

## Breakthroughs

## Salam's New Clue to "The Force"

When Pakistan's Professor Abdus Salam bagged the coveted Nobel Prize for his research in physics three months ago, it was hailed not only as a triumph for the man and his work but also a vindication for all those who believe that there is a unified force controlling the universe.

Prof. Salam's winning theory of weak interaction between protons and neutrons, a process that is crucial in the creation of the sun's energy, was proved only two years ago. For nearly thirteen years, scientists in North America and Europe have come up with contradictory theses on his theory. Now, to many scientists and researchers it seems possible that scientific proof of the ultimate unity in laws of nature may emerge before the turn of the century.

Salam's thinking emerged as early as 1965 when he agreed during a visit to his home country to do a series of lectures for Radio Pakistan on the "Symmetry Concepts in Physics." In the lectures — dedicated to the memory of Poet-Philosopher Sir Mohammad Iqbal, who first floated the idea of an independent Muslim state of Pakistan — Salam said, "One likes to believe in an eventual unity and ultimate symmetry in all basic laws governing the universe." What was once just an idea, soon became a belief. Earlier in the century this phenomenon of the unity of forces had baffled even Einstein.

Thirteen years later, experiments at the world's largest nuclear accelerator at Stanford University in the U.S., dramatically boosted Salam's theory by proving that at least two of nature's four fundamental forces — the weak force and electromagnetism — are two aspects of the same phenomenon. In fact, the experiment proved that the two forces were one and the same.

The four basic forces governing all phenomena in the universe are now reduced to a trio. With only three rather than four forces of nature to be unified, science today seems to be closer than ever to discovering a unity in all the diverse phenomena baffling mankind. Besides electromagnetism and the weak force that are scientifically considered to be the same, the two other forces known are the strong force and gravitational pull.

It was Isaac Newton who discovered the gravitational pull in

the 17th century. Newton found that every particle in the universe is attracted by another particle with a force that is directly proportional to the product of their masses and inversely proportional to the square of the distance between them. This pull or attraction is the same force that makes a body fall from the rooftop and which keeps the earth in orbit around the sun.

The second fundamental force called electromagnetism is the one that creates light and forces of chemistry. It involves electrical and magnetic attraction and repulsion. It acts between charged particles and is responsible for keeping the atoms together. In 1876 James Maxwell achieved another synthesis when he unified the forces of electricity and magnetism. Maxwell showed that the static electricity produced by combing one's hair and the magnetic force



Salam (inset); receiving Nobel: Linking nature's forces

on the compass needle or the light emitted by a candle are the one and the same thing.

The third basic force, the strong force, binds the neutron and proton in the nucleus of an atom. That is its sole role. Despite the apparent diversities in the fundamental forces of nature, scientists have always hoped to discover an underlying unity among them. Much to their chagrin, all theories until a few years ago were disproved. Einstein tried for a theory that would prove a link between gravity and electromagnetism in the early 1940s, but he was never able to prove it.

Salam's theory of unity of the weak force and electromagnetism is based, not surprisingly, on a complex mathematical calculation. Salam himself was basically a mathematician until the mid-fifties when he migrated from Pakistan to England to take up lecturership at Cambridge Uni-

versity. Now he teaches theoretical physics at London's Imperial College of Science & Technology and directs the International Centre for Theoretical Physics in Trieste, Italy.

It has long been known that as electrons move, they spin either clockwise or counter-clockwise; in other words they are either left-handed or right-handed. Scientists until a decade ago thought that nature was even handed, not inclined to left or right.

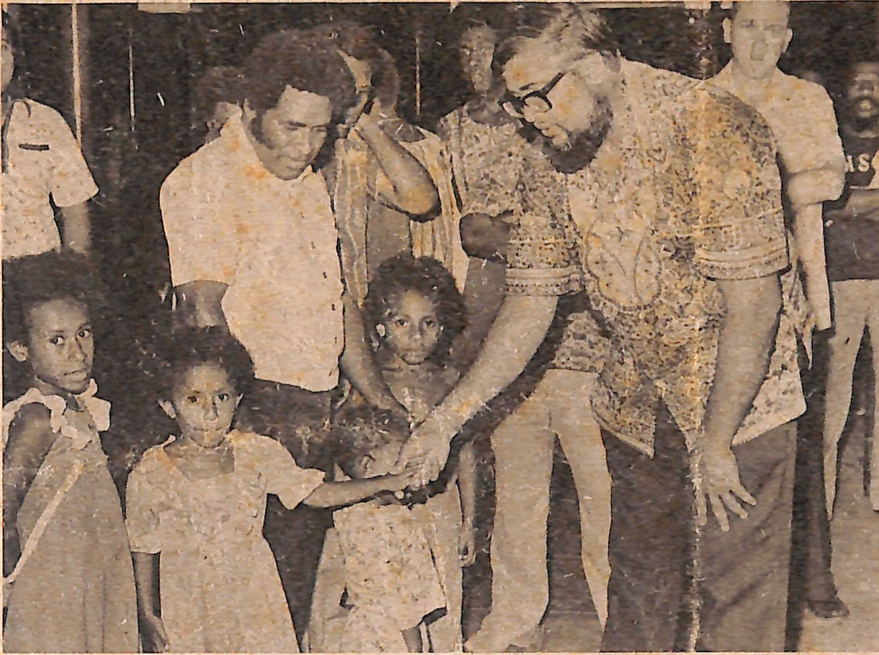
The success of the 53-year-old Salam's theory depended upon one vital prediction: when electrons are beamed at the element of hydrogen then those spinning counter-clockwise should be scattered more than those spinning clockwise or, in other words, violate the principle of parity. If this could be detected, Salam argued, it would mean that both the weak force and the electromagnetic force would come into play at once in the process of violation of the parity principle. If, as two apparently different forces, the electromagnetic and the weak force play a role in the process of beaming electrons at the hydrogen element, it would prove that both the forces had the same origin.

Four years ago, 20 scientists from six countries experimented with Salam's prediction. They produced a beam of electrons spinning in a specific direction. The electrons were then speeded up with the help of a two-mile-long linear accelerator at Stanford and bombarded at heavy hydrogen nuclei. As a result of the collision, electrons scattered, some clockwise, others anti-clockwise. With the help of delicate instruments the researchers observed that the difference in the number of electrons spinning clockwise and counter-clockwise was in exactly the amount predicted by Salam.

Salam's theory thus goes into scientific history. While Newton won laurels by combining the forces responsible for astronomical and terrestrial motions into a single force and Maxwell became famous for combining the phenomena of electricity and magnetism, Salam has won honours by proving that the weak force and electromagnetism are one and the same thing.

To scientists all over the world, the Stanford experiment is only a stepping stone to the universal acceptance of a unity of forces theory. Salam himself argues that the basic mathematical features of his theory could lead scientists to prove a link between the other two forces — the gravitational pull and the strong force.

The theory has a profound, non-scientific dimension for some. To Muslims like Salam — who is the first in Islam to win a Nobel — and, indeed, believers of many faiths over the globe, such a link between the forces in nature would narrow the gap between science and religion. □



At left, Premdas with Evara and children at Port Moresby airport; Somare: Charges of undermining national sovereignty

## Skulduggery in New Guinea

Four months ago, American Academic Dr. Ralph Premdas was deported from Papua New Guinea after Prime Minister Michael Somare accused him of meddling in government affairs and undermining national sovereignty. Upon his departure, however, the head of PNG University's political science department countered that government office in the country was being "used to promote self-interest and rarely the public interest." The dust has yet to settle. In the wake of the expulsion came a stream of controversial events. Most significant among them: the conviction of Minister of Justice Mrs. Nahau Rooney for contempt of court, and the resignation of five of eight Supreme Court justices after their contempt decision was effectively overturned by Somare.

Last June, the government had revoked Premdas' residence permit, but the American was permitted to stay on in Port Moresby after the Supreme Court issued an injunction barring his deportation pending legal appeal (which he subsequently lost). The court action prompted Minister Rooney to write to Chief Justice William Prentice, accusing the court of jeopardising judicial independence and neutrality. In response, the court sentenced Mrs. Rooney to eight months light labour for contempt.

But she spent only one day in jail. Somare, who assumed her duties, engineered a quick release. His justification: the move was to enable her to prepare an appeal to the Constitutional Advisory Committee, the only body that can grant her clemency. In protest against Somare's action, Prentice, Deputy Chief Justice Edmund Raine and Justices Loyola Saldanha, John Pritchard and Andrew Wilson — all Australians except for Briton Saldanha — resigned. Somare promptly replaced Prentice with Justice J.H. Wootten, former chairman of the New South Wales Law Reform Commission in Australia.

Meanwhile, Opposition Leader Iambabkey Okuk has continued his campaign for a fuller explanation of Prem-

das' ouster. He suggested that the Rooney affair would never have occurred "had the government not taken unjustified steps against Dr. Premdas. I believe he was the victim of the incredible power which the public service has in this country. He stood on the toes of a few top public servants and they forced the government to get rid of him. I suspect that one of the reasons used by the government to deport Dr. Premdas was that he might leak secret government documents to me."

During the November session of Parliament, some clarification was forthcoming. Deputy Speaker Michael Pondros tabled an Ombudsman Commission report which said that Premdas would have terminated his connection with the Department of Primary Industry (DPI) if Minister Roy Evara had not "misled" him. It was Premdas' involvement with DPI as acting executive officer that led to Somare's charges and the subsequent deportation.

Without the PM's approval and without taking an oath of secrecy (as required by the Ministerial Personal Staff Act), the American was authorised by Evara to operate as executive officer and given access to classified information. In this capacity, the scholar became entangled in an ongoing power struggle between DIP Secretary John Natera and Evara. And as Evara's proxy, reports Correspondent Ric Lardizabal, Premdas became the object of attacks by DPI staff, which led to the deterioration of relations between Evara and his department. This, too, was later blamed on Premdas.

Somare soon informed Evara that Premdas could only be engaged as a consultant after hours, outside the office and on non-confidential matters. But the DPI chief ignored the instructions, believing the Prime Minister to have been misinformed. The American then tendered his resignation but later withdrew it following assurances by Evara that his ties with DPI were fully approved by Somare. Thus if not for Evara's deception, surmised the Ombudsman Commission, Premdas probably would never have had to leave — and the country would be spared a judicial crisis.



Minister Rooney: A judicial crisis

Photos: Asiatweek News Service