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VIPNET NEWS

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National Mathematical Year 2012

Inside
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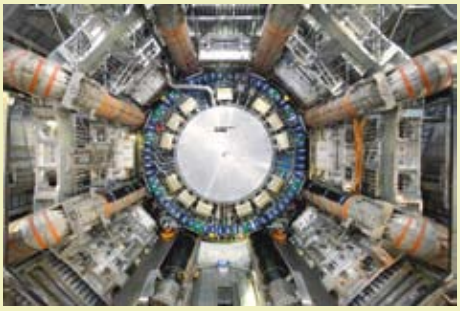
The God Particle

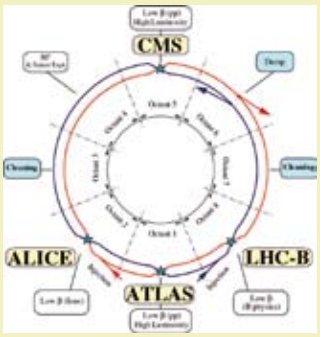
Dear Members,



Large Hadron Collider (LHC)

Initially we were planning to dedicate this editorial to programmes and activities which have been taken up by Vigyan Prasar as part of 'National Mathematical Year 2012'. But suddenly there was a news, which almost appeared in all news channels & Newspapers. As you guess it rightly, it was the news about the discovery of Higgs Boson particle, commonly known as God Particle. In 1964, three scientists, Higgs, Brout and Englert predicted the existence of this particle to explain the most important property of all matter-its mass. Since then, it is for the first time, a proof of the existence of such particle has been confirmed experimentally

This all begin in 2008, when the world's largest particle accelerator, the 'Large Hadron Collider' (LHC) started its operation at the 'European Organization for Nuclear Research', better known as CERN situated 100 meters underground near Geneva on the Switzerland-France border. This is the largest and the most complex particle accelerator of the world. It has four labs around the ring shaped tunnel.



shows the four main experiments and the two ring

Question is why such complex accelerator with such a huge cost ($10bn) was constructed? In this issue we will try to understand importance of this research and the implications of this new finding which has been equated by Prof. Themis Bowcock, University of Liverpol with Columbus discovery of America.

The Large Hadron Collider, or LHC as it is called, is basically a gigantic

Beam loss monitors (yellow tubes) installed on LHC magnets in the tunnel.

Never accept an idea as long as you yourself are not satisfied.

... S.N. Bose

Higgs boson –
a missing link between energy and mass

How was the Universe created? How were the billions of galaxies stars and planets created? Scientists always wanted to know answers to these questions with certainty. A major breakthrough in the particle physics came in 1970 when physicistsrealised that the unification of four fundamental forces in nature, namely gravitational, electromagnetic, strong and weak nuclear forces may be the key in formulation of a model to explain the creation of the Universe. Scientists found enough evidence to suggest unification of at least two of four fundamental forces – weak force and electromagnetic force-and proposed a model, called Standard Model, to explain the Universe as it exists today. However, one of the requirements of such a unifying model entails that all particles are massless – something which is apparently not true! After all, electron, proton, and neutron – all have definite masses. How can we then explain the creation of mass and the Universe, as we see it today? Physicists Peter Higgs, Robert Brout and François Englert came up with a solution to solve this conundrum. They suggested that particles had no mass just after the Big Bang. As the early Universe cooled and the temperature fell below a critical value, an invisible force field called the 'Higgs field' was formed together with the associated 'Higgs boson'. The field prevails throughout the cosmos: any particle that interacts with it isgiven a mass viathe Higgs boson. The stronger the interaction, the heavier they become, whereas particles that never interact are left with no mass. Photon, which is the carrier of the electromagnetic field, is an example of a particle with no mass and hence it does not interact with the Higgs field.

Peter Ware Higgs is a British theoretical physicist and emeritus professor at the University of Edinburgh. In 1960, in his electroweak theory, he explained the origin of mass in elementary particles in general and of the W and Z bosons in particular. During 1970, several physicists predicted the existence of a high-energy particle. This was named Higgs boson, honouring the contribution of Peter Higgs in developing the theory. On 4 July 2012, CERN announced that they had experimentally established the existence of Higgs boson.

Peter Higgs (1929 -)

Till recently, the Higgs boson existed only in theory; no experimental evidence of the existence of the Higgs boson was found. During last 40 years physicists tried to find the Higgs boson and did several experiments to create conditions that could simulate the formation of the early Universe. Fermi Lab in USA used the Tevatron – a powerful particle accelerator to accelerate protons to a very high speed (99.9 % of speed of light) and then collidethem. High-speed collision was expected to create the conditions prevailing in early Universe for a brief moment. The European Organization for Nuclear Research (CERN)built the Large Hadron Collider (LHC), a larger and more powerful particle accelerator, which could accelerate protons up to 7 trillion electron volts (TeV). Scientists did a number of experiments during last two years to search for any evidence that confirms the existence of the Higgs boson.

The Standard Model does not predict an exact mass of the Higgs boson. In a particle accelerator like LHC, smashing protons at near-light speed generates a vast shower of particles that are created only at extremely high energies. Systematic analysis of data is carried out to search for a particle over a range of masses. Scientists knew that Higgs boson cannot be observed directly because of its extremely short life of "a millionth of a millionth of a millionth of a millionth of a second". They were looking for Higgs boson that only fleetingly exists in a soup of particles but leaves behind a trail of other particles that could prove its existence.It was predicted that Higgs boson should havea mass much more than that of protons.

Finally on 4 July, scientists of CERN announced that the long-sought Higgs boson does exist. Experiments conducted in the Large Hadron Collider yielded results that were consistent with its existence. Scientists found data corresponding to a particle weighing about 125 billion electron-volts (GeV), which is about 133 times heavier than protons, thus confirming Higgs boson. So far, this discovery is claimed to be the greatest discovery of 21st century. Some physicists are comparing this to the Apollo program that landed man the Moon in 1960. Currently, however, the finding has been termed as tentative by the CERN teams and the final confirmation may come in a few months.

Discovery of the existence of the Higgs boson will certainly prove to be a major milestone in our understanding of the Universe. Scientists will also look at how the Higgs boson decays or transforms into other more stable particles. This will provide more data to support the Standard Model. As Professor Incandela of the University of California, Santa Barbara, says "We're on the frontier now, on the edge of new exploration. This could be the only part of the story that's left, or we could open a whole new realm of discovery."

Discovery of the Higgs boson may just be the beginning of many more discoveries to uncover other secrets of the Universe. All matter we see comprises only 4% of the observable Universe – the rest, as proposed by the scientists, is made up of mysterious dark matter and dark energy. Definitely science will explain these mysteries in days to come.

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Satyendra Nath Bose

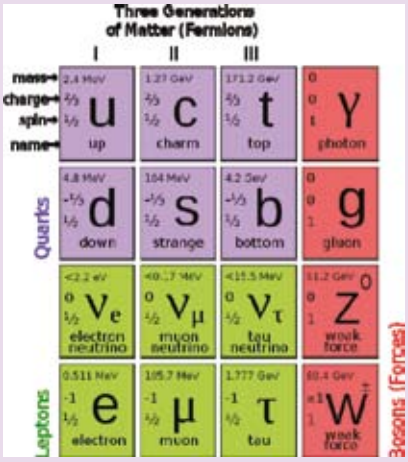
Higgs boson, the long-sought particle belongs to a group of fundamental particles named after an Indian scientist Satyendra Nath Bose. Bose was a physicist specialising in mathematical physics. In 1924, while working as a Reader at the Physics Department of the University of Dhaka, Bose wrote a paper deriving Planck's quantum radiation law using a novel way of counting states with identical particles. He sent the paper to Albert Einstein, who translated it into German and got it published in Zeitschrift für Physik under Bose's name. The result derived by Bose laid the foundation of quantum statistics. Einstein predicted that if a gas of such atoms were cooled to a very low temperature, all the atoms would suddenly gather in the lowest possible energy state. The process is similar to when drops of liquid form from a gas, hence the term condensation. This led to the prediction of the existence of a state of matter, which became known as Bose-Einstein condensate, a dense collection of bosons. However it took another seventy years before scientists succeeded in achieving this extreme state of matter. Bose-Einstein condensate was demonstrated to exist by experiment in 1995. The term 'boson', named after S. N. Bose, was coined to describe subatomic energy carriers which obeyed the Bose-Einstein statistics.

Satyendra Nath Bose
(1894 – 1974)

Satyendra Nath Bose (1894 – 1974) was born on January 1, 1894 in Calcutta. After school, he took admission in intermediate science course at Presidency College, Calcutta. Here he came under the influence of illustrious teachers as Jagadish Chandra Bose and Prafulla Chandra Ray. Meghnad Saha came from Dacca (now Dhaka) and joined the Presidency College two years later. P. C. Mahalanobis ans Sisir Kumar Mitra were a few years senior to this group. Satyendra Nath Bose opted for Mixed Mathematics for his B.Sc and passed the examination standing first in 1913. The same result was repeated in M.Sc Mixed Mathematics examination in 1915. After his M.Sc. he joined the Calcutta University as a research scholar in 1916 and started his studies in the theory of relativity. Next year, both he and M. N. Saha were appointed lecturers in Physics and Applied Mathematics department of the University College of Science, Calcutta. Bose left Calcutta and joined newly founded (1921) Dacca University as Reader. Bose had studied Max Planks book on thermodynamics. He knew about Einstein's deduction of Planks formula.

The Standard Model

The Standard Model is a theory concerning the three fundamental interactions called the electromagnetic, strong and weak nuclear interactions that mediate between the subatomic particles that are the building blocks of matter. It does not include gravity.



Atoms are made of particles called protons, neutrons, and electrons. Protons and neutrons are made of even smaller particles called quarks and gluons. Quarks are regarded as fundamental particles; they do not show any substructure. Electrons and neutrinos are also regarded as fundamental particles. Over the years, the physicists have worked out a mathematical model - The Standard Model - that describes the known fundamental particles that make up the matter (classified as fermions) and the particles that transmit the forces (classified as bosons). As it turns out, there are 17 particles in the Standard Model. Of these, 6 are fermions such as quarks that make up neutrons and protons in nuclei; and 6 leptons ("light" particles) such as electrons that go around these nuclei. Quarks and leptons are the particles that make up the matter. Four particles are called gauge bosons. These are the particles that transmit forces and thus allow fermions to interact. The Higgs boson is not a gauge boson. Higgs bosons give mass to other particles.

Continued on page 7

Leonhard Euler

"Master of All Mathematicians"

"Liesez Euler, Liesez Euler, c'est notre maitre a tous
(Read Euler, read Euler, he is our master in everything)"
The above testament to Euler's proficiency in all branches of mathematics was by Laplace.

"He (Euler) calculated just as men breathe, as eagles sustain themselves in the air."

Francois Arago

"Euler was the most prolific mathematician in history and contributed to all areas of pure and applied mathematics. In analysis he lacked Gauss's or Cauchy's rigour but he had a gift for deducing important results by intuition or by new ways of calculating quantities. He systematised much of analysis, cast calculus and trigonometry in its modern form and showed important role of e (Euler's number, 2.718 28…). Euler developed the use of series solutions, paying due regard to convergence; he solved linear differential calculus."

The Cambridge Dictionary of Scientists (2002)

"No other mathematician has published as much as Euler did. He wrote almost 900 papers, memoirs, books and other works. Of these almost half date from the second St. Petersburg period, when he was almost blind and everything had to be dictated to assistants. It is estimated that of all the pages published on mathematics, mathematical physics, astronomy, and engineering sciences during the last three quarters of the eighteenth century, one third were written by Euler."

Ioan James in *Remarkable Mathematicians: From Euler to von Neuman*

Leonhard Euler was the greatest mathematician of the eighteenth century. His influence on the development of mathematics was not simply restricted to the eighteenth century. The work of many outstanding nineteenth-century mathemati cians arose directly from Euler's work. He made numerous contributions to every branch of mathematics of his time, except probability. His major contributions were in the field of number theory. He founded the branch of mathematics known as graph theory. Euler intro duced the symbols 'e' for the base of natural logs, 'i' for the square root of -1, 'f(x)' for 'f' a function of 'x', etc. The introduction of these symbols led to the systematisation of mathematics. It was Euler, who first represented trigonometric values as ratios. Euler made so many important contributions that the term like "Euler's formula" or "Euler's theorem" may mean different thing depending on the context in which it is used.

Euler's contributions were not confined to the realm of pure mathematics. He made equally important contributions to the area of applied mathematics. Commenting on Euler's contributions to the area of applied mathematics, Ioan Jones wrote: "…Euler was remarkable for the skill with which he applied mathematics to practical problems. For example, he investigated the bending of beams and calculated the safety load of columns. He calculated the perturbative effect of celestial bodies on the orbits of planets. He calculated the paths of projectiles in resisting media. His three volumes on optical instruments contributed to the design of telescopes and microscopes. His work on the design of ships added to navigation. He produced a theory of the tides. Nor were his interests confined to subjects closely related to mathematics; he wrote about chemistry, geography, cartography, and much else."

Euler made significant contributions in optics, mechanics, electricity, and magnetism. He contributed to almost every branch of mechanics – the motion of mass points, celestial mechanics, the mechanics of continuous media, ballistics, acoustics, vibration theory, optics, and ship theory. He was also deeply interested in philosophy. He wrote 234 letters to the Princess of Anhalt-Dessau, the King's niece. The letters together presented a non-technical outline of the main physical theories of the time. They were among the most successful popularisations of sci ence. These letters writ ten during the period 1760-62 were published under the title Lettres a une Princesse d'Allemagne (Letters to a German Princess). Euler's letters to the Princess were translated into many languages.

Euler was the most prolific mathematician of all times. He found time to write over 800 papers in his lifetime. And what is remarkable is that Euler produced much of his work in the last two decades of his life when he was totally blind. His prolific output caused a tremendous problem of backlog.

The St. Petersburg Academy continued publishing his work posthumously for more than 30 years! Euler's complete works fill about 90 volumes. John L. Greenberg wrote in The Oxford Companion to the History of Modern Science: "…Euler was the most productive mathematician of all time. The measure is not the number of papers, for which the current record holder is the Hungarian Paul Erdos, but the number of published pages. Yet productivity was perhaps least important of Euler's claims to mathematical distinction. One of his great contributions was his clarity, in contrast to French math ematicians of the time, who rarely expressed themselves so lucidly.

Euler had a phenomenal memory. He could recite the entire Aeneid word-for-word. The mythological epic Aneid, which tells the story of the seven-year wanderings of Aeneas after the fall of Troy, was composed by Roman poet Virgil (70-19 BC). According to one story narrated by a contemporary French mathematician Condorcet, two students of Euler had independently summed seventeen terms of a complicated infinite series but their results differed at the fiftieth decimal place. This resulted in a minor dispute between the two, which was settled by Euler by re-computing the sum in his head.

Leonhard Euler was born in Basel, Switzerland, on April 15, 1707. His father Paul Euler, a Protestant minister, had studied theology at the University of Basel. As an undergraduate student of the Basel University, Paul Euler, not only attended lectures of Jacob Bernoulli I (1654-1705) but also lived in his house. It was here that he became a friend of Jacob's younger brother, Johann Bernoulli I (1667-1748), who was also an undergraduate student at the university. Euler's mother Margaret Brucker was the daughter of a Protestant minister. When Euler was one year old the family moved to a nearby village named Riehen. Euler spent his childhood at Riehen, where his father was a pastor. His father taught him elementary mathematics along with other subjects. Euler was sent to school at Basel where he lived with his maternal grandmother. The teaching in this school was far from satisfactory. He did not learn any mathematics from the school. However, he studied mathematical texts on his own and he also took some private tuitions. In 1720, Euler entered the Basel University. His father's friend Johann Bernoulli was professor of mathematics at the university. Bernoulli not only recognised Euler's great potential in mathematics but he also helped him develop his interest in the subject. Euler in his unpublished biographical writings wrote: "…I soon found an opportunity to be introduced to a famous professor Johann Bernoulli…True, he was very busy and so refused flatly to give me private lessons; but he gave me much more valuable advice to start reading more difficult mathematical books on my own and to study them as diligently as I could; if I came across some obstacle or difficulty, I was given permission to visit him freely every Sunday afternoon and he kindly explained to me everything I could not understand." Euler graduated in 1722.

Catherine the Great

Following his father's wishes, Euler's joined the faculty of theology. In 1724, Euler obtained his Master's degree in philosophy by writing a thesis comparing the natural philosophy of Descartes with that of Isaac Newton. But soon he realised that he had no interest in theology or subjects like Greek and Hebrew. He sought his father's consent to change to mathematics. He finally got the permission after his father was persuaded by his old friend Johann Bernoulli. Euler completed his mathematical studies at the Basel University in 1726. He studied the works of Varignon, Descartes, Newton, Galileo, van Schooten, Jacob Bernoulli, Hermann, Taylor and Wallis. In July 1726 he was offered a teaching assignment by St. Petersburg Academy of Sciences founded by Catherine I, the wife of Peter the Great. He was to teach applications of mathematics and physics to physiology. The post that was offered to Euler had become vacant after the death of Nicolas (II) Bernoulli. Euler did not accept the offer immediately. And even when he finally accepted it in November 1726 he was not prepared to travel to Russia until the spring of the following year. There were reasons for his delay. He needed time to prepare himself to study the topics of his teaching as-signment. They were new to him. He was also hoping to get the vacant post of the professor of physics at the University of Basel. To strengthen his claim for this post he wrote a treatise on acoustics, which became a classic on the subject. When Euler was not selected for the post at the Basel University, he finally decided to take up the assignment at St Petersburg Academy. He reached St Petersburg on 17 May 1727. He was appointed to the mathematical-physical division of the Academy rather than to the physiology post he had originally been offered. This was possible because of the recommendation of Daniel Bernoulli and Jakob Hermann. Euler served as a medical lieutenant in the Russian Navy from 1727 to 1730. When Daniell Bernoulli returned to Basel in 1733, the senior chair in mathematics at the academy held by him was offered to Euler. With this appointment Euler's financial situation improved considerably. In 1735, Euler was appointed Director of the Academy's geographic section. His task was to help the French astronomer Joseph Nicholas Delisle (1688-1768) in preparing a map of the whole Russian Empire. The result of this collaboration was the Russian Atlas, which first appeared in 1745. It consisted of 20 maps.

Euler's first stint with the St. Petersburg Academy continued for 14 years. He was mainly engaged in

mathematical research. During his first period of stay he completed about 90 works for publication. He also solved the problems of seven bridges of Konigsberg, which dated from 1736. This led to the establishment of a new branch of mathematics called graph theory. In his treatise Mechanica written during 1736-37, Euler for the first time presented Newtonian dynamics in the form of mathematical analysis. He regularly entered for the annual prize given by the Paris Academy. He won the award 12 times and thus made a record, which even surpassed that of Daniel Bernoulli. He also helped the Russian government by solving many practical problems brought to his attention. He also wrote elementary and advanced mathematical textbooks for use in school. It was during this period that Euler lost sight of his right eye. It is said that his loss of eyesight was due to looking at the Sun accidentally during astronomical studies.

Pierre Louis Moreau de Maupertuis

Frederick the Great

Euler had no intention of leaving St Petersburg. However, political turmoil in Russia made it difficult for foreigners to stay there. Anna Ivanovna's reign (1730-40) was one of the bloodiest in Russian history. The situation was little better after the death of Ivanovna, but by that time Euler had made up his mind for leaving Russia. He accepted the invitation of the King of Prussia Frederick II (1712-1786), who was planning to establish an Academy of Science replacing the Society of Sciences. Under the political and military leadership of Frederick II, also known as Frederick the Great, Prussia doubled its size and became a major European power. Euler arrived at Berlin on 25 July 1741. The Berlin Academy was established in 1744 with French mathematician Pierre Louis Moreau de Maupertuis (1698-1759) as the President. Euler was appointed as Director of Mathematics. He undertook wide-ranging duties at the Academy. "…he supervised the observatory and the botanical gardens; selected the personnel; oversaw various financial matters; and, in particular, managed the publication of various calendars and geographical maps, the sale of which was a source of revenue for the Academy. The King also entrusted Euler with solving practical problems, such as the project in 1749 of correcting the level of the Finow Canal. At that time he also supervised the work on pumps and pipes of the hydraulic system at Sans Souci, the Royal summer residence." In addition to these duties he served on the committee of the Academy dealing with the library and of scientific publications. After the death of Maupertuis in 1759, Euler assumed the leadership of the Berlin Academy. However, he was not given the title of President. The King was in overall charge of the Academy. In 1763, the Presidency of the Academy was offered to Jean d'Alembert (1717- 1783). Euler did not like this. There was too much French influence in the activities of the Berlin Academy. The members of the Berlin Academy were required to speak and write in French at the instance of Frederick II. However, he could not do much because by that time he had fallen out of favour of the King, who had no interest in Euler's mathematics. Though d'Alembert refused to accept the offer Euler's position did not improve. The King continued to interfering with the running of the Academy. As a result Euler decided to leave Berlin. During his 25 years' stay in Berlin Euler wrote 380 papers and books on a number of topics like calculus of variations, calculation of planetary orbits, artillery and ballistics, analysis, shipbuilding and navigation, motion of the Moon and others.

In 1766, Euler returned to St Petersburg at the invitation by Catherine II, the Great and stayed there till his death. He became the Director of the St. Petersburg Academy. Soon after his arrival in Russia he went completely blind. However, he continued his work on optics, algebra, and lunar motion. This he could do because of his remarkable memory. He produced almost half of his total works after he lost his eyesight.

Voltaire

Denis Diderot

Euler was very much interested in philosophy. However, his understanding of the subject was very limited. This did not deter him to get him engaged in philosophical debates, particularly with Voltaire (1694-1778), the French writer, philosopher and historian and who is regarded as the embodiment of the 18th century enlightenment in Europe. Voltair 's real name was Francois Marie Arouet. In these debates Euler often blundered to the amusement of the audience. There was an interesting episode about his philosophical debates. While he was in Russia for the second time, the Russian Czarina Catherine the Great invited to her court the French philosopher and writer Denis Diderot (1713-84). Diderot attempted to convert the Czarina's subjects to aetheism. The Czarina did not like this and so she asked Euler to quiet Diderot. One day in

the court Diderot was informed that someone has proved mathematically the existence of god. Diderot, who had no knowledge in mathematics, wanted to know more about it. Euler then stated: "Sir, a+bn /n = x, hence God exists; reply." Diderot had no idea of what Euler was talking about but he could realise by hearing the laughter in the court that he was made a fool. Afterwards he did not stay long in Russia.

While in Prussia (the former state and kingdom in Germany, its capital was Berlin), Euler's home was destroyed by the Russian army invading Prussia. However, as he was held in very high esteem in both Russia and Prussia, his loss was promptly compensated.

Euler did not have many disciples of his own. However, as French mathematician Pierre-Simon Laplace (1749-1827) said, Euler was considered as the teacher of all mathematicians of his time.

Euler died on 18 September 1783. Even on the last day of his life Euler worked as per his normal routine. He gave mathematics lesson to one of his grandchildren. He made some calculations with chalk on two boards on the motion of balloons. He discussed with others the planet Uranus, which was discovered in 1781 by the English astronomer William Herschel. About five o'clock in the afternoon he suffered a brain haemorrhage and died about eleven o'clock at night.

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(This is the abridged version of article by Dr. S. Mahanti appeared in the April, 2006 issue of 'Dream 2047')

Continued from page 3 (Satyendra Nath Bose)

Planks conditions ran counter to the classical idea. Plank was aware of the difficulties but he had never been able to resolve them. He wanted to reconcile his theory with the classical theory. However, Bose solved the problem in a different way, which ultimately laid the foundation of quantum statistics.

Bose was appointed as Professor at Dacca University in 1926 and he remained in the university till 1945. He returned to Calcutta in 1945 to become the Professor of Physics in Calcutta University which he continued till 1956. He was appointed National Professor in 1958. He held this position until his death 16 years later. In his later years he became actively interested in popularisation of science and wrote about science in Bengali. He was made a Fellow of Royal Society of London in 1958. He was a Foundation Fellow of the National Science Academy (1935). In 1986, as a tribute to Satyendra Nath Bose, the Department of Science and Technology, Government of India established the Satyandra Nath Bose National Centre for Basic Science in Calcutta.

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Particle accelerator

Physicists use particle accelerators to study the nature of matter and energy. Accelerators accelerate charged particles (ions) through an electric field in a hollow, evacuated tube, eventually colliding each ion with a stationary target or another moving particle. When charged particles colloid with each other at extremely high speed, sub atomic particles are produced. Scientists analyze the results of the collisions, and try to understand the interactions governing the subatomic world. The paths of the accelerating particles may be straight, spiral, or circular. Cyclotron use spiral path and the synchrotron use circular path. Both has increasingly strong magnetic field. Particle accelerators have enabled scientists to learn more about the subatomic world. Large Hadron Collider (LHC) is an example of particle accelerator.

If you want to know more about Vigyan Prasar, its publications & software, besides the next moves of VIPNET Science Clubs, please write to us at the address given below:-

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जॉन नेपियर
लघुगणक का आविष्कारक

''(जॉन नेपियर) ऐसे व्यक्ति हुए हैं, जो इस देश की धरती पर जन्मे किसी भी अन्य व्यक्ति की तुलना में महापुरुष की उपाधि के लिए सर्वथा योग्य हैं।''

– स्कॉटलैंड के बुद्धिजीवी डेविड फ्लूम

जॉन नेपियर गणितज्ञ, भौतिकीविद एवं खगोलविद होने के साथ-साथ दार्शनिक और आविष्कारक भी थे। वह प्रमुख रूप से लघुगणक के आविष्कारक तथा दशमलव बिंदु को प्रचलित करने वाले के रूप में याद किए जाते हैं। उन्होंने संख्यांकित दंडों का उपयोग करते हुए 'नेपियर हड्डियां' के नाम से मशहूर गुणन-उपकरण को ईजाद किया। यह युक्ति गुणा तथा भाग देने के काम आती है तथा इसका प्रयोग करके वर्गमूल और घनमूल प्राप्त किए जा सकते हैं। नेपियर अपने जीवन काल में प्रोटस्टंट धर्म-विज्ञान के उत्कृष्ट ग्रंथ के रचियता के रूप में जाने जाते थे। लैटिन में रचित 'प्लेन डिस्कवरी ऑफ द होल रेवेलेशन ऑफ सेंट जॉन (सेंट जॉन के संपूर्ण रहस्योद्घाटन की सुस्पष्ट खोज)' नामक यह ग्रंथ 1593 में प्रकाशित हुआ। इस पुस्तक के अनेक संस्करण निकले तथा यह अंग्रेजी, डच, फ्रांसीसी तथा जर्मन भाषाओं में अनूदित हुई। नेपियर ने युद्ध में काम आने वाले अनेक इंजनों और यंत्रोपकरणों का आविष्कार किया जिनमें स्पेन के फिलिप द्वितीय के खिलाफ़ लड़े गए युद्ध में प्रयुक्त आदिम टैंक भी शामिल है। नेपियर की ज्योतिष एवं भविष्यकथन में दृढ़ आस्था थी। प्रोटस्टंट मत के प्रखर अनुयाई होने के साथ वह राजनीति में भी काफी सक्रिय रहे। दिलचस्प बात यह है कि नेपियर का नाम उनके समय में विभिन्न वर्तनियों में लिखा जाता रहा, जैसे नापेर, नेपेयर, नेपेर, नेपर, नापर, नाइप्पर आदि। सबसे ज़्यादा रोचक बात तो यह है कि उनके नाम का वर्तमान रूप उनके जीवन काल में कभी व्यवहृत नहीं हुआ। उन दिनों उनका नाम जोहने (जॉन की पुरानी वर्तनी) लिखा जाता था। उनका उपनाम था मार्वेलस मेर्किस्टन (मेर्किस्टन का चमत्कारी पुरुष)।

जॉन नेपियर का जन्म स्कॉटलैंड स्थित एडिनबर्ग के मेर्किस्टन कैसल में 1550 में हुआ था। उनके जन्म की तिथि और महीना ज्ञात नहीं हैं। वर्तमान में उनका जन्म-स्थान नेपियर विश्वविद्यालय का एक हिस्सा है। उनके पिता सर आर्चिबाल्ड नेपियर सोलहवीं सदी उत्तर-स्कॉटलैंड के एक अहम लोक शख्सियत थे। वह न्यायाधीश के पद पर प्रतिनियुक्त थे और 1565 में उन्हें 'सर' की उपाधि से अलंकृत किया गया था। सन् 1582 में वह टकसाल के अध्यक्ष (मास्टर) नियुक्त हुए। जॉन नेपियर की मां जानेट नेपियर (विवाह पूर्व बोथवेल) ऑरनी के बिशप की बहन थीं।

जॉन नेपियर के बचपन के विषय में अधिक विवरण उपलब्ध नहीं हैं। सन् 1563 में वह सेंट एंड्रयूज़ विश्वविद्यालय के सेंट साल्वेटोर कालेज में दाखिल हुए। अपनी स्नातक की पढ़ाई पूरी होने तक नेपियर एंड्रयूज़ विश्वविद्यालय में टिके नहीं रहे और वह फ्रांस तथा यूरोप के अन्य देशों की सैर को निकल गए। इसका कोई ठीक-ठीक सबूत नहीं मिलता कि उन्होंने कहां पढ़ाई की थी। सन् 1571 में स्कॉटलैंड लौटने पर उन्होंने देखा कि देश की राजधानी में गृहयुद्ध छिड़ा हुआ है। एक तरफ़ महारानी मेरी की फौज थी जो सत्ता पर पुन: कब्जा करना चाहती थी और दूसरी तरफ़ रानी के युवा पुत्र का प्रतिशासक (रीजेंट) था जो प्रोटस्टंट सुधारवादी चर्च को कायम रखने के लिए प्रतिबद्ध था। नेपियर के पिता एडिनबर्ग के महल में रानी के रीजेंट के सैन्य बल द्वारा बंदी बनाए गए।

सन् 1572 में नेपियर परिवार की अधिकांश संपत्ति जॉन नेपियर के नाम कर दी गई। इसके पश्चात नेपियर ने गार्टनेस में अपने नई भूसंपत्ति (इस्टेट) के निर्माण की योजना बनाई जो 1574 में पूरी हुई। नेपियर ने इस इस्टेट के संचालन कार्य में स्वयं को समर्पित कर दिया था। उन्होंने खेती में सुधार लाने के लिए अनेक युक्तियां खोज निकालीं। आमतौर पर यही माना जाता है कि नेपियर ने लघुगणक पर अपना अधिकतर कार्य गार्टनेस इस्टेट में रहते हुए ही अंजाम दिया था।

नेपियर ने अपने सुप्रसिद्ध आविष्कार लघुगणक का वर्णन 1614 में प्रकाशित मिरिफिसी लॉगारिथ्मोरियम कैनोनिस डिसक्रिप्टियो (लघुगणक के चमत्कारी सूत्रों का वर्णन) नामक कृति में किया है। इस पुस्तक के 37 पृष्ठों में व्याख्यात्मक सामग्री तथा 90 पृष्ठों में सारणियां संग्रहीत हैं। लैटिन में इसके प्रकाशन के दो साल बाद इसका अंग्रेज़ी रूपांतर प्रकाशित हुआ। यह अंग्रेज़ी अनुवाद एडवर्ड राइट द्वारा किया गया था। इस अद्भुत ग्रंथ में परिकलनों को सरलीकृत रूप में सूत्रबद्ध किया गया है। गणितीय मूलों के अपने गहन अध्ययन के कारण ही नेपियर लघुगणक के सिद्धांत को विकसित करने में सफल हुए। उन्होंने सारणियों के परिकलन में अपने जीवन के 20 वर्ष बिताए थे। लघुगणक पर उनका काम 1594 में शुरू हुआ और 1614 में जाकर समाप्त हुआ।

'लॉगारिथ्म' (लघुगणक) शब्द भी नेपियर ने ही गढ़ा था। यह शब्द यूनानी भाषा के दो शब्दों लॉगोज़ यानी 'अनुपात' या 'माप' और 'अरिथ्मज़' यानी 'संख्या' से व्युत्पन्न हुआ है। लघुगणक की सहायता से जोड़ और घटाने की संक्रियाओं द्वारा गुणा और भाग करना सुगम हो गया। डिस्प्रिप्शन आफॅ द मार्वेलस कैनन आफॅ लागारिथ्म्स (लघुगणक के चमत्कारी सूत्रों का वर्णन) की प्रस्तावना में स्वयं नेपियर लिखते हैं, "लघुगणक के ये सूत्र परिकलन में जुटे व्यक्तियों के काफी समय की बचत करेंगे और उन्हें अपनी चूक द्वारा हुई अनेक त्रुटियों से बचाएंगे।'' नेपियर इसी प्रस्तावना में आगे लिखते हैं, ''यह देखकर कि गणितीय प्रक्रिया से गुजरते हुए गणना करने वाले लोगों के सामने उठ रही कष्टप्रद एवं पीड़ादायक बात, उनके मार्ग में बाधा डालने वाली विकट समस्या, बड़ी-बड़ी संख्याओं के गुणा-भाग करने तथा उनके वर्गमूल और घनमूल निकालने के अलावा और कोई नहीं है... इसीलिए मैंने अपने मन में यह सोचना शुरू किया कि किस दक्ष एवं स्वयंसिद्ध कला के माध्यम से मैं इन बाधाओं को दूर कर सकूं।" लघुगणक पर नेपियर की अगली कृति मिरिफिसी लॉगोरिथ्मोरियम कैनोनिस कंस्ट्रक्टियो

(लघुगणक के चमत्कारी सूत्रों की संरचना) उनके निधन के बाद 1619 में प्रकाशित हुई।

नेपियर के आविष्कार के महत्त्व का अनुमान इस तथ्य से लगाया जा सकता है कि जोहान्नस केपलर को केवल मंगल की कक्षा का परिकलन करने में चार साल लग गए और यदि उन्हें नेपियर के लघुगणक के ये सूत्र नहीं मिले होते तो अपना शेष कार्य पूरा करने में उन्हें अपने जीवन-काल से भी अधिक समय लगाना पड़ता। अत: नेपियर के लघुगणक सूत्रों के अभाव में केप्लर के लिए निश्चित रूप से ग्रह गतियों के नियम पर 1609 में अपनी पुस्तक का प्रकाशन करना संभव नहीं हुआ होता। केप्लर ने 1619 में नेपियर को अपना हार्दिक आभार व्यक्त करते हुए पत्र लिखा था। लेकिन उन्हें पता नहीं था कि स्कॉटलैंड की इस महान प्रतिभा का दो वर्ष पूर्व ही निधन हो चुका था। वह केप्लर ही थे जो यूरोप के एक विशाल जनसमुदाय को लघुगणक से परिचित कराने के लिए जिम्मेदार थे।

जोहान्नस केपलर

यहां पर यह भी उल्लेखनीय है कि स्विट्ज़रलैंड के जे. बर्जी (1552-1632) ने स्वतंत्र रूप से लघुगणक की अवधारणा उसी समय विकसित कर ली थी जब नेपियर ने इसका ईजाद किया था, परंतु बर्जी का कार्य 1620 के बाद ही प्रकाशित हो पाया था।

नेपियर की पद्धति में प्राकृतिक लघुगणक आधार 'ई' का प्रयोग हुआ है। ब्रिटिश गणितज्ञ हेनरी ब्रिग्ज (1561-1630) के सुझाव पर लघुगणक आधार 10 (जिसे सामान्य अथवा ब्रिग्जी लघुगणक के नाम से जाना जाता है) को बाद में अपनाया गया। नेपियर की पुस्तक के लैटिन संस्करण को पढ़ने के बाद ब्रिग्ज ने अपने एक मित्र को लिखा, "मेर्किस्टन के लॉर्ड नेप्पर ने अपने नूतन एवं सराहनीय लघुगणक सूत्रों से मेरे मस्तिष्क में नई रोशनी पैदा की और मेरे हाथों को नई गति प्रदान की। यदि ईश्वर की इच्छा हुई तो मैं इस ग्रीष्मावकाश में उनसे मिलने की आशा करता हूं क्योंकि इतनी अधिक प्रसन्नता देने या विस्मयविमुग्ध करने वाली पुस्तक मैंने इससे पहले कभी नहीं देखी थी।" जैसा कि ब्रिग्ज ने अपने मित्र को लिखा था, 1615 की ग्रीष्म ऋतु में वह नेपियर से नहीं मिल पाए। नेपियर से मिलने के लिए ब्रिग्स लंदन से एडिनबर्ग की कठिन यात्रा पर निकल पड़े। आज हमें आश्चर्य हो सकता है कि वह यात्रा क्यों इतनी कष्टप्रद रही होगी जबकि लंदन से एडिनबर्ग महज़ चार घंटे में पहुंचा जा सकता है। उन दिनों घोड़ों से खींची जाने वाली बग्घी में यह यात्रा चार दिनों में पूरी होती थी। ब्रिग्ज़ ने अपना संवाद इन शब्दों से शुरू किया, "श्रीमानजी, इतनी लंबी यात्रा मैंने जानबूझकर इसलिए तय की है कि आप का दर्शन-लाभ पा सकूं तथा यह जान सकूं कि वह कौन-सा नवाचारपूर्ण बुद्धि-विलास था जिससे प्रेरित होकर खगोलिकी में सर्वाधिक सहायक इस मौलिक खोज यानी लघुगणक के आविष्कार में प्रवृत्त होने का आपके मन में सबसे पहले विचार कौंधा।" एडिनबर्ग पहुचने से पहले ही ब्रिग्ज नेपियर को इस सुझाव के साथ पत्र लिख चुके थे कि लघुगणक का आधार 10 होना चाहिए। मुलाकात के दौरान ब्रिग्ज ने इस सुझाव को दोहराया कि नए लघुगणक की सारणियां 10 को आधार मानकर तथा लॉग 1 को शून्य मानकर तैयार की जानी चाहिए। कहा जाता है कि इसके उत्तर में नेपियर ने ब्रिग्ज को बताया था कि लघुगणक का आधार ई मानकर सारणियां तैयार करते हुए मेरे मन में भी यही विचार आया था परंतु "...कुछ तो अपनी शारीरिक अस्वस्थता और फिर नए सिरे से सारणियों को तैयार करने में बाधक कुछ अन्य बड़े कारणों से मैं इसे अंजाम नहीं दे सका।" ब्रिग्ज़ ने ऐसी सारणियां तैयार की। सन् 1624 में उन्होंने अपनी कृति अरिथ्मेटिका लॉगॉरिथ्मिका (लघुगणक का अंकगणित) प्रकाशित की। इस पुस्तक में ब्रिग्ज ने 'मैन्टीसा' (अपूर्णांश) एवं 'कैरक्टॅरिस्टिक' (अभिलक्षण) जैसे शब्दों का पहली बार प्रयोग किया था।

हेनरी ब्रिग्ज

नेपियर ने परिकलनों को सरल बनाने के लिए एक यांत्रिक विधि का विकास किया था। उनके द्वारा विकसित विधि को 'नेपियर की हड्डियां' नाम दिया गया और परिकलन के लिए उन्होंने संख्यांकित 'नम्बरिंग राड्स' का उपयोग किया था। नेपियर ने हाथीदांत की बनी छड़ों का इस्तेमाल किया जो स्वाभाविक रूप से हड्डियों जैसी दिखती थीं। तभी नेपियर की युक्ति को नेपियर की हड्डियों का नाम दिया गया। उन्होंने अपने परिकलनों के सरलीकरण की पद्धति को 1617 में अपनी कृति राडोलॉजिए, सियु न्यूमरेशॅनिस पर विरगुलॅस लिब्रि डुओ (स्टडी आफॅ डिवाइनिंग रॉड्स ऑर टू बुक्स आफॅ नम्बरिंग बाई मीन्स ऑफ रॉड्स) में प्रकाशित किया।

यहां यह गौरतलब है कि नेपियर ने शौकिया ही गणित का अध्ययन किया था। लघुगणक की खोज के अलावा नेपियर ने गणित में अन्य अनेक योगदान दिए थे। नेपियर ने ही पहले-पहल भिन्न संख्याओं के लिए दशमलव संकेतन पद्धति का प्रयोग किया था। उनके गणितीय अवदानों में त्रिकोणों के हल में प्रयुक्त स्मृति-सहायक सूत्र तथा 'नेपियर सादृश्य' नामक दो अन्य सूत्र सम्मिलित हैं। उन्होंने त्रिकोणमितीय फलनों के लिए चरघातांकी व्यंजक ज्ञात किए थे। उन्होंने एक जगह स्वयं उल्लेख किया है कि धर्मशास्त्र-संबंधी कार्यों में व्यस्तता के कारण उनके लिए गणितीय परिकलनों के लिए समय निकालना दूभर हो रहा है। नेपियर की खोज के आधार पर 1630 के दशक में परिकलन-पट्टिकाएं (स्लाइड रूल्स) बनाई गईं। गुणा और भाग की संक्रियाओं को संपन्न करने में सहायक स्लाइड रूल एक गणितीय उपकरण है। इसमें एक पट्टिका होती है जो एक दूसरी पट्टिका में बने खांचे से होकर सरकती है। दोनों ही पट्टिकाओं पर लघुगणक पैमाना (स्केल) अंकित होता है ताकि पट्टिका की लंबाइयों के सहारे लघुगणकों को प्रभावी ढंग से जोड़ और घटा कर गुणफल और भागफल का परिकलन किया जा सके। लंबे अंकगणितीय एवं त्रिकोणमितीय परिकलनों को अंजाम देने में भी परिकलन पट्टिका काम आती है। इसके लिए पट्टिकाओं को एक-दूसरे पर सरकाना पड़ता है। गति, परिशुद्धता एवं सुवाह्यता के अपने गुणों के चलते परिकलन पट्टिकाएं 1970 के दशक तक उपयोग में रहीं।

नेपियर को उनके पड़ोसी एक जादूगर तथा "स्याह ताकतों के साथ गठबंधन रखने वाला" व्यक्ति मानते थे। उनकी इस धारणा को दूर करने का नेपियर ने कोई प्रयत्न नहीं किया, उल्टे उन्होंने तो इसे प्रोत्साहित ही किया। वे जहां भी जाते अपने साथ एक छोटी ढिबिया में काली मकड़ी और एक पालतू काले मुर्गे को ले जाते। जादूगर के रूप में उनकी ख्याति को

सिद्ध करने वाली कुछ घटनाएं भी हुई थीं। उनमें से एक घटना उनके इस्टेट के नौकरों में से कौन-सा नौकर चोरी कर रहा है, इसकी पहचान करने में उनकी दक्षता से संबंधित है। इसके लिए वह अपने पालतू मुर्गे का प्रयोग करते। चोर की पहचान करने के लिए वे संदिग्ध नौकरों को अपने काले मुर्गे के साथ एक कमरे में बंद कर देते और उन्हें मुर्गे को अपने हाथ से पकड़ने का आदेश देते। जब यह प्रक्रिया पूरी हो जाती तो अपराधी की पहचान करने में नेपियर को कोई भी दिक्कत नहीं होती। दरअसल, इसमें किसी भी अलौकिक शक्ति का हाथ नहीं था। नेपियर अपने मुर्गे के बदन पर लकड़ी का कोयला मल देते थे। जो नौकर निरपराध होते वे बेहिचक मुर्गे को अपने हाथ से पकड़ लेते। लेकिन अपराधी उसे पकड़ने का बहाना मात्र करता। इसलिए नौकरों के हाथों का निरीक्षण करके नेपियर बता देते कि अपराधी कौन है क्योंकि साफ हाथों वाला ही चोर होता।

एक अन्य घटना नेपियर के एक पड़ोसी से संबंध रखती है। इस पड़ोसी के कबूतर नेपियर के खेतों से अनाज चुगते पाए गए थे। नेपियर ने अपने पड़ोसी को धमकी दी कि आइंदा जो भी कबूतर उनके खेत से अनाज चुगता पाया जाएगा वह उसे पकड़कर रख लेंगे। नेपियर के पड़ोसी ने इस धमकी को गंभीरतापूर्वक नहीं लिया। उसने नेपियर का उपहास उड़ाते हुए कहा, ''खुशी से रख लेना यदि तुम उन्हें पकड़ सको।'' अगले दिन सुबह लोगों ने देखा कि नेपियर के नौकर सैकड़ों आधे बेहोश हुए कबूतरों को बोरियों में भर रहे हैं। उन्हें विश्वास हो गया कि नेपियर ने उन कबूतरों पर जादू-टोना कर दिया है। लेकिन इसमें किसी जादूगरी या टोने-टोटके का इस्तेमाल नहीं हुआ था। नेपियर ने तो बस ब्रांडी में भिगोए मटर के दाने बिखेर दिए थे और इन दानों को खाकर कबूतरों को नशा चढ़ गया था जिसके कारण वे उड़ नहीं पाए थे।

नेपियर ने जादू टोने के सहारे फस्ट कैसल में छिपे खजाने को ढूंढ़ निकालने के लिए रेस्टेलरिग के रॉबर्ट लॉगन के साथ एक करार किया था। इस करार के नतीजे के बारे में कोई जानकारी उपलब्ध नहीं है। लोगों का ऐसा विश्वास था कि नेपियर कीमियागिरी और प्रेतसिद्धि (भूत-प्रेत बुलाने) आदि कार्यों में लिप्त थे। उन दिनों वैज्ञानिक प्रतिभा से संपन्न व्यक्तियों पर टोना-टोटका करने और प्रेतविद्या के प्रयोग का लांछन लगाया जाना कोई असामान्य बात नहीं थी।

नेपियर ने स्कॉटलैंड के इतिहास में सर्वाधिक अशांतिपूर्ण काल को जिया था। हालांकि नेपियर के गणितीय कार्य ही उनकी ख्याति का दारोमदार थे, एक आधुनिक युग के गणितज्ञ से उनकी छवि सर्वथा भिन्न थी। उत्तर-पुनर्जागरण युग के व्यक्ति होने के कारण नेपियर की पार्श्विक चिंतन-शक्ति उन्हें खेती में सुधार से लेकर युद्ध में काम आने वाले इंजनों के निर्माण तक अनेकानेक कार्यों में संलग्न रखती थी। नेपियर का निधन 3 अप्रैल 1617 को हुआ और उन्हें सेंट जाइल्स गिरजाघर में दफनाया गया। चंद्रमा पर एक क्रेटर का नामकरण उनके नाम पर हुआ है। वह नेपियर क्रेटर कहलाता है।

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(यह लेख पहले ड्रीम 2047 के जुलाई 2008 अंक में प्रकाशित हुआ है। विपनेट में इस लेख को राष्ट्रीय गणितीय वर्ष के अन्तर्गत पुनः प्रकाशित किया जा रहा है।)

Regional Workshop for VIPNET Club

S. No.	Workshop Station	Region	Dates	Venue/Host Institutions	Last date for receipt of completed registration form
1.	Ahmedabad	Western States (Maharashtra, Goa, Daman, Dadar & Nagar Hevali, Gujarat, Rajasthan,)	20-22 Aug., 2012	Gujarat Council of Science City, Ahmedabad.	15th August, 2012
2.	Gwalior	Central and Eastern States (M.P., Odisha, Jharkhand, Bihar, Chhattisgarh)	3-5 Sep., 2012	Yuva Vigyan Parishad, Gwalior.	15th Aug., 2012
3.	Guwahati	North East State & West Bengal (W.B., Assam, Mizoram, Nagaland, Tripura, Sikkim, Meghalaya, Arunachal Pradesh)	11-13 Sep., 2012	Assam Science Technology & Environment Council, Guwahati	15th August, 2012
4.	Chennai	Southern States (A.P., Karnataka, Tamil Nadu, Kerala, Lakshadweep, Andaman and Nicobar, Pondicheery)	9-11 Oct., 2012	Tamil Nadu State Council on Science & Technology, Coimbatore	15th August, 2012
5.	Dehradun	North States (Delhi, Haryana, H.P., J&K, Punjab, U.P., Uttarakhand, Chandigarh)	15-17 Oct., 2012	Uttarakhand State Council for Science & Technology, Dehradun	30th August, 2012

चित्र पहेली–73 / Photo Quiz-73

Brain Teaser / जुगत लगाओं

- Coins on the table
- Monu put some coins on the table.
- One half of them were tails up.
- Monu turned over two of the coins, and then.
- One third of them were tails up.

How many coins did Monu put on the table?

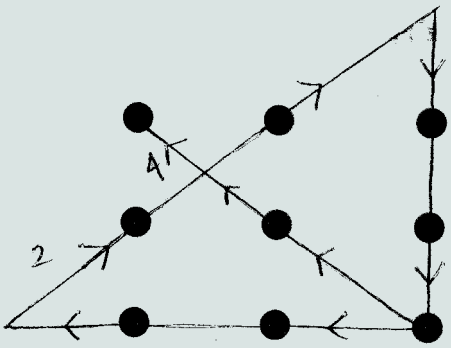
- मेज पर सिक्के
- मोनू ने 10 पैसे के सिक्के मेज पर रखे।
- आधे सिक्के का टेल ऊपर था।
- मोनू ने दो सिक्के को बदला और
- इसके बाद एक तिहाई सिक्के का टेल ऊपर हो गया।

अब बताइए कि मोनू ने कितने सिक्के को मेज पर रखा?

- उत्तर प्राप्त करने की अंतिम तिथि: 15, सितम्बर, 2012
- Last date of receiving correct entries: 15 August, 2012

अपने जवाब इस पते पर भेंजे	Send Quiz Answer to desk
विपनेट चित्र पहेली –73 **विज्ञान प्रसार** **ए-50, सेक्टर-62,** **नोएडा-201 309 (उ.प्र.)**	**VIPNET Photo Quiz 73,** **VIGYAN PRASAR** A-50, Sector-62, NOIDA-201 309 UP

Correct Answer of Photo Quiz 68

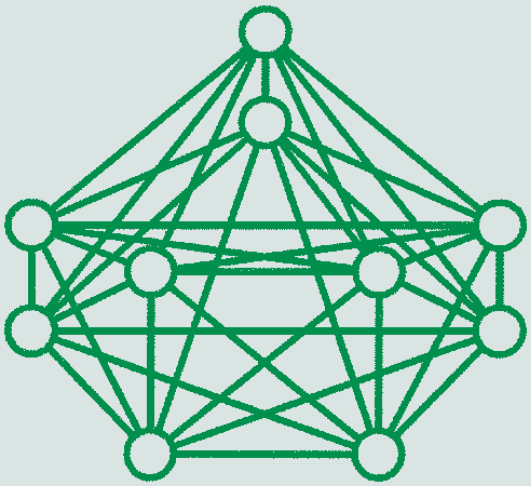


Name of the Winners

1. Debmalya Gharai (West Bengal)

Mathemitical Puzzle 27

- the numbers 0 to 9 in the circless so that no two consecutive numbers are connected by a straight line.



- गोलाकृत में 0 से 9 तक के अंकों को इस तरह से व्यवस्थित कीजिए, कि कोई भी लगातार आने वाले दो अंक सीधी रेखा में न हो।

■ R. K. Upadhyay
rkupadhyay@vigyanprasar.gov.in

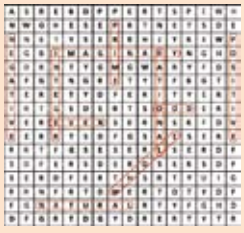
- Last date of receiving correct entries: 15 Sep., 2012.
- Winners will get activity kit/ books as a prize.

Please send your entries to:-

Mathematical Puzzle-25 , VIPNET News,
Vigyan Prasar
A-50, Sector 62,
Noida-201 309 (U.P.)

The puzzle has been Designed as part of
National Mathematical Year-2012

Chemicals Terminology Puzzle- 23



Name of the winners:

1. E. Socraties (Tamil Nadu)
2. Vipin Joshi (Sagar, M.P.)
3. G.S. Gavai (Maharashtra)

Club speak

चन्द्रग्रहण के रोचक तथ्य

कल्पना साइंस क्लब, सीतामढ़ी बिहार द्वारा दिनांक 28-01-2012 को चन्द्रग्रहण के बारे में लोगों को रोचक जानकारी दी गई। इस कार्यक्रम में सभी सदस्य, छोटे बच्चे तथा बुजुर्गो ने भाग लिया। काल्पनिक रुप से एक बच्चे को सूर्य, दूसरे को चाँद और तीसरे बच्चे को पृथ्वी मानकर चन्द्रग्रहण के बारे में गतिविधि करके बताया गया। सभी को बताया गया

कि सूर्य की परिक्रमा पृथ्वी करती है, तथा पृथ्वी की परिक्रमा चाँद करता है। जब चाँद और सूर्य के बीच पृथ्वी आ जाती है तब चन्द्रग्रहण होता है। इस कार्यक्रम में बहुत से बच्चों ने कई प्रश्न पूछे जिनके रोचक तथा वैज्ञानिक ढंग से समझाया गया।

*****

क्लब द्वारा विज्ञान पत्रिका का विमोचन

आर्यभट्ट विज्ञान क्लब सरकण्डा, विलासपुर द्वारा 28 फरवरी, 2012 को विज्ञान दिवस मनाया गया। इस कार्यक्रम में विज्ञान प्रदर्शनी विभिन्न वैज्ञानिक प्रयोग आदि का आयोजन करके छात्रों को विज्ञान संबंधी सामान्य ज्ञान व सामान्य अध्ययन के बारे में जानकारी दी गई।

पूरे सत्र छात्रों ने विज्ञान संबंधी लेख व रोचक जानकारी हाथों से लिखकर संकलित किया। पत्रिका का विमोचन संस्था प्राचार्य अनिल तिवारी द्वारा किया गया।

कार्यक्रम के अंत में सी.वी.रमन प्रभाव पर प्रकाश डाला व अनेक छात्रों से गणित से संबंधित प्रश्न पूछे गए व उनकी जिज्ञासा का समाधान किया गया।

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Earth Day 'April 22, 2012

The Kalpna Chawla Science Club, ZPPSS, Venkatpur, Distt. Warangal organized science exhibition during science fair (INSPIRED) in the month of August, 2011 on eradication of

plastic wastage as well as recycling of plastic material used in roads & agriculture sector. During this programme two members of the culb received INSPIRED award were also invited.

*****

Sky Watching Programme

Blackbody Science Club, Mysori organised a sky watching programme on February 28. 2012 on the occasion of National Science Day. During the sky watch, participants were shown some constellation and planets like Jupiter, Venus & Mars. Watching Star and planets through telescope was a unique expernce for all the participants.

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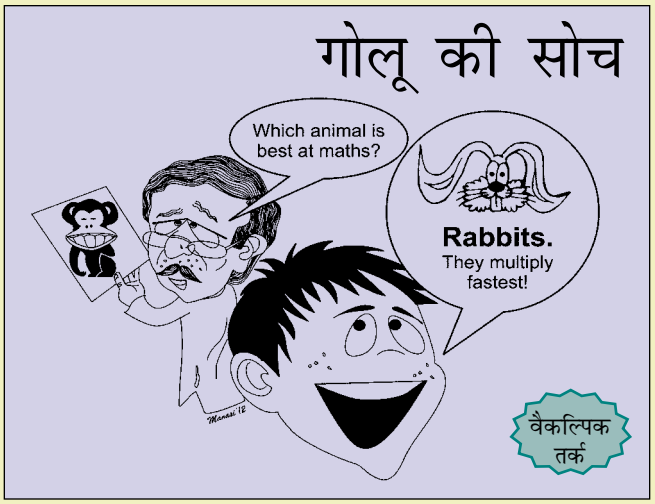

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