

N. R. SEN - LIFE AND SCIENCE



RAJINDER SINGH & SUPRAKASH C. ROY

Wissenschaftsgeschichte /
History of Science

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Shaker Verlag
Düren 2021

Bibliographic information published by the Deutsche Nationalbibliothek

The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie; detailed bibliographic data are available in the Internet at <http://dnb.d-nb.de>.

Titelbild Copyright: Indian National Science Academy, Delhi.

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Printed in Germany.

ISBN 978-3-8440-7839-8

ISSN 2198-8552

Shaker Verlag GmbH • Am Langen Graben 15a • 52353 Düren

Phone: 0049/2421/99011-0 • Telefax: 0049/2421/99011-9

Internet: www.shaker.de • e-mail: info@shaker.de

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Preface

In India, historians have written the biography of scientists like Chandrasekhara Venkata Raman, Meghnad Saha, Satyendra Nath Bose, Homi J. Bhabha, Jagadish C. Bose and Prafulla C. Ray. Over the last few years, we tried to introduce lesser known physicists like Debendra Mohan Bose, Sisir Kumar Mitra, Sukumar Chandra Sirkar, Bidhu Bhushan Ray, Bibha Chowdhuri and Purinma Sinha to the interested readers of history of science. While writing on them, we came across the name of Nikhil Ranjan Sen, a mathematician, who was the founder of the Calcutta School of Theory of Relativity and is known as the father of Applied Mathematics in India. N.R. Sen was contemporary of S.N. Bose and M.N. Saha. They studied at the Presidency College, Calcutta (now Kolkata). All three belonged to the Mathematics Department of the newly founded College of Science and Technology of the University of Calcutta. Unlike S.N. Bose and M.N. Saha, Sen stayed with the Department of Applied Mathematics at the University of Calcutta from the beginning to the end of his career.

NRS is known for his contribution to the theory of relativity and structure of stars. His work in the fields of fluid dynamics and ballistics is relatively unknown. He influenced the development of science and technology in India. Sen was a brilliant writer and translator. In the present book, we attempt to highlight his life and scientific work.

At the beginning of his scientific career, Sen's name was published as Nikhilranjan Sen and later as either Nikhil Ranjan Sen or N.R. Sen. In our book, we have adopted the name N.R. Sen (abbreviated NRS).

To become the first biographer of a scientist born in the late nineteenth century and less discussed scientist is always a challenge. Since getting information about his personal life in the absence of his close relatives or students is difficult, we had to depend on various indirect sources. As a result, we can not claim that the information presented in this book is complete. We will appreciate

receiving feedback from interested readers and others to update our knowledge.

Remarks: Nikhil Ranjan Sen was a mathematician and his works involved high level of mathematical sophistication. Since none of the authors is a mathematician, we must submit that we have tried our best to comprehend the essence of his works and have presented accordingly. Our humble attempt has been to get the ball rolling, since there was no biography of N.R. Sen and his works so far so that others can take it forward from there.

An obituary published by the Indian National Science Academy contains a list of Sen's publications. Unfortunately, either some of the listed items are incorrect or some articles are missing. For the sake of entirety, we have provided a new list in Appendix called "N.R. Sen – Improved List of Publications". However, we do not claim that the list is complete.

Acknowledgements

We are thankful to Prof. Ashok Kumar Singhvi - Vice President Indian National Science Academy (INSA), and Dr. Sudhanshu Aggarwal for sharing some articles from the Proceedings of the National Institute of Sciences of India (later renamed as Proc. INSA). We thank Professor Gautam Gangopadhyay, General Secretary of the 'Bangiya Bijnan Parishad', Kolkata for providing information on Sen's activities at the Parishad. Thanks are due to Siddhartha Ray, retired professor of physics of University of Kalyani, and Shri Tamal Majumdar for providing information about N.R. Sen's personal life. We thank Archives of Max-Planck Society, Berlin; Niels Bohr Archive Copenhagen, Indian Association for the Cultivation of Science (IACS), Kolkata; Raman Research Institute, Bangalore. Mr. Rüdiger Buchholtz, Mr. Kevin Ågerter and Mr. Henrik Hofer, University archive, Humboldt-University Berlin, are thanked for providing documents on N.R. Sen's Ph.D. thesis.

We are grateful to Prof. Narayan Chandra Ghosh of Rabindra Bharati University, Kolkata for kindly agreeing to write the

‘Foreword’. One of the authors (SCR) appreciates the useful discussion that he had with Prof. Ghosh during writing this book.

Special thanks are due to Sujata Roy, wife of Suprakash Chandra Roy for her untiring effort in reading the manuscript, for helpful discussions, comments and corrections in improving the manuscript.

One of us (RS) thanks Prof. Dr. Michael Komorek, Head – Physics Didactic and Science Communication, University of Oldenburg, Germany, for providing research facilities. Thanks are due to my wife Birgit Krahe, children Amer Simone and Hira Michael for moral support. I appreciate the help of Ms. Petra Raue and Ms. Simone Treunert, Head “Grund- und Oberschule”, Syke for assisting me in one way or other.

Last but not the least, we thank Ms. Kristina Ladwig and Shaker Publisher Dueren for publishing the present book.

Foreword

During late seventies, I, as a research student, met my teacher Professor K.M. Ghosh of Jadavpur University, who did his Ph.D. under Nikhil Ranjan Sen, for the first time. At his residence, I saw Professor Ghosh writing equations on turbulence narrating ejected gas flow from chimney, fluid flows in ocean and cyclone to his students. Professor Ghosh was explaining line by line from the book “The Modern Theory of Turbulence” by N.R. Sen. It was Professorship Lecture of 1951 delivered by Professor Sen. Later on, this lecture note was published by Indian Association for the Cultivation of Science (IACS) in the form of a booklet. Professor Ghosh used to tell his students “For you this small book is like the holy book *Gita*. Go through this book line by line, derive all the mathematical equations and try to understand physics behind mathematics in this book. Then you will be able to pass the gateway of the subject turbulence – most complicated and notorious subject to solve its problems”.

He advised me to purchase a copy of N.R. Sen’s “The Modern Theory of Turbulence” from IACS, Jadavpur. The next day when I met my teacher he gave me papers by S. Chandrasekhar, A.N. Kolmogorov, W. Heisenberg and G.K. Batchelor. He advised me to photocopy those and return the originals to him. Thus started my journey with the topic - turbulence.

During my student life I met Satyendra Nath Bose, Prasanta Chandra Mahalanobis but had no chance to meet Meghnad Saha and Nikhil Ranjan Sen. My teacher K.M. Ghosh frequently used to talk about both of them. He portrayed his teacher N.R. Sen to be so lively that till this day when I try to study fluid turbulence, I can feel his presence.

About six months later I had an opportunity to enter Prof. Ghosh’s room on the first floor of his residence. Then his wife was engaged in the daily ritual of worship. I was surprised to see that there was no idol of god or goddess; instead she was worshipping pictures of N.R. Sen and S.N. Bose. I had heard about our ancient *Guru-Shishya*

relationship but witnessed for the first time unprecedented regard of a student towards his teacher. We also know of S.N. Bose calling Einstein 'Respected Master' instead of the usual western salutation 'Dear Sir or Dear Mr. Einstein'. These forms of salutation may seem archaic, even quaint to western minds, perhaps also to the modern generation of Indians. But in India traditionally the seniors are addressed in a special polite way. Einstein was a master or 'guru' as per the Ekalavya tradition, where the 'master' is not even aware of the devotion of a student with whom he has had no direct contact. N.R. Sen, M.N. Saha and S.N. Bose were all products of our notable Indian culture. N.R. Sen's student K.M. Ghosh was highly influenced by Sen's practices. So perhaps worshipping Guru daily was a culture followed in Ghosh's house. I feel extremely proud, as well as grateful, for bearing the torch that ignited my grand teacher N.R. Sen.

During eighties, Dr. Ambarish Ghosh, Professor - Indian Statistical Institute used to come to the Department of Applied Mathematics, Calcutta University to teach Fluid Mechanics in post-graduate classes. He, with his student, used to frequently visit the Fluid Dynamics Laboratory established by Professor N.R. Sen under the control of Department of Applied Mathematics, Calcutta University. I used to meet Professor Ghosh to learn fluid mechanics and tried to be present in the fluid mechanics laboratory during their experimental work. There was a wind tunnel, water channel and some other instruments. Perhaps that was the first fluid mechanics laboratory of its kind in any mathematics department in India. It was designed and developed by N.R. Sen. It is astonishing to learn that N.R. Sen started Laboratory Based Mathematics Teaching in India much before the idea was conceived at the end of nineties of the last century.

In the year 2018, Paschimbanga Ganit Parsad in an article published in its journal 'Ganit Bhavana' wrote that N.R. Sen, M.N. Saha and S.N. Bose were scientists of equal merit but N.R. Sen was less known to commoners. This gave me an impetus to introduce N.R. Sen to the common people and I contacted 'Paschimbanga Ganit Parsad'. They readily agreed to my proposal of publishing my article

on N.R. Sen and organized a seminar on mathematician N.R. Sen. In Sept. 1995 Calcutta Mathematical Society had organized a National Seminar on 'Environment Pollution Caused by Power Plant: Mathematical View Point' under the banner of 'N.R. Sen Center for Pedagogical & Professional Mathematics'. In September 1996 I organized a National Seminar on 'Theory and Methodology of Mathematics Teaching' in Calcutta Mathematical Society under the same banner of 'N.R. Sen Center for Pedagogical & Professional Mathematics'. A good number of associates and former students of N.R. Sen attended the above seminars to uphold Professor Sen's contributions to mathematics teaching and research. I was proud to meet the dignitaries as Convener of the noted national seminar.

When I came to know that Rajinder Singh and Suprakash C. Roy were writing an article on N.R. Sen and his contribution to turbulence research in India for "Science & Culture", a journal initiated by M.N. Saha, I was really delighted, rather tempted to know more about it. Later, when Professor Suprakash C Roy informed me that he, along with his collaborator Rajinder Singh, was writing a book on N.R. Sen's life and contributions, I was convinced that finally, a forgotten legendary Indian mathematician was going to get his share of recognition. They have done an arduous task of painstakingly collecting authentic information about N.R. Sen and his research work. I am sure Rajinder Singh & Suprakash C. Roy's contribution will be a historic one.

Professor Nikhil Ranjan Sen did research in a wide range of subjects and topics. He did pioneering work in the fields of turbulence, ballistics and cosmology. George K. Batchelor, Cambridge University, who studied under Sir G.I. Taylor, regarded as the father of modern fluid mechanics in the Cavendish Laboratory, cited N.R. Sen's paper in his book 'The Theory of Homogeneous Turbulence'. I understand that Sen's works on ballistics science and cosmology have been referred to by many authors/researchers. In 1924, Prof. Sen took over as the Rashbehary Ghosh Professor of Applied Mathematics. But it was not the end. Sen's sense of social justice and social responsibility towards human beings and human communities made him a 'lone traveler'.

Rajinder Singh and Suprakash C. Roy have unearthed a wide range of N.R. Sen's contributions and activities. Not just accumulation of information but through their lucid writing, readers will gain entry into an unexplored area so far. Both of them deserve thanks not only from the readers of the book but also from conscious people, particularly from Kolkata, who would like to see history in its true form.

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Birgit Krahn



Sujata Roy

**Dedicated to two ladies whose quiet presence is spread
throughout this book.**

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1. Nobel Laureate C.V. Raman's Work on Light Scattering, Logos Publisher, Berlin 2004.
2. Nobel Laureate C.V. Raman's Science, Philosophy and Religion, Dharmaram Publications, Bangalore 2005.
3. Characteristics of Solar Radiation Photovoltaic Pyranometers - Licor 200SZ and Matrix 1G, Shaker Publisher, Aachen 2012.
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Rajinder Singh: 1. 'DM Bose—A Scientist Incognito' published by Bose Institute, Kolkata 2. 'A Jewel Unearthed: Bibha Chowdhuri' published by Shaker Verlag Aachen. 3. 'D.M. Bose - His Life, Science and Connection with Global Elites', Shaker Publisher Dueren, Germany. 4. 'Clay, Craft, Music and Science: Purnima Sinha's Life', Shaker Publisher, Düren 2020. 5. 'Bibha Chowdhuri, eine indische Hochenergiephysikerin als „Star“ am Himmel', Shaker Verlag, Düren 2020.