R.N. 70269/98
ISSN : 0972-169X

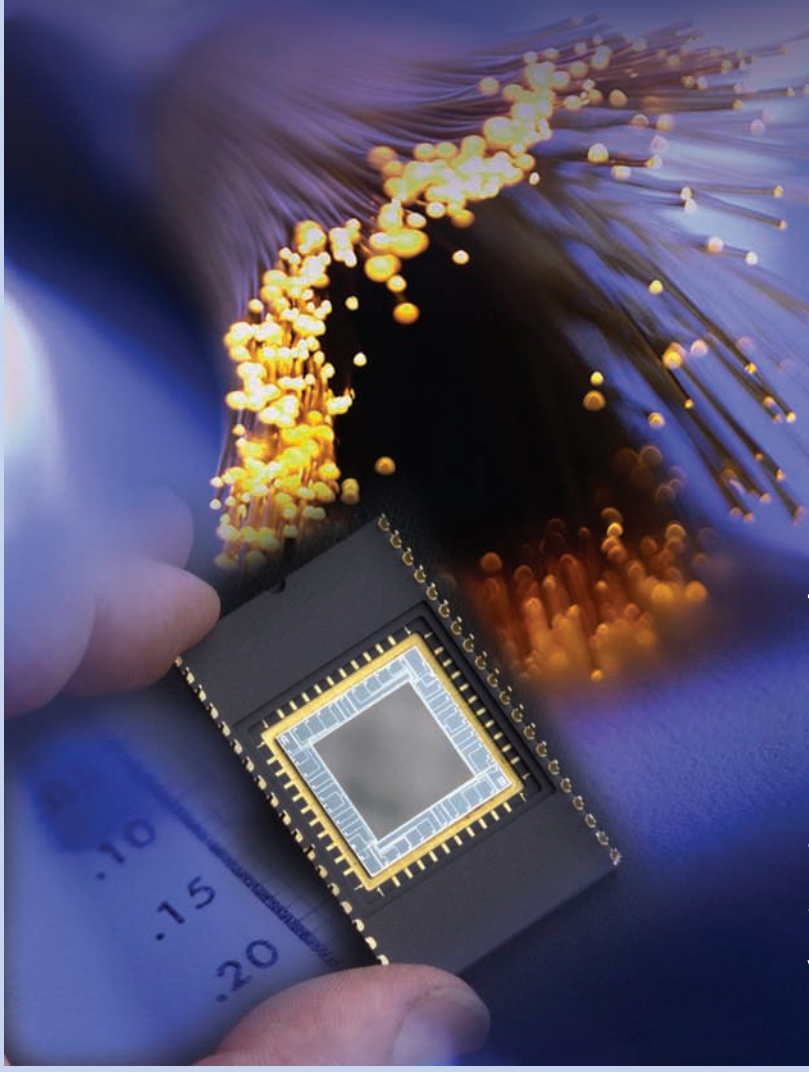
Postal Registration No.: DL-SW-1/4082/09-11
Date of posting: 26-27 of advance month

Vigyan Prasar

DREAM 2047

January 2010 Vol. 12 No. 4 Rs. 5.00

Revolutionary Optical Technologies



Inside

... think scientifically, act scientifically... think scientifically, act scientifically... think scientifically, act...

Harnessing the Power of Biotechnology Responsibly for All People

Humans have been trying to use nature's own processes to advance their conditions, to make life safer, healthier and more productive. This process, which started from the time when humans first appeared on the Earth, is continuing till today and it can be safely said that this will continue in future also. In this unending human endeavor biotechnology has emerged in recent years as the most productive and powerful tool. The very term "biotechnology" connects knowledge to practice that is, science to technology. The impact of biotechnology on everyday life is all-pervasive. In fact many believe that biotechnology will surpass the information and communication technology (ICT) revolution in terms of being the prime driver for economic, political and cultural change. What is more this is going to happen in not-so-distant future.

While far-reaching and beneficial outcomes are anticipated, some aspects of biotechnology research have raised social, economic and ethical issues. Today the society is divided on issues like human dignity, ownership of life, indigenous rights, animal welfare and the intrinsic value of the environment. There is an ongoing conflict between industry, public authorities and other interested groups on the evaluation of risks and benefits of biotechnology.

If it is used appropriately and responsibly biotechnology can, among other things,: i) provide more and healthier foods; ii) reduce dependence on fossil fuels; iii) offer more effective cures for diseases; and create positive environmental effects.

The future challenge for meeting the need of food, feed and fiber is really daunting. It has been estimated that the world will need to produce more food, feed and fiber during the next 50 years than it has in the entire history of humankind. Biotechnology, if properly harnessed, has the potential to achieve this goal.

VIGYAN PRASAR WISHES ITS READERS A VERY HAPPY AND PROSPEROUS 2010

Biotechnology is playing an important role in preventing disease. Today there are over 100 recombinant drugs and vaccines in use today. Developments in biotechnology have made it possible to produce much safer vaccines than traditional vaccines. Biotechnologists are trying to produce genetically engineered plants so that vaccines can be delivered through food instead of the more-invasive injections. Plant-derived vaccines will be orally administered and they will also be much cheaper. Gene therapy is another area of great promise. Stem cell research is a still another important research activity. The applications of stem cells go beyond medical imagination. These have the potential to address diseases such as Parkinson's, Alzheimer's, Diabetes, heart disorders, spinal cord injuries or for development of *in vitro* assay system for drug discovery and toxicity or for understanding basic developmental process. Biotechnology has dramatically improved diagnostic capabilities. Today genetic testing is available for many rare disorders. Biotechnology is also solving the problem of antibiotic resistance.

Biotechnology alone cannot solve complicated health problems. It is essential to have supportive health care infrastructure in place. Cultural, economic, and political barriers to change must be overcome through a concerted drive aimed at educating the masses who are the potential recipients of the benefits of biotechnology.

The field of nanobiotechnology is bursting with promise. In near future it will be possible for nano bio-devices to repair body parts, to rejuvenate the skin, enhance human capabilities, harness the unlimited solar energy and achieve many other feats.

Biotechnology is making a substantial contribution to the energy area. Recent advances in biotechnology have made it possible to use inexpensive cellulases to convert cellulose to simple sugar, which in turn can be fermented into fuel such as ethanol.

Today genetically modified (GM) bugs are generating a lot of interest.

(Contd. on page...22)

Editor : **Dr. V. B. Kamble**
Address for correspondence : Vigyan Prasar, C-24, Qutab Institutional Area, New Delhi-110 016;
Tel : 011-26967532; Fax : 0120-2404437
e-mail : info@vigyanprasar.gov.in
website : http://www.vigyanprasar.gov.in

Published and Printed by Dr. Subodh Mahanti on behalf of Vigyan Prasar, C-24, Qutab Institutional Area, New Delhi - 110 016 and Printed at Aravali Printers & Publishers Pvt. Ltd., W-30, Okhla Industrial Area, Phase-II, New Delhi-110 020. Ph : 011-26388830-32 **Editor : Dr. V. B. Kamble**

Arno A. Penzias and Robert W. Wilson

Discoverers of the Cosmic Background Radiation

□ Subodh Mahanti
E-mail: smahanti@vigyanprasar.gov.in

"Cosmology is a science which has only a few observable facts to work with. The discovery of the cosmic microwave background radiation added one—the present radiation temperature of the universe. This, however, was a significant increase in our knowledge since it requires a cosmology with a source for the radiation at an early epoch and is a new probe of that epoch. More sensitive measurements of the background radiation in the future will allow us to discover additional facts about the universe."

Robert W. Wilson in his Nobel Lecture delivered on 8 December 1978.

"Throughout most of recorded history, matter was thought to be composed of various combinations of four basic elements; earth, air, fire and water. Modern science has replaced this list with a considerably longer one; the known chemical elements now number well over one hundred. Most of these, the oxygen we breathe, the iron in our blood, the uranium in our reactors, were formed during the fiery lifetimes and explosive deaths of stars in the heavens around us. A few of the elements were formed before the stars even existed during the birth of the universe itself."

Arno A. Penzias in his Nobel Lecture on 8 December 1978.

Arno Allan Penzias was born on 26 April 1933 in Munich, Germany. With the rise of Hitler, Jews were forced to leave the country or face persecution. The situation was such that his parents had to send their two small children to England. At the time Arno was barely six years old. Later, in his autobiographical note prepared for the Nobel Foundation he wrote: "In the late spring of 1939, shortly after my sixth birthday, my parents put their two boys on a train for England; we each had a suitcase with our initials painted on it, as well as a bag of candy. They told me to be sure and take care of my younger brother." Six months later his parents also fled the country.

Robert Woodrow Wilson

Describing the situation Penzias wrote: "My mother received her exit permit about a month later (just a few weeks before the war broke out) and was able to join us in England. My father had arrived in England almost as soon as the two of us, but we hadn't seen him because he was interned in a camp for alien men. The only other noteworthy event in the six or so months we spent in England, awaiting passage to America, occurred one morning in a makeshift schoolroom. At that moment, I suddenly realised that I could read the open page of the (English) school book I had been staring at."

The Penzias family did not stay in England for long. They went to America. To quote Penzias: "We sailed for America toward the end of December 1939 on the Cunard liner *Georgic*—using tickets that my father had foresightedly brought in Germany a year and a half earlier. This ship provided party hats and balloons for the Christmas and New Year's parties, as well as lots of lifeboat drills. The grey three-

Arno Allan Penzias

inch gun on the aft deck was a great attraction for us boys."

The Penzias family settled in the Garment district of New York in January 1940. Arno and his brother joined Brooklyn Technical High School. Their parents initially worked as superintendents of an apartment building, where they were given free accommodation in the basement. Subsequently his mother took up a sewing job in a coat factory and his father became a carpenter in the carpentry shop of the Metropolitan Museum of Art.

Arno graduated from the High School in 1951 and then joined City College of New York from where he received a bachelor's degree in 1954. In the college he first joined the chemical engineering course but soon he discovered his interest in physics. So he switched his "major" from chemical engineering to physics. He spent two years in the US Army Signal Corps before he got a research assistantship in the Radiation Laboratory of the Columbia University. He did his Ph.D. under the supervision of C. H. Towens. His Ph.D. work involved building a maser amplifier in a radio-astronomy experiment

After completing his Ph.D. work, Arno Penzias went to Bell Laboratories, Holmdel, New Jersey in search of a temporary assignment because he thought it would be an ideal place to complete the observations that he had began during his Ph.D. work. However, after having been persuaded by Rudi Kompfner, then Director of Radio Research Laboratory of Bell Laboratories, he took up a permanent assignment and remained there for 37 years. At the Bell Laboratories he met Robert Woodrow Wilson. Their collaboration led to the discovery of the cosmic microwave background radiation.

Wilson was born on 10 January 1936 in Houston, Texas, USA. His father worked in oil well service company in Houston. Robert attended a public school in Houston. While in school he took piano lessons for several years. Influenced by his father, he developed a keen interest in electronics. He wrote: "During my pre-college years I went on many trips with my father into the oil fields to visit their operations. On Saturday mornings I often went with him to visit the company shop. I puttered around the machine, electronics and automobile shops while he carried on his business. Both of my parents are inveterate do-it-yourselfers, almost no task being beneath their dignity or beyond their ingenuity. Having picked up a keen interest in electronics from my father, I used to fix radios, and later television sets, for fun and spending money. I built my own hi-fi set and enjoyed helping friends with their amateur radio transmitters, but lost interest as soon as they worked."

Charles Hard Towens

Like Arno Penzias, Robert Wilson also went to Bell Laboratories. He wrote: "I joined Bell Laboratories at Crawford Hill in 1963 as part of A. B. Crawford's Radio research department in R. Kompfner's laboratory. I started working with the only other radio astronomer, Arno Penzias, who had been there about two years."

Engineers working at the Bell Laboratories had built a radio antenna which was used in the early 1960s to transmit and receive radio signals to and from *Telstar* satellites. When the antenna was made available for research purpose, Penzias and Wilson planned to use it to examine whether the gaseous halo surrounding the Milky Way galaxy was made up of glowing radio waves. Their initial task was to calibrate the instrument to eliminate its noise.

They took the device apart. They checked the dish and all other connections. While checking the device they found pigeons nesting on the dish. They cleaned the dish and removed the pigeons. However, the pigeons kept returning. They set up the instrument for a wavelength of 7.35 centimetres because they thought that the Milky Way's gaseous halo would be practically invisible at this wavelength.

A highly sensitive solid-state maser detected the waves received by the antenna. The device detected a microwave noise for which Penzias and Wilson had no explanation. They found that it was far less energetic than the radiation given off by the Milky Way and it was isotropic; that is, came from all directions with equal strength. Assuming that their device was subject to interference from terrestrial sources, they initially assumed that the radio noise emanated from New York City. However, they rejected their assumption after scrutinizing the possibility. They continued to look for any possible source of the faint background radiation for almost a year without finding any. Penzias was advised by one of his colleagues to discuss the matter Robert Dicke, a Professor of Physics at the Princeton University.

Prof. Dicke and one of his postdoctoral students, James Peebles made detailed calculations to find out the radiation that should have permeated the universe soon after the Big Bang. They argued that because of the expansion of the universe, the originally produced short-wavelength photons should become long-wavelength photons, in the microwave region of the electromagnetic spectra. Further they argued that such photons should now form a radiation field encompassing the entire universe. The situation is such that it can be assumed that the radiation is emitted by a blackbody and its temperature can be estimated from the Plank's radiation law. After discussing with Prof. Dicke, Penzias realised that the mysterious radiation was actually left-over, cooled-down radiation of the Big Bang. The theory of the Big Bang was originally proposed by George Gamow and Ralph Alpher. The term "Big Bang" was coined by Fred Hoyle.

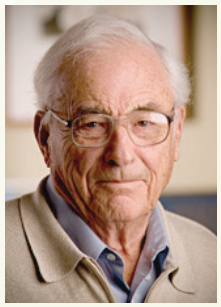
(Contd. from page...30)

Revolutionary optical technologies

☐ Biman Basu
E-mail: bimanbasu@gmail.com

During recent years, information technology has revolutionised our daily life – be it high-speed broadband networks for Internet or the ubiquitous digital camera. This has been possible to a large part due to the development of advanced electronic and optical devices and systems that brought sea change to the fields of high-speed communication and imaging technology. The Nobel Prize in Physics for 2009 has been jointly awarded to three scientists, Charles K. Kao, Willard S. Boyle and George E. Smith, in recognition of their roles in shaping the modern information technology. Kao receives half the prize money for initiating the search for and the development of the low-loss optical fibre presently used in optical fibre communication systems, while Boyle and Smith share the other half for inventing the charge-coupled device (CCD) presently used in many digital cameras and in advanced medical and scientific instruments.

Charles K Kao



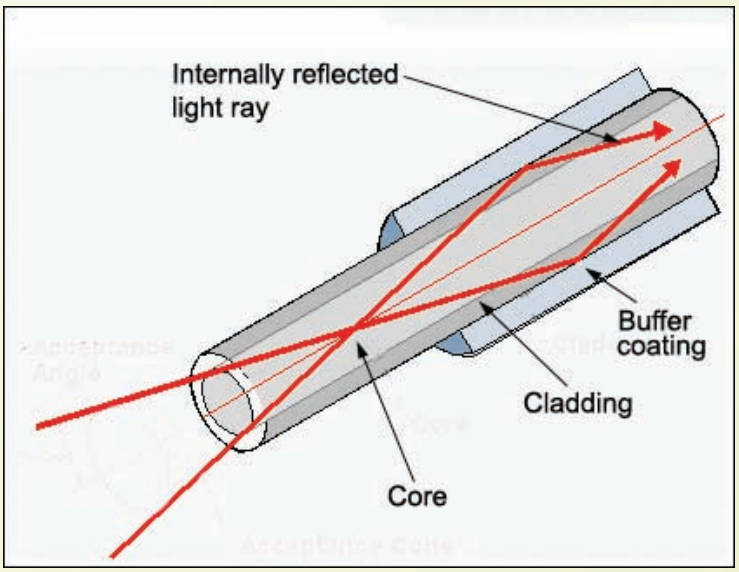
Willard S. Boyle

George E. Smith

Fibres as light pipes

The first ideas of applications of glass fibres (i.e. extremely thin glass rods) for guiding light date from the late 1920's. They were all about image transmission through a bundle of fibres. Bare glass fibres were, however, quite inefficient, as much light escaped through the sides and only a small part could be transmitted. Each time the fibres touched each other, or when the surface of the fibres was scratched, light was led away from the fibres, leading to loss of light.

A breakthrough came in the early 1950's when it was demonstrated that cladding the fibres with glass of lower refractive index could prevent light loss by facilitating improved total internal reflection. (Total internal reflection is an optical phenomenon that occurs when a ray of light strikes a medium boundary at an angle larger than the critical angle with respect to the normal to the surface. If the refractive index is lower on the other side of the boundary no light can pass through, so effectively all of the light is reflected.) At about the same period, Indian-born physicist Narinder Singh Kapany and H.H. Hopkins at Imperial College in London successfully constructed a bundle of several thousand fibres 75 centimetres long and demonstrated good image transmission properties. Later, in a paper published in 1961, Kapany described the theory of light propagation into fibres. By combining the fibre bundle technology with cladding, some applications, in particular the gastroscope (an optical instrument used for inspecting the interior of the stomach), soon went all the way to industrial production.



Schematic cross-section of an optical fibre

Kao's contribution has been mainly in studying in detail the fundamental properties of optical fibres with respect to optical communication. His research concerned the study of the attenuation (weakening) coefficient of silica as a function of wavelength. His most important finding was that losses in dielectric media were mostly caused by absorption and scattering He discovered that on the short wavelength side, attenuation is due to Rayleigh scattering (scattering of light by particles much smaller than the wavelength of the light, which may be individual atoms or molecules), while on the long wavelength side, it is due to absorption in molecules. This meant that fibres with glass of higher purity could be a good candidate for optical communication. In particular, Kao's research showed that fused silica (SiO_2) had the purity required for optical communication. An intense worldwide search with the aim to produce glass fibres with low losses began, stimulated by Kao's work.

Subsequently research by other workers succeeded in making glass fibres of fused silica with the low losses that Kao had

Fibre optic endoscopy image of the stomach of a healthy person

envisioned using a clever chemical method called CVD (chemical vapour deposition). To make a core and a cladding with very close refractive indices, titanium was used to dope the fused silica core, and pure fused silica was used in the cladding, which substantially improved the quality of light transmission by the fibres.

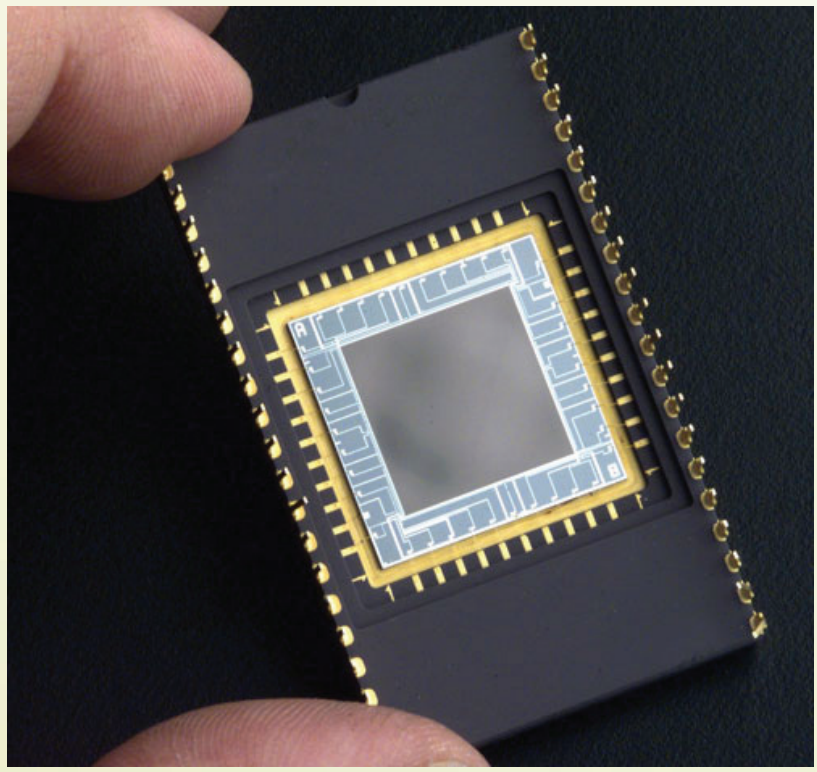
Global communication, and in particular internet and long-distance telephony, is now based primarily on optical fibre technology. The main advantage of using light compared to radio waves in communication is the high frequencies that allow high data transmission rate. Nowadays, several terabits (10^{12} bits) per second can be transmitted in a single fibre which represents an increase by a factor of one million to what could be achieved fifty years ago with radio signal transmission. Moreover, light beam is not affected by electrical or magnetic disturbances that often caused disruption in electric signals passing through wires. Naturally, the number of optical fibre cables being installed all over the world is increasing rapidly. Fibre optics has also brought in a revolution in a huge number of other applications, in medicine, laser technology, and sensors.

Images become digital

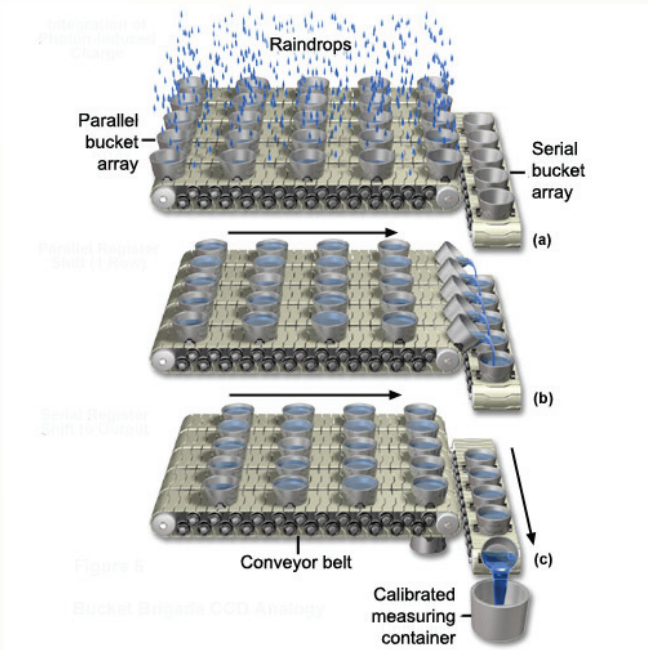
It was in 1826 that the French inventor Joseph Nicephore Niépce captured the first image on a bitumen-coated metal plate in 1826 using a *camera obscura* with an 8-hour exposure time. Since then, photography has come a long way. The roll of film was invented 1887 by a priest, H. Goodwin, and explored by George Eastman. The Eastman Kodak box camera for roll film appeared on the market in 1888. Different schemes for colour photography were also explored during the 19th century. Gabriel Lippman was awarded the 1908 Nobel Prize in Physics for his colour photographic process based on interference effects. But the invention of digital imaging in the 1980s changed the technique of photography like never before.

At the heart of digital imaging is a solid-state device called the charge-coupled device, or CCD in short. The CCD was an accidental invention. When the inventors, Willard Boyle and George Smith, started their work on CCD, imaging was not their goal. Their aim was to create a better electronic memory, but as a memory device the CCD is now forgotten. Instead it has become an indispensable part of modern imaging technology.

The imaging technique makes use of the photoelectric effect, which was first theorised by Albert Einstein and earned him the 1921 Nobel Prize in Physics. The effect occurs when light hits a silicon plate and knocks out electrons in the photocells. The larger the amount of light, the larger is the number of electrons that are liberated. Just like many other devices in the electronics



A charge-coupled device (CCD) uses charges generated via the photoelectric effect to create digital images



Working of a CCD can be compared to buckets on conveyor belts catching falling rain, to represent photons of light. Each bucket (packet) contains a different amount of water (charge), depending on how much rain fell on that part of the array. The buckets are shifted in an orderly fashion to a collecting row, then to a final measuring device at the front. In this way the quantity of water in each bucket is counted. In a typical CCD this can happen very fast: about 30 times per second for every one of millions of "buckets" (pixels) on the CCD

industry, the CCD is made out of silicon. The size of a stamp, the silicon plate holds millions of photocells sensitive to light.

When a voltage is applied to the CCD array, the content of the individual photocells can be progressively read out; row by row, the electrons slide off the array onto a kind of a conveyor belt. For example, an array of 100 × 100 image points is transformed into a 10,000-point- long chain. In this manner the CCD transforms the optical image into electric signals that are subsequently translated into digital ones and zeros. Each cell can then be recreated as an image point, a pixel. When the width of a CCD, expressed in pixels, is multiplied with its height, the image capacity of the sensor is obtained. Thus a CCD with 1280 × 1024 pixels yields a capacity of 1.3 megapixels (1.3 million pixels).

The advantages of the electronic image sensor quickly became evident. In 1970, just about a year after the invention, Smith and Boyle demonstrated a CCD in their video camera for the first time. The first camera with built-in CCD appeared on the market in 1981. Five years later in 1986, the first 1.4 megapixel image sensor arrived, and a further nine years on in 1995, the world's first fully digital photographic camera appeared. Camera manufacturers around the world were quick to catch on, and today the market is flooded with ever smaller and cheaper products including mobile phones with built-in digital cameras.

Without the CCD, the development of digital cameras would have taken a much slower course. Without the CCD we would not have seen the astonishing images of space taken by the Hubble Space Telescope, or the images of the red desert on our neighbouring planet Mars. And without the CCD the almost-instantaneous global coverage of events by the international media would have been impossible. ■

Contd. from (page...33)

Later Alpher and Robert Herman argued that if there was really a Big Bang then the accompanying radiation should still be present today, though it would have lost energy as the universe expanded. It was this idea of a left-over radiation that was further elaborated by Prof. Dicke and his group.

Penzias and Wilson published their findings in the *Astrophysical Journal* (1965). In the same issue of the journal, Dicke and his colleagues argued that the radiation studied by Penzias and Wilson was actually the remnant of the Big Bang. After the pioneering observations made by Penzias and Wilson, physicists in different parts of the world carried out similar measurements and all of them came to the same conclusion that radiation as 'frozen remnant' of the Big Bang really exists. The discovery of the cosmic microwave background radiation was clinching evidence in favour of the Big Bang theory.

Guyana has issued a stamp in honour of Robert W. Wilson. Antigua and Barbuda has issued a stamp in honour of Arno Penzias.

References :

1. *A Dictionary of Astronomy*, Oxford : Oxford University Press, 1997.
2. *A Dictionary of Scientists*, Oxford : Oxford University Press, 1999.
3. *Chambers Biographical Dictionary*, New York : Chambers, Harrap Publishers Ltd., 1997
4. Dardo, Mauro, *Nobel Laureates and Twentieth-century Physics*, Cambridge: Cambridge University Press.
5. Heilbron, J.L. (Ed.), *The Oxford Companion to the History of Modern Science*, Oxford : Oxford University Press, 2003.
6. Pannekoek, K., *A History of Astronomy*. New York : Dover Publications, Inc., 1989.
7. Seeds, Michael A. *Foundations of Astronomy*, Pacific Grove, CA: Thomson Learning Academic Resource Centre 2003.
8. *The Cambridge Dictionary of Scientists*, Cambridge : Cambridge University Press 2004.
9. Available sources on the Internet.

(The article is a popular presentation of the important points on the life and work of Arno Allan Penzias Robert Woodrow Wilson available in the existing literature. The idea is to inspire the younger generation of know more about Arno Allan Penzias Robert Woodrow Wilson . The author has given the sources consulted for writing this article. However, the sources on the Internet are numerous and so they have not been individually listed. The author is grateful to all those authors whose works have contributed to writing this article). ■

Retreat from Reality
Schizophrenia

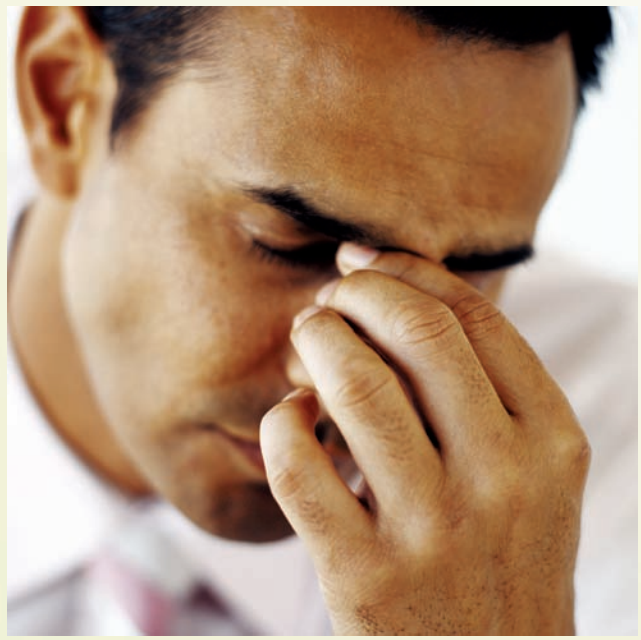
Dr. Yatish Agarwal
e-mail: dryatish@yahoo.com

> When a man says that he is Jesus or Napoleon, or that the Martians are after him, or claims something else that seems outrageous to common sense, he is labelled psychotic and locked up in a madhouse. Freedom of speech is only for normal people.
>
> —Thomas Szasz in *The Second Sin Schizophrenia*

Schizophrenia is a devastating mental illness. It imprisons the human consciousness in cobwebs of absurdity. The person loses contact with reality, and the thinking apparatus goes haywire. With thought processes going awry, the mind becomes a prisoner of private fantasies. Emotional expressiveness gets blunted, behaviour becomes odd, actions turn bizarre, the person becomes limited in his or her ability to interact with other people and often withdraws from the outside world.

Of all the mental illnesses, schizophrenia is probably the most difficult to understand for everyone involved. The first signs of illness typically emerge in adolescence or young adulthood. Most people suffer the illness throughout their lives, thereby losing opportunities for careers and relationships. Due to a lack of public understanding about the illness, people with schizophrenia often feel isolated and stigmatised, and are reluctant or unable to talk about their illness. This secretiveness comes as a major shock to families and friends. They feel acutely distressed and confused to see the effects of the illness on their relative, who they remember as being active and lively person before being taken ill. The economic burden and social stigma associated with supporting such a person can also complicate the situation, and family members may try to deny the existence of the illness. Earlier on, this illness was sometimes described as 'cancer of the mind' or even 'living death' because the person was totally lost to the 'normal' world. With modern treatment and management this is no longer true of the majority.

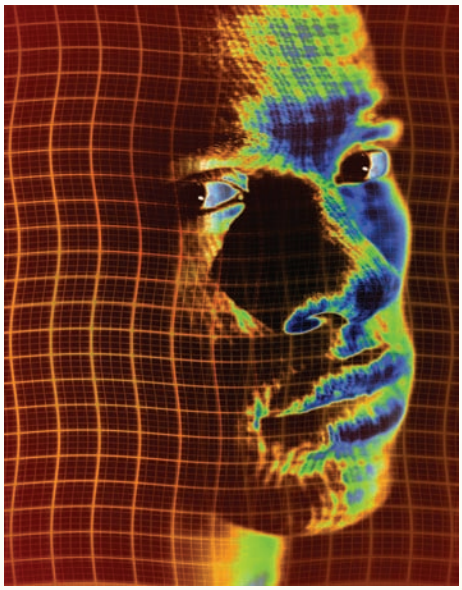
Modern anti-psychotic medications can limit the symptoms of schizophrenia quite effectively. More than 60 per cent people with schizophrenia can return to normal and lead active fruitful lives. There are a number of people, including some rich and famous and some who have given much to the world, who have flown over the cuckoo's nest. The famous mathematician, John K Nash, who gave the framework of the Game Theory and received the Nobel prize in 1994, is just one of the many such success stories. In societies where the family network and support is robust, the outcome is even better as the sufferer is not able to totally withdraw into his or her inner fantasy world—the real world never loses its hold on the person.



Genesis and History

Strangely though, the name schizophrenia is a misnomer. Its origin goes back to a Greek word which means 'split mind'. However, contrary to the popular belief, a person with schizophrenia does not have split or multiple personalities. Rather, the illness is a disorder of the thinking apparatus. A person with schizophrenia has difficulty in telling the difference between real and unreal experiences, logical and illogical thoughts, and appropriate and inappropriate behaviour. It is as if the electrical circuitry of the brain has gone haywire and wrong or random cross connections result in odd fragmented thinking. These characteristics were first noted by Eugene Bleuler, a Swiss psychiatrist, who wrote a classic paper on the subject, giving the illness its modern name.

Schizophrenia is not a disease of the new age. It merits description in several of the ancient texts, some as old as 1400 BC. The founder of modern psychiatry, German psychiatrist Emil Kraepelin, who devised the first scientific system to identify and classify mental disorders, gave it the name of 'dementia praecox', which means premature dementia, in 1899.



Schizophrenia causes an enormous cost to society, both in terms of treatment and lost productivity. Those who suffer from the illness occupy the largest number of beds in psychiatric wards. During an acute phase of the illness they may require hospitalisation because of the danger they pose to themselves. Some 40 per cent people with schizophrenia try to commit suicide and 15 per cent end their lives this way.

With nobody to take care of them, many people with schizophrenia wander around, homeless. The need in their case is the treatment of the illness, rather than letting them slip away.

One in a Hundred

Schizophrenia affects between one and two per cent of people during their lifetime. The illness is found all across the world and the rates are also rather similar. Race and culture do not affect the numbers, and men and women are at equal risk. Whereas most men face the onset of the illness between 16 and 25 years of age, women frequently develop the symptoms between the ages of 25 and 30. There are other differences as well between the two sexes. The illness generally takes a less severe course in women than in men—they need fewer hospitalisations than men, and function better socially in the community.

Symptoms

The illness usually develops slowly over months or years, and can surface at any time. In some people the symptoms may only last for a brief period, disappear, and then appear again in a cyclical fashion for a few years. The illness may then stop recurring and leave no residual effect. This is called the schizophreniform disorder.

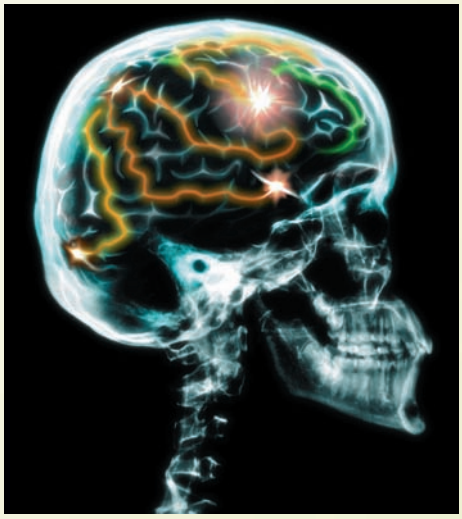
In most people the disease runs a long and continuous course. The severity of symptoms and the functioning of a person may however wax and wane. The disease may erupt and become severe, but may again become placid. Some people, as they grow older, are fortunate to experience a gradual decline in symptoms. About 25 per cent people with schizophrenia become symptom-free in their later lives.

The illness is marked by a variety of symptoms. The most prominent features are: disordered thinking—thinking becomes incoherent, disjointed and rambling; emotions get unrelated to the situation, actions and utterances become impulsive, and hallucinations overtake—the person begins to hear voices, often of unfriendly kind, or see objects that do not exist. Bizarre delusions are another common feature. The movements may become strange. Most people with schizophrenia cannot recognise that their mental functioning is disturbed or that they need help. They often do not understand that medication is a necessity for them and this worsens their suffering.

Common Handicaps in Schizophrenia

Core Difficulties

- Disorderly thinking
- Incongruity of emotion
- Impulsive actions and utterances
- Bizarre delusions (with little or no appreciation of why the ideas are not acceptable to the people around)
- Paranoid thoughts (the belief that one is surrounded by hostile forces which keep a close watch and secretly intervene to harm)
- Hallucinations (hearing threatening or unfriendly voices, where none exists)
- Passivity feelings (the person is convinced that his actions are controlled by an alien power)
- Thought insertion and thought broadcasting (the person feels that his thoughts are not his own, that other people put thoughts into his mind or withdraw them and make them public in some way, that other people can read his thoughts, or that his thoughts are being said aloud or broadcast on radio or TV)
- Incoherent bizarre behaviour
- Incoherent, disjointed, or rambling speech
- Abnormal posturing or movement
- Difficulty in coping with home and work-related responsibilities



Associated Difficulties

- Obsessive thinking
- Compulsive secret rituals
- Prolonged anxiety, tension or worry
- Fidgeting, pacing, or hyperactivity
- Depressed mood
- Irritability or hostility
- Feeling worthless or guilty
- Unexplained physical tiredness
- Poor concentration
- Sleeping problem
- Appetite or eating problem
- Diminished sexual interest
- Overly dependent behaviour
- Poor physical health

Difficulties when the illness is severe

- Difficulties in money management; excessive spending
- Severe distrust or acute tendency for suspicion
- Compromised learning ability
- Poor memory
- Physical violence
- Risk of harming self
- Poor grooming and hygiene

To develop a clearer understanding of the illness, let us take a closer look at its characteristic symptoms:

Delusions

Delusions are false ideas or beliefs that obviously appear untrue to other people. People with schizophrenia experience delusions of many kinds and are unable to appreciate why their ideas are unacceptable to those around them. Sometimes, these delusions are extremely grandiose. A person with schizophrenia thus may believe that he is the king, prime minister, or president of a country! Often, the delusions are persecutory in nature. He may believe that people are plotting against him, and are out to get him, or that he is being spied on. This condition is known as paranoia. The delusions may also be bizarre. A person with schizophrenia may thus believe that a stranger has removed his internal organs and has replaced them with someone else's organs without leaving any wounds or scars. He may also believe that aliens are controlling his thoughts or that his own thoughts are being broadcast to the world so that other people can hear them.

Hallucinations

People with schizophrenia may also experience hallucinations (false sensory perceptions), and may see, hear, smell, feel, or taste things that are not really there. Auditory hallucinations, such as hearing voices when no one else is around, are especially common in schizophrenia. These hallucinations may include two or more voices conversing with each other, voices that continually comment on the person's thoughts or behaviour, or voices that command the person to do something. These are fairly characteristic of the illness. These hallucinations must occur when the person is clearly awake and not at the time when he is about to fall asleep or is waking up.

Disorganized Thinking and Speech

Since the thought process get disorganised in people with schizophrenia, they may talk in an incoherent or nonsensical way and may jump from topic to topic or string together loosely associated phrases. They may also combine words and phrases in meaningless ways or make up new words. In addition, they may show 'poverty' of speech, in which they talk less and more slowly than other people, fail to answer questions or reply only briefly, or suddenly stop talking in the middle of a conversation.

Bizarre Behaviour

A person with schizophrenia may behave bizarrely. He may appear markedly dishevelled, may dress in an unusual manner (for example, wear multiple shirts, coats, scarves and gloves or use inappropriate makeup), may talk to himself, may shout or swear without provocation, may walk backward, laugh suddenly without explanation, make funny faces, or may display clearly inappropriate sexual behaviour. In rare cases, he may maintain a rigid, bizarre pose for hours on end, or may engage in constant random or repetitive movements.

Social Withdrawal

A person with schizophrenia may experience several negative symptoms, the most characteristic of them being social withdrawal. The person may thus begin to avoid others or act as though others do not exist. He may show decreased emotional expressiveness, and may talk in a low, monotonous voice, avoid eye contact with others, and display a blank facial expression. He may also have difficulty in experiencing pleasure and may not feel up to taking part in any work or social activities. This lack of volition stops him from initiating and pursuing goal-directed activities.

Other Symptoms

People with schizophrenia may face difficulties with memory, attention span, abstract thinking, and planning ahead. They commonly suffer from anxiety, depression, and suicidal thoughts. They may experience physical tiredness for no valid reason, may oversleep or find difficulty in sleeping, suffer a loss of sexual interest, become overly dependant, and face problems in money management.

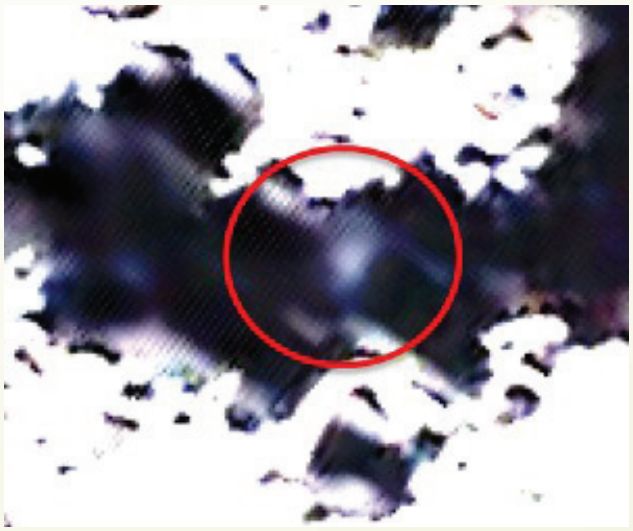
(Read about the Causes and Cures of Schizophrenia in this column next month)

Recent Development in Science and Technology

□ Biman Basu
e-mail: bimanbasu@gmail.com

LCROSS finds water on Moon

NASA's *L*unar *CR*ater *O*bservation and *S*ensing *S*atellite, or *LCROSS*, has indeed found water on Moon. Analysis of data from the satellite, which studied the dust plume created by the impact of Centaur upper stage rocket before it crashed into the permanently shadowed region of Cabeus cater near the Moon's south pole on 9 October 2009, showed telltale signature of water. The impact created by the *LCROSS* Centaur upper stage rocket created a two-part plume of material from the bottom of the crater. The first part was a high-angle plume of vapour and fine dust and the second a lower angle ejecta curtain of heavier material. This material has not seen sunlight in billions of years.



Plume of debris thrown up by the impact of the *LCROSS* Centaur upper stage in the Cabeus cater near the Moon's south pole.

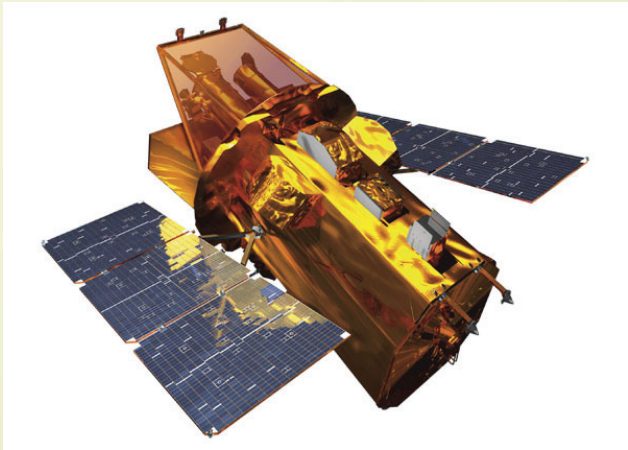
Since the impacts, the *LCROSS* science team has been working almost nonstop analysing the huge amount of data the spacecraft collected. The team concentrated on data from the satellite's spectrometers, which provide the most definitive information about the presence of water. At a press conference on 13 November, researchers revealed preliminary data from *LCROSS*, indicating that water exists in a permanently shadowed lunar crater. An infrared spectrometer on *LCROSS* had recorded absorption bands of water vapour at wavelengths of 1.4 and 1.85 microns. Another spectrometer registered ultraviolet emission at 309 nanometres, a telltale sign of hydroxyl (OH) radicals created when water molecules break apart in ultraviolet radiation from the Sun. Earlier, ISRO's *Chandrayaan* had provided evidence of water on the lunar surface.

Scientists have long speculated about the source of vast quantities of hydrogen that have been observed at the lunar poles. The *LCROSS* findings are shedding new light on the question of water, which scientists now believe could be more widespread and in greater quantity than previously suspected. Besides, the permanently shadowed regions of Moon's polar regions could hold a key to the history and evolution of the solar system, much as an ice core sample taken on Earth reveals ancient data. In addition, water, and other compounds represent potential resources that could sustain future lunar exploration.

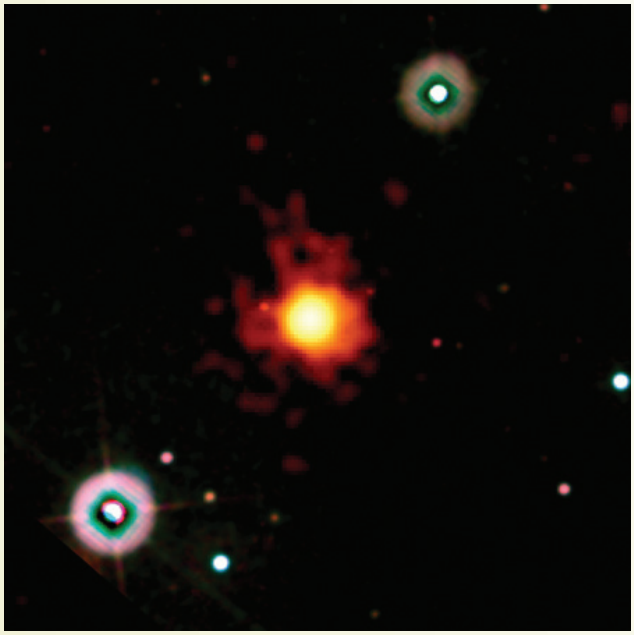
LCROSS was launched on 18 June 2009 as a companion mission to the *Lunar Reconnaissance Orbiter*, or *LRO*. After separating from *LRO*, the *LCROSS* spacecraft held onto the spent Centaur upper stage rocket of the launch vehicle and went into orbit around the Earth in preparation for the Moon impact. The Centaur and *LCROSS* separated on final approach to the Moon on 9 October, and travelling as fast as a speeding bullet, the Centaur rocket stage crashed on the lunar surface, with *LCROSS* making a spectral analysis of the resulting plume of debris with its onboard instruments. The plume itself grew to 6-8 km across some 15 seconds after impact. Approximately four minutes of data was collected before the *LCROSS* itself crashed on the Moon.

Farthest object in the universe detected

Gamma-ray bursts (GRBs) are flashes of gamma rays associated with extremely energetic explosions in distant galaxies. They are the universe's most luminous explosions. Most occur when massive stars run out of nuclear fuel. The current theory, which is now supported by observational evidence, is that these massive stars evolved extremely rapidly in the early universe, as massive stars tend to do, and then died in a sudden and extremely violent



The *Swift* satellite



This image of GRB 090423 (centre) combines data from *Swift*'s ultraviolet/optical (blue, green) and X-ray (orange, red) telescopes. No visible light accompanied the burst, which hints at great distance. (Credit: NASA/Swift/Stefan Immler)

manner when their hydrogen and helium fuel was exhausted.

Most observed GRBs are believed to be a narrow beam of intense radiation released during a supernova event, as a rapidly rotating, high-mass star collapses to form a black hole. Astronomers have recently imaged GRB from the most distant object ever seen – a star collapsing into a black hole more than 13,000 million light-years away. The resulting burst of gamma rays was detected by NASA's *Swift* satellite in April 2009. Within three hours of the detection by *Swift*, astronomers at the University of Leicester in UK had detected an infrared source at the same position using the United Kingdom Infrared Telescope (UKIT) on Mauna Kea, Hawaii. It was also observed by astronomers at the Harvard-Smithsonian Center for Astrophysics, along with colleagues elsewhere in the United States and the United Kingdom, using ground-based telescopes. Collapse of massive stars also generates short-lived afterglows in other wavelengths, which ground-based telescopes can observe. Reports of the discovery were published in the journal *Science* (18 September 2009) and *Nature* (29 October 2009).

Launched in November 2004, *Swift* is a first-of-its-kind multi-wavelength observatory dedicated to the study of gamma-ray bursts (GRBs). Its three instruments work together to observe GRBs and afterglows in the gamma ray, X-ray, ultraviolet, and optical wavebands.

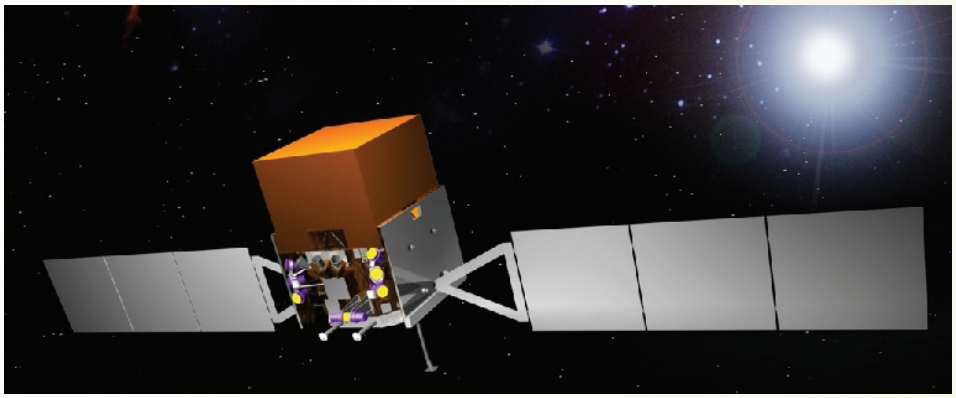
The red shift of 8.2 of the new GRB means that it went off a mere 625 million years after the Big Bang, when the universe was less than 5% of its current age. The photons it spewed into space travelled for more than 13,000 million years before reaching Earth. According to the researchers, not only did the newly discovered source, named GRB 090423 (after the date it was detected), shatter the previous record for the farthest object seen – a galaxy at a distance of 12,800 million light-years, discovered in 2006 – but it also proved that the universe came alive with stars within a few hundred million years of the Big Bang.

Researchers are interested in spotting and studying such distant objects because they provide a window on the early universe. Theoretical models predict that blobs of gas began collapsing into massive stars within a few hundred million years of the Big Bang. These stars burned for a while before exploding as supernova. But the information obtained from the spectra of GRB 090423 reveals an interesting fact. Despite the source star being born within a short time after the Big Bang, it does not belong to the first generation of stars, which means stars have been forming and dying much earlier than it was hitherto believed. It also throws new light on the evolution of the universe.

Antimatter detected in lightning storms

In particle physics, antimatter is supposed to be composed of antiparticles in the same way that normal matter is composed of particles. For example, an anti-electron (a positron, an electron with a positive charge) and an antiproton (a proton with a negative charge) could form an anti-hydrogen atom in the same way that an electron and a proton form a normal hydrogen atom. Furthermore, it is also known that mixing matter and antimatter would lead to the annihilation of both in the same way that mixing antiparticles and particles does, giving rise to high-energy photons (gamma rays) in the process. It is these tell-tale signs of matter-antimatter annihilation that were recently detected by the ***Fermi Gamma-Ray Space Telescope***, a joint venture of NASA, the U.S. Department of Energy and institutions in France, Germany, Japan, Italy and Sweden, in lightning bolts during thunderstorms.

Antimatter has been detected in lightning storms.



Fermi Gamma Ray Telescope

While carrying out its normal routine of scanning corners of the universe, the *Fermi* telescope detected signatures of antimatter in lightning strikes during severe thunderstorms on Earth. The orbiting telescope picked up as many as 17 gamma-ray flashes that occurred just before, during and right after lightning strikes during two thunderstorms. What was surprising was that the gamma-ray emissions were of a particular energy that could have been produced only by the decay of energetic positrons, the antimatter equivalent of electrons, indicating that lightning can produce antimatter.

Gamma-ray flashes have been observed in lightning flashes before, as energetic electrons moving toward observational spacecraft slowed down, but the unique signature found by *Fermi* has researchers puzzled. According to Michael Briggs of the University of Alabama, who announced the puzzling findings on 5 November at the '2009 Fermi Symposium' in Washington D.C., the unusual positron signature seen by *Fermi* suggests that the normal orientation for an electric field associated with a lightning storm somehow reversed.

For now, the discovery raises more questions than it answers. For instance, how did the orientation of the electric field get turned on its head? What does the existence of antimatter particles in lightning mean? Researchers are trying to work out exactly what happens during the lightning strikes to reverse the electric field.

Genome of domesticated horse sequenced

As one of the earliest domesticated species, the horse, *equus caballus*, has played an important role in human exploration and colonisation of the world. For centuries, horses have been close human companions. The animals were first domesticated 4,000 to 6,000 years ago and were harnessed primarily for power and transportation. Over time, as machines became the chief sources of agricultural and industrial muscle, those roles have shifted to mainly sports and recreational activities.

Humans and horses share an evolutionary history that has implications for the health of both species. Like other mammals, the two species share much of the same DNA. Moreover, horses suffer from more than 90 hereditary diseases that show similarities to those in humans. Recognising the need for genomic tools to foster biomedical research on horses as well as humans, a research consortium led by scientists at the Broad Institute of Massachusetts Institute of Technology (MIT) and Harvard launched a project three years ago to decode the horse's genetic blueprint. The effort was based on ten-year collaboration among an international group of scientists known as the 'Horse Genome Project' with the objective of exploiting genomic technologies for the benefit of equine health. The group has now come out with the genome sequence of the domestic horse.

To generate a high-quality genome sequence, the researchers analysed DNA from an adult female thoroughbred named Twilight. The horse's DNA was sequenced using capillary DNA sequencing technology (known as Sanger sequencing) to reveal a genome that is roughly 2,700 million "letters", or nucleotides, in size. It was found to be slightly larger than the genome of the domestic dog and smaller than both the human and cow genomes.

Subsequent analyses suggest that the horse genome is highly repetitive: 46 percent of the assembly contains repetitive sequences. In contrast, less than one percent of the genome is comprised of segmental duplications (segments of DNA with near-identical sequence). Likewise, the genome contained relatively few large rearrangements. In fact, the team found that more than half of horse chromosomes – 17 of 32 – had similar gene sequences as found in human chromosomes.

The horse genome is already proving useful for comparative genomic and population studies of the horse. It also reveals similarities between the horse and other placental mammals, such as

Twilight, the mare whose genome was sequenced

the hoofed group including goats, bison and cattle. According to co-author Kerstin Lindblad-Toh, of the Broad Institute at MIT, horses and humans suffer from similar illnesses, so identifying the genetic culprits in horses promises to deepen our knowledge of disease in both organisms. The work, published in the journal *Science* (6 November 2009), may also shed light on how horses were domesticated.

In addition to sequencing the genome of a thoroughbred horse, the researchers also examined DNA from a variety of other horse breeds. The team surveyed the extent of genetic variation both within and across breeds to create a catalogue of more than one million single-letter genetic differences in these breeds. Till date, scientists have also sequenced the genomes of the platypus, mouse, rat, chimpanzee, rhesus macaque and, of course, humans.

New drug target for cancer

In the field of molecular biology, a transcription factor is a protein that binds to specific DNA sequences and thereby controls the transfer (or transcription) of genetic information from DNA to messenger RNA (mRNA). If we compare human physiology to a puppet show, then transcription factors pull the puppet strings. They bind to DNA and turn genes on or off,setting in motion genetic processes that control how normal cells grow and develop. They also help maintain tumour growth, underscoring their importance as cancer drug targets. Inactivating a key transcription factor could be a simple way to stop the growth of tumours. Yet transcription factors are counted among the most difficult molecules to neutralise with a drug – in fact, no such drugs are currently available.

Now there is hope. A team of scientists has recently developed a new drug that blocks a transcription factor – previously thought to be impossible to block – that has been linked to leukaemia and several other cancers of the lungs, ovaries, pancreas, and gastrointestinal tract. The drug potently blocks a signalling pathway called NOTCH, known to be active in various cancers. Developed by a US team led by Greg Verdine at Harvard University and James Bradner at the Broad Institute of Harvard and Massachusetts Institute of Technology, the new drug called SAHM1 targets NOTCH and works by preventing the assembly of the complex needed to activate NOTCH genes – the NOTCH transcription factor complex. (*Nature*, 12 November 2009).

The NOTCH transcription factor regulates cell-to-cell communication in the NOTCH signalling pathway, a system governing cell growth and development. The NOTCH complex is of tremendous interest because of its role as a master developmental regulator of gene transcription. Inappropriate activation of the NOTCH complex of transcription factors is directly implicated in the causation of several diseases, including T-cell acute lymphoblastic leukaemia – a type of blood cancer. Mutations in the transcription factor can result in uncontrolled cell growth, often causing cells to turn cancerous. Ordinarily, drugs have no effect on transcription factors because they work by forming complexes with multiple proteins, leaving no open binding sites for small drug molecules to fit into. To get around the problem the researchers designed novel synthetic, cell-permeable, stabilised á-helical peptides that disrupt protein-protein interactions in NOTCH. The hydrocarbon-stapled peptide called 'SAHM1' is a promising NOTCH antagonist.

The really distinctive aspect of this new class of drug, according to the researchers, is its remarkable ability to penetrate cells. Despite being much larger than most small molecule drugs, SAHM1 can still get into cells, unlike a biological drug. The peptides are taken up by an active transport mechanism into compartments called endosomes, from which they can reach their target.

The researchers tested the stapled peptides on human T-cell acute lymphoblastic leukaemia and found that the drug inhibited cell proliferation associated with the NOTCH transcription factor, but did not block the growth of cells that are not regulated by NOTCH. This led them to believe that the peptides were effectively targeting the transcription factor complexes in the right spot. The researchers also found that mice injected with leukaemia cells and treated with the stapled peptides showed lower leukaemia counts in the bone marrow and spleen than those that went untreated.

Letters to the Editor

Spreading scientific temper

I have been reading the magazine *Dream 2047* for the last three years and found it quite useful for popularising science and inspiring teachers and students of science. Your editorials are thought-provoking, very informative and make interesting reading. You touch upon the latest happenings in science and technology, which is very useful for all those involved in teaching of science. The articles are very informative and appear to be specially written to encourage students and teacher community and motive them to work in fundamental science. You have been doing a commendable job in spreading the scientific temper in the country.

M.Sudurshan
Lecturer in Biological Science
Nehru College of Education
Pillaiyarkuppam Village
Puducherry-605 502
E-mail: msudurshan@yahoo.in

Rendering yeoman's service

We had an opportunity to go through the editorial of *Dream 2047* (December 2009). We are much impressed and we do appreciate that Vigyan Prasar is rendering yeoman's service to the nation in promoting scientific temper amongst people and to transform our nation into a scientifically thinking one through *Dream 2047* and also its science programs aired from Doordharshan and AIR. Ours is a residential school promoting quality education predominantly for the rural area children having a total strength about 3,000 students from K.G. to XII std. We would be grateful if you could kindly arrange to include our school's name in your mailing list.

M. Selvaraj
Principal, Aditya Vidhyashram
5, New Saram (Near Avvai Thidal),
Puducherry-605 013

Editorial (Contd. from page...35)

Scientists are working to develop a broad array of insects with new characteristics that could make them useful in fighting the spread of infectious diseases, controlling noxious weeds and insect pests, and producing pharmaceuticals.

It is anticipated that like information technology, biotechnology has the potential for improving army readiness and soldier survival. It has been projected that biotechnology can offer some of the most immediate solutions for fighting climate change.

The apprehensions relating to biotechnology are not simply related to their effects on human health, environment or ethical issues. There are issues relating to control of biotechnology research and also issues relating to access, such as implications of intellectual property rights. Today many are concerned about the control of global food security falling into the hands of a few multinational corporations. The advances in biotechnology have posed new ethical dilemmas. These need to be addressed though they are not simple issues to deal with.

Many countries including India are actively reviewing the safety and ethics of biotechnology research and its applications. Strict guidelines have been established for monitoring work on embryo transplantation, embryo research and surrogate motherhood.

It is to be noted that issues of concern are not same in every area of biotechnology. For example, the ethical issues assume far greater importance in medical biotechnology in areas such as human cloning. We need to develop 'a disaggregated' approach to analyse the issues involved in various areas of biotechnology research.

Reasons behind strong opposition to GM foods are not very well understood and often these vary from one region to another. Surveys have revealed that in advanced countries the lack of information is not the primary reason for opposition to GM foods. However, in developing countries the lack of knowledge and awareness is playing a significant role in whipping up the passion against the introduction of GM foods. It is not simply the concerns about health and safety but also social and political values that are responsible for the opposition to GM foods.

Certainly many applications of biotechnology carry risks that need to be adequately addressed through regulatory and safety measures. Fears raised in people's minds need to be removed. We should remember that biotechnology does not exist in vacuum. A technology evolves by human efforts and is shaped by social, cultural and political climates. Regulation of biotechnology by the society is required so that the benefits are maximized and negative effects are minimized. People are not per se for or against biotechnology. They are also not so naïve to think that any new technology will have zero risk. They are aware of the fact that their lives are full of risks. What we need to learn is to optimally balance the risks against each other and weigh it against potential benefits.

It is to be underlined that the effect of information and knowledge is very much dependent on how they are interpreted or selected by pre-existing attitudes, rather than on factual content itself. This phenomenon is very much culture-dependent and it varies from country to country.

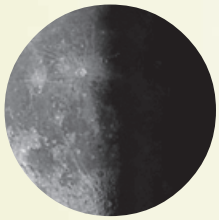
It has to be ensured that new knowledge and technologies are not used to discriminate inappropriately against individuals and groups.

To overcome the people's concerns about biotechnology an ongoing dialogue between scientists, policy makers, opinion leaders, educators and the public needs to be established. Such dialogue needs to be open and well informed. Such a dialogue will be possible only if we can create public awareness and understanding on issues relating to biotechnology in local languages/ media. And here lies the role of science communicators.

☐ Subodh Mahanti

Sky Map for January 2010

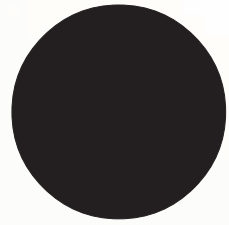
Moon - Last Quarter



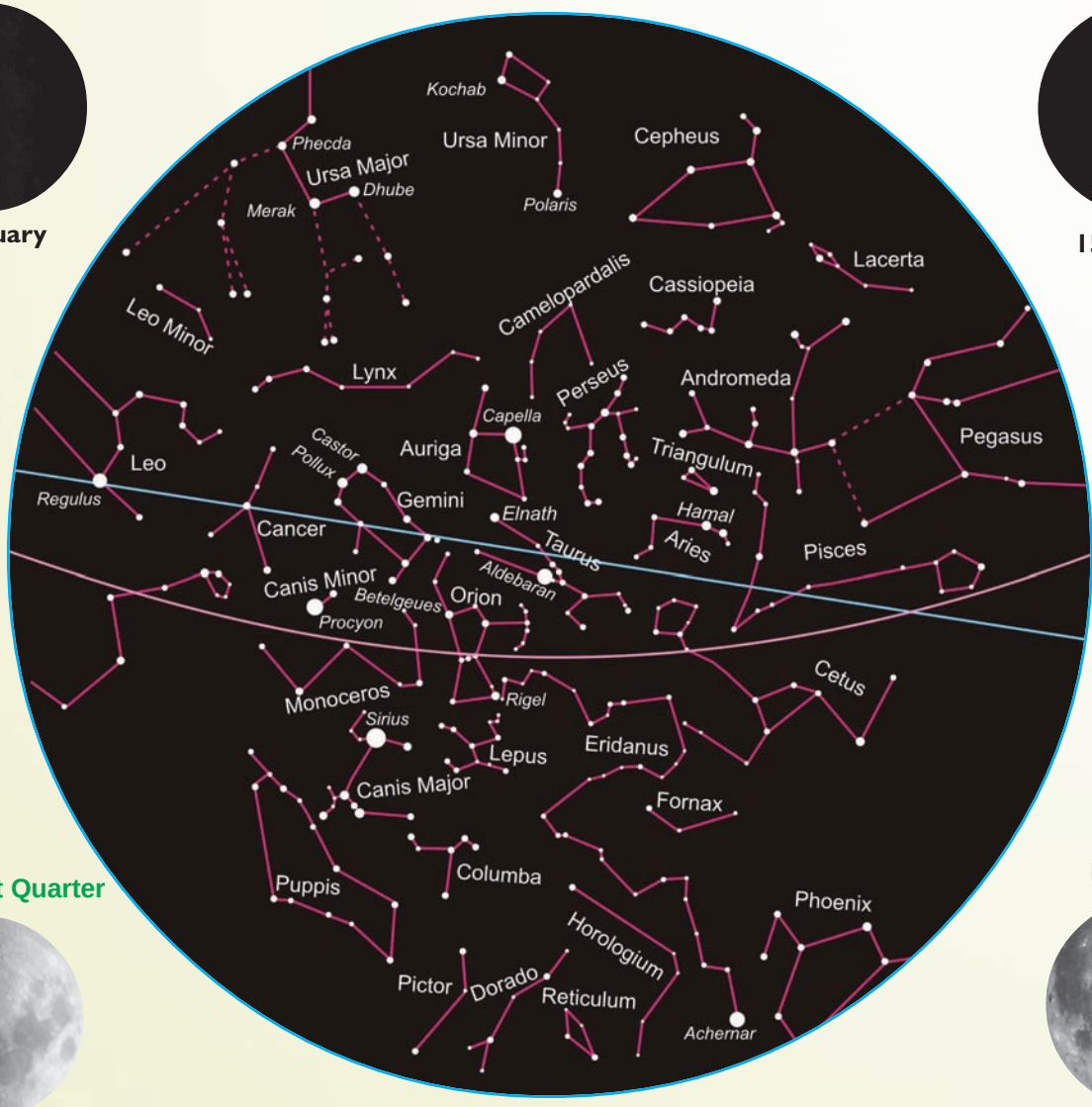
7 January

North

New Moon



15 January



Moon - First Quarter

23 January

South

Full Moon

30 January

The sky map is prepared for viewers in Nagpur (21.090 N, 79.090 E). It includes constellations and bright stars. For viewers south of Nagpur, constellations of the southern sky will appear higher up in the sky , and those of the northern sky will appear nearer the northen horizon. Similarly, for viewer north of Nagpur, constellations of northern sky will appear higher up in the sky, and those of the southern sky will appear nearer the southern horizon. The map can be used at 10 PM on 1 January, at 9 PM on 15 January and at 8 PM on 31 January.

Tips to use sky map:

(1) Choose a place away from city lights/street lights. (2) Hold the sky-map overhead with North in the direction of Polaris. (3) Use a pencil torch for reading the sky map. (4) Try to identify constellation as shown in the map one by one.

Visibility of Planets[1] (IST)

	Rising	Setting	In the Zodiac
Mercury	05:26	16:36	Sagittarius
Venus	06:55	18:03	Sagittarius-Capricorns
Mars	19:23	08:23	Leo-Cancer
Jupiter	08:58	20:30	Capricorns-Aquarius
Saturn	22:53	11:01	Virgo
Uranus*	10:17	22:11	Aquarius-Pisces
Neptune*	08:42	20:11	Capricorns

[1]Time shown is subject to vary (± 1 hr) from place to place.
*Not naked eye object

Sky Event

Date	IST	Event
01	01:21	Partial Lunar Eclipse
02	03:06	Moon Perigee
03	03:29	Perihelion
05	01:32	Mercury Inferior Conjunction
12	03:04	Venus Superior Conjunction
15	**13:37**	**Annular Solar Eclipse**
17	08:10	Moon Apogee
27	11:29	Mercury at greatest Elongation
30	01:41	Mars Opposition
30	15:33	Moon Perigee

□ Arvind C. Ranade
E-mail : rac@vigyanprasar.gov.in

YOUR OPINION

Dream 2047 **has been inviting your opinion on a specific topic every month. The reader sending the best comments will receive a popular science book published by VP. Selected comments received will also be published in *Dream 2047*. The comments should be limited to 400 words.**

This month's topic:

"Can nuclear power reduce global warming?"

Response should contain full name; postal address with pincode and email ID, if any; and should be accompanied by a recent passport size photograph. Response may be sent by email (**opinion@vigyanprasar.gov.in**) or by post to the address given below. If sent by post, "**Response: *Dream 2047* January 2010**" should be clearly written on the envolope.

Vigyan Prasar
A-50, Institutional Area, Sector-62, NOIDA 201 307
Phone: 91-120-240 4430/35 Fax: 91-120-240 4437
Email: info@vigyanprasar.gov.in Website: www.vigyanprasar.gov.in

Winners of "Your Opinion" contest for October 2009.

Topic: "Does the heavy pressure of studies and homework deprive today's children of adequate physical activity, thus affecting their healthy growth?"

1. **Tapata Sahoo**
   Bhandaripokhari High School
   PO Bhandaripokhari
   District – Bhadrak
   PIN – 756120

"Childhood is the stage that lays the foundation of good health in later life. Today's teachers and parents want their children to put their head in study materials and curricular framework 24×7. But it is worth remembering that a "sound mind resides in a sound body" and vice-versa. Health does not only mean physical health but a mixture of mental and social health. So, for a sound physical health adequate physical activity is necessary. If children are always flooded with excessive homework and study pressure they would be in danger of delayed growth".

2. **Mr. Rajkumar Garg**
   74-87/3, D.L. Road,
   Dehradun – 248001
   Uttarakhand.

"Today without a good percentage in the exams, a student can neither get entry in reputed higher centres of learning, nor has any future prospects for success. When the question arises of deprivation of today's children of adequate physical activity due to more studies and homework, I think most children today are not only excelling in academics, but they are also attending health clubs and gymnasiums regularly, thus promoting amongst themselves, not only a good health, but also keeping abreast of the latest changes and developments in science and commerce. In fact, the peer-pressure faced by children at schools and colleges is far more trustful. It draws its power from the innate desire of a today's child to be a successful and talented person".

3. **Dongare Ashok Kalyan**
   7, Ramkrishna Apartment,
   Shivaji Nagar.
   Beed – 431122 (M.S.)

"In my opinion there is indeed effect on healthy growth of a child due to heavy pressure of studies and home work. The study and home work keep the child totally busy. Their parents' attention is mainly towards the study and diet, but no attention is paid towards health in term of play, exercise, yoga and physical exertion, which is essential for good health".

The winners will receive a copy of VP Publication

Science for All : Quest for Excellence
(A brief report on 6th International Conference on Hands-on Science)

The 6th International Conference on Hands-on-Science-2009 was held at Gujarat Science City, Ahmedabad from 27-31 October 2009. This was the first occasion when this meet was held in India. The conference was organised jointly by the International Network on Hands on Science (HSCI, Network), International Centre for Science Communication, National Council for Science and Technology Communication (NCSTC), New Delhi, Vigyan Prasar (VP),Noida (UP), Gujarat Council of Science City (GCSC), Ahmedabad, Institute of Management and Advance Studies (IMAS), and Science Technology and Development Initiative (STAD), Lucknow (UP).

The main objective of the conference was furthering the culture of innovation and experimentation. Primarily, it offered a common platform for different groups – science communicators, scientists, researches, universities, students and common man – to be together in India and directly interact with the similar experts from across the world. This interaction was through sharing of knowledge in the form of presentation of views, experiences, research papers, surveys, data analysis, live demonstrations of activities and a series of workshops covering different areas of science and technology communication. Besides, there was a component of invited talks, exhibition, activity corners, display and posters as well.

The Hands-on-Science Network is maintained in the form of an international association with the objective to promote experimental teaching of science as a way of improving science education in school and science literacy in society. Last year this conference was organised in Brazil on theme "Hands-on science – formal and informal science education".

The conference started on 28 October 2009 with the inaugural function. Focal theme of the conference was "Science for all: Quest for Excellence" with following sub themes:

i) Science innovation and hands-on science
ii) Science communication through hands-on activities
iii) Experience in science – fun living
iv) Hand-on science – evolution of modern knowledge
v) Promotion of scientific and technological temper

Around 200 papers were presented during the conference through three parallel sessions and each session was chaired by distinguished scientists, communicators, and science journalists from India and abroad. Scientists, communicators, science activists, teachers and professors from different countries like Portugal, USA, Brazil, Korea, France, Turkey, Ukraine, Australia, Taiwan, China, and Qatar participated in the conference.

Dr. V.B. Kamble, Director VP delivering a lecture during Valedictory session in ICHS-2009

The main attraction of the conference was the series of talks given by eminent scientists on the path-breaking efforts based on the experiences of the speakers in the area of hands-on science. All the talks generated a lot of interest and curiosity in the minds of participants, specially the students. In this series, talk on "Ideas and innovations" by N.K. Sharma, "Use of drama as a living strategy" by Richard Pinner, "New US report of learning science in informal environments" by Bruce V. Lewenstein, "Between question and clarity" by Dr. V.B. Kamble, Director Vigyan Prasar, and "Experience from Science Express" by Er Anuj Sinha, Head, NCSTC were well appreciated by all.

Padam Vibhushan, Dr. Saroj Ghose, President NCSM/ICM was the chief guest at the inaugural function. Dr. D. Balasubramanian, Director L.V. Prasad Eye research Institute, Hyderabad and well-known science writer graced the occasion at the valedictory function and his talk on "History of genetics – Past and present" was enjoyed by all. Shri Anuj Sinha presented the draft resolution of the recommendations of the conference HSCI-2009.

During the conference Vigyan Parasar organised an exhibition along with several activity-based corners. Several resource persons/experts on different hands-on activities were invited from different parts of the country to display their activity and conduct workshops for the participants and the general public. Some of the activity corners which caught the imagination of the participants as well as the general public were "Joy of chemistry", "Origami", "Making of folk toys based on scientific principles", "Rocketry", "Robotics", "Observing nature through handmade equipment" besides demonstration and explanation of so-called miracles. The "Fun with mathematics", puzzles and activity kits were added attraction at the exhibition. Vigyan Prasar also displayed its books, posters, activity kits, and CD ROMs during the conference.

Software developed by Vigyan Prasar were appreciated by both Indian and foreign participants, especially from Portugal, Turkey, who explored the possibilities of having some collaboration with Vigyan Prasar, specially for the demonstration of kits. B.K. Tyagi, Scientist-D, Kapil Tripathi, Scientist-D, Navneet Gupta and Chander Pal from Vigyan Prasar participated to coordinate the exhibition and workshops during the conference.

A major outcome of HSCI-2009, among others, was the "Hands-on Science India Declaration - 2009, which is a road map for chalking out a coordinated effort in achieving the goal of "Science for All: Quest for Excellence".