



## BOOK REVIEW

---

---

**Suman Beri - Higgs Boson, Top Quark and Single Top Quark**  
The Story of a Punjabi Woman Scientist

**Rajinder Singh**

Shaker Verlag, Düren, Germany/2022

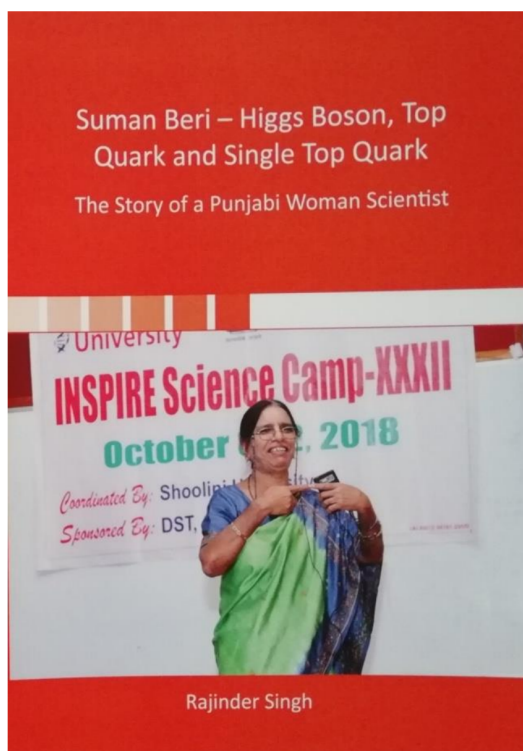
Price: 23.90 Euro; Pages: xxiv +160

---

---

Hardev Singh Virk <sup>1</sup>

*Professor of Eminence, SGGS World University, Fatehgarh Sahib, India*



---

<sup>1</sup> Email: [hardevsingh.virk@gmail.com](mailto:hardevsingh.virk@gmail.com)

In the **Preface**, Rajinder Singh, the author of this volume, recounts his achievements in the history of Indian Science. I felt humbled by his track record of 100 research publications and 39 books in this domain. So this volume is 40<sup>th</sup> in the series. He also recounts the reasons for undertaking this onerous task: “In 2021, on the Women Science Day, in Chandigarh, the Society for the Promotion of Science and Technology of India invited prominent female scientists from different fields of research, to deliver lectures. Professor Suman Bala Beri, formerly at the Punjab University (PU) Chandigarh, was one of them. I was fascinated by her life story, as she is the first female Professor of the Physics Department, PU. In addition to that, she is one of the first female Indian scientists to work on high energy particle physics”. He acknowledges the help of Prof. Arun Kumar Grover, Ex-VC PU, for providing moral support and help.

The Foreword to this volume is written by Prof. Bindu Bambah, Ex-Senior Professor of University of Hyderabad, and herself a prominent Theoretical Particle Physicist. Bindu writes: “I have known her for nearly 50 years, half a century of ups and downs. How can one write objectively about a person one has known since childhood, as a teacher, friend and physicist? So, if my words sound subjective, it is with a reason. There is emotion involved, and with feeling invariably comes subjectivity”. Bindu ends her write up by paying glowing tributes to Suman: “This book is a biography of one such a “Violet”, and I hope it spreads the fragrance of her life as a role model for coming generations of women. Let them be inspired by a life in Physics that overcame many hurdles, many downfalls, and many losses but still survived to be part of not only the top quark discovery but the Higgs search as well”.

In his message, Prof. Arun Kumar Grover, Ex-VC of PU Chandigarh, narrates how he motivated Rajinder Singh to write biographies of BM Anand and Suman Beri: “In March 2021, he proposed to write a biography of Suman Beri and I offered to assist him in collation of relevant material available in PU and TIFR and also put him in contact with scientists who have known her”.

In the **Introduction** to this volume, author writes: “Suman Beri is one of the inventors of top quark, single top quark and Higgs boson. She is one of the top ten Indian physicists with highest h-index. She is honoured by different institutions. She is one of the persons who work for the promotion of girls’ education. To the best of my knowledge, there is no book which deals with her life and science. The present book intends to fill the gap”.

**Chapter 1** deals with family life of Suman Beri. She belongs to a middle class family of Himachal area of old Punjab but her father was Headmaster of a High School in Simla. All her siblings got good education. Her parents played important role in molding the direction of her life as a prominent future scientist. She had interest in Physics, Chemistry and Mathematics. However, Physics was her favorite subject.

The story of her admission to PU Honours School in Physics is interesting. The day she entered the Physics block, some senior Professor entreated her with the query: “Physics is a tough subject – have you thought about it”. She was not discouraged by his remark. She got admission to B.Sc. (Honours School) and passed BSc (Honour School) in 1969, and MSc (Honour School) in 1970 from the Punjab University, both in the first division. Suman was motivated by KL Verma, an old student of her father, to join as Research Scholar in the department.

Suman was encouraged by her parents to choose research as a career. She was married in 1977 but unfortunately her husband died in 1992 and her dreams were shattered. But Suman found solace in moving on in life by engaging full time in research. She recounts: *“There were two options - either I absorb myself fully to work not giving any time to my mind for anything else OR do not do anything and wait for life to finish without any contribution. Here I chose first option.”*

**Chapter 2** deals with views of Suman’s colleagues, students, friends and relatives. This is the lengthiest Chapter covering more than 50 pages. Her well wishers include Gurmukh Singh and Manjit Kaur, her research collaborators in PU, Keya Dharamvir, Bindu Bambah & RK Puri of PU Physics, RK Kohli, DUI PU; her foreign collaborators, Ph.D. Scholars supervised by Suman, and her friends and relatives. I found the views of Harrison Prosper, her research collaborator in D0 experiment, as the best tribute to Suman: “I found Suman to be very approachable and quickly learned that this pleasant highly inquisitive physicist demanded clarity and precision in our discussions of scientific matters. Later, when she embarked on a long, distinguished, career as a gifted mentor of young people, I would learn of other important traits: the highly inquisitive physicist was also kind, thoughtful, and firm; she holds herself and her students to high standards, and she insists that projects started be brought to satisfactory conclusions. *Professor Beri has left her mark on the scientific enterprise of India not only through her*

*scientific contributions but also through the many young people who have had the good fortune of having been mentored by Suman Beri”*

**Chapter 3** is one of the core Chapters based on the Doctoral Thesis of Suman Beri. The author traces the roots of cosmic ray research in Punjab. “*The cosmic ray research began in Lahore due to a visit by the American scientist Arthur H. Compton in 1926. As Punjab University did not possess its own laboratories, the main research work was done at the Government College Lahore and Christian Forman College*”.

Suman Bala wrote her thesis on “*A comparative study of the fluxes of low energy helium and  $Z \geq 10$  nuclei in primary cosmic rays over Fort Churchill in 1963, 1964 and 1967*”. What motivated her to begin this research? Suman wrote that it was a paper by T.F. Cleghorn *et al.* on “The effects of solar modulation on the energy spectrum of heavy cosmic ray nuclei”. She pointed out the following two drawbacks in their results: (i) “low statistics”, and (ii) the helium and  $Z \geq 10$  nuclei fluxes were taken from experiments, performed at different times.

In her thesis, Suman studied: (i) Relative modulation of helium and  $Z \geq 10$  (nuclei with  $10 \leq Z \leq 28$ ). (ii) “Characteristics of interstellar propagation of these nuclei”. After applying different corrections (scanning loss, loss due to interaction in the stack, correction for  $Z \geq 10$  nuclei, correction for solid angle, ‘correction for loss due to air-cut-off’, ‘correction due to fragmentations and ionisation losses in air’), she determined the differential energy fluxes on the top of the earth’s atmosphere for helium and heavy nuclei. She was awarded her Ph.D. degree in March. 1976.

**Chapter 4** gives details of her teaching career in PU Chandigarh. Suman joined as Teaching Assistant in 1974 and re-designated as Lecturer in 1981. Her duties included teaching Theory and Practical courses, supervising M.Phil. dissertations and doing research work on Cosmic rays. In due course of time, she was promoted as Reader in 1987 and as Professor in 2001. Her application for Professorship shows her achievements in research and participation in research projects as Co- or Principal Investigator, and collaborator in major International projects like D0 and CMS experiments at Fermi Lab. and CERN, respectively. This Chapter gives details of Ph.D. theses guided by Suman: 9 under CMS Project and 5 under D-Zero collaboration.



**Chapter 5** describes Suman's international connections and important scientific discoveries. Her scientific work deals with the detection of cosmic rays and fundamental particles of the standard model. The author gives description of some old techniques of particle detection and new detectors being used at CERN and Fermi Lab. This Chapter also narrates the trials and tribulations of Suman Beri to get duty leave, travel grants and other facilities to participate in international projects abroad. It shows her "*perseverance, grit and patience*" to overcome the bureaucratic hurdles created by the university administration. I wonder she not only survived but also won laurels by her success stories in the international projects.

The author gives details of discoveries made by Suman in this Chapter. She was a participant in discovery of "*top quark*", "*single top quark*" and "*Higgs Boson*". The mass of top quark and its production cross-section was determined at the Fermi Lab. Tevatron. How difficult is to discover these elementary particles of the Standard Model will be clear from this statement: "*Searching for single-top production makes finding a needle in a haystack look easy. Only one in every 20 billion proton-antiproton collisions produces a single top quark. Even worse, the signal of these rare occurrences is easily mimicked by other "background" processes that occur at much higher rates.*"

**Chapter 6** gives details of Suman's media interactions. Generally, Indian media ignores the scientific achievements of Scientists and keep busy reporting of political and sports events which are liked by the public. However, Suman got lot of media attention in Chandigarh after the discovery of single top quark and Higgs Boson. A local newspaper reported on March 12, 2009: "*In the discovery of the single top quark, Suman Beri played leading role. The team headed by Prof. Suman Beri also collaborated in the D-Zero experiment.*"

The recent trend to boast of the contribution of a scientist is the h-index, which measures the productivity and citation impact of the publications. Not only due to her scientific achievements, but also for the importance of her publications on the international and national level, local media reported on her. *She is among the TOP TEN highly cited scientists of India and occupies the Top position in PU list of achievers.*

**Chapter 7** mentions Suman's achievements through Awards and Honours bestowed upon her. As mentioned in the last two Chapters, Suman came into limelight due to her participation in discoveries of 3 new particles. She was honoured by the University Syndicate "*for actively participating in the exciting discovery of top quark and as co-author of top discovery paper which had citation of more than 800 (D0 collaboration, Fermi Lab, USA)*". Suman Beri was awarded CSIR Emeritus Scientist status in 2012, and UGC Emeritus Fellowship from 2015-2017. She is the first female Professor to be honoured as 'Professor emeritus' in the department of physics.

In **Chapter 8** "Concluding Remarks", the author sums up his impressions about Suman Beri, her achievements in life, and the Indian University system:

1. Suman Bala Beri's life is an encouraging story for younger generation, in particular girls/boys from the middle class. She inspired many and touched the lives of those, with whom she came in contact.
2. Author takes a dig at Indian Science Academies: "In spite of SB's or Manjit Kaur's high h-index and huge number of publications, they are not elected as Fellows of any of the three academies. Why so"?
3. Success has its own price. We have seen that she has to often beg the authorities for duty leaves. She often worked on half-pay or without pay, while she was abroad.
4. Author appreciates Suman's life philosophy: "I personally differentiate between religion and science. They are two opposite poles. They have nothing to do with each other. Still, I believe that Suman Beri's biography is of interest, because her religious life philosophy is to help mankind; and apply her religious idea to motivate students to do good science research".

There is an Appendix listing Suman's 32 research publications during 1971-1985. Of course, she has more than 1600 publications in all, most of these under her collaborative research projects. As usual, Rajinder Singh gives an exhaustive list of bibliography at the end of the volume.

I may point out some mistakes which crept in due to oversight or error of judgement. For example, in Gurmukh Singh's narrative (p. 18), PU Chandigarh is being confused with Chandigarh University without realizing that there is a private

University of this name located at Gharuan, near Kharar. Forman Christian College is being written as Christian Forman College (p. 65). Piara Singh Gill (p. 66) was never a student of Forman Christian College, he was a teacher there. There are some typos which need to be taken into account in the next edition.

I enjoyed reading this biography as there is lot of new information about Suman Beri which I relish. I know her since the last 50 years and met her just after my return from Marie Curie University, Paris. This is an inspiring biography for our young students, specially the girls of this country who face lot of hardships in the patriarchal society of India. Suman is a role model for our girl students.