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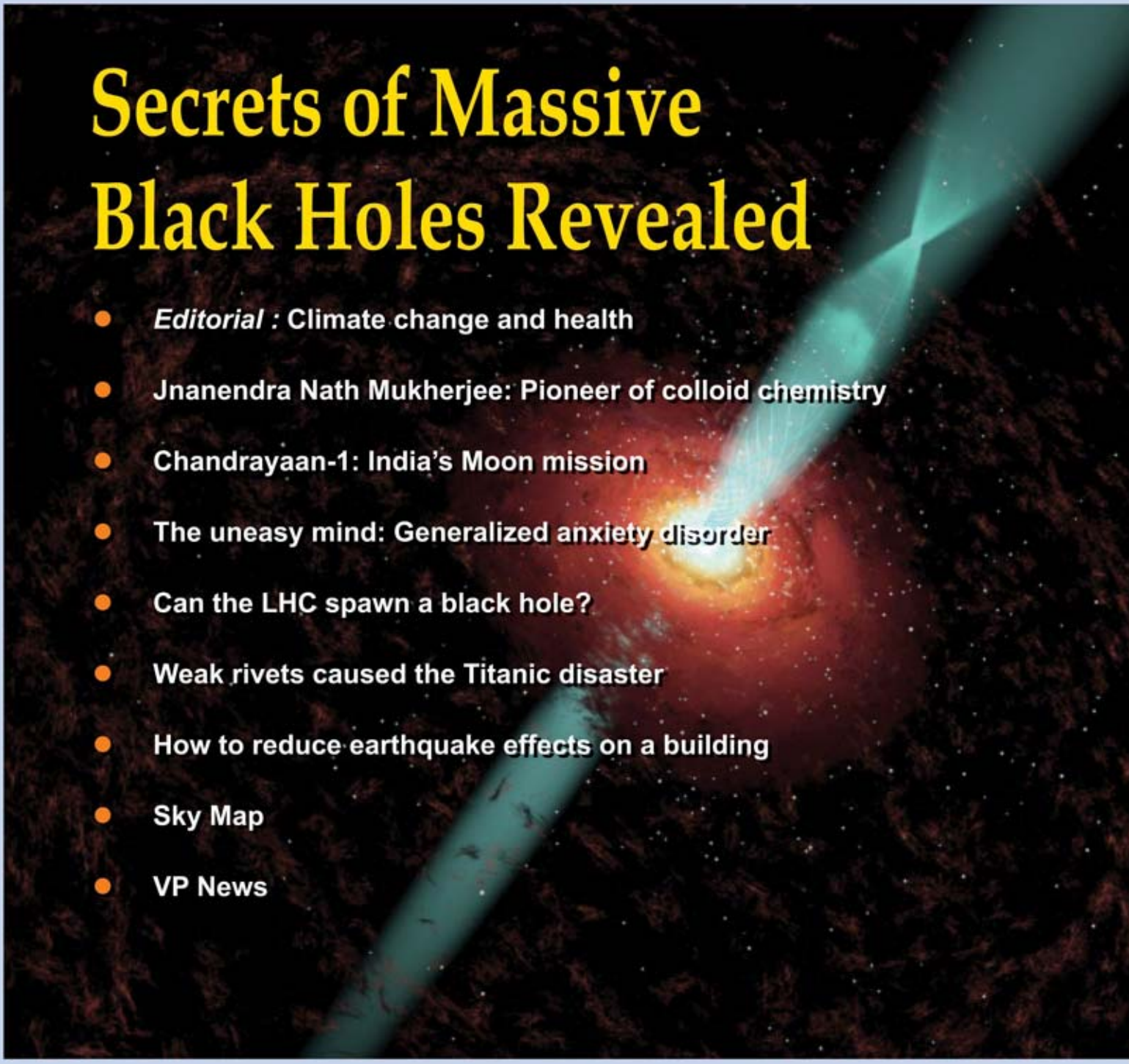

Secrets of Massive Black Holes Revealed

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

Climate Change and Health

Through this column, we have been voicing concern over the continuous warming of this planet and the consequent change in the climatic pattern the world over. After the report of the Inter-Governmental Panel on Climate Change (IPCC) in 2007, there is now little doubt that the Earth *is* warming, due to the emission of greenhouse gases as a result of human activity. It is clear that the current trends in energy use, development, and the population growth would lead to continuing climate change in an even more severe manner. It will affect the health and well-being of all populations, with impacts escalating in foreseeable future. In particular, this change is bound to affect the basic requirements for maintaining health - clean air and water, sufficient food, adequate shelter, and freedom from disease.

But, what are the risks? Who is at risk? And what needs to be done to protect health from the challenges posed by the climate change? It is these concerns that prompted the World Health Organization (WHO) to choose 'Climate Change and Health' as the theme for this year's World Health Day (8 April 2008). Surely, climate change endangers health in fundamental ways. According to the issue paper *Protecting Health from Climate Change* brought out by WHO, the aim is to turn the attention of the world community and the decision makers to climate change and compelling evidence from the health sector. There is absolutely no doubt that the climate change *is* real. But, the magnitude of its consequences - especially in regard to health - can still be reduced by taking right actions.

To begin with, let us consider what the risks are. The world has warmed by approximately 0.75°C in the last 100 years. However, the rate of increase in the last 25 years has been much higher - over 0.18°C. In particular, the land regions are warming faster than the oceans. Sea levels are rising, glaciers are melting and precipitation (rainfall) patterns are changing. There has been a global reduction in mountain glaciers and snow cover. From 1900 to 2005, precipitation increased significantly in parts of North and South America, Europe and Asia, but declined in the Sahel, the Mediterranean, southern Africa and parts of southern Asia. Area affected by drought has increased globally since 1970s. Next, extreme weather events are changing in frequency and intensity. For example, heat waves have become more frequent over land areas, frequency of heavy precipitation has increased, and since 1975, sea level has risen worldwide. There is also evidence that frequency of intense tropical storms has increased since 1970s. Most of the observed increase in temperature since the mid-20th century can be attributed to the increase in the concentrations of the greenhouse gases released by the human activities, mainly CO_2, emitted by burning the fossil fuels.

Continued warming could lead to abrupt or irreversible impacts like melting of ice sheets on the polar lands causing several metres of sea level rise inundating low-level areas. It is estimated that human induced climate change will continue at least for the next few decades. If we place emphasis on the sustainable use of energy, the temperatures could rise by about 1.8°C by the turn of this century. If not, the temperatures could rise by 6.0°C with even greater probability of causing abrupt or irreversible impacts. How will the changing climate affect our health, anyway?

Extreme high air temperatures can kill directly. Indeed, over 70,000 excess deaths were recorded in the extreme heat of the summer of 2003 in Europe. Such extreme temperatures would be the norm by the second half of this century. Heat waves directly contribute to deaths from cardiovascular and respiratory diseases, especially among the elderly people. High temperatures raise the levels of ozone at ground level and other air pollutants, and hasten the onset of pollen season. Pollen and other allergens in the air trigger and aggravate asthma and cardiovascular respiratory diseases. Incidentally, urban air pollution currently causes about 800,000 deaths each year.

Higher temperatures are hastening rates of evaporation of surface water thereby reducing the availability of fresh water. Lack of fresh water compromises hygiene and hence increasing incidence of diarrhoeal disease. Diarrhoea remains one of the biggest killers of children and accounts for a total of around 1.8 million deaths every year. On the other hand, too much water, in the form of floods, causes contamination

Contd. on page... 21

Editor : **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

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Jnanendra Nath Mukherjee

Pioneer of Colloid Chemistry

Subodh Mahanti
E-mail: subodh@vigyanprasar.gov.in

"Superstition, ignorance and the domination of perceived notions unsubstantiated or contradicted by facts stand in the way of rational and objective thinking and cloud reasoning. They may also obstruct the adoption of measures based on well-established scientific knowledge for the improvement of social and economic condition."

J. N. mukherjee

"Science shows the way but what use we make of it depends on us. With an objective approach to the study of problems, coordinated team work and the will to succeed we are bound to reach our goal – the improvement of the conditions of living in India. In this, the scientist has a great responsibility and the noble task of serving his fellow countrymen."

J. N. Mukherjee

Jnanendra Nath Mukherjee made pioneering contributions in the fields of colloid science. *Nature*, the international science journal considered Mukherjee as "the exponent of colloid chemistry in India, having established his reputation throughout the scientific world as an eminent worker in this field." He also made significant contributions in the areas of the electrochemistry of clays and clay minerals and in several branches of soil science. He was the first to place due importance of soil surveys for agricultural development. He also played a pioneering role in the development of agricultural research and education in the country. He reorganised the Indian Agricultural Research Insitute (IARI), New Delhi, the Sugarcane Breeding Station, Coimbatore, and the Sub-station of the IARI at Pusa, Bihar. In 1949, the Ministry of Agriculture, Government of India constituted the Central Committee on Soil Science under the chairmanship of Mukhejee.

Mukherjee considered the universities as the backbone of scientific training and scientific research conducted in the universities as of paramount importance for national development. For him quality was more important than quantity. He was of the opinion that a low level of training and research in the country would prove to be a great handicap to its progress.

J. N. Mukherjee

Jnanendra Nath was born on 23 April 1893 at Mahadevpur in Rajshahi district (now in Bangladesh) of erstwhile Bengal. His father Durgadas Mukherjee had a brilliant academic career. He rose to become the Principal of the Raj Chandra College of Barisal, a job he later left in favour of a post in the Provincial Judicial Service. His mother Saratshasi Devi 'had a strong character, intelligence, courage, business ability and determination.' In 1906, Jnanendra Nath was admitted in the Dinajpur High School. In 1907, he was shifted to Municipal High School in Burdwan from where he appeared in the Entrance Examination of the Calcutta University and got a district scholarship. He then joined the Presidency College at Kolkata (then Calcutta) in 1909.

Mukherjee obtained his BSc (1913) and MSc (1915) degrees of the Calcutta University. His teachers at the Presidency College included Acharya Prafulla Chandra Ray and Jagadis Chandra Bose. Among his classmates were Satyendra Nath Bose, Meghnad Saha and Prasanta Chandra Mahalanobis, three most illustrious names of Indian science.

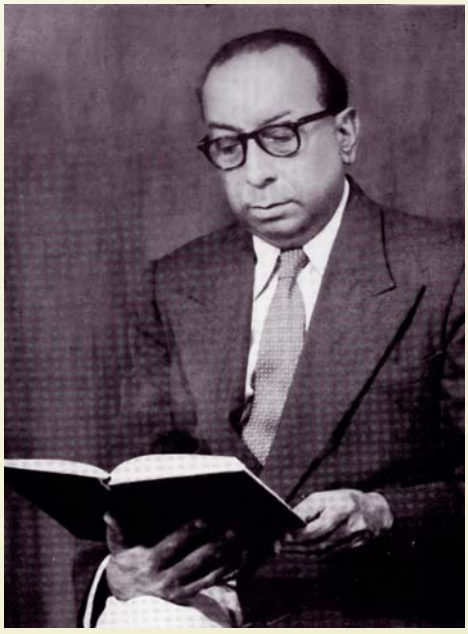
While still an MSc student, Mukherjee published a research paper on colloids in the *Journal of the Chemical Society*. This was certainly an extraordinary feat. After his MSc, he was appointed as lecturer in chemistry in the newly created University College of Science by the then Vice Chancellor of the University, Asutosh Mookerjee. Commenting on his appointment at the Calcutta University Mukherjee later wrote: "Satyendra Nath Bose, Jnan

M.N. Saha

Chandra Ghosh, Meghnad Saha, Nikhil Ranjan Sen, Pulin Behari Sarkar, Prasanta Chandra Mahalanobis (Presidency College), Sisir Kumar Mitra and myself along with some others were appointed as lecturers in our respective subjects. Asutosh Mookerjee believed in young talents and selected promising young men and appointed them straightway as lecturers for the postgraduate classes and provided some facilities for research also. He was the first and perhaps the last to establish a centre of academic studies at the university stage with a distinct atmosphere of learning and scholarship and appointed some of the best men available in the country as University Professor or Lecturers."

In 1919, Mukherjee went to England to work in the Laboratory of F. G. Donnan at the University College, London. Mukhejee continued his work on colloids. He wanted to develop his theory of the electrokinetic double layer and its ionic constitution. He presented his research paper on 'Origin and neutralisation of the charge of colloids' at the Discussion on the Physics and Chemistry of Colloids organised by the Faraday Society and Physical Society of London. The proceedings were published in *Nature*. The reviewer of the proceedings wrote: "perhaps the most important paper of the whole discussions, in that it represented a distinct advance in theory was that by J N Mukherjee in the Section of 'Precipitation in disperse systems'." This section was presided over by the Nobel Laureate Theodore Gyedberg. A second paper titled 'On the adsorption of ions' published in the *Philosophical Transactions* in 1922 further developed the theory and marked a definite step forward in our understanding of the complex chemical reactions.

Another important research contribution of Mukherjee while working at Donnan's laboratory in London was the development of the Boundary Method for the determination of the cataphoretic speed of colloid particles. The results of this study including the apparatus and its working were later published in the *Proceedings* of the Royal Society. Later Arne Tiselius developed a more refined apparatus.



S.K. Mitra

After coming back to Kolkata, Mukherjee continued to work to further refine his Boundary Method. An important paper (jointly with N. N. Sen) was published in the *Journal of the Chemical Society*, London. The paper was

S.N. Bose

titled 'Coagulation and effect of dilution.' Commenting on the importance of this paper S. K. Mukherjee, an eminent physical chemist, wrote: "The work published by Professor Mukherjee was of so fundamental a nature on the study of colloids that it at once attracted the attention of the stalwarts in the field. He received spontaneous appreciation and approbation from almost all quarters. Many of the complexities which were less understood or vaguely understood could be clarified by the theory put forward by him. Colloid chemists throughout the world have either written to him personally or mentioned in their publications in laudatory terms about his contributions."

Mukherjee turned his attention to soil science. This was because he "was able to foresee how basic soil colloid studies could be of help in understanding many of the soil properties and problems." The tools and techniques developed and improved over the years for studying colloids came to his aid in studying the soil. He published a series of research papers on 'Nature of reactions responsible for soil acidity' in the *Indian Journal of Agricultural Science.* He also studied clay fractions

Frederick George Donnan

isolated from different soils of India and then the clay minerals, which constitute the major portion of soil clays. He established an active school of soil science in the Calcutta University, which used to be referred to as 'Calcutta School of Soil Science.' Mukherjee's work on soil was quite significant. John Russel, Fellow of the Royal Society of London in his report to the Government of India wrote: "(Mukherjee's work) was clearing up a lot of difficulties in regard to chemical constitution of clay substances in the soil, which is of fundamental importance for the study." Russel further added that "his investigations on soil colloids are recognised in Europe as being both sound and important."

In 1945, Mukherjee became the Director of the Indian (then Imperial) Agricultural Research Institute in New Delhi. S K Mukherjee wrote: "Under his direction the Institute expanded considerably in terms of its academic activities and scientific performance. He initiated research in the area of soil-plant studies. Among the sections he created in the Division of Soil Science are Agricultural Chemistry, Soil Survey, Soil Physics, Soil Fertility, Soil Microbiology, Biochemistry, Organic Chemistry, and Spectroscopy. Recent expansion of some of the sections such as Soil Survey, Microbiology, Biochemistry, Agricultural Chemicals, and Agricultural Physics to full-fledged divisions bears testimony to his great foresight. The credit for initiating systematic studies on micronutrient elements in soil and plants and also on clay mineralogy of soils with the help of sophisticated instruments and modern techniques goes to him. He initiated work in the Institute on the nutritive value of foods, feeds and fodders, on insecticides and fungicides, and on the chemistry of plant products."

Mukherjee believed that more widespread and systematic dissemination of scientific information through science writing, the press and the radio was sure to educate public opinion. He played instrumental roles in establishing and promoting several learned scientific societies and scientific organisations. He was the Chairman of the Sub-Committee on Soil Conservation and Afforestation of the National Planning Committee of the Indian National Congress (1938). During 1944-1945, he served as member of the Policy Committee on Agriculture, Forestry and Fisheries of the Viceroy's Executive Council. He was the Secretary of the Foundation Committee of the Indian Chemical Society. He was the Convener of the Foundation Committee of the Indian Society of Soil Science. He was a Member of the Foundation Committee of the National Institute of Sciences (later renamed as Indian National Science Academy). As a member of the Board and of the Technical Committee of the Council of Scientific and Industrial Research since its inception till 1952, he helped to shape the organisation. He was also a Member of the original committee for establishment of the National Chemical Laboratory, Pune and the Central Glass and Ceramic Research Institute, Kolkata. He was closely involved with the development of the Indian Science Congress

P. C. Mahalanobis

Association. He served as its General Secretary-Headquarters (1935-39) and Treasurer (1939-45). He was the General President of the Indian Science Congress held at Kolkata in 1952. He served as a member of the Agricultural Research Committee of West Bengal for over two decades.

Mukherjee died on 10 May 1983.

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Chandrayaan-1 : India's Moon Mission

☐ *NarendraBhandari*
E-mail: bhandari@prl.ernet.in

Laboratory study of lunar samples brought back by the six *Apollo* and three *Luna* missions and direct exploration of the Moon, particularly by *Clementine* and *Lunar Prospector* missions carried out during the past century have provided a considerable amount of data which gave us an insight into the processes responsible for the formation of the Moon and its subsequent chemical and geological evolution. Based on the radiometric dating of a variety of lunar rocks and their chemical composition, some important stages in the chemical, physical and geological history of the Moon have been constructed. A synthesis of these results shows that impact of a giant celestial body (with about a tenth Earth mass) on Earth, followed by accumulation of the impactor's crustal material and the terrestrial material ejected in a near-Earth orbit led to the formation of the Moon. The giant impact probably occurred between 4.56 to 4.46 billion years ago while the Earth was still forming but had already differentiated into core and mantle. Computer simulation of the giant impact and the processes that followed indicate that the ejected debris in Earth orbit started accreting in a disk within a period of a day and the proto-Moon accreted from this disk within a period of weeks after the impact. Soon afterwards the crust of the Moon solidified and subsequent major impact events leading to formation of large impact basins and lava filling in these basins were complete by about 3 billion years ago.

Although this general picture has emerged, several aspects of these events and processes responsible for them remain uncertain. Size and composition of the lunar core, if it exists, and internal and bulk composition of the Moon, essential for modelling the formation of the Moon, are not accurately known. Some isotopic data are not consistent with the values expected in high-temperature fractionation which should have occurred following the giant impact. Since the Earth formed by accreting planetesimals (small solid celestial bodies thought to have existed at an early stage in the development of the solar system), it is reasonable to assume that a small fraction of them, depending on their orbital geometry, would be captured in geocentric orbits. The role of these 'moonlets', which might have been existing in Earth orbit when the giant impact took place, in accretion of the proto-Moon and subsequently in formation of large basins on the Moon is not fully understood.

Chandrayaan-1 spacecraft

Furthermore, several aspects of crustal inhomogeneity, particularly the mechanisms that gave rise to the differences between the Earth-facing and the far side of the Moon are still a matter of debate. The depth to which the Moon melted during magma ocean formation, the rates of cooling and the mechanism of late heavy bombardment remain open questions. Existence of ice in the permanently shadowed lunar polar regions has been a subject of intense interest and needs to be confirmed. Some areas on the Moon, such as the South Pole Aitken (SPA) basin, north and south polar regions appear to be of special interest requiring a more detailed study.

In view of these problems of considerable scientific interest, the Indian Space Research Organisation (ISRO) has examined the possibility of a series of missions which may orbit, land and return samples of the Moon from some selected areas. The first mission, *Chandrayaan-1* is proposed to be a long duration (~ 2 years), low-altitude (100 km), polar orbiter mission. The orbiter mission was preferred compared to landing and sample return missions, because it provides a synoptic and global view of the Moon. Recent advances in sensor technology and planetary remote sensing techniques should enable us to obtain better spatial resolution and quality of data compared to the past missions.

However, before describing the salient features of the *Chandrayaan-1* mission, it may be useful to focus on some key issues in lunar science which can be addressed by chemical, mineralogical and topographic mapping.

Key questions in lunar science

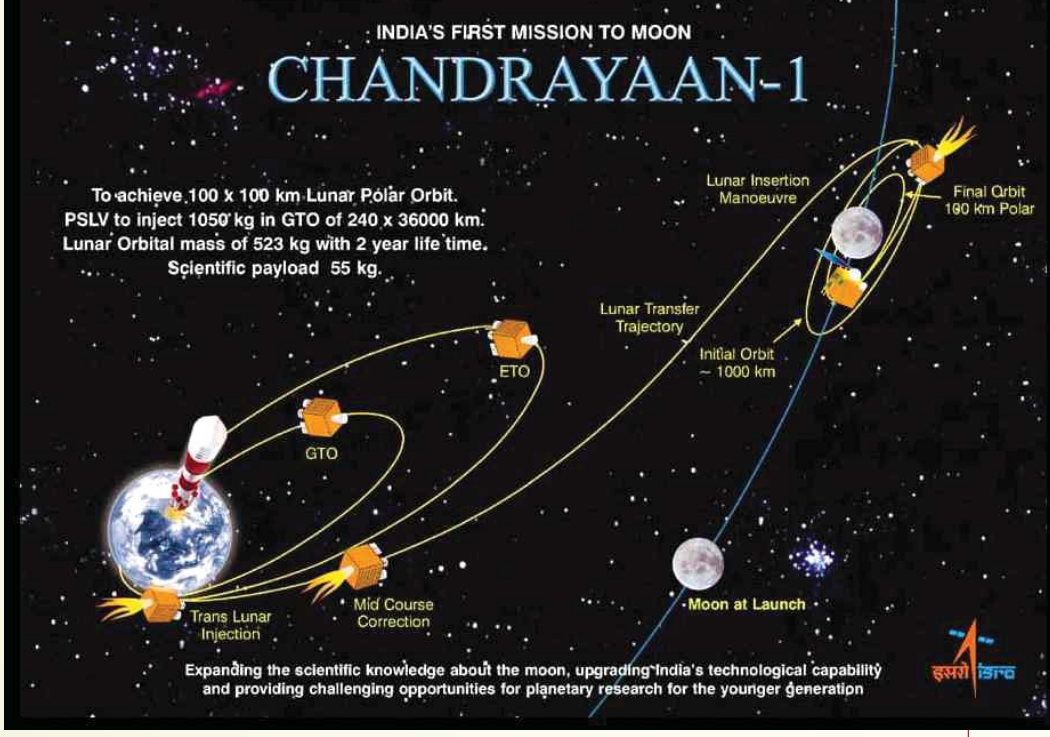
As has been mentioned above, the most enigmatic question about the Moon is its origin. After several decades of intense study of the Moon and its samples in the laboratory, it is now clear that the Earth acquired such a large satellite neither directly by condensation of the solar nebula in a binary planet (Earth–Moon) system nor by fission of a fast rotating Earth, nor by capture of a stray interplanetary body roaming in the vicinity of the Earth, but by a rare chance coincidence of an impact of a large differentiated asteroid (called 'Theia') on the infant Earth. Bulk composition of the Moon has been modelled with the experimental data available from various lunar rocks, but large uncertainty remains because its

interior composition is not known. Precise bulk composition should enable us to determine the composition of the impactor(s) and probably their source regions in the solar system.

An important problem in lunar crust formation is the size of the magma ocean and its cooling rate. The crust is made of light calcium-aluminum rich minerals (plagioclase) and is poor in heavy iron-bearing and other siderophile elements (having chemical affinity for metallic iron), which sank down in the moon. The highest Al and lowest Fe composition can be used to infer the time taken by the crust to crystallize. This can also be determined by chemical mapping. Several other problems can be enumerated where high-precision chemical mapping with good spatial resolution can provide useful insight, but one which is important from the point of mare formation is the composition of the basin-forming impactors, whose signatures can be found in fragmented rocks and ejecta around the large basins. Three main payloads for *Chandrayaan-1*, viz., hyperspectral imager, X-ray fluorescence spectrometer and low-energy gamma-ray spectrometer have been designed keeping these problems in view.

Chandrayaan-1 mission profile

Chandrayaan-1 is a remote sensing mission proposed to be launched from the Satish Dhawan Launch Station at Sriharikota, Andhra Pradesh later this year by the Indian Space Research Organisation using the Polar Satellite Launch Vehicle. It will be injected into 240 × 36,000 km geostationary transfer orbit (GTO) around Earth and after several orbits around the Earth for about 2 days, it will achieve a more elliptic transfer orbit (ETO). Subsequently the *Chandrayaan* craft will be put in a lunar transfer trajectory (LTT) and travelling for about 5 days it will encounter the Moon where it will be captured into a circumlunar orbit. The spacecraft will enter the lunar orbit at about 1,000-km altitude and will be brought down to 100-km polar circular orbit in one or two stages. The lunar craft is designed to orbit the Moon for a period of two years during which it will carry out



Chandrayaan trajectory

chemical, mineralogical and topographic study of the lunar surface.

The main objective of the mission is simultaneous chemical, mineral and topographic mapping with the specific goal of understanding the early evolution of the Moon. Chemical stratigraphy can provide better estimation of the average lunar composition and processes responsible for chemical differentiation of the Moon. Degassing of the hot daytime Moon at about 120°C and subsequent transport of volatiles, specifically water, on to the colder regions of the Moon can be understood by using radon and its daughter nuclide ^{210}Pb as tracers.

Science objectives and payloads

Chandrayaan-1 is designed for high-resolution photo-geological, chemical and mineralogical mapping of the Moon. There are eleven instruments that have been selected to meet these objectives considering the radiation environment of the Moon. In addition, *Chandrayaan-1* will have a Moon impact probe, having its own set of instruments, which will fall on the Moon and make observations during its descent.

The radiation and particles around the Moon arise either by processes inherently occurring in the Moon such as radioactive decay of naturally occurring or cosmic-ray produced radioisotopes (alpha particles, gamma rays, X-rays, etc.), or are induced by radiations from the Sun (visible, UV and X-rays) . The solar and galactic particles – mainly protons and alpha particles – interact with the lunar surface materials and produce radiations (X-rays, gamma rays, neutrons, for example) which have signatures of lunar surface chemistry. On the macroscopic scale, impacts of micrometeorites, asteroids and comets, covering a large range of sizes from microns to hundreds of kilometres, sculpture the lunar surface and are responsible for the lunar surface topography and morphology.

Taking advantage of these processes and considering the launch vehicle capabilities, various payloads of *Chandrayaan-1* have been decided upon. Some of these instruments are briefly described below.

Geochemical mapping

X-ray fluorescence, produced by Solar X-rays falling on the Moon, specially during times of flares, is ideally suited for determining the major element composition of the lunar surface materials and therefore the geochemical mapping of elements like Mg, Al, Si, Ca, Ti, Fe will be accomplished using low-energy X-ray fluorescence spectrometer. Nuclear interactions of solar and galactic cosmic rays and their secondaries (including protons, alpha particles and neutrons)

excite various elements present within about a metre of the lunar surface. De-excitation of these nuclides and decay of radioactive nuclides produced in their nuclear reactions result in characteristic gamma rays, which can be detected using a gamma-ray spectrometer and can be used to infer the abundance of several nuclides.

Radon is a gaseous daughter of uranium and escapes from the lunar interior by thermal diffusion or leaks through cracks, fractures and faults. Seismic activity and micrometeorite impacts may also help radon atoms to collect in small bubbles and escape from the lunar interior together with other gases like He, Ar, CO_2, and N_2, which have significant inventories in the Moon. Volatile transport on the lunar surface will be studied by mapping ^{210}Pb which is produced by decay of radon using a low energy gamma ray spectrometer.

Mineral mapping

Minerals present on the lunar surface provide an insight into the melting, differentiation, crystallization and volcanic history of the lunar surface and also give us some idea of the time scales on which these processes occurred. It can, for example, give information on depth and spatial extention of magma ocean and crustal formation processes. The minerals also bear signatures of the material from which the Moon was formed and together with their chemical composition could enable us to model the differentiation sequence. The mineral mapping will be accomplished by the three spectrometers operating in the 400 to 3000 nanometre range.

Topographic mapping

The information obtained from chemical, radioactive and mineral mapping has to be superimposed on a topographic map to identify the areas of interest. Therefore a terrain mapping camera has been included in *Chandrayaan-1* mission as one of the payloads. In addition a laser altimeter will provide elevation map of the lunar features. Three-dimensional topographic mapping of the lunar surface will enable us to study the geomorphological and structural features of the lunar surface and correlate them with chemical and mineralogical features. These primarily include physical components of the craters such as crater rim, crater basin, and ejecta blanket etc and central hill of the crater where deep interior material may be exposed.

Chandrayaan-1 thus has, in addition to the Terrain Mapping Camera, three optical-near infrared spectrometers, two X-ray spectrometers, a solar X-ray monitor and a laser altimeter, a synthetic aperture radar, a low-energy neutral atom analyser, a radiation monitor and a Moon impact probe. The radar is capable of looking underground and the neutral atom analyser can monitor the few atoms existing in the lunar environment.The radiation monitor will measure the radiation dose in lunar environment.

Development of these payloads has been a challenging problem of the *Chandrayaan-1* mission. It involved selection of the best detectors based on their response functions, heritage, degradation in space due to radiation etc. and development of suitable flight models.

Areas of special interest

Apart from a general study of the whole lunar surface, it is recognized that some areas are of special interest particularly on the far side of the Moon and the polar regions which are under permanent shadow and where temperatures can be as low as -230°C. Specifically, the large 2500-km-wide basin on the far side called South Pole Aitken Basin (SPA) and north and south poles deserve detailed study. The SPA is one of the oldest basins (more than 4.2 billion years old) on Moon and the largest in the solar system. It has anomalous depth-to-diameter ratio and its origin is being intensely debated. It is possible that it was formed by impact of a moonlet in a geocentric orbit as the Moon was receding away from Earth. Some areas within the basin, e.g., Olivine Hill and Bhabha and Bose craters probably have deep lunar material, i.e., from lower crust exposed on the surface.

Chandrayaan-1, together with European Space Agency's *SMART-1*, Japan's *SELENE*, China's *Chang'e-1*, and the forthcoming missions of the US will provide more than five years of observation of the Moon. This may constitute the longest continuous and overlapping period of study of the Moon and should help us resolve some of the outstanding questions regarding chemical, mineralogical and geological evolution of the lunar surface, Earth–Moon interactions in the remote past and size-dependent evolution of the planetary bodies.

Adapted from a paper published in Current Science.

Prof. Narendra Bhandari is in the Planetary Science and Exploration Programme, Physical Research Laboratory, Navrangpura, Ahmedabad 380 009, India, and is actively involved with *Chandrayaan-1* mission.

Relevance of Lonar and Ramgarh impact craters

Like the Moon, the Earth has also been bombarded by rocks from space which form craters. Two such craters exist in India and recently one more has been identified. The Lonar and Ramgarh craters are suitable for field testing of various instruments designed for *Chandrayaan-1*. Lonar, located in Buldana district of Maharashtra, is the only impact crater on Earth which is formed in a basaltic terrain, similar to lunar mare regions. It has a diameter of 1.8 km and a depth of 130–150 m. The present crater rim stands 20 m above the surrounding area. It is dated to be about 50,000 years old although there is some uncertainty. Because of its young age and low erosion, the crater morphological features like crater rim and ejecta material are relatively well preserved. It is ideal for testing some payloads of *Chandrayaan-1* using an airborne platform.

Located in Baran district of Rajasthan, the Ramgarh crater is 4 km in diameter and 250 m high. There are evidences, although in some ways inconclusive, that it is an impact crater. It is thus another good crater analogue for testing the *Chandrayaan-1* instruments.

The Uneasy Mind
Generalized Anxiety Disorder

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

Who can win over the world? The person, who reins in his mind.
Shankaracharya

Millions of people living on this planet make our wonderful habitat so riveting. All these humans are so much alike, yet so different from each other! Their bodies vary in shape and size and colour, and so do their minds, their productivities, disposition, and coping abilities. Some can stay calm and happy in all circumstances, while some never stop worrying. They fret and fret and pluck at the thorny bushes of anxiety and uneasiness even when the quality of their lives is first-rate. Quite a few may realize the truth of the maxim – worry is like the interest paid on the troubles yet to come – and recognize that the anxiety is unwarranted, but are unable to cap it. The fault lies with their mind machine. It is wired that way.

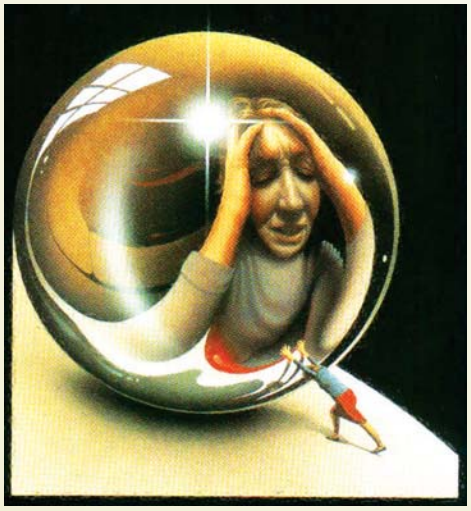
If you find yourself in such a chronic nervous state for six months or more, and in spite of recognizing that the anxiety is phoney or that you cannot switch off the anxiety-button, you definitely have a problem. Clinically, it is termed as 'generalized anxiety disorder'.

Who gets affected?

Generalised anxiety disorder affects three per cent of the population. The ratio of afflicted women to men is approximately 2:1. The disorder most often develops in one's twenties, although people in other age groups can also be affected. Strangely, children also suffer from this disorder. They could be at the top of the class and still agonize over their academic performance. Genetic studies indicate that the disorder may in part be inherited. Approximately 25 per cent of the first-degree relatives are affected – women more than men. In identical twins, if one twin is affected, then the other may also get affected in 50 per cent cases. The hypothesis that the disorder may be related to stresses of modern life-style seems attractive, but there is little evidence to support it; the disorder is also discerned in those who live far away from the stresses and strains of modern civilization.

What causes the disorder?

In psychological parlance, anxiety is a mental response to an unknown, internal, vague, or conflictual threat which is felt, but hard to define. An event



may be perceived as a threat, depending on the nature of the event and on the assets, defences, and the coping mechanisms of the individual mind. All this involves the ego, a collective abstraction that refers to the processes by which a person perceives, thinks, and acts on external events or internal drives. A person whose ego is functioning properly is in adaptive balance with both the outer and inner worlds; if it is not functioning properly and the imbalance lingers, he or she may become a candidate for chronic anxiety or generalized anxiety disorder.

These imbalances, or conflicts, can be of two kinds: external, between the pressures of the outside world and the person's ego; and internal, between the person's impulses and conscience. In both situations, if there are too many conflicts, or the inner self cannot resolve them, a situation comes to pass when they begin to upset the involuntary nervous system and activate the stress chemistry of the body.

Community surveys suggest that a person who experiences several negative life events has a greatly increased likelihood of developing this disorder. Prolonged insecurity during the early formative years can be a major culprit. A child may feel unloved, when the parents are overburdened, a sibling seems to receive preferential treatment, or a mother has her own exaggerated anxieties. This can lead to excessive timidity in the child, and undermine the child's psychological defence. As a consequence, the disorder may appear at a later stage.

Still, these psychoanalytical formulations do not quite explain why people in similar taxing circumstances differ in their response. It is in this context that the biological theories and genes come into play. It is believed that human brain produces a natural substance which curbs anxiety. The happy-go-lucky people probably have plenty of this natural substance, but those who are in short supply of it fall easy victims to this disorder.

Symptoms

The disorder presents itself through both physical and psychological symptoms. People with generalised anxiety disorder often find that the worries interfere with their ability to work or concentrate. Physical symptoms include rapid heartbeat, fast breathing,

disturbed sleep, muscle aches, tightness of chest, and easy fatigability experienced continuously for at least six months. The symptoms can vary between individuals, but typically they are related to the muscles and involuntary actions and the performance of mind.

Symptoms related to muscular tension

- Trembling, twitching, or feeling shaky
- Muscular aches and pains
- Restlessness
- Easy tiredness

Symptoms related to involuntary actions

- Shortness of breath
- Palpitations or rapid heart rate
- Sweating or cold clammy hands
- Dryness of mouth
- Dizziness or light-headedness
- Nausea, diarrhoea, or abdominal discomfort
- Hot flashes or chills
- Frequent urination
- Trouble in swallowing

Symptoms related to cerebral functions

- Feeling keyed up or on edge
- Excessive irritability
- Exaggerated startle response
- Lack of concentration
- Mind going blank
- Trouble in falling or staying asleep

These symptoms are typically physical in nature, and people suffering from anxiety disorder often get directed to a family physician, cardiologist, or pulmonary specialist rather than a psychiatrist. The story of Tara Ghosh exemplifies the point:

Tara Ghosh, a homemaker, was 36 years old. She had a caring husband and two wonderful children. Her husband worked as a Vice President with a multinational company. They lived in comfort. Yet, for over two years, she complained of sweaty palms, heart palpitations, dizziness, hot flashes, and tightness in the chest. She suffered aches and pains, got tired easily and felt edgy. She could not concentrate and had trouble falling asleep.

Tara consulted the family doctor. She was referred, in turn, to a cardiologist, an orthopaedic surgeon, and an ear-nose-and-throat specialist. Each one of them asked her to undergo expensive laboratory tests. Each specialist also gave a different diagnosis and handed her a different prescription. She received ultrasonic treatment for her back, took pain relief medication for several weeks and also physiotherapy for a pinched nerve root in the neck. But nothing worked. Her husband also stopped taking notice of her complaints. Tara was at a complete loss and did not know what to do.

At last, help came from an unexpected quarter. Meeting an old school friend at a supermarket one afternoon, she confided in her. Her friend, a clinical psychologist, was sharp enough to diagnose her condition. She took her up for counselling and began relaxation therapy sessions with her. Soon, Tara was discovering her new self. Gone were her grouchy ways, her aches and pains and lack of sleep.

Do you suffer from it? (A ready reckoner)

Check out if:

- You suffer excessive anxiety and worry about at least two life situations. For example, worry about mishaps to your child who in fact is in no danger and worry about finances without any valid reason. These worries have lasted for a period of six months or longer. In children and young people, the anxiety and worry may be related to academic, athletic, and social performance.
- You find it is difficult to control these worries.
- Your anxiety and worry is associated with three or more of the following symptoms:

1. You feel restless or too keyed up or on edge.
2. You feel easily tired.
3. You have difficulty concentrating or your mind goes blank.
4. You feel unduly irritable.
5. You experience tension in the muscles.
6. You have difficulty falling or staying asleep, or you have a restless unsatisfying sleep.

- The anxiety, worry, or physical symptoms have been causing you distress or has been affecting your social and work-related functioning.

Treatment

Psychotherapy, particularly counselling, is often the first treatment of choice. It can help free people from their worries and psychological conflicts; provide them with a proper understanding of the problem and relieve them of their symptoms. Most people experience a marked lessening of anxiety when given an opportunity to discuss their difficulties. Reassurance about unrealistic fears, encouragement to face anxiety-provoking situations, and the continued opportunity to unwind oneself before a concerned and sympathetic physician are helpful to the person.

Relaxation therapy can also work wonders. It produces physiological effects that are opposite to that of anxiety. It slows heart rate, eases pressure on the arteries, calms muscles and nerves, and makes breathing easier. A number of relaxation methods have been developed, including yoga which

has been in practice for centuries. In progressive muscle relaxation, you need to relax the body's muscle groups one by one in a definite order.

Visual imagery is also a good way to relax. For this, you have to imagine that you are in a place associated with pleasant memories. Open the floodgate. Let the mental images flow. You would enter a relaxed state of mind. Meditation and biofeedback can also help you relax. These are long-term measures aimed at weeding out the elements of anxiety.

As a short-term quick relief measure, medicines can also be used. The most commonly used are benzodiazepines. They relieve anxiety and are quick acting and offer rapid relief. These include alprazolam and diazepam. They must not be continued, however, for more than three or four weeks because they are habit forming and can impair higher faculties. While taking them, it is good to remember that they may impair alertness. This increases the risk of an accident if you take the wheel.

Buspirone is another excellent anxiety reducing medication. It has a lag period of one to three weeks before it shows its full effect, but it is a better choice because it does not lead to sedation and is not habit-forming.

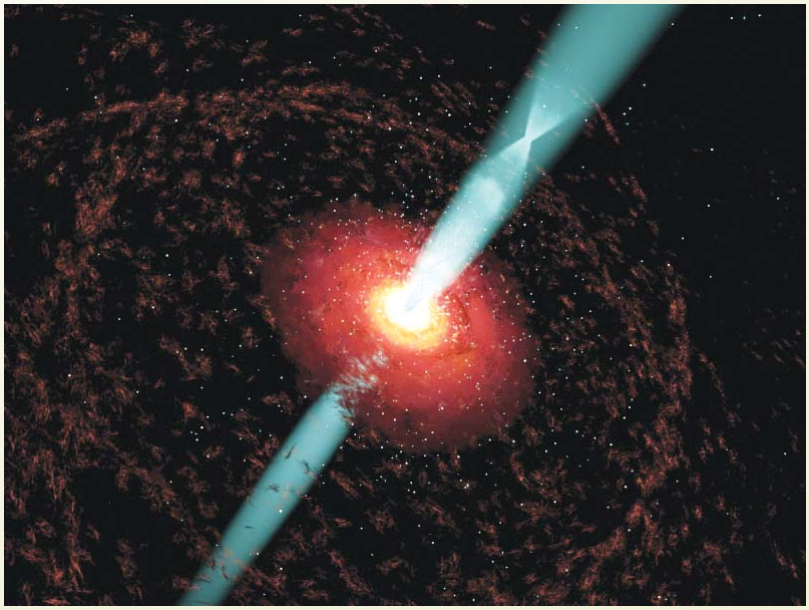
Some antidepressant pills can also help allay anxiety. They also have a long lag period, but are quite effective and do not pose the risk of addiction.

Recent Developments in Science and Technology

Biman Basu
Email: bimanbasu@gmail.com

Secrets of massive black holes revealed

Black holes are strange objects that are so massive yet so small and their density so high that their intense gravitational force does not allow even light to escape. But black holes are known to eject powerful jets of particles at nearly the speed of light. How they do it has been a mystery for a long time, although it was believed that the particles were probably accelerated by tightly-twisted magnetic fields close to the black hole. There was no way of proving that it was actually so. Now astrophysicists appear to have a proof. The National Radio Astronomy Observatory in USA announced in April that using the Very Long Baseline Array astronomers have discovered how it happens. The particles were observed coming out in a winding corkscrew-shaped path (*Nature*, 24 April 2008).



Artist's conception of region near supermassive black hole where twisted magnetic fields propel and shape jet of particles (Credit: Marscher et al.*, Wolfgang Steffen, Cosmovision, NRAO/AUI/NSF).*

According to Alan Marscher, of Boston University, leader of the international research team that carried out the study, this was the clearest look yet at the innermost portion of the jet where the particles actually are accelerated and that the observation supports the idea that twisted, coiled magnetic fields are propelling the material outward, as predicted by theory.

According to theory, material pulled inward toward the black hole forms a flattened, rotating disk, called an 'accretion disk'. As the material moves from the outer edge of the disk inward, magnetic field lines perpendicular to the disk are twisted, forming a tightly-coiled bundle that, astronomers believe, propels and confines the ejected particles. Closer to the black hole, space itself, including the magnetic fields, is twisted by the strong gravitational pull and rotation of the black hole.

Theorists had predicted that material moving outward in this region would follow a corkscrew-shaped path inside the bundle of twisted magnetic fields. They also predicted that light and other radiation emitted by the moving material would brighten when its rotating path was aimed most directly toward Earth. This was the first time that such as event has been actually observed.

Marscher's team studied a galaxy called BL Lacertae (BL Lac), some 950 million light-years from Earth. BL Lac is one of the most energetic types of black-hole-powered galactic core. Supermassive black holes in cores of galaxies have been known to power jets of particles and intense radiation in similar objects including quasars and Seyfert galaxies (galaxies with intensely bright nuclei).

In addition to the continent-wide VLBA – an array of 10 radio telescopes spread from Hawaii to the Virgin Islands – the team also used telescopes at the Steward Observatory in Arizona, USA, the Crimean Astrophysical Observatory in Ukraine, Lowell Observatory in Arizona, USA, Perugia University Astronomical Observatory in Perugia, Italy, Abastumani Astrophysical Observatory in Tbilisi, Georgia, the University of Michigan Radio Astronomy Observatory in USA, and the Metsahovi Radio Observatory in Helsinki, Finland, and NASA's *Rossi X-Ray Timing Explorer*.

Can the LHC spawn a black hole?

The commissioning of the Large Hadron Collider (LHC) in a few weeks is expected to give a tremendous boost to particle physics research. It is expected to create for the first time the

elusive Higgs boson that may provide clue to conditions in the early universe soon after the Big Bang. The experiments at the LHC are also expected to answer fundamental questions like the origin of mass or the nature of the so-called dark matter. But there are also speculations that the LHC could also spawn a black hole that could swallow Earth. Naturally there is public apprehension about the safety of the LHC. Is it true that the LHC can produce a black hole?

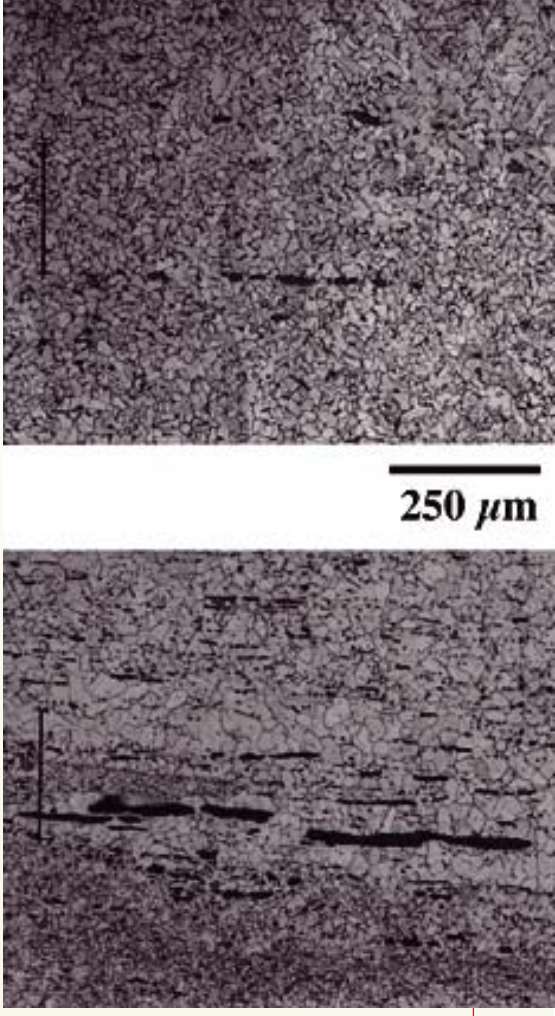
The $8-billion Large Hadron Collider of the European Organization for Nuclear Research (CERN) is a massive assemblage of iron, steel and superconducting wire set up 100 metres underground in a 27-kilometre-long circular tunnel on the Franco-Swiss border. The most complex piece of scientific equipment ever built, the LHC is the most powerful particle accelerator ever built. When operational it will send particles crashing into each other at almost the speed of light, generating energies more powerful than the Sun. In the debris of such massive collisions scientists hope to find the Higgs particle, one of the most exotic undiscovered objects till date.

By smashing protons and lead ions together at energies reaching 14 trillion electron volts, the LHC will dwarf the world's other atom-smashers, including the Fermi National Accelerator Laboratory's mighty Tevatron in Batavia, Illinois, USA. When the two beams collide, they would generate temperatures more than 100,000 times at the heart of the Sun. As a result of the violent collisions, the colliding particles would be transformed into packets of energy, which would in turn condense back into various intriguing types of particles including, probably, the Higgs boson. But could it produce a black hole? According to some variants of string theory, the possibility cannot be ruled out.

Michelangelo L. Mangano, who is part of the CERN group studying the safety of the collider, does not deny the scant possibility that the collider could yield a mini black hole, but he says, "any black hole would be so tiny that it wouldn't be able to get its teeth around a bit of local cheese, let alone the world. Still, if a black hole were produced at all, that would be an extremely spectacular result." According to a paper by the British cosmologist Stephen Hawking published in 1975, any black hole produced in high-energy collision would rapidly evaporate in a bundle of radiation (Hawking radiation) and elementary particles, and thus pose no threat.

Weak rivets caused the *Titanic* disaster

The sinking of the luxury ship *Titanic* after hitting an iceberg on its maiden voyage 96 years ago has always remained an enigma. No one knew how the giant ship, which was said to be unsinkable, went down so fast after it scraped past an iceberg on a foggy night on 10 April 1912, killing more than 1,500 people. According to experts the ship's double-bottomed hull was specially reinforced to withstand the kind of impact it suffered. Then, was the iceberg alone responsible for the tragedy? Or did other factors contribute to the collision's deadly toll? A conclusive explanation was not available – until now. Now Timothy Foecke, a metallurgist at the U.S. government's National Institute of Standards and Technology who has been studying the *Titanic* for a decade, and Jennifer Hooper McCarty, who started researching the *Titanic*'s rivets while working on her Ph.D. at Johns Hopkins University in 1999 provide an explanation in their newly published book *What Really Sank the Titanic: New Forensic Discoveries*. McCarty spent two years in Britain studying the company's archives and works on the training and working conditions of shipyard workers. She and Foecke also studied engineering textbooks from the 1890s and early 1900s to learn more about shipbuilding practices and materials. By analysing step by step how the ship was designed and constructed, and what vulnerabilities were overlooked, the authors show how this marvel of modern engineering may have been a disaster waiting to happen. And their finding is unequivocal: low-grade rivets did the majestic ship in.



Micrographs of normal rivet (top) and rivet recovered from Titanic *(bottom). Black patches show areas of slag.*

During construction the *Titanic* required more than three million rivets that acted like glue to hold everything together. Two other large ships were also being built in the shipyard at the same time. According to the authors the builders may have compromised on the quality of rivets under pressure of meeting the huge demand. The authors tested 48 rivets from the *Titanic* and found that slag concentrations were as high as 9 percent, when they should have been only 2 to 3 percent. The slag is a by-product of the smelting process and unlike the metal it is brittle. The iron becomes weak the more slag there is because the brittleness of the slag takes over and it breaks easily. According to the authors the large slag content had weakened the rivets and made them rupture easily under stress, leading to flooding of as many as six watertight compartments that caused the *Titanic* to go down.

Earthquake Tip-24
How to Reduce Earthquake Effects on Building?

Why Earthquake Effects need to be Reduced

Conventional seismic design attempts to make buildings that do not collapse under strong earthquake shaking, but may sustain damage to non-structural elements (like glass facades) and to some structural members in the building. This may render the building non-functional after the earthquake, which may be problematic in some structures, like hospitals, which need to remain functional in the aftermath of the earthquake. Special techniques are required to design buildings such that they remain practically undamaged even in a severe earthquake. But such buildings usually cost more than normal buildings do. However, this cost is justified through improved earthquake performance.

Two basic technologies are used to protect buildings from damaging earthquake effects. These are 'Base Isolation Devices' and 'Seismic Dampers'. The idea behind base isolation is to detach (isolate) the building from the ground in such a way that earthquake motions are not transmitted up through the building, or at least greatly reduced. Seismic dampers are special devices introduced in the building to absorb the energy produced by the ground motion to the building (much like the way shock absorbers in motor vehicles absorb the impacts due to undulations of the road).

Base Isolation

Base isolation can be done by resting the building on frictionless rollers (Figure 1a). When the ground shakes, the rollers freely roll, but the building above does not move. Thus, no force is transferred to the building due to shaking of the ground. Now, if the same building is rested on flexible pads that offer resistance against lateral movements (Figure 1b), then some effect of the ground shaking will be transferred to the building. If the flexible pads are properly chosen, the forces induced by ground shaking can be a few times smaller than that experienced by the building built directly on ground, namely a fixed base building (Figure 1c).

The flexible pads are called 'base-isolators', whereas the structures protected by means of these devices are called 'base-isolated buildings'. The main feature of the base isolation technology is that it introduces flexibility in the structure. As a result, a robust medium-rise masonry or reinforced concrete building becomes extremely flexible. The isolators are often designed to absorb energy and thus add damping to the system. This helps in further reducing the seismic response of the building. Several commercial brands of base isolators are available in the market, and many of them look like large rubber pads, although there are other types that are based on sliding of one part of the building relative to the other. A careful study is required to identify the most suitable type of device for a particular building. Also, base isolation is not suitable for all buildings. Most suitable candidates for base isolation are low to medium-rise buildings rested on hard soil underneath; high-rise buildings or buildings rested on soft soil are not suitable for base isolation.

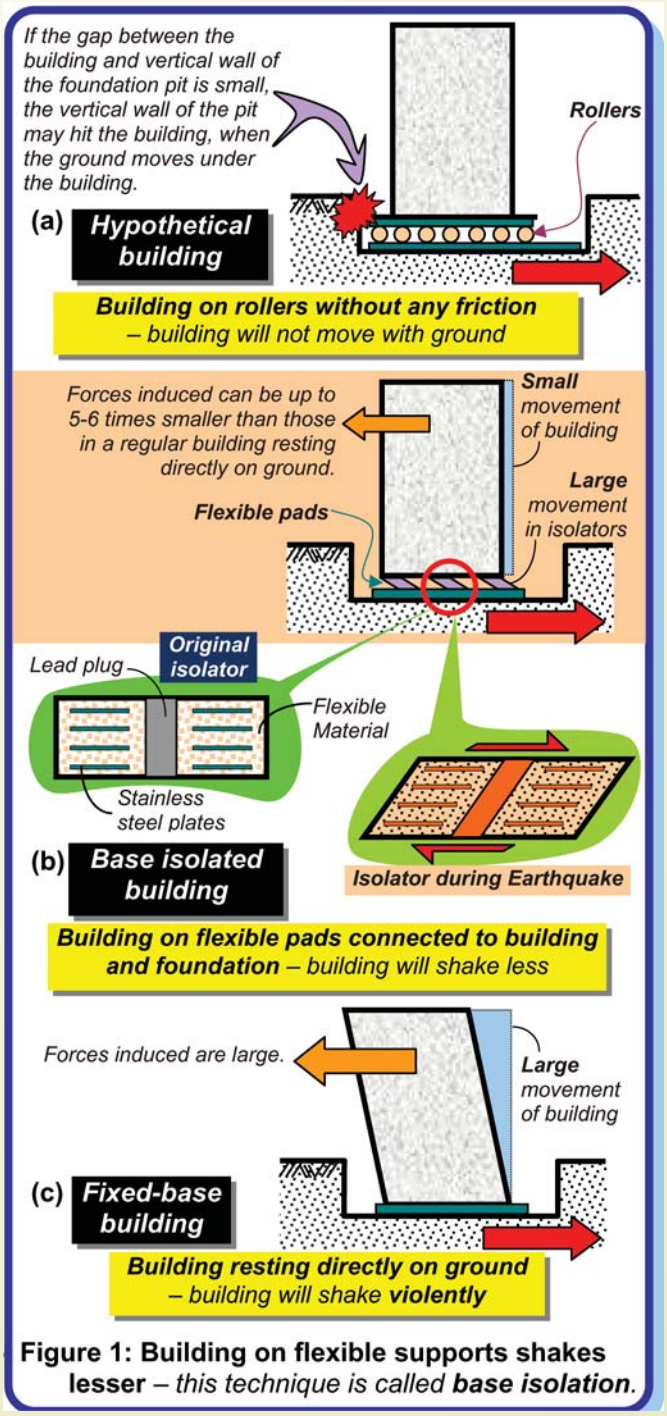


Figure 1: Building on flexible supports shakes lesser – *this technique is called* ***base isolation.***

Base Isolation in Real Buildings

Seismic isolation is a relatively recent and evolving technology. Its use has increased since the 1980s, and has been well evaluated and reviewed internationally. Base isolation has now been used in numerous buildings in countries like Italy, Japan, New Zealand, and USA. Base isolation is also useful for retrofitting important buildings (like hospitals and historic buildings). By now, over 1,000 buildings across the world have been equipped with seismic base isolation. In India, base isolation technique was first demonstrated after the 1993 Killari (Maharashtra) Earthquake [*EERI*, 1999]. Two single-storey buildings (one school building and another shopping complex building) in newly relocated Killari town were built with rubber base isolators resting on hard ground. Both were brick masonry buildings with concrete roof. After the 2001 Bhuj (Gujarat) earthquake, the four-storey Bhuj Hospital building was built with base isolation technique (Figure 2).

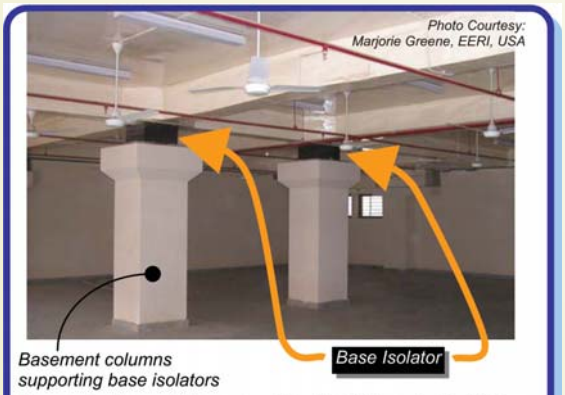


Figure 2: View of basement in Bhuj Hospital building – *built with base isolators after the original District Hospital building at Bhuj collapsed during the 2001 Bhuj earthquake.*

Seismic Dampers

Another approach for controlling seismic damage in buildings and improving their seismic performance is by installing seismic dampers in place of structural elements, such as diagonal braces. These dampers act like the hydraulic shock absorbers in cars – much of the sudden jerks are absorbed in the hydraulic fluids and only little is transmitted above to the chassis of the car. When seismic energy is transmitted through them, dampers absorb part of it, and thus damp the motion of the building. Dampers have been used since 1960s to protect tall buildings against wind effects. However, it was only since 1990s, that they were used to protect buildings against earthquakes. Commonly used types of seismic dampers include 'viscous dampers' (energy is absorbed by silicone-based fluid passing between piston-cylinder arrangement), 'friction dampers' (energy is absorbed by surfaces with friction between them rubbing against each other), and 'yielding dampers' (energy is absorbed by metallic components that yield) (Figure 3). In India, friction dampers have been provided in a 18-storey RC frame structure in Gurgaon (See *http://www.palldynamics.com/main.htm*).

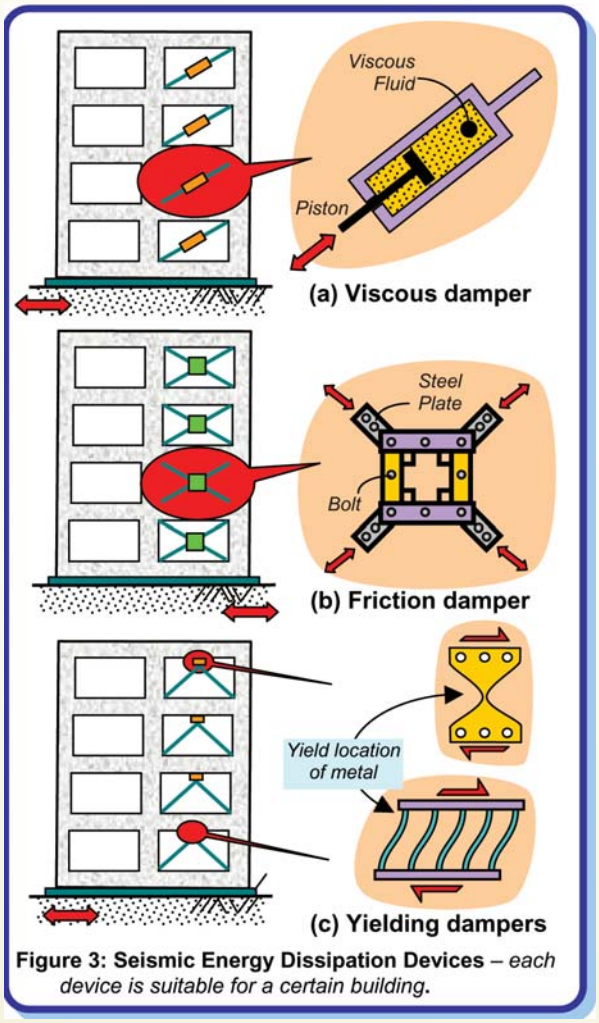


Figure 3: Seismic Energy Dissipation Devices – *each device is suitable for a certain building.*

Related IITK-bmTpc Earthquake Tip

Tip 5: What are the Seismic Effects on Structures?

Tip 8: What is the Seismic Design Philosophy for Buildings?

Resource Material

1. EERI, (1999), *Lessons Learnt Over Time – Learning from Earthquakes Series: Volume II Innovative Recovery in India,* Earthquake Engineering Research Institute, Oakland (CA), USA; also available at *http://www.nicee.org/readings/EERI_Report.htm*.
2. Hanson,R.D., and Soong,T.T., (2001), *Seismic Design with Supplemental Energy Dissipation Devices*, Earthquake Engineering Research Institute, Oakland (CA), USA.
3. Skinner,R.I., Robinson,W.H., and McVerry,G.H., (1999), *An Introduction to Seismic Isolation,* John Wiley & Sons, New York.

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Authored by : C.V.R.Murty, Indian Institute of Technology Kanpur, Kanpur, India.

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Editorial (Contd. from page 35)

of freshwater supplies. Both flooding and low levels of water lead to water contamination and bring higher level of illness and death from diarrhoea. Changing rainfall patterns, increased rates of evaporation and melting of glaciers, combined with population and economic growth are expected to increase the number of people living in water-stressed water basins from about 1.5 billion in 1990 to 3-6 billion by 2050, a situation that is bound to amplify the hazards to health.

Warmer temperatures, shifting rainfall patterns and increasing humidity affect the transmission of diseases by vectors like mosquitoes. Malaria, a vector borne disease, currently kills 1.1 million people each year in the world. Malaria is not transmitted in the cooler temperatures associated with higher altitudes and latitudes. Further, the number of mosquito vectors depends on the availability of fresh water breeding sites. But, the changing temperatures and patterns of rainfall could alter the geographical distribution of insect vectors that spread infectious diseases. As the temperatures rise in the higher altitudes or latitudes, vectors like mosquitoes could find a new breeding ground there. Already there are indications that malaria has spread to sites having a warming trend, say, highlands of East Africa; and dengue to tropical cities of developing countries, including India. Some studies suggest that climate change may swell the population at risk of malaria in Africa by 90 million by 2030s; and the global population at risk of dengue by 2 billion by the 2080s.

Rising temperatures, changing patterns of rainfall, and more frequent droughts and floods are projected to decrease crop yields in many developing countries causing shortages of food supplies. In some African countries, yields from rain-fed agriculture could be reduced by up to 50 per cent by 2020! This could result in severe malnutrition and under-nutrition, especially among children, in countries where large populations depend rain-fed farming at subsistence level. Already there are causes 3.5 million deaths each year as a result of nutritional deficiencies the world over, increasing at the same time the vulnerability to diseases such as malaria, diarrhoea, and respiratory infections.

Gradual sea level rise coupled with stronger storm surges, would be more frequent and cause more severe coastal flooding, forcing unprotected populations to seek safer grounds increasing environmental and social pressures in their new locations. Extreme events like these can be followed by outbreak of diseases such as cholera. Contamination of water could give rise to diarrhoea, while water-logging could provide opportunity for breeding of mosquitoes and spread malaria and dengue.

Who are at risk, anyway? Populations in small island developing states and low lying regions are vulnerable from severe tropical storms and sea level rise. Urban populations and tropical megacities, are exposed to health risks arising from heat waves, floods, air pollution and infectious diseases. Mountain populations are at increased risk of water insecurity, floods, landslides, and infectious diseases. Populations living in the coastal areas would be exposed to the risk of salinization of water resources, and loss of agricultural land from sea level rise, thus affecting their livelihood. But, for sure, the burden of climate sensitive diseases would be greatest for the poorest populations. The women and children in developing countries are particularly vulnerable to death and illness following natural disasters. In the 1991 cyclone disaster that killed 140,000 people in Bangladesh, death rates among women were four times higher than those among men. Death rates amongst children under 10 years were six times more than that of adult men! It is an irony that children in poor countries, who have made the least or no contribution to the greenhouse gases that are causing climate change, are among the most vulnerable to the resulting health risks and will be exposed much longer to the health consequences of a degraded natural environment! Indeed, all populations without exception, in developing or developed nations are vulnerable to the health risks caused by the climate change.

With India's ecological and socioeconomic systems already facing tremendous pressures due growing population, rapid urbanization, industrialization, and a 7,500-km long densely populated and low-lying coastline, India is considerably vulnerable to the impact on health due to climate change. Extreme temperatures and heat spells, change in monsoon pattern, receding glaciers, frequent floods, loss of coastal mangroves, expected sea level rise of 25-40 cm by 2050s, shifting of lower altitude tropical and subtropical forests to higher altitude temperate regions due to rise in temperatures, would all have sizeable adverse effect on health of her citizens. High temperatures can increase the range of vector-borne diseases such as malaria, particularly in regions where minimum temperatures have currently limited pathogen and vector development.

It is clear that climate change can no longer be considered as an environmental or developmental issue alone. It would affect the health and well-being of all populations, with its impacts escalating in not too distant a future. Human health needs to be placed at the centre of environment and development decisions. Protection of health from climate change has to be a part of a basic, preventive approach to public health. Some of the measures would include controlling vector-borne diseases, provision of clean water and sanitation; and reduction of dependence on energy sources that pollute the environment and harm health. These measures would not only improve health now, but also reduce the vulnerability to climate change in future.

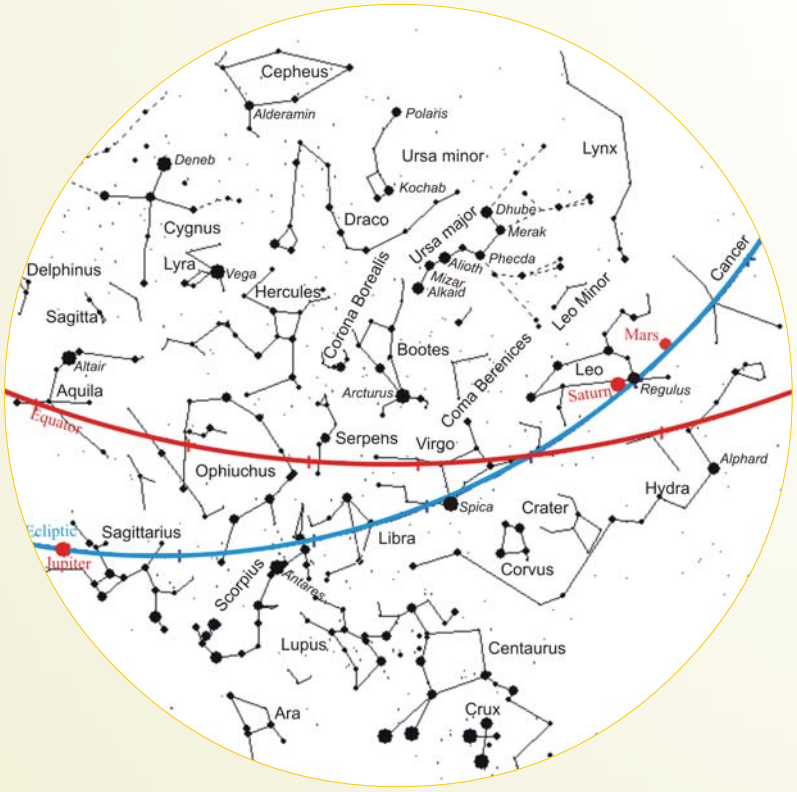
☐ Vinay B. Kamble

Sky Map for June 2008

Full Moon

18 June

North

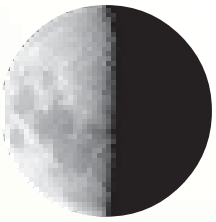


East

West

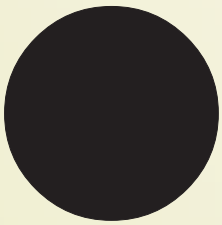
South

Moon - Last Quarter



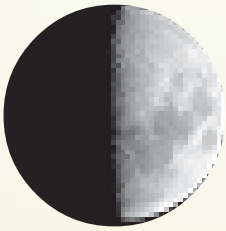
26 June

New Moon



3 June

Moon - First Quarter



10 June

The sky map is prepared for viewers in Nagpur (21.09^0 N, 79.09^0 E). It includes bright constellations and planets. 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 northern horizon. Similarly, for viewers 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 01 June, at 9:00 PM on 15 June and at 8 PM on 30 June.

Tips for watching the night sky :

(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 constellations as shown in the map one by one.

Planet/Dwarf Planet Round Up:

Mars : In the constellation Leo (*Simha Rashi*) up in the Western sky.

Saturn : In the constellation Leo *(Simha Rashi)* up in the Western sky.

Jupiter : In the constellation Sagittarius (*Dhanu Rashi*) near Eastern horizon.

Prominent Constellations: Given below are prominent constellations with brightest star therein (in the parenthesis). Also given are their Indian names.

Eastern Sky : Aquila (Altair), Cygnus (Deneb), Delphinus, Lyra (Vega) / (*Abhijeet*), Ophiuchus, Sagitta.

Western Sky : Cancer / *Karka Rashi,* Hydra (Alpherad), Leo (Regulus) / *Simha Rashi (Magha)*, Leo Minor.

Southern Sky: Ara, Centaurus, Corvus, Crater, Crux, Libra / *Tula Rashi,* Lupus, Sagittarius / *Dhanu Rashi*, Scorpius / *Vraschik Rashi.*

Northern Sky : Cepheus (Alderamin) / *Vrashaparva*, Draco, Lynx, Ursa Major (Dhube) / *Saptarishi (Krutu),* Ursa Minor (Polaris) / *Dhruvamatsya (Drhuvataraka).*

Zenith : Bootes (Arcturus) / *Bhutaap (Swati)*, Coma Berenices, Corona Borealis, Hercules, Serpens, Virgo (Spica) / *Kanya Rashi (Chitra).*

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

Astronomy

Release of Vigyan Prasar Publications

Vigyan Prasar's recent publication, "Experimenting with The Quantm World", by Dr. S T Lakshmikumar was released by Dr. A.P.J. Abdul Kalam, former President of India at National Physical Laboratory, New Delhi on 25 April 2008. Also seen in the photo are: (from L to R) Prof. Samir Brahmachari, Director General, CSIR; Dr. S. T. Lakshmikumar and Dr. Vikram Kumar, Director, NPL.

Vigyan Prasar's Recent publication, "Thin Film Technology — A layman's Perception", by Dr. V. V. Shah and Dr. A. Basu was released by Dr. A.P.J. Abdul Kalam, former President of India at National Physical Laboratory, New Delhi on 25 April 2008. Also seen in the photo are: (from L to R) Prof. Samir Brahmachari, Director General, CSIR, Dr. A. Basu and Dr. Vikram Kumar, Director, NPL.

Letters to the Editor

Lucid Editorial

I have just received a copy of *DREAM 2047* (May 2008) containing your editorial titled "Smashing Particles to Understand the Universe". I am thrilled to read it, as the topic is dear to me. The lucid style in which you have explained one of the most complex subjects in physics including the modern and up-to-date details about LHC and also on future possibilities of gaining more knowledge about the hitherto enigma of dark matter and anti-matter is really commendable. The language is simple, the description is updated and summing up is so comprehensive and non-mathematical! Kindly accept my personal appreciation as it enhances the status of the magazine. I would also like to congratulate Dr. Subodh Mahanti for bringing in focus the biography of great scientists.

Dr. H.L. Nigam
M.Sc., D.Phil (Alld.), Ph.D (Lond.), D.Sc. (h.c), F.N.A.S.C., F.N.A., Former Vice-chancellor, A.P.S. University, Rewa (M.P.). (Retd.) Professor of Chemistry, Allahabad University.

All the articles in *DREAM 2047* are very much important for students. I request you to kindly increase the number of pages of the magazine so that a few more items can be covered in each issue. You may also publish a list of forthcoming programmes of VP, like seminars and workshops so that students like me can attend them.

Anup Pattanaik,
Sailo, PO. Rahana, Orissa 754140

I am grateful to you for sending *DREAM 2047* to our school every month. It is highly informative and useful for us and I would request you to kindly continue to send the magazine.

R. Sangkhuma
Headmaster, Govt. High School, Tawipui 'S', Mizoram