The most influential Pakistani physicist

Dr Abdus Salam The real story of Pakistan’s Nobel prize winner

Syeda Sultana Rizvi

Eighteen years ago on November 21st with the death of Dr Abdus Salam, though we physically lost Pakistan’s only Nobel laureate, a physicist and a mathematician par excellence. His merits were not confined to this only, he was also a man whose passion and deep love for Quran and Pakistan was manifested in both his words and deeds, but the spirit of his legacy is alive and cherished in many parts of the world as the institutions he established continue to benefit millions of human beings.

Salam was a multidimensional individual and so is his legacy. His scientific contribution remains influential even today. His contribution and prediction for Higgs boson particle - a discovery that earned Nobel prize for physics this year - was recognized by the scientists. However, his achievements in the fields other than sciences and sometimes in the realms considered contrasting to sciences are equally fascinating and motivating. Thus, we have all the reasons to remember this role model more often than on birth and death anniversaries.

Most of us are aware of traditional conflict between faith and reason and religion and science. A general view is that these streams cannot go hand in hand. They are rather seen as opposing each other, sometimes, deemed fatal to each other’s growth. Salam successfully busted this myth and established reconciliation between the two by achieving the heights of excellence in Mathematics and Physics while retaining deep connections with faith and religion. He rather proved both supporting each other. For him Holy Quran and his firm belief in unity of Allah were his biggest guiding principles in widening his vision of scientific inquiry.

Salam understood meanings of Holy Quran and found it great source of guidance and motivation for his scientific work. He made huge efforts to introduce the world, the, often forgotten, intellectual side of the Holy Quran. He tried to make people aware of Quran’s injunctions for quest for knowledge; a book not in conflict with reason but one that is truly compatible with reason, knowledge, scientific thinking and the one that guides people to avoid conflict on earth.

Anyone who would have tried to understand meanings of Holy Quran must be aware of the fact that the book is full of wisdom and knowledge and covers besides morality and philosophical issues a much wider range of guidance on different spheres of life including sociology, economics and even touches upon many scientific concepts, some of which were even not talked about just a few centuries ago.

Salam stated many a times and proved through his works that he derived motivation for scientific achievements by reading and contemplating on the verses of Holy Quran. He stated, “The Holy Quran enjoins us to reflect on the verities of Allah’s created laws of nature”. During his acceptance speech for the 1979 Nobel Prize in Physics for his work on unification of electroweak interactions he established his first paper in 1943. It was titled, “A problem of Ramnathan”. He graduated next year with ‘A’ level results: 300 out of 500 marks in every subjectota total of 150 in English Honours. He stood first at his university, breaking all records in the B.A examinations. As a result of Salam’s high scores, he secured a scholarship for further studying mathematics at Cambridge University’s prestigious Cavendish Laboratory.

While being groomed in a quintessentially British environment at Cambridge University, Salam did not lose sight of his purpose of being there. His grades spoke volumes about his performance. As K Ask Aziz points out in this book, The Coffee House of Lahore, he got a first class in preliminary in 1947 and Part II in 1948, and then gave up Mathematics for the time being because on the higher level it could not be fully mastered without a good knowledge of physics. In an unprecedented performance, he read Physics for one year and took its Part I and II together in 1949; scoring a first and surprising even his teachers.”

His time at Cambridge ended, for the time being, with a PhD at the Cavendish Laboratory of St John’s. By the end of his tenure, he had made a mark in the scientific fraternity as a promising young scientist.

Mathematics at Government College Lahore

In 1942, Salam joined the Government College University at Lahore. He enrolled to study Mathematics A and B, and English. Apart from being somewhat of a prodigy at mathematics, Salam was also seen as a highly able student of the English language by his mentors. It is recorded that some of his tutors thought he would make a great English teacher.

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Intellectual isolation in Pakistan

In 1951, after having won a number of awards and accolades, Salam was ready to move back to Pakistan. He dismissed an opportunity to spend a year at Princeton University (where Professor Albert Einstein was too) and took up the offer to head the mathematics department at the Government College Lahore (GC).

Unfortunately, his time in Lahore was turbulent right from the start. The university allegedly failed to give him an official accommodation. Salam, with his wife, moved with his colleague Qazi Mohammad, a professor of Philosophy at GC. To resolve the matter, Salam scheduled a meeting with then minister of education, Abdul Harneen Dasti. The minister, dismissively said to Salam, “If it suits you, you may continue with your job; if not, you may go.”

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Abdus Salam died at age 70 on 21 November 1996, at his home in Oxford, England. He was best known for his pioneering work on electroweak unification, for which he shared the Nobel Prize in Physics in 1979 with Sheldon Glashow and Steven Weinberg. Salam will be remembered also for his invaluable contributions to the propagation of science in the third world. He founded the International Center for Theoretical Physics (ICTP) in Trieste, Italy, and directed it for over 30 years; he also helped create other international research centers, several international foundations, such as the Third World Academy of Science, and a number of international prizes.

Salam was born in Jang, a district in the part of British India, that is now Pakistan. Known at an early age for his sharp intellect, he completed his undergraduate education at the University of the Punjab in 1946, and won a scholarship to continue his graduate studies at the University of Cambridge’s St. John’s College. He excelled there, securing a first (top honors) in both physics and mathematics. While seeking a research problem for his thesis, he asked the advice of Paul Mat- thews, who was about to finish his PhD. Mathews had been attempting to extend to meson theories, which describe the nuclear forces, the renormalization tech-
After finishing his PhD at Cambridge in 1951, Salam returned to Pakistan as a professor of mathematics at the University of the Punjab, hoping to build research groups in theoretical physics in his own country. However, he was frustrated in achieving his goals by both the lack of official support and the acute isolation in physics that he faced in Pakistan. He felt that he could serve his country better by staying abroad, so he returned to Cambridge in 1954 as a lecturer and fellow of St. John's College. Three years later, he accepted a professorship at what is now the University of London's Imperial College of Science, Technology and Medicine, where he succeeded in establishing one of the best theoretical physics groups in the world, well known for its contributions to the role of symmetries in particle physics. He maintained his professorship at Imperial College to the end of his career, despite spending most of his time after 1964 at the ICTP.

From 1957 to 1967, Salam, initially in collaboration with John Ward, attempted to unify the radioactive weak and electromagnetic forces - an idea introduced by Julian Schwinger in 1957. Following a suggestion by Glashow on the usefulness of the gauge symmetry SU(2)xU(1) and a crucial observation made by Peter Higgs and independently by F. Englert and R. Brout and (earlier) by Philip Anderson on how massless gauge particles can acquire masses through spontaneous breaking of symmetries, Weinberg (in 1967), and independently Salam (in 1968) proposed a model for electroweak unification based on the idea of a spontaneously broken SU(2)xU(1) gauge symmetry.

During 1974 and 1975, Salam collaborated with John Strathdee on the superspace-superfield formalism for dealing with a new type of symmetry -- supersymmetry. The Salam-Strathdee formalism has turned out to be an
indispensable tool for dealing with the quantum behavior of super-symmetric field theories.

My personal collaboration with Salam started in the summer of 1967, and remained intense for over ten years. Together, we intro-
duced the idea of an underlying unity of quarks and leptons and, simultaneously, of gauge forces. In 1973, despite the skepticism of the physics community at the time, Salam and I noted that a gauge unification of quarks and lep-
tons would inevitably lead to non-conservation of baryon and lepton numbers and thereby naturally to an unstable proton. These ideas have matured and evolved considerably. Salam had hoped to see a more final chapter of this story of unification in his lifetime. We were both encouraged, however, to see that the search for proton decay was continuing with the recent completion of the Superkamiokande detector in Japan.

During our collaboration, Salam always reacted to our occasional disagreements with a good-natured spirit. If he were greatly excited about an idea that I did not like, he would impatiently ask, “My dear sir, what do you want? Blood?” I would reply, “No, Professor Salam, I would like something better.” Whether I was right or wrong, he never took it ill.

While Salam was moving forward in his research, he never lost sight of his ardent desire to help the growth of science and technology in the third world. Determined to help, he approached the International Atomic Energy Agency (IAEA) of the United Nations in 1960 for support of what was to become the ICTP. Salam’s proposal met with great resistance, with one delegate from a developed nation saying, “Theoretical physics is the Rolls-Royce of sciences – the developing countries need only bolluck carts.” After Salam and several colleagues lobbied intensely for four years, Salam finally succeeded in creating the center in 1964, with the partial support from the IAEA (now taken over by UNESCO) and primary support from the government of Italy.

Thanks to Salam’s tireless efforts, the ICTP has emerged as one of the finest research-cum-training institutions in the world, not only producing high quality science but also providing opportunities for scientists from the developing and developed nations to interact regularly through annual workshops and summer schools. In its 33 years, the ICTP has hosted some 60,000 visits by experimental and theoretical research physicists, about half of them are from the developing countries.

Salam dreamed of creating 20 international centers like the ICTP spread throughout the world and empha-
sizing different areas of science and technology. He appealed vigorously to the developed as well as the developing countries and to the World Bank for funds to create the centers. Meanwhile Salam also dreamed of creating a “World University”, which would be funded internationally and would be linked for its functioning to a consortium of universities worldwide.

Salam’s efforts in these directions in the last eight years of his life were unfortunately severely ham-
pered by a crippling neurological illness, attributed to a variant of Parkinson’s disease. Thanks to his own initiative and that of several others, he nevertheless succeeded in creating the International Center for Genetic Engineering and Biotechnology, with compo-
nents in Trieste and Delhi, and the International Center for Science and High Technology in Trieste.

Salam will surely be remembered as one of the great scientists of the 20th century and as a human-
itarian who devoted much of his life to uplifting the status of science and technology in the third world. Salam may have been somewhat ahead of his time in dreaming of 20 international centers and a world university. It remains for the present generation of sci-
entists and world leaders to fulfill this dream.