Sir Jagadish Chandra Bose
Biologist, Biophysicist, Botanist, Physicist, Archaeologist and Polymath

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Sir Jagadish Chandra Bose was a Biologist, Biophysicist, Botanist, Physicist, Archaeologist and polymath. He has pioneered the investigation of radio and microwave optics, made significant contributions to plant science, and laid the foundations of experimental science in the Indian subcontinent. IEEE named him one of the fathers of radio science.

Jagadish was born in Munshiganj (Bikrampur), present day in Bangladesh on 30th November 1858. His father, Bhagawan Chandra worked as a deputy magistrate and assistant commissioner in Faridpur, Bardhaman and other places. He was a leading member of the Brahmo Samaj. He was a firm believer in learning and knowing one's mother tongue prior to any foreign language and therefore Bose's early education started in a vernacular school. Jagdish's education started in same school.

Bose joined the Hare School in 1869 and then St. Xavier's School at Kolkata. In 1875, he passed the Entrance Examination (equivalent to school graduation) of the University of Calcutta and was admitted to St. Xavier's College, Calcutta. At St. Xavier's, Bose came in contact with Jesuit Father Eugene Lafont, who played a significant role in developing his interest in natural sciences. He received a BA from the University of Calcutta in 1879.

Bose wanted to go to England to compete for the Indian Civil Service. However, his father, a civil servant himself, canceled the plan. He wished his son to be a scholar, who would "rule nobody but himself." Bose went to England to study Medicine at the University of London. However, he had to quit because of ill health. The odour in the dissection rooms is also said to have exacerbated his illness.

Then Jagdish secured admission in Christ's College, Cambridge to study natural sciences. He received a BA (Natural Sciences Tripos) from the University of Cambridge and a BSc from the University of London in 1884, and a DSc from the University of London in 1896. Among Bose's teachers at Cambridge were Lord Rayleigh, Michael Foster, James Dewar, Francis Darwin, Francis Balfour, and Sidney Vines.

Bose returned to India in 1885, carrying a letter from Fawcett, the economist, to Lord Ripon, Viceroy of India. On Lord Ripon's request, Sir Alfred Croft, the Director of Public Instruction, appointed Bose officiating professor of physics in Presidency College. The principal, C.H. Tawney, protested against the appointment but had to accept it. The British still believed that Indians were gifted in sciences but lacked the capability to deal with exact sciences.

Bose was not provided with any facilities for research. On the other hand, he was a "victim of racialism" with regard to his salary. In those days, an Indian professor was paid Rs. 200 per month, while a European drew Rs. 300 per month. Since Bose was officiating, he was offered a salary of only Rs. 100 per month. With a remarkable sense of self-respect and national pride, he decided on a new form of protest. He refused to accept the salary check. In fact, he continued his teaching assignment for three years without any salary. Finally, both the Director of Public Instruction and the Principal of the Presidency College fully realized the value of Bose's skill in teaching and also his lofty character. As a result, his appointment was made permanent with retrospective effect. He was given the full salary for the previous three years in lump sum. Very soon Bose became popular professor among students and Simultaneously he started research on electromagnetic waves.

During the decade1960s; Scottish scientist James Clerk Maxwell had published his landmark paper, `A Dynamical Theory of the Electromagnetic Field', in which Maxwell's equations demonstrated that electric and magnetic forces are two complementary aspects of electromagnetism. He shows that the associated complementary electric and magnetic fields of electromagnetism travel through space, in the form of waves, at a constant velocity of light. He also proposes that light is a form of electromagnetic radiation and that waves of oscillating electric and magnetic fields travel through empty space at a speed that could be predicted from simple electrical experiments.

After Maxwell, German physicist Heinrich Hertz published the results of his experiments on electromagnetism and shown the existence of electromagnetic waves in free space in 1890s. Subsequently, British physicist Oliver Lodge, who had demonstrated their similarity to light and vision including reflection and transmission. Hertz and post-Hertzian experiments used wavelength in cm. and short cm. wave region. in August 1894 (after Hertz's death) Lodge's work was published in book, `The work of Hertz and his successors', caught the attention of scientists in different countries, including Bose in India.

To conduct research on electromagnetism, Bose had converted a small enclosure of 24 square foot space, adjoining a bathroom in the Presidency College into a laboratory. He invented generator, transmitter and receiver for microwave region

of electromagnetic spectrum there. He devised equipment's for the research with the help of one untrained roadside tinsmith.

Bose made public demonstration of his invention at Town Hall of Kolkata, in November 1895. Bose ignited gunpowder and rang a bell at a distance using radio waves. Lieutenant Governor Sir William Mackenzie witnessed Bose's demonstration.

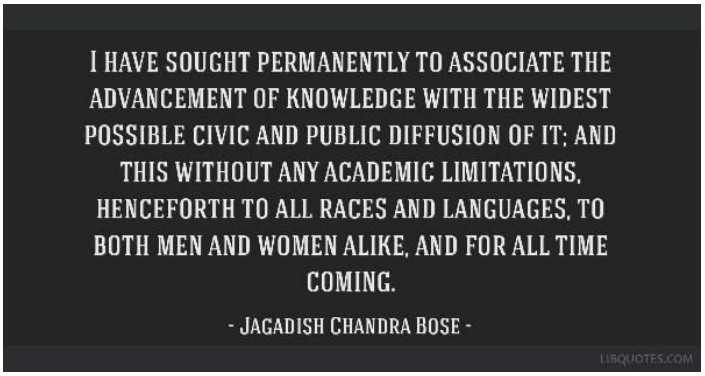
The spark gap transmitter used a spark gap radiator made of three tiny 3 mm metal balls excited by high voltage from an induction coil to generate microwaves at 60 GHz. The transmitter was enclosed inside the metal box to prevent sparks from the coil's interrupter from disturbing the action of the receiver, and the microwaves emanated from the waveguide i.e. metal tube. The receiver point contact detector was placed inside a waveguide receiving antenna, very much like the transmitting antenna with a matching polarizing grid.

Bose had also carried out experiments to study refraction, diffraction and polarization for same electromagnetic waves. Bose also developed spiral-spring detector and coherer. He publishes scientific papers on his research in 1995 and communicated to the Royal Society of London. Bose was invited by Royal Institution to give the prestigious Friday evening discourse on 29th January 1897. There he openly displayed the construction and workings of his microwave apparatus.

Sir J C Bose's work is commemorated by IEEE, as the oldest milestone achievement from Asia.

About the author

Mr. Sudhir Phakatkar is working in GMRT, TIFR as an Electronics Technician for 29 years. He is also serving on the committee of Khodad Rural Science Center. He is very active in science popularization among in students and laymen. As a part of it, he wrote two books in Marathi, namely - Radio Durbin and Vidnyanyatri Dr. Govind Swarup. Mr. Phakatkar wrote a column in the Sunday supplement of a Marathi newspaper on research organizations of India as well as several articles on scientific subjects for Marathi Science Magazines. Three more books by him are in the production.



The Bose Research Institute in Calcutta