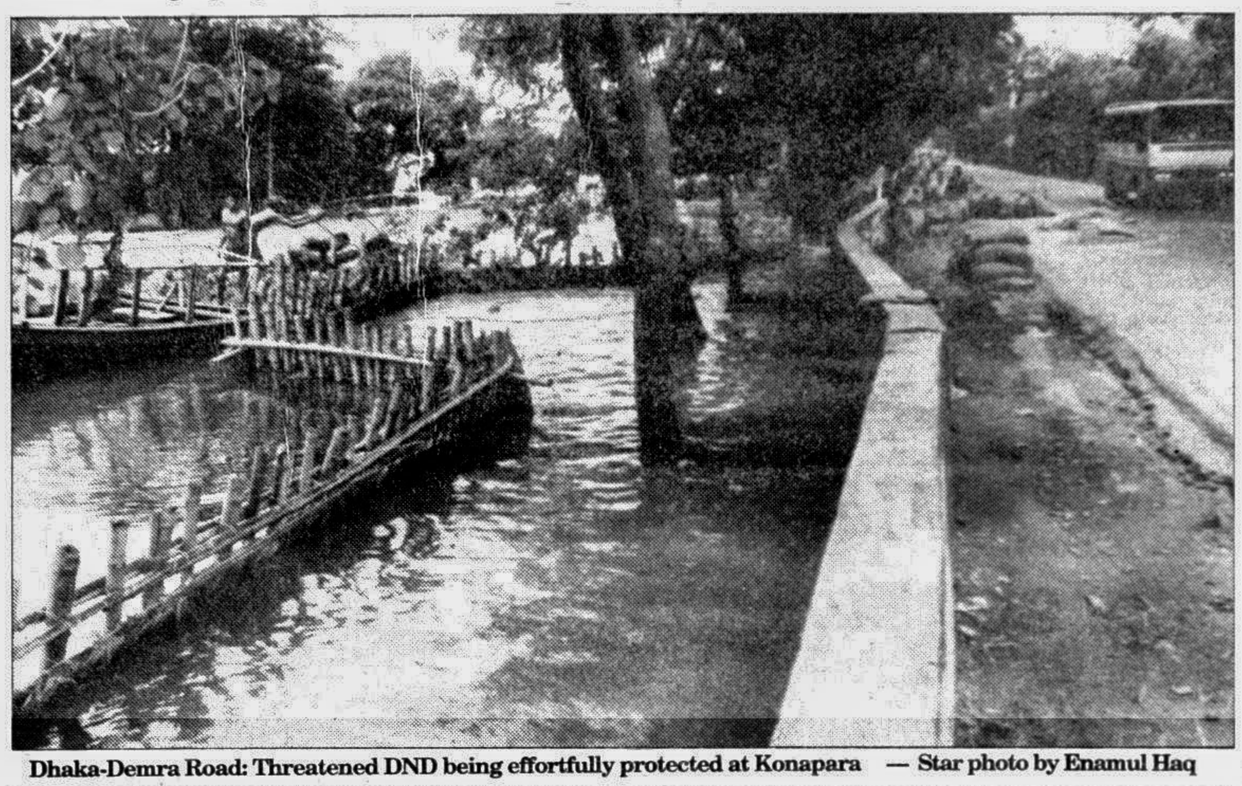
Heading for a Greater Deluge?

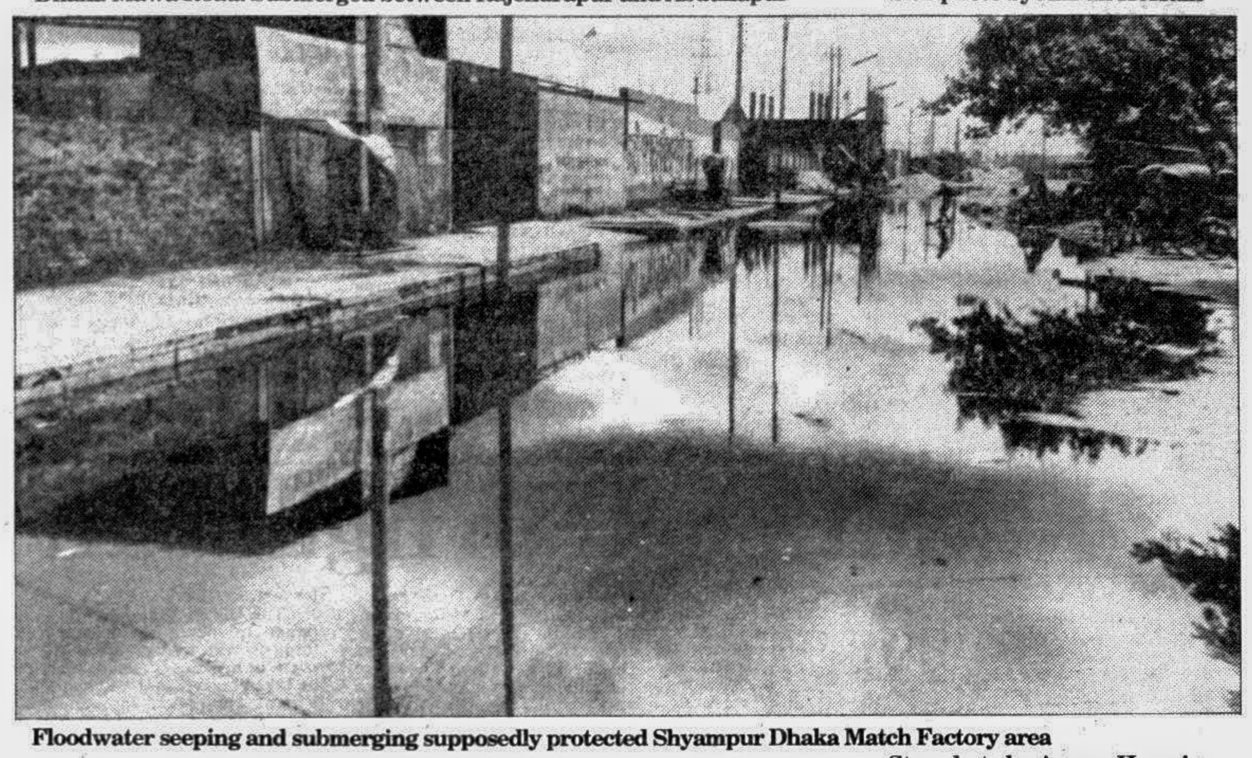
PHOTO FEATURE ON FLOOD

Dhaka-Chittagong Highway: Over flooded at Sonargaon area — Star photo by Amran Hossain

Dhaka-Mawa Road: Submerged between Rajendrapur and Abdullapur — Star photo by Amran Hossain



Dhaka-Demra Road: Threatened DND being effortfully protected at Konapara — Star photo by Enamul Haq



Floodwater seeping and submerging supposedly protected Shyampur Dhaka Match Factory area — Star photo by Amran Hossain

Now There is Something

by Shobit Mahajan

Normally, in any process, energy only changes form. In a small light bulb for instance, electrical energy changes to light and heat energy. The total energy, however, remains constant in accordance with the law of conservation of energy. This discrepancy in the amount of initial and final energy led scientists to wonder that they were missing something.

THERE comes a time in the history of the Universe when the laws which are supposed to govern it have to be rewritten. Scientists feel the time has come with the discovery that tiny sub-atomic particles — making up most of the empty space in the Universe — have mass.

Neutrinos are sub-atomic particles similar to the more familiar electrons and protons. They are, however, electrically, neutral unlike the electron or proton which carry negative and positive charges respectively. This means that the neutrinos do not interact with any electromagnetic force. They are affected only by the "weak" sub-atomic force which has a much shorter range than the electromagnetic force. Three kinds of neutrinos exist, each associated with particles like electron and protons. Apart from the electron neutrino, we also have neutrinos associated with two heavier particles, the muon and the tau lepton.

The story of the discovery of the neutrino in as enigmatic as the particle itself. In the 1930s it was realised that in certain radioactive processes some energy is lost after the reaction. Normally, in any process, energy only changes form. In a small light bulb for instance, electrical energy changes to light and heat energy. The total energy, however, remains constant in accordance with the law of conservation of energy. This discrepancy in the amount of initial and final energy led scientists to wonder that they were missing something.

It was the Swiss physicist Wolfgang Pauli, who conjectured that this energy was being embezzled by a previously-undiscovered particle. This particle was christened neutrino or 'little neutral one' by Enrico Fermi who also developed a theory to explain the production of these particles. Though studied extensively for two decades by the theoretical physicists — that is, physicists who theorise about the nature and structure of matter — the neutrino eluded all attempts to find it.

This was because being neutral, neutrinos interact only with the weak nuclear force and their bonds with matter are extremely feeble. This means that the neutrino can travel through light years of matter before it loses any of its energy due to interaction with other particles. In fact, these interactions are so weak that a neutrino could easily pass through Earth without even interacting with a single atom.

It was not until 1959 that an experiment designed by Frederick Reines detected the particle for the first time. A beam of neutrinos from the nuclear reactor at the Savannah River site in the US was made to pass through a container holding one tonne of water.

The idea was that with many neutrinos in the beam and with so many target atoms of water, there would be an occasional reaction which would identify the neutrino. The neutrino did interact with the proton in the water and the light emitted was detected by the surrounding photomultiplier tubes capable of detecting even the faintest light. Out of every billion neutrinos passing through the detector, only one would interact and give itself away. With this, the existence of this phantom-like particle was firmly established. Reines, who received the 1995 Nobel Prize for his discovery of the neutrino, is also one of the founding members of the Super-Kamiokande.

Though other properties of the neutrino were well established, it was always assumed they have no mass. Several experiments were carried out, but they failed to establish the existence of mass. The question of the neutrino having mass or not is of profound significance in physics.

But then came the question of missing mass or dark matter, the two terms coined by physicists to explain certain puzzling observations in the Universe. When distant galaxies are observed, there seems to be more gravitational attraction among certain parts of the galaxies than can be accounted for by the estimated matter in the stars. Since gravity is the result of attraction between matter, it appears that there is additional matter which is contributing to the excess gravity. This unseen (and hence missing) matter has to be dark (that is not emitting light) or otherwise we would be able to see it. Cosmologists conjecture that this dark matter could account for up to 90 per cent of the matter in the Universe.

It was to answer such questions regarding the nature of neutrinos that the Super-Kamiokande experiment was set up in Japan. About 1.6 kilometres (km) under the ground, in an unused mine of the Kamioka Mining and Smelting Corporation in Kamioka, sits the mammoth detector where the existence of the neutrino was confirmed. The detector is a large, 47 million-litre tank of ultra-pure water surrounded by more than 13,000 photomultiplier tubes. With an international team of more than 120 physicists from Japan, the United States, Poland and South Korea in attendance, the $100 million detector went operational in 1996.

There is a reason for the detector being placed under 1.6 km of rock. This has to do with keeping away all the other particles except neutrinos. The atmosphere is constantly being showered by cosmic rays which produce all kinds of particles. Most of them are absorbed by the atmosphere but at least one kind, the muons, can reach sufficient depth. If the experiments were conducted on ground level then interference from these particles would completely swamp the detector and it would be impossible to see the neutrinos. Even under 1.6 km of rock, the detector still gets about three muons every second, though 99.9 per cent of the muons are filtered by the rocks above.

The experiment looks at neutrinos produced in the upper atmosphere by cosmic ray collisions. The neutrinos produced directly above the detector in the atmosphere (about 40 km above) do not have time to change form. But the particles produced at a distance of 20,000 km from the other side of Earth, which pass through the Earth to enter the detector have enough time to oscillate and change form. These are detected as flashes of light.

This has led scientists to believe that the neutrinos have mass because something which changes form must, according to quantum physics, have mass.

The approximate mass of the heaviest neutrino is estimated to be about 0.05 electron volts (electron volts are convenient units of mass of sub atomic parcles; a proton is about one billion electron volts while a small twig of wood is a staggering 10^{33} (1 billion trillion) electron volts. It would therefore take about 20 billion neutrinos to equal the mass of one proton.

What does this mean for physicists? The standard model of the Universe will not have to undergo any major changes since it can accommodate neutrino mass, though with some modifications. Neutrino mass may shed some light on the larger question of why particles have mass. Till now, neutrinos were the only particles that were supposed to be without mass.

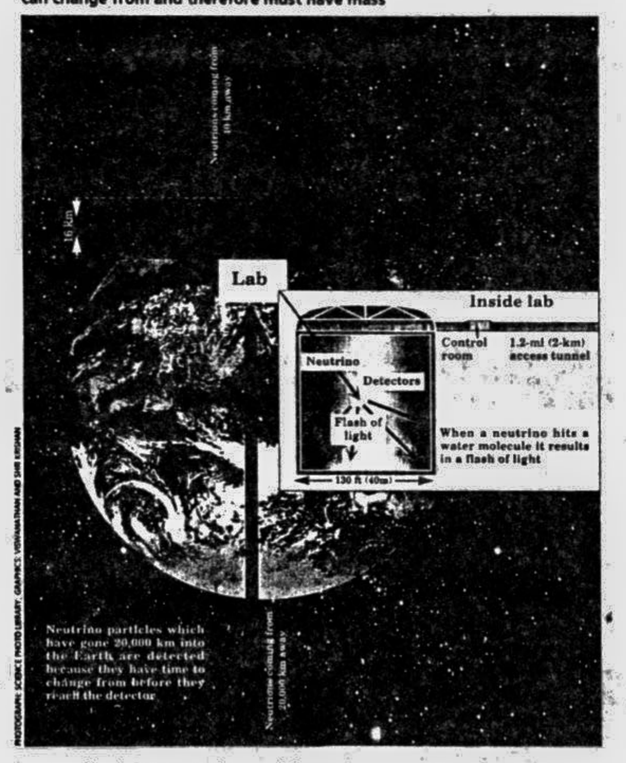
Now that we know that they too have mass, we may be closer to understanding how this universal property of mass emerges.

What will probably be seen is a renewed interest among cosmologists to study the effect of neutrinos in the Universe. It has been suggested that neutrinos could speed up the process which leads to the formation of galaxies and stars. Such theories were mostly based on speculation but now they will receive renewed attention. What is certain is that the community of physicists can look forward to very exciting times as the existing theories of physics will have to be readjusted to accommodate this new discovery.

CSE-Down To Earth Features

Little Wonder

Trillions of neutrinos pass through every human every second. A staggering number pass through the Earth. A steel vessel containing 47.3 million litres of ultra pure water was used as a detector 1.6 km below the Earth's surface. When a neutrino collides with a water molecule it results in a blue flash. This has led scientists to determine that neutrinos can change from and therefore must have mass



It's Now Cyberabad versus Cyberlore

The new title for the city was even mentioned in a statement released at the launch of the Karnataka Information Technology Venture Capital (KITVEN) by state government agencies, The Pioneer newspaper reported.

CALIFORNIA has competition in faraway India, where two southern cities, Bangalore and Hyderabad, are slugging it out for the title of Silicon Valley. It wasn't too long ago when Bangalore, the capital of Karnataka state, had the clear monopoly when it came to software development and training in India. And then came N. Chandrababu Naidu, as the Chief Minister of neighbouring Andhra Pradesh.

Once he started on his mission to promote state capital Hyderabad as the software capital of India -- possibly the world, after California -- there was no stopping the computer-savvy Naidu. He embarked on several ambitious software projects, the most conspicuous being two nodal institutes, Indian Institute of Information Technology (IIIT) and Hitech city.

But soon after Naidu nicknamed the city Cyberabad, the J.H. Patel government of Karnataka -- upset that its neighbour had stolen the thunder -- decided to float the name of Cyberlore for Bangalore. The new title for the city was even mentioned in a statement released at the launch of the Karnataka Information Technology Venture Capital (KITVEN) by state government agencies, The Pioneer newspaper reported.

While sceptics have felt that Bangalore will have to do much more than give itself a catchy alias -- it will have to improve its roads and the availability of power and water -- Karnataka officials are upbeat, the paper says. Citing figures in the state's favour, they claim that in 1997-98 software export from Karnataka touched the Rs. 20 billion ($476 million) mark. Hyderabad, they say, is actually a poor third, with Rs. 2.7 billion ($64.3 million); Chennai, the capital of Tamil Nadu, had a higher figure, Rs. 2.9 billion ($69 million), the paper said.

The Karnataka officials also claim that with a total investment of Rs. 25 billion ($595 million) in the sotware sector, and with almost 25,000 software professionals, Bangalore continues to be the hub. As many as 45 new companies were started last year, the paper quoted them as saying. Bangalore's claims notwithstanding, Naidu continues to attract national and international attention for his initiatives in promoting Hyderabad as the mecca of Information Technology -- something that may be rankling Patel and his men.

Not only did the laptop-friendly Naidu achieve a series of firsts -- he even got global IT giants like Oracle, IBM and Microsoft to set up shop in the city -- he has also been getting unmatched press coverage for it both in the national and international media. Former Prime Minister V P Singh, in an interview published on August 23, said Naidu was a man other chief ministers in the country should emulate.

People of Bangalore, meanwhile, are quick to point out that the city's pub culture, salubrious climate and metropolitan status make it a more conducive choice for IT professionals.

Whichever way the battle between Cyberabad and Cyberlore goes, it certainly means more bonanzas for the cyber world.

— India Abroad News Service