Riazuddin: The Self-Effacing Quintessential Physicist of Pakistan

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This is a biographical article about the life and work of Dr. Riazuddin. This is published in the 2019 edition of *The Sahiwal* of Government Postgraduate College, Sahiwal. This version is intended for readers who cannot access the printed copy of *The Sahiwal*. References have also been added in this soft version. Urdu translation of this article can be read at the https://www.humsub.com.pk/208540/bilal-azam-2/.

IT WAS tumultuous 1947 when the world observed the violent partition of India. Bloodthirsty savages put up communal riots all over the country. Religiously divided Ludhiana was also engulfed. Meanwhile, a lower middle-class family left the city for good and migrated to the newly established Pakistan. There were 17 years old twins in the family, Riazuddin and Fayyazuddin, who schooled in Islamia High School ran by Anjuman-i-Islamia philanthropy. Their inquisitiveness and appetite for knowledge were out of bounds. It was an ultimate sign of their dedication towards the beloved homeland that after losing all material possession in migration, they didn't bemoan but ready to construe dreams with the hope of bright future. So the family enrolled the children in Government Muhammadan Oriental (MAO) College but soon got admission in Government College Lahore (now Government College University, Lahore) in 1949.

FIG. 1: Riazuddin in his office (Courtesy: Pakistan Science Club - Link)

In Government College Lahore, they started studying engineering but they couldn't make their way spectacular and stunning. So a teacher there suggested them to study physics rather than engineering. Riazuddin gave his assent. Although it was quite disturbing and uninteresting situation for Riazuddin yet it was the outset of a celebrated career in the cosmos of physics. It was Government College Lahore, where Riazuddin met with his mentor Abdus Salam, in 1951. Salam's sharp-witted personality and perspicacity to deal with theories in physics made him the rising star in the physics community all over the world. It was not only Riazuddin but the nations who spurred by Salam. After declining the offer of professorship at Cambridge, Salam joined Government College, Lahore and at the same time, he started a new course of Quantum Mechanics in Punjab University, Lahore. It was Salam's repute who drew the attention of students. But only Riazuddin and Fayyazuddin got success in surviving the thicket of mathematical equations involved in quantum mechanics. Although it was a disheartened experience for Salam yet the twins made their identification as best students in that course.

FIG. 2: Riazuddin with Abdus Salam (Courtesy: Friday Times – Link)

Riazuddin got his Master's degree in mathematics from Government College Lahore under the mentorship of Abdus Salam and joined his alma mater in 1954 as a lecturer in mathematics. Riazuddin left for Cambridge in 1955 on the invitation of Dr. Abdus Salam to pursue his doctorate under his supervision. His dissertation entitled "Charge Radius of Pion" got published in *Physical Review Letters* on May 15, 1959. It dealt with certain regularities underlying nuclear forces. It was an influential research paper but something more outstanding was yet to come.

After his return to Pakistan in 1959, he joined Punjab University Lahore as an associate professor of mathematics. In 1963, Norman March and Michael Duff awarded him a fellowship in the United States and he

became a research associate professor at University of Rochester. He stayed there until 1965. His stay extended there and in 1965, he joined the University of Pennsylvania to teach physics until 1966. Meantime, his brother Fayyazuddin also completed his doctorate on "Preliminary Analysis of Photoproduction of K Mesons in the Mandelstam Representation". On his way to University of Chicago's Enrico Fermi Institute, Riazuddin convened his brother along with Faheem Hussain (late)[1] in Illinois. In 1966, Riazuddin and Fayyazuddin published an authoritative research paper entitled "Algebra of Current Components and Decay Widths of ρ and K^* Mesons" in *Physical Review Letters* on July 29, 1966. It is the widely used Kawarabayashi-Suzuki-Riazuddin-Fayyazuddin (KSRF) relation. Actually, this fruitful relation was separately derived by Japanese scientists Ken Kawarabayashi and Mahiko Suzuki and Pakistani twin scientists Riazuddin and Fayyazuddin. According to Pervez Hoodbhoy, "The Relation (KSRF) has stood the test of experiment, but even today continues to tantalize physicists—because it works so much better than it really should".

FIG. 3: Dr. Riazuddin (L) with his brother Dr. Fayyazuddin (R) (Courtesy: Dr. Pervez Hoodbhoy – Link)

Riazuddin found 1968, an efficacious year, for him. He came back to Pakistan on the request of Abdus Salam and joined Quaid-e-Azam University Islamabad's Institute of Physics (now National Centre for Physics). Vibrant research groups on relativity, particle physics, and string theory were brought about in those days. On Salam's postulation, Enrico Fermi Institute had also engaged its scientists in such groups. It was the start of an entirely new epoch in the field of physics in Pakistan. But still there is one more thing was to come into being on the part of Riazuddin in 1969, which made him acknowledged all over the world. It was his classical and well-founded textbook in particle physics *Theory of Weak Interactions in Particle Physics* coauthored with C. P. Ryan and Robert E. Marshak. He also penned two widely recognized textbooks, together with Fayyazuddin, *Quantum Mechanics* in 1990 and *A Modern Introduction to Particle Physics* in 1992.

Salam's relation with Riazuddin was lenient and unparalleled. Two nonpareil physicists of the homeland enthralled the physicists of all castes and creeds all over the world. International Centre for Theoretical Physics (ICTP) Trieste, Italy shortly after its establishment became world's leading cornerstone research institute. Riazuddin, along with Salam's other students, created theoretical physics group there.

Astonishingly, it was ICTP, where Salam summoned Riazuddin and advised him to meet Munir Ahmed Khan upon his return to Pakistan to start the progress for the designing of the atomic bomb. In Salam's views, the creation of theoretical physics group in Pakistan was mandatory to explore the technical aspects of fissile core and triggering mechanics of fissile material. Riazuddin made himself busy in the collection and analysis of data, which he procured from research papers, Manhattan project, Los Alamos laboratory etc. and started working day and night with sagacious engineers and canny physicists. Now, the rest was history. By shrugging off conspiracies, Pakistan made its way towards success. There was mass jubilation on May 28, 1998.

Overlooking minute details, in my opinion, the nation has forgotten the man who adept at complex calculations involved in the set-up of a nuclear arsenal. Riazuddin played a seminal and catalytic role, on the advice of Abdus Salam, in Pakistan's nuclear program. He awarded with Hilal-i-Imtiaz by the Government of Pakistan but it can never be the meed of Riazuddin's diligence.

FIG. 4: Dr. Pervez Hoodbhoy, Dr. Riazuddin, and Dr. Fayyazuddin (L to R) (Courtesy: Dr. Pervez Hoodbhoy – Link)

Once Riazuddin dreamt that he would transform and develop National Centre for Physics on the lines of ICTP. He became the director of NCP but unluckily owing to administrative and political reasons, he could not have

expounded his dream and removed by authorities from the directorship of NCP.

Riazuddin remained in search of something new. He wanted to find modern ways to look at. Being a dignified professor, it was his commitment and passion which made him the great Riazuddin. He knew how to evolve in the essence of theoretical physics. Around 165 research papers in reputed journals all over the world, more than 1900 citations along with a number of books, Riazuddin became one of the ever-leading physicists of the country.

One can easily recognize his thirst for knowledge by the fact that this self-effacing quintessential physicist published his last paper on August 20, 2013 at the age of 82 just 29 days before his demise. On September 9, 2013, this archetypal scientist took his last breath but had left an unexampled legacy. Motherland produced only a handful of physicists like Riazuddin who have exceptional advocacy and subservient innovation. He left this materialistic world but his affection and services will remain forever with us.

Riazuddin made us proud. We cannot pay his debt for the services, he offered for us. But we can tribute to his intentness by following his footsteps with great zeal, glorious knack, coherent allegiance and continuous hard work.

He often said that "It was the idealism of the youth which not only enabled many of us, who could have stayed abroad, to return, but also infused a great enthusiasm to succeed in the pioneering role of establishing a new institution from scratch".

He tried to encourage his students, talented youth of motherland, with sententious comments: "One has to live this life only once in this world. So try to do something of which you would proud of. Learn and spread knowledge and try to create new knowledge. Be helpful to others."

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[1] (Faheem Hussain was recently awarded Spirit of Abdus Salam Award (2016) along with Seifallah Randjbar-Daemi and Galileo Violini by The Abdus Salam International Centre for Theoretical Physics (ICTP) Trieste, Italy.