Saha and Bose – Champions of a Common Cause

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The twenties and the thirties of the present century have been called the golden age of Indian Science. The standard reached by the stalwarts of that time has not been surpassed by the later generations although transfer of power in 1947 has brought about a sea-change in the science scene. People like Saha, Bose, Raman and their contemporaries worked in conditions which would seem prehistoric by present standards. Not only was there no government support, often there was active hostility. But they went on undaunted and succeeded. What was their motivation, we may very well wonder. Was it purely a passion for science, or was it something else?

Let us take a look back to the atmosphere, the spirit of the time in which these brilliant people grew up. Though I am here to talk about Meghnad Saha and Satyendra Nath Bose, I should make it clear at the outset that no man is an island. He is affected by his contemporaries. So even when we consider Saha and Bose we cannot look at them in isolation. Others were there too, each complimenting the other – all of them contributing to the general atmosphere of intellectual excitement. The young men who were all destined to leave a mark in history – Saha, Bose, Mahalanobis, Jnan Ghosh – and in other fields Rajendra Prasad, Netaji Subhas Chandra Bose (who went to college in Calcutta) were influenced by a major event in their adolescence – it was the 1905 partition of Bengal.

The year 1905 was in many senses a turning point. Its immediate impact was political. Bengal at that time was the centre of anti-British political activity. Though for some time a partition of the huge province was being considered for administrative convenience, Curzon decided to kill two birds with one stone. By dividing the Bengali-speaking population on communal grounds (East Bengal had a Muslim majority, West Bengal had a Hindu majority) he hoped to break the nationalist movement. But what happened was quite contrary to his expectations. The smouldering discontent flared up. A new wave of patriotism swept through the province. The protest was so strong that finally in 1911 the partition was annulled. But the protesters had to pay a price. The capital was shifted to Delhi.

Saha, Bose and their contemporaries grew up in this atmosphere of inspired idealism. Children along with their elders roamed the streets singing patriotic songs. British goods were burnt – ‘Boycott British goods, buy Swadeshi’ became a popular slogan. Satyen Bose had written in his memoir about those heady days: ‘We must do something for our country just to show the British that we are in no way inferior.’ The reason why many good students of the generation opted for science was again this vague sense of patriotism. Through science it was possible to do things, to improve things. So in 1909 a remarkable batch of students took admission in the intermediate class of Presidency College. Saha joined two years later, he passed his JSc from Dacca.

Many historic factors combined as though to make way for these two promising young men. After passing their MSc in Mixed Mathematics in 1915 both Saha and Bose were looking for suitable employment. An unexpected offer came from Sir Asutosh who was trying to introduce post-graduate teaching and research. He had already given appointment to C. V. Raman as the Palit Professor and D. M. Bose as the Ghose Professor (Palit and Ghose were the two generous donors who helped Sir Asutosh) but Raman was not yet released from the Finance department and D. M. Bose was stranded in Germany because of the war. Sir Asutosh asked the young men Saha and Bose in particular (because the others were students of physics, but Bose and Saha had specialized in mathematics) to prepare themselves to teach the subject.

Then began a period of intensive study. New things were happening in physics. Germany was then in the forefront of physics research. The war created the extra problem of unavailability of books and periodicals. Saha already knew German. Bose started taking lessons – but he already knew some French. Equipped with great confidence they procured books from a German professor who was then teaching in Shibpur Engineering College. They were also allowed to use Sir Asutosh’s huge collection. After D. M. Bose’s return they also learnt from him about the new physics that was making waves in Europe. It is a measure of their involvement in the subject that they, for the benefit of the students of the post-graduate classes, undertook a translation of Einstein and Minkowski papers on the theory of relativity from the original German. It was published in 1920 by the Calcutta University with an introduction by P. C. Mahalanobis. Surprisingly, it was then the only available translation of those papers of Einstein.

The British press was not pleased. A reviewer in Nature commented in the August 1922 issue:

The year 1905
Events of Political, Historic and Scientific Importance
Political – Partition of Bengal
Historic – Graduation of C. V. Raman
Scientific – Einstein’s special Theory of Relativity
The translation cannot be called a good one. In a work of this kind we expect a fairly literal translation, but in the present book there are numerous errors in translation and the order of English equivalents for German words is frequently unfortunate. In many instances the mathematics is faulty reproduced. The numbering of the pages is not continuous but recommences at the beginning of Section 4 and the omission of the footnotes from the original is regrettable. Provided it is studied with care, the translation nevertheless well be of service to those who are unfamiliar with German, and wish to grapple with the pioneer works on this subject, some of which are rather inaccessible.

Technically it was not of a high quality which is understandable. It was published in the Zeitschrift fur Physik and asked Bose to think about it.

Actually Bose’s interest in the matter goes back to 1919 when he first saw a copy of Max Planck’s work, brought by D. M. Bose from Germany. Bose was not satisfied with the ad hoc assumption contained in the Planck derivation. Saha’s request provided him the spark. He wrote his now famous paper on “Planck’s law and light quantum hypothesis” – the history of the publication of this and the second paper is well known. But there was a third paper in this series which seems to have been lost.

Einstein had certain disagreement with Bose’s second paper. Bose pondered over them for two months and wrote a third paper. In his letter to Einstein on 27 January 1925, he mentions having shown the paper to Langevin who thought it was interesting and worth publishing. The paper was sent under separate cover, but nobody has heard of it since. Bose claimed that he has anticipated the idea of photon spin in his first paper to derive the factor 1/2 but Einstein had struck it off in fact. C. V. Raman on his paper on photon spin (communicated to the Indian Journal of Physics on 24 October 1931) writes: "We understand from a personal communication by Prof. Bose that he envisaged the possibility of the quantum possessing besides energy $h\nu$ and linear momentum $hv\lambda$ also an intrinsic spin of momentum $\pm h/2\pi$ round an axis parallel to the direction of its motion. The weight factor 2 thus arises from the possibility of the spin of the quantum being either right-handed or left-handed, corresponding to the two alternative signs of the angular momentum.'

Prof. Partha Ghose of S. N. Bose Centre for Basic Sciences has shown that Bose was also denied credit of (a) the idea that spontaneous emission is not an inherent property of an isolated atom, totally independent of the radiation field and (b) the idea of the propagation of empty electromagnetic waves carrying no quanta of energy.

Saha did not have it very smooth-sailing either. While he was in England, fantastically looking for a suitable place to verify his theory, he was told by Prof. Turner of Oxford to write to Dr Hale of the Mount Wilson Observatories who had a large number of spectroscopic data on sun-spots. In his letter Saha gave him the details of his predictions. He was
Saha and Bose came from very different backgrounds and temperamentally they were very different. Bose belonged to the mainstream. He was a kayastha by caste - this caste took to English education first. Bose had three generations of English education behind him. He was middle-class urban - his ancestral home at Calcutta was built by his great grandfather. Saha on the other hand came from rural East Bengal. His vaishya background did not place him high in the caste hierarchy. His father was a small trader - there was absolutely no tradition of college education in their family. He had to fight his way up, at every stage of his career. He rose by sheer virtue of his own talent and determination. But there was one common point between these two very dissimilar class friends. It was their concern for others, for the common people, for their country.

But their reaction to the prevailing situation was again different. S. N. Bose in his adolescence was attached to the romantic notion of a mother India in chains, he had great sympathy with the revolutionaries, was openly critical of the Gandhian philosophy. But after partition he was a frustrated man. Though he belonged to West Bengal, his 25 years in Dacca made him a strong Dacca man. That people from Dacca would now need passports to come to India was a ridiculous idea - he could
never accept it. His nationalism in the later stage became a kind of Bengali nationalism and the idea of making Bengali the medium of instruction at all levels became a kind of mission with him. He spoke at the Ungeze Italo conference in Hyderabad - it was his firm conviction that English was our greatest block to progress - that our students had to spend all their energy learning a foreign tongue, this was standing in the way of creativity. Though he was not a prolific writer himself, he encouraged others to take up science writing in Bengali and formed the Bangiya Bijan Parishad for this purpose. Established in 1948 this organization has been doing commendable work in popularizing science through Bengali.

Saha decided to come out of the 'ivory tower' in 1930. From 1923 to 1930 he was busy building his school of research at Allahabad. Then the time was ripe to give his thoughts to national planning. The two formative influences in his life were his two teachers - P. C. Sengupta of Dacca College and the great P. C. Ray. Sengupta was responsible for initiating him in the study of ancient and modern astronomy. They were Saha's life-long preoccupations. His love for modern astronomy led to his famous work in astrophysics. Interest in ancient astronomy led to his paper on 'The origin of the Saka era' and the reform of the Indian Calendar.

In P. C. Ray, Saha found a mentor like Saha, Ray too was from a village and kept in touch with his village all his life. P. C. Ray's pragmatic philosophy of improvement through the application of science made a strong appeal to Saha who had himself known poverty and seen extreme conditions in which the rustic poor live.

As early as in 1922 Saha spoke at the first Bengal Youth Conference, invited by Subhas Chandra Bose. In an inspiring speech Saha spoke in detail about how science has the key to all progress...
In order to have a decent life we must extract whatever we can from nature and science is the best tool in this effort, he said. This speech contains his basic ideas and convictions which were later to develop into elaborate plans for national reconstruction. All his speeches and writings are now available in the four volumes of Collected Works of Meghnad Saha. Since it is impossible to cover the entire span I will just choose one subject – river planning.

Saha’s interest and involvement in river planning evolved from his early acquaintance with floods. He came from a part of Bengal where children learn to swim before they can walk. The next phase was his training in flood relief work – first in 1913 during the devastating Damodar floods. Saha was then a student of fifth year class. The relief operations were conducted by Krishna Kumar Mitra of the Bramho Samaj. His next involvement was ten years later. He had just returned from England. This time floods devastated north Bengal. Acharya P. C. Ray conducted the relief operations. Saha was now in a position to take it up as a scientific challenge. The tremendous energy trapped in the flooding water can be converted to good use, as had been done in the West, as was being done in the princely state of Mysore.

He proposed setting up of hydraulic research laboratories and wrote a series of articles in *Science and Culture*. The plan for the D. V. C. was born in the pages of this journal. But when after independence multi-purpose river projects were taken up, Saha had to move back from the centre stage because of differences with Pandit Nehru. To make his voice heard he chose the parliament but his untimely death did not let him complete one full term.

The common bond which linked Bose and Saha, so dissimilar in background and temperament was a concern for their country. This concern brought both of them eventually out of their ivory tower. Along with this was a sense of national pride, evident less in words but more in deeds. Their sincerity of purpose won the love and respect of their countrymen who were unaware of such terms as Bose statistics or thermal ionization.

**Conclusion**

No study of Saha and Bose can be complete without taking into account other scientists sharing their common concern. As mentioned in the beginning of this article, there were others, all adding their bit, but in the light of later developments two personalities stand out: H. J. Bhabha and S. Chandrasekhar. One could almost say they are studies in reverse, Bhabha could have stayed in Europe but he decided to come back (one should not forget the fact that C. V. Raman gave him a berth at the Indian Institute of Science, Bangalore), thus making a great deal of personal sacrifice. There is no doubt that he would have accomplished more had he chosen his own scientific career as his only goal in life. But he did not. As a result we have TIFR and BARC and what is more, a new scientific work culture in the country.

S. Chandrasekhar in spite of repeated offers from Raman and others preferred to stay back. But in an interview given to his biographer K. Wali he openly admits that his choice was wrong. "How does one evaluate relative contributions? But I think I would have been satisfied with half my scientific work if I could have served the Indian Scientific Community at least to half the extent that I have served the American Scientific Community. Because in total terms for the future, it would have meant far more for Indian Science than in fact it has to American Science".

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