

Dr. Amarjit Singh— a Phenomenon

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I thank the **VEDA Society** for giving me an opportunity to say a few words about Padma Bhusan Amarjit Singh (**Dr. Singh**) on his Centenary Birth Anniversary

Dr. Singh served CEERI for about quarter of a century: first from 1959 to 1962 and then, after about a year gap, from 1963 to 1984.



“Was there ever a more horrible blasphemy than the statement that all the knowledge of God is confined to this or that book? How dare men call God infinite, and yet try to compress Him within the covers of a little book!”
— Swami Vivekananda (Raja-Yoga)

This presentation is based on the information that I obtained from Professor SC Dutta Roy, Dr. SN Joshi, Dr. Chandra Shekhar, and the information available from the following articles:

Amarjit Singh, “Towards a Shining India: Recollection and Reflections of a Research Scientist,” private communication (unpublished).

B. N. Basu, “Journey of Amarjit Singh from Phagwara to Pilani,” *CEERI News*, vol. 60 (1), January 2021,

which was subsequently reproduced as:

B. N. Basu, “Journey of Amarjit Singh from Phagwara to Pilani,” *IETE Journal of Education*, vol. 64, no. 2, July-December 2023.

Dr. Amarjit Singh

19th November 1924 – 17th August, 2021



Son of Sardar Jagdish Singh and Ishar (Kaur) Singh—**Dr. Singh**—was born on 19th November 1924 in Ramdas near Amritsar, India. He breathed his last at Davenport, United States on 17th August, 2021 August 17, 2021.

Dr. Singh was felicitated by Padma Bhusan Award by the President of India in 1985.



Manfred Thumm[Ⓢ], Amarjit Singh, Ernst Bosch, SN Joshi,
Michael Petlin[Ⓢ], BN Basu[Ⓢ]

[Ⓢ]Recipient of John R. Pierce Award for Excellence in
Vacuum Electronics of IEEE Electron Devices
Society, USA

Manfred Thumm received this award in 2008.

Michael Petlin received this award in 2011.

BN Basu received this award in 2023.

Ernst Bosch: Thales Deutschland GmbH, Ulm, Germany

Michael Petlin: Institute of Applied Physics, Russian Academy of Science in Nizhny Novograd

Manfred Thumm: Karlsruhe Institute of Technology, Germany

“True knowledge is not attained by thinking. It is what you are; it is what you become,”—Sri Aurobindo

“It is true that existence consists only in the action of energy. Or is it not rather that energy is an output of existence?”—Sri Aurobindo

Padma Bhusan **Dr. Singh** often used to start a monthly meeting with the scientists of CEERI, Pilani with a quotation from Sri Aurobindo.

I am privileged to say a few words about the legendary **Dr. Singh** who served CSIR-CEERI as Director for about half a century even though I worked at CEERI as a Scientist-B for a stint of only about ten months?

I thank the Organizer of the VEDA Society Conference for giving me this privilege.

My PhD supervisor **Professor NB Chakrabarti** D. Sc. suggested me that I should further my work carried out in my doctoral research by going to CEERI, Pilani and taking guidance from **Dr. Singh**.

One of the concerns of my doctoral research was the analysis of a beam-plasma amplifier.

Dr. Singh had interest in this subject.

During 1962-1963, Professor JE Rowe at Michigan University assigned **Dr. Singh** the task of developing a high-frequency source by passing an electron beam between two closely-spaced electrodes, which essentially involves beam-plasma interaction (see Section 8.3.2 of B. N. Basu, "Electromagnetic Theory and Applications in Beam-Wave Electronics," World Scientific Publishing Co. Inc., Singapore, New Jersey, London, Hong Kong (1996)).

I served as Scientist B at CEERI, Pilani, for a stint: from 19th September 1977–28th July 1978, when Dr. Singh was the Director, CEERI, Pilani.

I was motivated by Dr. Singh to measure the AM-to-PM conversion coefficient of the first Indian TWT at CEERI, Pilani under the guidance of Dr. SSS Agarwala.

I authored two Internal Reports during my ten months stay as Scientist B at CEERI:

- CSIR-CEERI-IR-01/VT/78: B.N. Basu and S.N. Joshi: Equivalent circuit analysis of a helix in free space.
- CSIR-CEERI-IR-02/VT/78: B.N. Basu: Field analysis of dielectric supported and shielded sheath helix.

An Anecdote

I was then an employee of CEERI. One day I was entering the CEERI main gate. I was surprised that Dr. Singh was waiting for me to join him in the walking from the main gate of CEERI to the CEERI lab building. The security personnel at the main gate checked my I-card. Thereafter, as we two walked together a few meters from the main gate, Dr. Singh asked me to halt and wait for him for a while. I found him to go back to the security personnel and scold him as he had checked my I-card and had not checked the I-card of Dr. Singh.

Later on I collaborated with CEERI, Pilani as Distinguished Visiting Scientist (DVS) of CSIR when I was Professor of Banaras Hindu University (BHU). Hence, I used to visit CEERI quite often.

In one of my visits under the DVS scheme from BHU to CEERI, I was advised by Dr. Singh to study by electromagnetic analysis the stop-band created in the ω - β dispersion characteristics of helical SWS due to the asymmetry of the dielectric helix-support rods.

Dr. AK Sinha of CEERI—whom earlier I had provided my guidance in his doctoral research—successfully carried out this analysis assigned by Dr. Singh, and documented the findings in the following paper:

Y.D. Joo, A.K. Sinha, and G.S. Park, “Electromagnetic wave propagation through an azimuthally asymmetric helix slow wave structure,” *Jpn. J. Appl. Phys.* vol. 42, 7585–93 (2003).

Father of Dr. Singh, Sardar Jagdish Singh (JS), a renowned science teacher at a high school in Phagwara, Kapurthala, Punjab, enthused **Dr. Singh** to study science.

JS in school used to demonstrate science experiments, for instance, Wimshurt machine, a class of electrostatic generators, to motivate his students.

JS taught **Dr. Singh** at home how to prepare oxygen.

Dr. Singh at home experimentally validated James Watt's principle of steam engine.

Dr. Singh was also fortunate to have in his school Sri Banwari Lal as his teacher,

who stoked his enquiring mind by lending him books from his personal library.

Reading these books Dr. Singh learned more science than what was taught In his school.

Hertz's experiment attracted Dr. Singh leading to his interest in communication engineering.

Timeline

1944: Bachelor of Science (Hons.), Punjab University, Lahore

1945: Master of Science, Punjab University, Lahore

1947: Master in Engineering Science, Harvard University

1949: Doctor of Philosophy, Harvard University

1949-1953: Lecturer in Radio Physics, Delhi University

1953-1959: Science Officer, CSIR-NPL, New Delhi

1959-1962: Assistant Director, CSIR-CEERI, Pilani

1962: Research Engineer, Michigan University, Ann Arbor

1963: Research Engineer, Michigan University, New Jersey

1963-1984: Director, CSIR-CEERI, Pilani

1975: D. Sc. (Honoris Causa), Punjab University

1979: Industrial Research Award, Federation of Indian Chamber of
Commerce and Industry, New Delhi

1984-1987: National Project Coordinator, UNDP, CEERI, Pilani

1985: Padma Bhusan Award of the President of India

Period-Wise Tenure of Scientists Spearheading CSIR-CEERI, Pilani

1954-1956: Dr. NB Bhat: Planning Officer

1957-1959: Dr. BH Wadia: Assistant Director-cum-Officer-in-Charge

1959-1962: Dr. Singh: Assistant Director-cum-Officer-in-Charge

1962-1963: Dr. DL Subramaniam: Assistant Director-cum-Officer-in-Charge

1963-1984: Dr. Singh: Director

1984-1989: Dr. GN Acharya: Director

1989-1993: WS Khokle: Director

1993-1999: RN Biswas: Director

1999-2003: Dr. S Ahmad: Director

2003-2015: Dr. Chandra Sekhar: Director

2015-2016: Dr. RK Sinha, Director, CSIO: Director Additional Charge

2016-2018: Professor Santanu Chaudhury: Director

2018-2019: Professor Raj Singh: Acting Director

2019-2020: Dr. RK Aswal (Director, NPL): Director, Additional Charge

2020 onward: Dr. PC Panchariya (Director)

1944: Bachelor of Science (Hons.),
Punjab University, Lahore
1945: Master of Science, Punjab
University, Lahore

Dr. Singh studied B. Sc. Physics Honours at Sikh National College, Lahore under Punjab University, Lahore, where he received immense inspiration from Professor JB Seth. Dr. Singh obtained his **M. Sc. degree** in Physics in 1945 from **Punjab University, Lahore**.

C.V. Raman evaluated and highly praised the M. Sc. thesis of **Dr. Singh** titled “A small shielded transmitter.”

1947: Master in Engineering
Science, Harvard University

1949: Doctor of Philosophy, Harvard
University

For higher studies, **Dr. Singh** availed of the “Sargent Scheme” and moved to Ohio State University for Radio Engineering course and thereafter Harvard University for Applied Physics course. **Dr. Singh** received Master in Engineering Science and Doctor of Philosophy degrees in 1947 and 1949, respectively, both from **Harvard University**.

Professor Roland WP King supervised the doctoral research of **Dr. Singh** on the topic: **Extension of the Tuning Range of a Magnetron**.

1949-1953: Lecturer in Radio Physics, Delhi University

Dr. Singh joined the **Physics Department of Delhi University (DU)** as lecturer, teaching Electronics and History of Science to postgraduate and undergraduate students. He was not assigned the so-called 'pure' Physics class, his experience in the development of magnetrons at Harvard University being considered as the so-called 'applied' Physics.

Dr. Singh made operational one of the four SCR 584 (fire-control) radar sets lying around in the Physics Department of DU, which were procured earlier from defence disposals. **Dr. Singh** also intended to reuse the magnetrons for the purpose of developing a medical LINAC.

Dr. Singh had then collaborative interactions with CSIR-NPL at New Delhi in the development of magnetrons. In view of his two-year contract with DU, Dr. Singh could not join then NPL as a regular Scientific Officer at NPL advertised by **Dr. KS Krishnan**, the first Director of NPL.

1953-1959: Science Officer, CSIR-NPL, New Delhi (around six years)

Dr. Singh delivered a talk on the development of magnetrons based on his doctoral work at Harvard University at CSIR-NPL. The talk impressed Dr. KN Mathur, a close associate of the erstwhile lab Director Dr. KS Krishnan, in the audience of the lecture delivered. Due to their intervention, the hurdle of two-year notice period of DU could be overcome and Dr. Singh joined CSIR-NPL. Fortunately, he continued to enjoy access to the magnetrons of SCR 584 radar sets at Delhi University for the purpose of his research work at CSIR-NPL.

At CSIR-NPL, **Dr. Singh** was successful in developing an interdigital magnetron with a wide tuning-range. Many distinguished visitors flocked to the laboratory to see the equipment, including the first Indonesian President, Sukarno. Dr. Krishnan also arranged the visit of Pt. Jawahar Lal Nehru to the laboratory, finding an opportunity when the latter was in CSIR-NPL to attend a conference of the directors of CSIR.

Dr. Krishnan also arranged the visit of Prime Minister Jawahar Lal Nehru (PM) to the laboratory of Dr. Singh, finding an opportunity when PM was at CSIR-NPL to attend a conference of the CSIR Directors.



1959-1962: Assistant Director-cum-Officer-in-Charge, CSIR-CEERI, Pilani
1962-1963: Dr. DL Subramaniam: Assistant Director-cum-Officer-in-Charge
1962-1963: Dr. Singh: Michigan University
1963-1984: Dr. Singh: Director (~21 years)

Dr. Singh appeared for an interview at CSIR for the post of Assistant Director, CSIR-CEERI, and was offered the same. Dr. Singh was, however, in a dilemma, as he had a simultaneous offer of a research position at Stanford University from Prof. M. Chodrow. Dr. Krishnan was in favour of Dr. Singh joining CSIR-CEERI, and he tried to convince his wife Ms. Surinder by explaining her the advantages of her husband's joining CSIR-CEERI when Dr. Krishnan chanced upon her once during her evening walks with family. Matters fell in place when Dr. Singh discovered CSIR-CEERI Pilani to be much richer than CSIR-NPL in terms of equipment for the development of vacuum tubes, thanks to the substantial grant received from Technical Cooperation Mission (TCM) of USA. He overcame his dilemma and joined CSIR-CEERI in 1959.

Some of the magnetrons developed later by CSIR-CEERI include X band, 200 kW coaxial magnetron; and S-band, 1.0/2.0/2.6/3.0 MW tunable pulsed magnetron. A 35 GHz, mm-wave magnetron was also developed at CSIR-CEERI. Recently, the technical know-how of a 2.6 MW, S-band magnetron has been transferred to M/s Panacea Medical Pvt. Ltd., Bengaluru, for production. Currently, the development of low-power CW magnetron, spatial harmonics magnetrons, and system-based on low-power CW magnetrons are being explored at CSIR-CEERI.

S.Mourya, “Past and present status of the magnetron development in the country and the efforts at CSIR-CEERI leading to the product development for the users,” in Proceedings, Webinar 2 on VED Thinkers Group platform (Ed. V. Kesari and B.N.Basu).

The problem assigned by Prof. Rowe at Michigan University to Dr. Singh was to develop a high-frequency source through an electron beam passing the interaction region between two closely-spaced electrodes. The problem turned out to be one of developing a device that accrues beam-plasma interaction for an electron beam penetrating through a plasma medium—a device similar to Haeff tube or double-stream amplifier in which two intimately mixed electron beams of slightly different velocities interact with each other. Such a device would do away with the slow-wave structure that is required for a TWT.

1962-1963: Dr. Singh: Michigan University

1963-1984: Dr. Singh: Director (~21 years)

During his stay at Michigan, Dr. Singh visited Bell Telephone Laboratories to observe developments in the field of semiconductor devices that were competing with vacuum electron devices in function. An emergent political situation in India the war between India and China, however, made it expedient for Dr. Singh to return to India without completing his one-year tenure at Michigan University. He was responding to an SOS from CSIR asking him to join back as the Director of the Institute. He joined CSIR-CEERI afresh in 1963.

1962-1963: Dr. Singh: Michigan University

1963-1984: Dr. Singh: Director (~21 years)

Dr. Singh during his occasional visits to CEERI used to see the coming up of the gyrotron lab at CEERI due to the untiring effort of Dr. AK Sinha with the support from Dr. Chandra Shekhar, the erstwhile CEERI Director, and Dr. SN Joshi, the erstwhile National Coordinator of the DST-sponsored gyrotron project. I was one of the members of the DST Steering Group to monitor the project. I evolved this project at BHU, Varanasi by handing over a position paper to Professor RK Jha, who moved it to DST. Dr. Vishal Kesari, then a PhD scholar at BHU and now at MTRDC, typed the position paper following my dictation. I was motivated all throughout by Dr. Lalit Kumar to do research in the area of gyro-devices. Both Dr. Lalit Kumar and I were inspired by a lecture of Dr. Singh at BITS, Pilani arranged by IETE.



CSIR-CEERI greeting Dr. Singh with flower bouquet on his 90th Birthday celebration on 19th November 2014.



Padma Bhusan Dr. Singh blessing the audience on his 90th Birthday celebration at CSIR-CEERI.

Acknowledgment

- Dr. S.C. Dutta Roy, former Research Council Chairman, CEERI, Pilani
- Dr. S.N. Joshi, Former Head, Microwave Tube Area, CEERI, Pilani
- Dr. Chandra Shekhar, Research Council Chairman and former Director, CEERI, Pilani
- Mr. Rohit Singh (Knowledge Resource Centre, CEERI, Pilani)
- Ms. Sreelatha Menon (Universities Press, Hyderabad)
- Dr. P.C. Panchariya, Director, CEERI, Pilani

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- Chandra Shekhar, private communication
- S.N. Joshi, private communication
- U.N. Pal, private communication
- S.Mourya, “Past and present status of the magnetron development in the country and the efforts at CSIR-CEERI leading to the product development for the users,” in Proceedings, Webinar 2 on VED Thinkers Group platform (Ed. V. Kesari and B.N. Basu)
- Dr. Chandra Shekhar and Dr. S.N. Joshi giving their respective speeches in Felicitation of Padma Bhusan Amarjit Singh, the first Director of CSIR-CEERI, on his 90th Birthday:
“सीरी में प्रथम निदेशक पद्म भूषण डॉ. अमरजीत सिंह का का सम्मान”:
Available: www.ceeri.res.in.