

Meghnad Saha and his contributions

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Meghnad Saha (1893–1956) is a prominent name in the history of Indian science. Each of his contributions – as a physicist, teacher, institution builder, Member of Parliament and social thinker and reformer – is monumental. In spite of meagre resources, struggle at every stage and hardly any encouragement for his work, Saha’s achievements are remarkable. He was of the firm opinion that in a country like India, the problems of food, clothing, eradication of poverty, education and technological progress can be solved only with proper planning, using science and technology. His untimely and sudden demise occurred 60 years ago. Here is a brief overview of his contributions.

Early life

Meghnad Saha was born on 6 October 1893 in Seoratali, a small village near Dhaka (now in Bangladesh), then in British India. His father had a small grocery shop. Saha was studious as a child, and slate and pencil were dearer to him than anything else. After primary education, his father was reluctant to send him for higher education, but his teachers persuaded his father to do so. A kind hearted Anand Kumar Das allowed Saha to stay in his house when he was studying in high school at Simulia, 10 km away from his village. In 1911, he joined Presidency College in Calcutta and completed M Sc in mixed mathematics. Satyendranath Bose was his classmate, Prashantchandra Mahalanobis his senior and Subhas Chandra Bose was his junior.

Asutosh Mukherjee was a pioneer in higher education in Bengal at the beginning of the 20th century. In the newly established University College of Science, Saha was offered a lectureship in mathematics. Later he was shifted to the physics department. Along with teaching he embarked upon research in physics.

The physicist

Saha’s initial papers were on diverse topics: Maxwell’s stresses – a study of the electromagnetic theory of radiation (1917); limit of interference in the Fabry–Perot Interferometer (1917); a new theorem in elasticity (1918); Pressure of light (1918); dynamics of the electron (1918); new equation of state with S. N. Bose (1918); mechanical and electro-dynamical properties of the electron (1919); radiation pressure and quantum theory (1919) and fundamental law

of electrical action (1919). He used to regularly read German journals and was up-to-date with research in physics. Saha taught thermodynamics and spectroscopy to M Sc students. In 1919, while thinking about problems in astrophysics, he came across Eggert’s paper on high ionization in stars due to high temperatures and immediately realized the importance of introducing the value of ionization potential in the formula, used by Eggert, under various combinations of temperature and pressure. He developed the theory of thermal ionization and arrived at a ionization formula, now known as Saha’s ionization formula (or equation). He communicated his papers to *Philosophical Magazine*. For experimental verification of his theory, Saha went to Nernst’s laboratory in Germany and worked there for a year. The results of his experiments were promising, but he had to return to Calcutta due to an urgent call from Asutosh Mukherjee. His later work on spectroscopy, nuclear physics and ionospheric research was also of considerable importance. He became Fellow of the Royal Society of London (FRS) at the age of 34. His name was proposed for the Nobel Prize as well. But due to various complicated issues¹, he did not receive the prize.

The teacher

In 1923, Saha joined Allahabad University as head of the physics department. With his colleagues and students, he built up a research school from scratch. Even with limited resources, his group made notable contributions. Whenever he found that any student was capable of doing research independently, he encouraged him to pursue his own line. At Allahabad, Saha built the apparatus to

verify his theory of thermal ionization. Many of his students have contributed to their chosen fields with distinction. As a teacher or guide Saha was remarkably successful, initially at Allahabad and then at Calcutta. The contributions of his students and their personal reminiscences testify to this.

Institution builder

Around 1930, Saha strongly felt the need for an organization of scientists to discuss scientific issues as well as important national issues of social and economic welfare. He was a major force in the formation of the United Provinces Academy of Sciences (UPAS), which was later renamed as The National Academy of Sciences, India.

Immediately after the discovery of nuclear fission in 1939, Saha realized the importance of nuclear physics and initiated an M Sc degree course in nuclear physics at Calcutta University in 1940. Forming a research group in nuclear physics and later converting it into the Institute of Nuclear Physics, which was later renamed as Saha Institute of Nuclear Physics (SINP), shows his far-reaching vision. The construction of a cyclotron in 1940s was a major achievement for Indian nuclear science. The struggle at almost every stage and scarcity of funds in establishing a separate Institute of Nuclear Physics could not deter Saha^{2,3}. Finally he succeeded. The SINP is his monumental achievement.

The Indian Association for the Cultivation of Science (IACS), Kolkata founded by Mahendralal Sircar played an important role in the beginning of Indian science. After Saha’s return to Calcutta from Allahabad in 1938, along with other responsibilities, he took keen interest in

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the functioning of IACS. In 1946, he was elected as the President of IACS. Under his leadership, the managing committee charted a plan for expansion in research and a new building to house IACS. In 1952, S. S. Bhatnagar, then Secretary to the Government of India in the Ministry of Natural Resources and Scientific Research, and a member of the Council of IACS, persuaded Saha to accept the full-time post of Director of IACS.

Member of Parliament

In 1938, Netaji Subhas Chandra Bose, then President of the Indian National Congress, appointed a National Planning Committee, for the seven Congress-administered provinces in pre-independent India. Saha was a member of the core committee and chairman of two sub-committees, i.e. power and fuel; and technical education. He worked meticulously. But in independent India, Saha was not included in the planning committee. Though he had a notable contribution in nuclear science in India, he was not appointed as a member of the Atomic Energy Commission. He had some reservations about the Indian atomic energy programme. In the first couple of years after independence, Saha found that there was confusion in the ruling party about priorities in rebuilding the nation. The projects of national importance were mismanaged; there were lapses in Government policies and so on. He thought the floor of the Parliament was an appropriate place to raise his voice against these matters, so that the entire nation could be alerted. Though he was inclined towards the Left parties, Saha was not a member of any political party. He contested from northwest Calcutta constituency and won with thumping majority. He was Member of Parliament from 1952 to 1956, till his sudden death. Saha's speeches and debates in the Parliament⁴ show his comprehensive understanding of many topics, the scientific way of analysing any problem and proposing a solution for it, and above

all, inherent fervour for betterment of his countrymen and rapid progress of India. The topics he discussed in Parliament also show the breadth and depth of his studies; for example, higher education, Damodar Valley Corporation, tariff commission, States Reorganization Commission, flood control, planning, industry, atomic energy, refugee and rehabilitation, railway budget, and so on.

Social thinker and reformer

While thinking about various issues of national importance, Saha realized the need for a scientific periodical, like *Nature*, to air his views as well as those of his friends and experts in different fields. With the help of his friends and colleagues, he founded a monthly titled *Science and Culture*. His aim was to inform educated people about social, economic and educational problems of national importance and their probable solutions. In many of his articles, Saha pointed out, how other countries had solved such problems and what would be suitable for India. During the first half of the 20th century the means of communication were poor; yet Saha collected and analysed the required information with remarkable promptness. The range of topics in editorials and general articles was amazing; for example, the need for a hydraulic research laboratory, irrigation research in India, planning for the Damodar Valley, the Damodar Valley reclamation scheme, multipurpose development of Indian rivers, public supply of electricity in India, national fuel policy, oil and invisible imperialism, fuel in India, some constitutional hindrance to the development of India's national resources, development of resources and Indian constitution, mineral sources and mineral policy, problem of industrial development in India, automobile industry in India, industrial research and Indian industry, industrial policy of the Planning Commission, scientific research in national planning, principles of regional

planning, problems of independent India, national planning commission, the five year plan, and so on. Every article shows his inner urge for the goal of national reconstruction. Some of his articles are relevant even today.

Calendar reform was also one of his subjects of concern. Saha tried to inculcate scientific methods in time reckoning by way of calendar reform. In 1952, when CSIR appointed a calendar reform committee under his chairmanship, Saha worked very hard and wholeheartedly. Along with other committee members, he had to study 30 different calendars which were used in different parts of India to make an Indian calendar. He also worked on a 'world calendar'.

Saha's writings, speeches from various platforms, contribution to calendar reform, work on pre-independent National Planning Committee and Education Commission show his direct or indirect role as a social thinker and reformer. In Indian history, Meghnad Saha will be remembered as an exceptional scientist, remarkable teacher, institution builder, Member of Parliament, and social thinker and reformer.

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