



BOOK REVIEW

Suman Beri: A fearless woman scientist



Suman Beri-Higgs Boson, Top Quark and Single Top Quark: The story of Punjabi woman scientist

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The author of the book Rajinder Singh is a prolific explicator, he is credited with 140 articles and 38 books. He is a lauded biographer of pioneering Indian physicists. Recently he focused his attention towards Indian women physicists who deserve to be remembered for their contributions. The present book is an addition to this series, where he revealed illuminating details of Suman Beri's life and work.

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Suman Bala Paruthi (nee Beri) was born on 6 August 1949 to Daulat Ram Paruthi and Morni Devi. They had two sons and two daughters. Suman was the youngest in the family. Her brother Ish Kumar died in 1974 due to heart attack. Her second brother Suresh Chandra is retired Professor of Medicine from the Government Medical College, Patiala. Her elder sister Saroj Bala is a retired Post Graduate teacher.

Suman started her school education at the Convent of Jesus and Merry School, Shimla. She did her Higher Secondary from the Punjab University in 1965. Completed her B.Sc. (Honours) in 1969 and M.Sc. (Honours) in 1970 from the same university. In 1972, she qualified ETT Course (Russian) with distinction. She did her Ph.D. under the supervisor Virinder Singh Bhatia in 1976. Her Ph.D. thesis was on "*A comparative study of the fluxes of low energy helium and $Z > 10$ nuclei in primary cosmic rays over Fort Churchill in 1963, 1964 and 1967.*"

In fact Suman wanted to be an engineer, but after pre-engineering she realized that she was the only one female student in the engineering college. Suman's instinct led her to study and face the challenges of studying physics, a male dominated subject. While going through the process of admission some faculty members wanted to dissuade her. But the Head of the Department, Bal Mukand Anand came forward to confirm her admission to the Physics Department, Punjab University (PU).

In 1974, she was appointed as Teaching Assistant. She was promoted to the post of Lecturer in 1981. During this period she conducted two projects under DAE Scheme (1973--1974) and one project under TIFR (1981--1984). She was upgraded to the position of Reader in February 1987 under the UGC Merit Promotion Scheme. In 1996, she was raised to the post of the first woman Professor in Physics. She retired from the Department of Physics, PU, Chandigarh in August 2009. After her retirement, she continued in the Department as Professor until 2014. She became CSIR Emeritus Scientists in 2012. From 2015-17, she served as UGC Emeritus Fellow. She also worked as adjunct Professor in Sholini University, Solan. She served as the President, Physics Association for about ten years till her retirement in 2009. She was the founder Vice-President of the Society for the Promotion of Science and Technology in India from 2008--2015. Unfortunately she is not a fellow of three Indian Science Academies.

The document traced the history of the foundation of cosmic ray research in India. Initially it started at the Forman Christian College, Lahore in 1920s. When the American scientist Arthur H Compton visited in 1926 and started a research project in India with the support of the Punjab University, Lahore. As the Punjab University did not have its own suitable laboratory, the research related to the project was conducted at the Government College and the Forman Christian College, Lahore. A H Compton (USA) and C T R Wilson (UK) shared Nobel Prize in physics in 1927. This project implanted interest in the field of cosmic ray research among the scientists of the PU. In 1946, Hari Ram Saran and O P Sharma recorded valuable observation on measurement of directional total intensity of cosmic rays in Lahore. Piare Singh Gill, a student of the same college also made valuable research findings on cosmic rays. In 1945, the Bombay Chronicle reported the progress of the cosmic rays research done in the Forman Christian College.

Due to the development of the particle accelerator, scientists found more than 100 subatomic particles, classified as Quarks (6 types) and Leptons. Proton and neutrons are made up of still smaller particles called quarks. Quarks and Leptons are the building blocks of matter. C T R Wilson first took the photograph of ionized particles through his newly invented Cloud Chamber method, for which he received the Nobel Prize in Physics. The cloud chamber method was further improved by D M Bose (Kolkata), who laid the foundation of High Energy particle physics in India. In 1940, D M Bose and Bibha Chowdhuri showed the advantage of photographic plate method over the cloud chamber method for the detection of cosmic particles. This method was further studied by C F Powell (UK), who won the Nobel Prize in physics for his work in 1950. Later he wrote a book on the subject and duly acknowledged the work of D M Bose and Bibha Chowdhuri.

B M Anand from Punjab University did his Ph.D. under C F Powell and he introduced the emulsion technology in the Department of Physics, PU. The Compact Muon Solenoid (CMS) is one of the two large particle detectors constructed on Large Hadron Collider (LHC) at CERN. The CMS is built to study particles like Higgs boson and dark matter. In the construction and experimenting of CMS, 206 institutions from 47 countries (including India) were involved. As per CERN Library's record, many scientists from India participated in CERN projects. Suman made valuable research contributions in particle physics in Hadron-Nucleus Collisions in nuclear emulsions. She was a member of India-CMS collaboration and served as a co-investigator in CMS project.

She visited Fermi Lab, USA in 1993 and 1996 to collaborate with Manbir Kaur (Ph.D. scholar), Dimtri Bandurin (Virginia) and Ashis Kumar (New York) in D Zero (D0) experiments. Their research findings were published on the front page of "*Fermilab Today*" along with the photograph of four scientists. Fermilab is the United States' premier national laboratory for particle physics research. The "*Fermilab Today*" is one of the most reputed journals in high energy particle physics.

She worked in the top quark group and the group successfully discovered top quark. In 2009 the landmark discovery of single top quark was observed. The experiment involved 501 discoverers from 80 institutions across the world. She made notable contributions in these projects. Review of modern day Cosmic ray research remains incomplete without the inclusion of Suman Beri's contribution in the field. I feel there is an utmost need to revise the write up entitled with "The pioneers of cosmic ray research in India" by Hardev Singh Virk and Rajinder Singh [*J. Space Sci. and Tech.* 5 (2016) 17--23].

A separate chapter has been devoted to highlight the publication of Suman Beri's achievements through press. It has provided copies of many press clippings mainly from Punjab dailies. Her publications are frequently reported in Indian print and electronic media, whenever they became international news. However date and source of their reference are missing in many of the clippings documented. She has published 1615 articles (under single or joint authorship) in literary journals with high impact factor. She edited one book on high energy and nuclear physics. The Department of Science and Technology, Government of India published "*International Comparative Performance of India's Research Base (2009-14): A bibliographic analysis.*" According to this the publication Suman Beri and Vipin Bhatnagar of PU (both of them related to the CERN and Fermi Lab projects) are the two teachers, who are in the list of top 10 scientists in the country in terms of publications. She was honoured by the Rotary Club, Chandigarh for the discovery of the top quark. She received the Best Faculty Award from the Ministry of Human Resources and Development.

Suman's life journey to a scientific career was not easy. She had to struggle through various personal tragic events. She was married in 1977 to Hainder Krishan Beri, who was in Agriculture Research Services in the Central Institute of Fisheries Technology. Unfortunately he expired in 1992 due to cardiac arrest. She learnt lesson from the compelling events and reaffirmed herself to never give up. Fortunately she received support from her parents, in-laws, friends and colleagues. During the time of difficulties she got the support of scientific meditation techniques at home by joining Yogoda Satsanga Society of India, headed by Sri Paramahansa Yogananda. She always respected good teaching of all religions and believed that "Spiritualism starts where religion ends."

She is very fond of gardening, cooking and public relations. She always accommodated herself in any situation. She is a perfect balance between a traditional and modern Indian woman. Difficulties and challenges could never deter her from achieving her target. From the enrolment of students under her guidance, it appears that she lifted feminism in the field of science. It is notable that 12 out of 17 Ph.D. scholars completed under her supervision were female.

It is a brilliantly written biography which re-emphasized that science has no gender or ethnicity. Only the merit of research matters. I am sure the document will inspire younger generation to pursue their dream of scientific exploration and discovery.