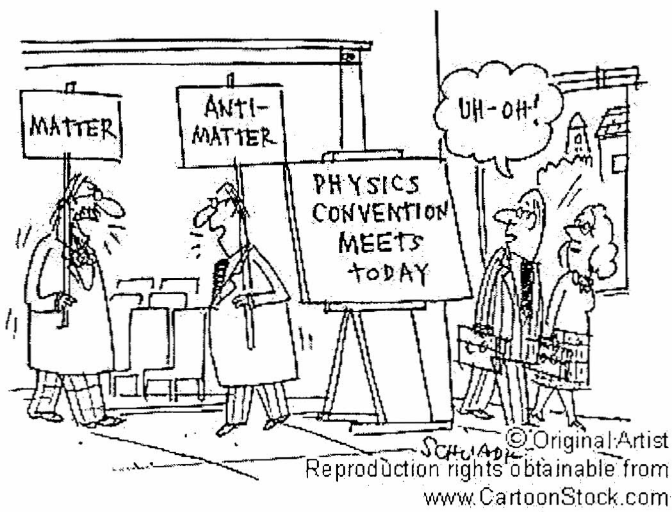
"The last thing I said to him was: 'Whatever you do, don't look at the sun through this thing'."

It can be said that in quantum mechanics, Bohr moved in atomic circles, While Schrodinger waved and Heisenberg was uncertain!!

Why did the cat fall off the roof?

- He lost his mew(μ)

Two electron convicts are sitting in jail. The first electron says “Why are we in jail?” The second one says “for attempting a forbidden transition.”



BLACK HOLE QUANTIZED

One of the most mysterious objects in the universe is the black hole. Only indirect evidences are available about its presence and yet on paper it shows out itself prominently with two striking characteristics. One is that no physical laws of gravitation and motion are valid on its surface. The other is that it is gravitationally so strong that even light cannot escape from its surface. Recent researchers viewing it from quantum mechanical angle attribute to this "space-time" hole, colorful possibilities. So much has been speculated about this hypothetical object that it now seems likely to be soon detected.

There are similarities between the properties of black hole and laws of thermodynamics, that it emits radiation just as an ordinary hot body does, that when it vanishes, it explodes releasing energy equivalent to many millions of hydrogen bombs.

BLACK HOLE AND THERMODYNAMICS:

Entropy is a measure of the degree of disorderliness in a system. The more there is disorder in a system, the higher is its entropy. In case of a black hole, they behave just as molecules do but in somewhat different context. It is found that when two black holes merge, some matter gets absorbed by a black hole, the event horizon (the boundary of black hole where the wave-front of light hovers just as the uppermost layer of earth's atmosphere does is called event horizon) of the product hole is always higher than the mathematical sum of the individual event horizons of the two. This parallelism between the properties of black hole and laws of thermodynamics raises some questions and provides insight into the nature of a black hole.

As the entropy of a system increases, the more information about the system gets irretrievably lost to us. Entropy of a black hole means just that. As a black hole retains only three of its soul quantities namely (i) Mass, (ii) Angular momentum, (iii) Electric charge, after the reincarnation and loses everything else about itself. This degree of information lost, or disorder created is called the entropy of a black hole. It has been found quantum mechanically to be finite.

As entropy of a black hole is proportional to its event horizon, the temperature of the black hole is proportional to its surface gravity. In a state of thermal equilibrium a black hole therefore should emit radiations.

Just as we have potential barriers around atomic nuclei, black hole, too has one. The influencing strength of this barrier is proportional to its size. Estimations tell that a black hole with a mass equivalent to sun's has an insignificant cold temperature of ten-millionth of a degree above absolute zero. On the other hand, a black hole with mass equal to that of a mountain, say a billion tons, has a temperature of 120 billion degree Kelvin. Such a small sized black hole, of the order of 10^{-18} , would radiate energy equivalent to 6000 Megawatt, the output of six large nuclear reactors.

It is apparent that a large black hole in time would "disintegrate" into a small black hole because of radiation, and it would finally blow up. This blow up is termed as an explosion. The black hole explosion is now claimed to be an effective tool in probing into fields of particle physics and cosmology.

-Ann Tresa George

II Year

Physics and Sports

A great Physicist once told me that Physics was at the heart of everything! A phrase that was verified in all aspects.
It just goes to show that Physics has actually helped those sports men and women win those nice shiny medals and awards.But ever wondered how Physics could have actually played a role?
Let's take a closer look...

THE SPORT OF AUTO RACING:

One of the basic laws of physics with race cars is that the wider the car, the faster it corners. Curves on a racetrack offer special challenges to race car drivers because of physics principles. Newton's First Law brings us face-to-face with inertia. Because of inertia, the race car (and driver) would continue on a straight line, non-curving track if some force were not applied. The force must produce a change in direction toward the center of the curve. This type of force that acts perpendicular to the car's velocity is called centripetal force. It serves to change direction but not speed. The friction between the tires and the track provide that force. The force is directly related to the square of the speed of the car. If a car goes too fast, the friction force is not great enough to hold the car in the track. The centripetal (center-seeking) force is also inversely related to the radius of the curve. The bigger the radius of turning the less force needed to make the curve. Some tracks are banked (tilted) toward the center of the curving section to help friction hold cars on the track at high speeds. That is also true on exit ramps from major highways.

THE SPORT OF GOLF:

Golf is a game of timing-- as with most sports-- but most golfers can tell you that small actions can have big impacts especially in this game. The head of a golf club accelerates about 100 times faster than a very fast sports car. In about one fifth of a second the club goes from zero to 100 mph. Quite a takeoff! The impulse (Force x change in Time) of the impact with the ball propels the ball away from the head of the club at 135 mph. The club is in contact with the ball only about half a millisecond (0.0005 s) and any imperfections in a swing can have a big affect on the way the ball travels in the air. If at impact, the club head points to the left of the ball's correct path then the ball will hook; if pointed to the right the ball will slice. Just a one-degree tilt away from a head-on collision will cause an error of 24 feet off to the side. Golf is not an easy game! "Keep your eye on the ball!" applies aptly to golf. At first golf balls were smooth but golfers noticed that old scuffed balls flew longer. The dimples on a golf ball serve to reduce the drag on a golf ball somewhat as the stitches on a baseball also reduce drag.

THE SPORT OF BASKETBALL :

 Michael Jordan seemed to hang in the air forever when he went up for a slam-dunk. What laws of physics is he breaking? On the ground or in the air, Jordan is governed by the same laws of physics as everyone else. How high he goes depends on the force he uses to push on the floor when he jumps. The harder he pushes, the higher he goes and the longer he stays in the air. To jump 4 feet vertically -a jump that is very high for a basketball player-the hang time would be 1.0 seconds. Jordan's dunk is a very exciting basket that takes place in less than just one second. Jordan makes it seem longer because when he dunks he holds onto the ball longer than most players. He actually places it in the basket on the way down from the top of his leap. He also pulls his legs up as the jump progresses making the jump look more impressive. Physics affects free-throw techniques as well in basketball. When a spinning ball bounces, it always bounces in the direction of the spin on the ball. A backspin on the ball tends to make it bounce backwards into the basket.

THE SPORT OF SOCCER:

A free kick taken by Brazilian World Cup player, Roberta Carlos reaches a 70 mph speed with a spin of 600 rev/min.The amazing spinner that David Beckham used to curve a free-kick around a defensive wall and goalkeeper to score his goals!How did they manage that?A soccer ball is an Archimedean Solid -a "truncated icosahedron" of 60 vertices and 32 faces. Twelve of the faces are pentagons (5-sided polygons) and twenty are hexagons (6 sided polygons). There is a carbon molecule named the "Buckeyball" which has the same shape as a soccer ball. Force vectors play a great part in directing the kick or a header. Physics calculations show that at 25 m from the goal and a velocity of 25 m/s, Beckham can swing the soccer ball 4.57 m from the straight path by using spin. Niels Bohr, the famous quantum physicist and Nobel Prize winner in physics, was an excellent soccer player when a university student.

THE SPORT OF TRACK :

One of the most striking innovations in field and track was the "Fosbury Flop". In 1968, Dick Fosbury pioneered a radical new technique in high jumping in the Olympics. Prior to this time jumpers had cleared the high jump by running, jumping and while remaining head up throwing over one leg and then another (straddle style). that meant that their center of mass must go over the top of the bar. (Your center of mass is generally located just below your naval.) Fosbury twisted his body so that he went over head first with his back next to the bar. He developed the technique by trial and error but physicists were able to explain why it worked so well. It takes a lot of energy (work done by your legs) to leap into the air. In the old way of high jumping, the center of mass of the body had to clear the bar. In Fosbury's new way, he could arch his body so that his center of mass was outside his body and did not have to clear the bar. This takes less energy and that meant this new style caught on very quickly! Incidentally, Fosbury won the gold medal in high jumping that year.

THE SPORT OF TENNIS:

Tennis is a very old game played since the 1500's. Originally rackets were made of wooden frames with strings from the intestines of animals. Howard Head, an engineer. He revolutionized the sport (and improved his game) by designing a racket with a larger frame and one made of lightweight aluminum. Physics tells us that the less mass, the greater the acceleration from the same applied force. So balls hit from the "Head" racket came off much faster. The strength of the new metal racket also meant less bending in the frame from the impact. So more of the energy went to the ball and less to the frame. Another great advantage of the Head Racket was that the larger frame meant a larger "sweet spot". To a physicist, a sweet spot is the place on the racket where the ball will get the maximum rebound power (energy per time) from the collision. Needless to say, almost no one uses wooden tennis rackets anymore!

So there you have it! Physics is indeed involved in sports to quite a large extent. I'm pretty sure the players themselves had no idea what they're doing but I'm sure if they did we would have the perfect sports men and women.

- Sonia H.L.Francisco
III Year

Book Reviews

WHAT EINSTEIN TOLD HIS BARBER?
By Robert Wolkes

The book, pared to the bone, elucidates some really wacky and intellectually stimulating questions about science in everyday life (like, for instance ' why it does not rain sparrows' that is how come sparrows perched on electric poles do not get electrocuted and die....). Entertaining, immensely funny and informative. It appeals to anyone with an inquisitive mind.

ENGINES OF DISCOVERY
By Andrew Sessler & Edmund Wilson

The book chronicles the development of particle accelerators from the invention of electrostatic accelerators, linear accelerators, and the cyclotron to the colliders of today. A fascinating array of images accompany this exciting volume and an interesting read for the technical minds.

A PASSION FOR DISCOVERY
by Peter Freund

This fascinating book assembles human stories about physicists and mathematicians. Remarkably, these stories cluster around some general themes having to do with the interaction between scientists, and with the impact of historic events

STALIN'S GREAT SCIENCE- The Times and Adventures of Soviet Physicists
by Alexei B Kojevnikov

an invaluable book that investigates this paradoxical success by following the lives and work of Soviet scientists. The book examines how scientists operated within the Soviet political order, communicated with Stalinist politicians, built a new system of research institutions, and conducted groundbreaking research under extraordinary circumstances.

THE UNIVERSE AND THE ATOM
by Don Lichtenberg

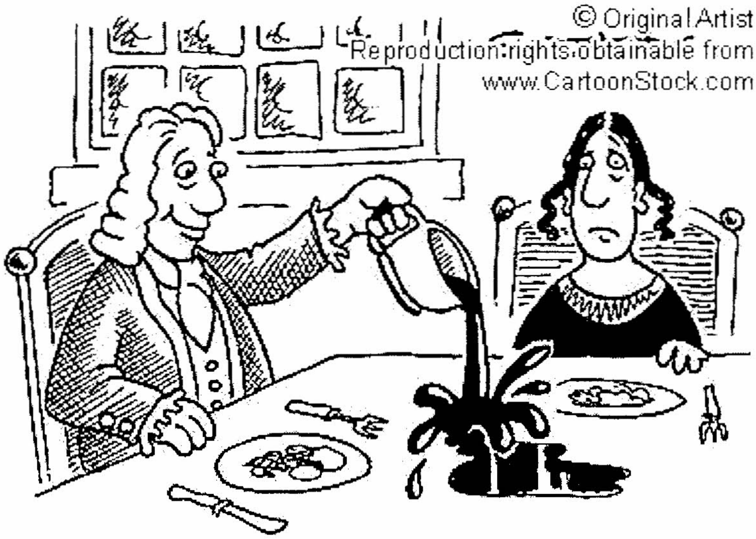
This is a fascinating and popular account of the very large and the very small, from the universe as a whole to subatomic physics. it provides and overview of what we know about the universe and what it is made of, and also what we don't know.

Further reading :

- PHYSICS: ITS STRUCTURE AND EVOLUTION
  By William A. Blanpied

- PHYSICS IN FOCUS
  By Micheal Brimicombe

R. Akhilandeswari & Sonia H.L.Francisco
III Year



1720 - Newton discovers gravy

Cyber Physics

Here's list of some cool physics websites:

1. learnerstv.com

This website contains lecture videos of many physics courses and also a lot of free e-books.

2. physics.org

If you have a burning physics question then search their database.

3. http://www.pbs.org/wgbh/nova/

This website airs science programmes and also has some cool documentaries.

4. http://www.physicstoday.org/

this website contains physics news and also good research database.

5. http://www.upscale.utoronto.ca/GeneralInterest/Harrison/Flash/#qm

this site contains flash illustrations of various topics in physics.

6. http://math.ucr.edu/home/baez/README.html

This website is maintained by a mathematical physicist named John Baez. He specializes in n-categories and their applications, but he's also interested in many other things too.

- E. Fathima Rufaa Thazyeen
III Year

So Long…. Farewell…..

Three years at Stella…. What can I say?
We laughed, we cried, we fought, we sang and sure did stay away from those microprocessor classes!
Our class…. We had the sporty NCC people, the artsy people, the studious ones, the people who just couldn't stay in class, the silent killers, and of course hilariously loud people(not mentioning any names machan)
Our department….. The smart, talented teachers who were our educational backbones and motivators. Yes, they too survived our chaotic nature. Hats off to them!
It was definitely fun and memories to look back on nostalgically..
So as we say tata, bye bye, adios, kwaheri… wish all the girls the very best and let the star of the sea guide our way!

Who is taking Jerox ya??

Asha☺

Serious CEO 1& 2 (Nenapu)☺

Mooki: Nenachuparu!!

Deepa☺

NCC Lincy

Raj: Pathuku Rendu! (12 o clock)

Miya : Shut up girls!

Goof Roof☺

Rekha

Mangai Karvapillai☺

Danadanaka!

Sami: Chamathu Kodam!

Khush☺

Kalai☺

Bonda!!

Giraffy!

Madhu

Flora☺

Tiger Dayanidhi!

Cream bun!

Sara!

Mande: Mokkae thaangala!!

Brush☺

Sharmi

Sister☺

Varsh: Vetti makal of India!

Jenny☺

Slim beauty(nenapu):Canteen anybody?

KD sappa☺

Donut!

Rupa☺

Nilla☺

Sappa: Shabbaa…..

Lincy

This is a very cute derivation girls!

Elvina☺

Surul!!

Bel!

Hockey Rekha☺

Padma☺

Selvi☺

Chancey illa…. Byeeee….

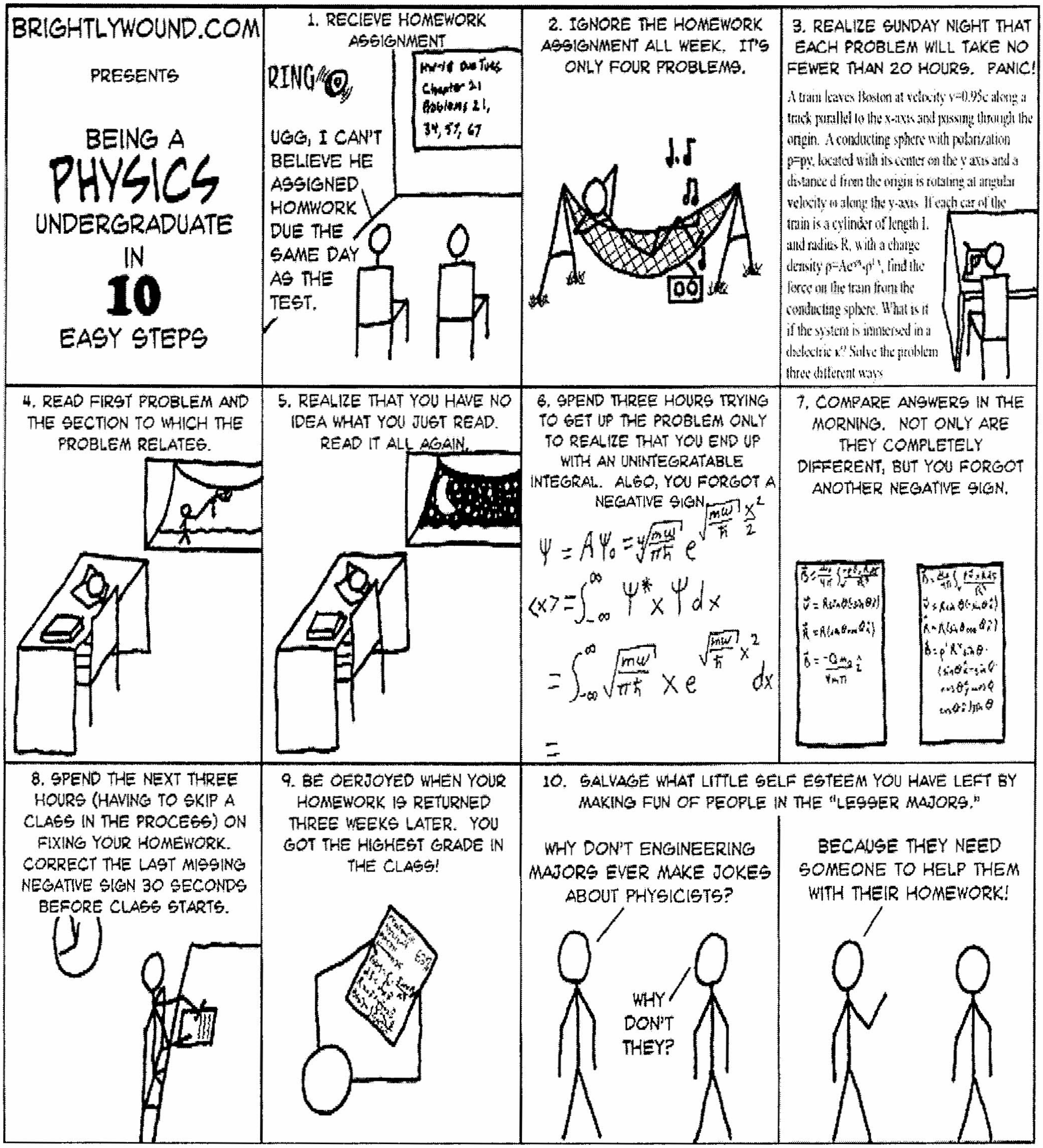
Kuruvi kudu☺

Mary☺

Scientist: Don't forget remedial classes!!

Be…lin..daaaaa

Zany soni!


BRIGHTLYWOUND.COM
PRESENTS
BEING A PHYSICS UNDERGRADUATE IN 10 EASY STEPS
1. RECIEVE HOMEWORK ASSIGNMENT
RING
UGG, I CAN'T BELIEVE HE ASSIGNED HOMWORK DUE THE SAME DAY AS THE TEST.
2. IGNORE THE HOMEWORK ASSIGNMENT ALL WEEK. IT'S ONLY FOUR PROBLEMS.
3. REALIZE SUNDAY NIGHT THAT EACH PROBLEM WILL TAKE NO FEWER THAN 20 HOURS. PANIC!
A train leaves Boston at velocity v=0.95c along a track parallel to the x-axis and passing through the origin. A conducting sphere with polarization p=py, located with its center on the y axis and a distance d from the origin is rotating at angular velocity ω along the y-axis. If each car of the train is a cylinder of length L and radius R, with a charge density ρ=Ae, find the force on the train from the conducting sphere. What is it if the system is immersed in a dielectric κ? Solve the problem three different ways
4. READ FIRST PROBLEM AND THE SECTION TO WHICH THE PROBLEM RELATES.
5. REALIZE THAT YOU HAVE NO IDEA WHAT YOU JUST READ. READ IT ALL AGAIN.
6. SPEND THREE HOURS TRYING TO SET UP THE PROBLEM ONLY TO REALIZE THAT YOU END UP WITH AN UNINTEGRATABLE INTEGRAL. ALSO, YOU FORGOT A NEGATIVE SIGN.
7. COMPARE ANSWERS IN THE MORNING. NOT ONLY ARE THEY COMPLETELY DIFFERENT, BUT YOU FORGOT ANOTHER NEGATIVE SIGN.
8. SPEND THE NEXT THREE HOURS (HAVING TO SKIP A CLASS IN THE PROCESS) ON FIXING YOUR HOMEWORK. CORRECT THE LAST MISSING NEGATIVE SIGN 30 SECONDS BEFORE CLASS STARTS.
9. BE OERJOYED WHEN YOUR HOMEWORK IS RETURNED THREE WEEKS LATER. YOU GOT THE HIGHEST GRADE IN THE CLASS!
10. SALVAGE WHAT LITTLE SELF ESTEEM YOU HAVE LEFT BY MAKING FUN OF PEOPLE IN THE "LESSER MAJORS."
WHY DON'T ENGINEERING MAJORS EVER MAKE JOKES ABOUT PHYSICISTS?
WHY DON'T THEY?
BECAUSE THEY NEED SOMEONE TO HELP THEM WITH THEIR HOMEWORK!

THE END!

MEET THE BRAINS OF 2005-2008