

Abdus Salam
by
Pervez Hoodbhoy

Pakistan's pre-eminent theoretical physicist and sole Nobel Prize winner, Abdus Salam (born 29 January 1926), grew up in the town of Jhang (Punjab). An unsophisticated home and environment notwithstanding, he rapidly outpaced his teachers who recognised and respected the young boy's talent for physics and mathematics. Winning a scholarship enabled him to proceed to England and in 1949 Salam earned a first-class degree in physics from Cambridge University in just one year. Then in 1950 he solved an important problem in renormalisation theory, becoming a minor celebrity. In 1951 he returned to Government College, Lahore, but found to his disappointment that research was not encouraged. Without a library or colleagues to talk to, he reluctantly went back to Britain in 1954.

By the early 1960s, Salam was already among the world's top authorities in particle physics. At 31, he was the youngest ever professor of theoretical physics at Imperial College, London. Apart from the 1979 Nobel Prize, he holds, among others, the Adams Prize (1958) from Cambridge University, Atoms for Peace Prize (1968), the Einstein Medal (1979) and the Peace Medal (1981). Salam received honorary degrees from over 40 universities worldwide and a Knighthood in 1989 for his services to British science.

Scientific Accomplishments: Among Salam's earlier achievements was clarifying the role played by renormalization in quantum field theory. During his Ph.D work at Cambridge, he had resolved the thorny problem of "overlapping divergences". His abiding interests lay in various aspects of quantum field theory: renormalizability, non-abelian gauge theories, and chirality. Salam was among the earlier pioneers who applied group theory to classify existing particles and predict new ones. These were crucial elements that went into unifying the weak and electromagnetic forces for which he shared the 1979 Nobel Prize with Steven Weinberg and Sheldon Glashow. This unification work is considered foundational for modern elementary particle physics.

Subsequently, together with Jogesh Pati from the University of Maryland, Salam proposed that the strong nuclear force might also be included in this unification. This "Grand Unified Theory" predicts magnetic monopoles and proton decay: phenomena which are still being searched for. Salam, together with his lifelong collaborator John Strathdee, also proposed the idea of superspace, a space with both commuting and anti-commuting coordinates, extensively used in supersymmetry research.

Salam's interest in weak interaction physics led him to believe that all neutrinos are two-component left-handed particles, an idea which he put before the doyen of 20th century quantum physics, Wolfgang Pauli. But Pauli rejected the idea and advised against publication, a mistake Salam regretted because a Nobel Prize was awarded to T.D. Lee and C.N. Yang for the same idea some years later. One of his students, Yuval Ne'eman, was the co-discoverer of "the eight-fold way" of classifying baryons, with Murray Gell-Mann. Another, Ronald Shaw, discovered the non-Abelian gauge theory independently of C. N. Yang and Robert Mills.

Views on Islam and Science: Salam wrote extensively on the Golden Age of Muslim science, seeking to inform and enthuse Muslims by copious references to that period. He would frequently return to the reasons why science has vanished from Muslim lands today. Salam concluded that "Science only prospers provided there are sufficient practitioners to constitute a community which can work with serenity, with fullest support in terms of the necessary experimental and

library infrastructure, and with the ability to criticize openly each other's work. These conditions are not satisfied in contemporary Islam.”

Although Salam’s frequent allusions to mystical experiences have left a widespread impression that he favored a fusion of religion with science, he made explicit his position that this is not what he actually believed to be true. In fact, he explicitly stated that there is only one universal science. Its problems and modalities are international and there is no such thing as Islamic science just as there is no Hindu science, no Jewish science, no Confucian science, nor Christian science.

Developing Science: As a Pakistani theoretical physicist in Britain, Salam became one of the most authoritative and influential advocates of science for third world development. His position on scientific development went against the grain of commonly accepted wisdom of his times, i.e. that scientific development in developing countries is best done by concentrating on specific technologies. Salam took umbrage at notions like “theoretical physics is the Rolls Royce of sciences – what the developing countries want is nothing more than bullock carts”. He held that the theoretical sciences are central to both intellectual and material progress, and so proposed and promoted the idea of the International Centre for Theoretical Physics (ICTP) in Trieste. Founded by him in 1964, it was renamed the Abdus Salam ICTP after his death. The Centre has remained intellectually vigorous under subsequent directors and continues to host hundreds of visitors from developing countries every year.

In earlier years, Salam had been very influential in Pakistan. Seen as a kind of cultural amphibian equally at home in Pakistan and in scientific circles of the West, Salam became the chief scientific adviser to President Ayub Khan. He helped establish SUPARCO (Space and Upper Atmosphere Research Commission), and PAEC (Pakistan Atomic Energy Commission). But 1974 marked the turning point in his life when, by a decision of the Pakistan’s national assembly, the Ahmediyya sect of Islam was declared heretical. Salam resigned his official position. Earlier, he had been only moderately observant of Islamic rituals but subsequently became much stricter. Perhaps in reaction, he began signing his name as Mohammed Abdus Salam.

Subsequent years saw Salam’s influence in the Muslim world fade. The Islamic Science Foundation, Salam’s grand scheme for scientific advancement with a projected endowment of \$1 billion collected from oil-rich countries, came to naught after he was banned from setting foot in Saudi Arabia. Kuwait and Iran gave only small amounts of money for supporting their scientists at the ICTP. Salam died in Oxford at age 70 on 20 November, 1996, after a debilitating illness and was buried in Rabwah, Pakistan. He is uncelebrated in the country today because of his religious affiliation; the world “Muslim” was scratched away from his tombstone by a court order.

Bibliography

Fraser, Gordon, *Cosmic Anger: Abdus Salam – The First Muslim Nobel Scientist*, Oxford U. Press, New York, 2008

Salam, Abdus. *Ideals and Realities -Selected Essays of Abdus Salam*, (3rd Edition), by C H Lai & Azim Kidwai, World Scientific, 1986.

Salam, Abdus. In preface to “Islam and Science – Religious Orthodoxy and the Battle for Rationality”, Pervez Hoodbhoy, Zed Books, London, 1990.

de Greiff , Alexis. *Abdus Salam: A Migrant Scientist in Post-imperial Times*, , Economic and Political Weekly, January 21, 2006.