



ABDUS SALAM 1926-1996

Mujahid Kamran

Salam Session 5th International
Workshop on Particle Physics at
NCP, QAU Nov 20-25, 2006



- ◆ Abdus Salam's astonishing emergence from the backyards of Jhang to one of the leading positions on the stage of twentieth century physics is a dramatic story. In some ways he reminds one of Lord Rutherford, the great patriarch of the tribe of physicists during the first four decades of the twentieth century. Both were born in far flung areas of the British Commonwealth to parents in the teaching profession. Both were outstanding students who, by sheer strokes of luck, won scholarships that took them to Cambridge.



- ◆ While Rutherford became the most powerful scientific figure of the British Commonwealth Salam assumed the mantle of a “People’s Emperor” of scientists from the underdeveloped countries.
- ◆ The kinship between Salam and Rutherford runs deeper (the weak force of beta decay connects them)



Early Life

- ◆ Born Santok Das in District Sahiwal on January 29, 1926; grew up in Jhang where he was admitted directly to class four in school (his brother told me how Salam had learnt mathematical tables while still not of school going age)
- ◆ Salam stood first in the entire province of Punjab in his class 10 exam setting up a new record and making headlines in the press. He thus had become famous at a very early age. Thence onwards he stood first in every major exam that he took setting up new records each time. In 1944 he did his B.A. from GC Lahore.



- ◆ It was before his B.A. that Salam published two research papers, one in the field of mathematics (“On a problem of Ramanujan”) and the other on the history of Urdu literature establishing the year in which the greatest Urdu poet changed his pen name from Asad to Ghalib. (Dr. Waheed Qureshi)
- ◆ After his B.A. Salam toyed with the idea of pursuing studies in English Literature, a subject usually chosen by those wishing to appear in the qualifying exams for entry into ICS – Salam’s father wanted him to join the prestigious ICS.



- ◆ He was undecided between pursuing mathematics or English and discussed the matter with at least one individual (still alive who told me about it) who advised him to pursue mathematics.
- ◆ Salam did his MA in mathematics from GC Lahore in 1946 setting a new record.
- ◆ Awarded scholarship along with four others in 1946. By a sheer stroke of luck only Salam could make it to UK! The other four lost the scholarship due to the subsequent death of the man who instituted the scholarship.



SALAM AT CAMBRIDGE

- ◆ A chance vacancy at the last moment landed Salam in St. John's College where he was admitted to the famous 3 year Tripos in Mathematics. Salam completed the three year course in two years winning the title of Wrangler.
- ◆ The famous astro-physicist Frd Hoyle advised Salam to attempt a two year Physics Tripos in Physics in one year. When Salam expressed reservations Hoyle (later Sir Fred Hoyle) asked him to take it up as a “challenge”. A friend told Salam “You see Mott and G.P. Thomson tried, but they failed”. Thomson was a Nobel Laureate already and Mott too would win a Nobel Prize.



- ◆ Years later Salam told some one “by God it was hard”. He was poor in experimental work but extremely good in theory. He narrates how, after his result was declared, he went to Sir D. Wilkinson who asked Salam what class / division he had obtained. Whenin Salam told Sir Wilkinson that he had obtained a first class he “turned round a full circle” in his chair and said “Shows how wrong you can be about people”. Salam thus had the unique distinction of doing a five year course work in three and securing first classes both. (Salam’s younger brother told me of the test that Salam failed!)



- ◆ Salam was asked to do experimental work for his PhD at Cambridge since Cambridge had a tradition of putting the best students in experiment. As Salam later put it *“I knew the craft of experimental physics was beyond me - it was the sublime quality of patience – particularly patience with the recalcitrant equipment of Cavendish Lab that I sadly lacked. Sadly I turned my papers in and started instead on Quantum Field Theory with Nicholas Kemmer in the exciting department of P.A.M. Dirac.”*
- ◆ Kemmer accepted Salam after he agreed to work only *“peripherally”* with him. He told Salam that



- ◆ Prof. Kemmer told me while I was a student at Edinburgh(1975-79) that he almost refused Salam. Kemmer had his hands full – he already had eight research students. As he was to write in 1996
“Some of my colleagues, both experimental and theoretical, approached me demanding ‘You must accept one more student’. ‘Impossible! Not many students have been as easy to cope with as Paul Matthews. He will get his Ph.D. and be off my hands!’ ‘But this one is has done better in his finals, both in Physics and Mathematics than anyone we sent you before.’ ‘Who is he anyway?’ ‘A Pakistani’. ”



- ◆ Salam was able to solve the problem in about three months and his paper on the topic, published in 1951, made him famous almost immediately. The work was enough for a Ph D but Cambridge regulations required that a candidate submit his thesis at least three years after registration. So he was awarded the Smith prize for the most outstanding pre-doctoral contribution and sent off to Princeton with Matthews who was also leaving for Princeton as a post-doc. As Kemmer wrote *“Then Matthews came to me to say farewell and saying ‘I had worked out a program for Princeton but this chap Salam has solved my intended problem’ ”*



- ◆ From Princeton Salam returned to Lahore as Professor of Mathematics at Government College Lahore and simultaneously Head of the Mathematics Department at Punjab University in 1951.
- ◆ Kemmer was appointed Professor at Edinburgh in 1953 and suggested that Salam take up his position at Cambridge. Thus Salam returned to Cambridge in 1954 as lecturer.
- ◆ Two component neutrino theory – first proposed and written up by Salam in 1956 but publication delayed due to objection by Pauli (*“Give my regards to my friend Salam and tell him to think of*



IMPERIAL COLLEGE

- ◆ In Jan 1957 Salam was appointed Professor of Theoretical Physics at Imperial College.
- ◆ In 1957 Salam wrote a remarkable paper that was never published – it had been accepted for publication in Phys Rev Lett but Salam had withdrawn it. I once asked him how he issued the V-A theory of weak interactions. He told me that he had done it for leptons and produced a photocopy of the proofs of the paper in which he had conjectured that weak interactions could be V-A type. The paper also mentioned the breaking of chiral symmetry to generate masses of the electron and the muon.



- ◆ Unitary Symmetry – work with Ward. Neeman was his Ph D student at Imperial.
- ◆ ICTP set up in 1964
- ◆ Electro-weak unification 1967-68. Weinberg and Salam tried to prove renormalisability but it was the 24 year old T’Hooft who did it in 1970. As Coleman stated “Salam even gave the kernel of a correct argument for his belief” in the renormalisability of the theory.
- ◆ SUSY – superfields Saalm and Strathdee 1974



- ◆ GUTS Pati and Salam 1974 (proton decay)

HUMAN SIDE

