MEGHNAD SAHA: SCIENTIST AND CRTIQUE

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Abstract

The paper will attempt to look at Meghnad Saha's involvement in scientific discourses with Jawaharlal Nehru and his contemporary scientist Dr. Homi J. Bhabha. The idea is to understand the contestation over knowledge production within scientific discourse in India. Meghnad Saha a leading scientist of 1940s in a seriesof letters to Nehru and Bhabha, expressed his views that reflected both his vision, perceptions and dissatisfaction over the Indian Atomic Program.

Keywords **:** *Laboratories, Cyclotron, energy, nuclear, discourse.*

The historiography of Nuclear Science for the last one decade notably by historians like Robert S. Anderson, Jahanvi Phalkey, has tried to focus on the history of laboratories and the fundamental role played by the scientists and the government that led to the development of Nuclear power in India. the trend has shifted from that of the history of the making of the atom bomb to the more complex historical exploration of different actors and institutions. In continuance of this tradition, the paper will look at the Saha's efforts for establishing Nuclear 'Cyclotron' in Calcutta and also try to bring in, his criticism of the Indian Atomic Program. The paper is limited in its scope in the sense that it does not include Meghnad Saha's as a

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Member of parliament of the Independent India, where he debated, opposed and critiqued many of the decisions about Atomic Energy Program.

SCIENTIST AND NATION BUILDING

Meghnad Saha was born to a meager income earning family on 6th October 1893 in the small village of Sereotal, which was situated 45 km from Dhaka. Being a brilliant student he was able to get merit scholarship through which he pursued his higher studies. He subsequently in the year 1916 joined Calcutta University as a faculty member for post graduate classes.[1]Saha furthergained fame in his field after the publication of his paper "Ionisation in the Solar Chromosphere".[2] He later on explained that his idea was largely shaped by his readings of the German literature that arrived in Calcutta after four years gap due to World War (1914-1918).[3]Meghnad Saha upon his return from Berlin in 1921joined the Department of Physics as Khaira Professor at the University College of Science in Calcutta but within two years he joined the University of Allahabad.[4] As soon as Saha moved to Calcutta after his long fifteen years stay at Allahabad, he joined as the Palit Professor of Physics, the chair which was earlier held by C.V. Raman. Meanwhile Uranium fission was discovered in 1938-39 by Otto Hahn, Lise Meitner and Fritz Strassman in Germany, which kick-started the interest in Nuclear Physics.[5] Saha grapsed the importance of Nuclear research and thus introduced Nuclear Physics as a course of study in the M.Sc. Physics syllabus of Calcutta University. He also started a research program work in Nuclear Physics and Cosmic Rays at the Palit Laboratory.[6]He started a journal "Science and Culture" in 1935, which was also the journal of the Indian Science News Association, wherein in 1940 he published a paper on "Uranium Fission" (1940) .[7]

SAHA ON ENERGY AND POWER

To look into the background of his vision and critique for the development of energy and power. It could be well documented from a symposium held on March 1938 when Saha was still in Allahabad. A National symposium was organized by the National Academy of Sciences, which was attended by leading scientists of the time viz., Prof. Meghnad Saha himself, Professor B.C. Chattopadhyay and Professor N.N. Godbole of Banaras Hindu University, Prof. N.C. Chatterjee of Cawnpore, Prof. B.P. Adarkar, Dr. G.R. Toshiwal and A.N. Tandon of Allahabad University. Jawaharlal Nehru had presided over a session and it was here that Saha expressed his opinions and views about the energy and power requirement of India.

He stated that "one of the objects of the National Academy of Sciences was to organize a discussion on subjects of great importance than that of cheap and abundant poor supply for whole industrial efficiency of a nation depends upon".[8]

He further added that "there are countries in the world which have completely harnessed all their power resources e.g. Norway, USA, England and Germany and there were others who are half towards it, e.g. Russia. There are others who are still dependent on a medieval economy, e.g., India, China and Abyssinia."[9]

He held the view that the reason for India being poor was her low output of work per head, which was twenty times lesser than that of an advanced country, thus in order to bring India to a level of Europe, America, Japan, India was to solve her problems of poverty and unemployment. Following this he laid down the functions of the states, and stated that the development of abundant and cheap energy and power was one of the "Prime" duty of the state and cautioned that powers like water and air, should be protected from becoming a commodity for exploitation and profit by any profit oriented group. So he laid down the proposal to institute a Power Supply

Department, whose primary function would be to make a systematic survey of the available resources of power like coal, petrol, running water and others which existed within the control of the State. He criticised the state for being responsible for the backwardness of the country. India as a whole during 1938 produced only two percent of its hydroelectric capacity, whereas Japan had developed 80 percent of her capacity. The Indian Electricity Act of 1910, granted licenses and rights for the generation or production and supply of electricity, without imposing any safeguard rules against exploitation.

Saha stated, "Though now, owing to the technical efficiency of new machinery, one ton of coal produces nearly four times as much electricity as it used to do 25 years ago, our transmission losses have been reduced to a minimum, the rates have not undergone corresponding reduction."[10] He gaveexample of the Calcutta Electric Supply Company, which produced electricity at the cost of thirty-five annas but charged two annas per unit for domestic use. Which according to Saha was six times higher than the cost of production. Different power and electrification schemes like Mundi Scheme in Punjab, western Ganga Hydro-electric scheme in United Province resulted in losses which were according to Saha, was due to the absence of proper survey of the hydro-electric sites, distribution of the produced electricity without any sound economic principles and lack of expertise in the science of technology as no steps were taken to train the indigenous technicians.[11] This criticism was based on his understandings, and all could not have been possibly true, but it does bring out his critial approach thathe linked up with the state and its functioning.

Saha had a large international experiences, and this might have driven him to develop India into a country which was, if not at par but at least competitive with the advanced countries. His vision seems to be quite farfetched as India was still a

British Colony but Saha being aware of the existing problems of his time, shared his analysis with his colleagues and Jawaharlal Nehru. Thus a discourse on future planning and the problems were pointed out for possible future solutions in these symposiums and seminars, which preceded the formation of the National Planning Committee in the same year. These seminars thus reflects the critical enquiry and analyses made by Saha.

SAHA'S INVOLVEMENT IN NATIONAL PLANNING

Saha was invited by Subhash Chandra Bose to a meeting in October 1938 at Delhi. The meeting was intended to form the National Planning Committee. It was initially decided that M. Vivesvaraya would be the Chairman of the NPC but Saha suggested that Jawaharlal Nehru to be chosen as the Chairman, as this would not lead to limiting NPC to a small group of academic personalities. This argument found to be pragmatic, and thus Nehru accepted the chairmanship.[12] In a letter dated October 7th 1938 to Jawaharlal Nehru, Saha mentioned that "The National Planning, which is to meet afterwards, and in which the Planning Committee will be mergedwill decide how the policy is to be carried out and what lines of campaigns to be adopted"[13] and his "hopes and ambition is that the Planning Committee should prepare aReport, which will serve as a guide to the whole Indian people and to the congress Governments, in matters of full constructive work.".[14] Saha in his capacity as a scientist freely expressed his view about developing India and position in the NPC since its inception. This phase witnessed Saha's importance in the NPC.

He further adds: "I find that there is a great confusion ideas regarding the ideal, the program and the plan of action of National Reconstruction. This haze must be removed by a clear cut new philosophy of life and action. You hold, as you have often told me, that it will not be possible to do anything substantial unless the

congress captured power at the centre and you may think that work of the National Planning committee may be like putting the cart before the horse. I agree that if and when the congress captures the center, any more tools of power will be at its disposal, for example, control of the fiscal policy, the power to give real protection to infant industries struggling for life and to possible future industries which might come into existence, are an important condition precedent to successful industrialization."[15]

Saha was since the inception of the National committee very much involved with the development of Industries, which would be facilitated by the Indians themselves. Various sub committees were formed to look into the report of each sub-committee under the National Planning Committee, Meghnad Saha himself chaired one such Power and Fuel Sub-Committee held on 19th October 1940, which was appointed to discuss and examine the Electrical Act and how to provide cheap power. The sub-committee passed a resolution, and recommended the centre and the provincial power board, to chart out a plan for the better use of power for industrial and agricultural purposes.[16]However, the NPC by this time had receded in its activities, when the second world war began in September 1939, and Nehru was also imprisoned in November 1940. Working in NPC brought Scientists and the politicians together to a common platform. It was a time which led to the articulation of voices of scientists in the field of development in both agriculture, fiscal problems and industries. There was a shared assumption between Nehru and Saha when it came regarding developing electricity and power. They held that harnessing power would elevate India out of poverty and would solve many problems. Along with Saha, there was also another leading scientist figure like Shanti Swarup Bhatnagar, who too were in direct touch with Nehru. These discourses led to developing a group

of scientists which according to Deepak Kumar led to the formation of "scientocracy" that developed in 1940s.[17]

SAHA AND CYCLOTRON

By 1940 Meghnad Saha was in Calcutta and had already started to work on Cyclotron, a nuclear machine in the physics department of Calcutta University, to establish the Nuclear research program around it. It was a costlymachine, so he had to depend on the grant, which was provided by the Tatas to Calcutta University which was recommended by Nehru, and the Birlas. [18]The grant was sanctioned about five years earlier than the grant that was approved to Homi Bhabha for the establishment of the Tata Institute of Fundamental research. The work proceeded very slowly as expected, which Saha confessed to Nehru in a letter dated October 24, 1941. Saha had sent about sixteen hundred dollars to his student B.D. Nag for the procurement of the part for the cyclotron from the USA, who was working under the supervision of Dr. Lawrence, who had invented the cyclotron machine. Meghnad Saha had direct access to the latest technology as he was in touch with the leading scientists of the time. Dr Nag by 1941 had returned to India and was working on the building of Cyclotron. The materials he ordered for cyclotron could not reach in time due to shipping difficulties during wartime crisis. In the same letter he mentions "if the east does not flare up, we expect to get the remaining materials by the end of next November".Nehru, in turn, had asked Saha, the reason for the delay on the progress work of cyclotron at Saha's laboratory to which Saha in a letter dated November 14, 1941, replied that:"even in the USA, it generally takes three years to complete a cyclotron, so we have not asked for any unusual length of time. But war has made it difficult for us to get things".[19]

The cyclotron was one of the major projects of Meghnad Saha, and a huge amount of money was already invested but the progress was rather going too slow, and this had

made Nehru quite anxious. However, Meghnad Saha shared, as mentioned before, a very cordial relation with Nehru. Though Saha a scientist and Nehru, a politician, both Saha and Nehru exchanges was not only limited by the scientific development but also touched upon the topics related to culture and development. In the letter, Saha referred to the article published in Science and Culture about "all India languages"[20], at a time when Nehru was in jail. Thus correspondence between them reflected both business and cultural conversations. Saha seemed very supportive of Nehru at this point, as in the same letter which was written on Nehru's birthday. He wrote "we have been hearing of your impending release and hope you will soon be out and give the country the lead which is badly needed at the present moment."[21] Immediately after Nehru was released from prison in 1941, Saha asked Nehru if he "happen to visit Calcutta he should visit his Laboratory, where the cyclotron was under construction." By that time the construction was going on "smoothly", and parts like Magnet had already arrived in Calcutta. The work on cyclotron by then was progressing, but Saha was facing difficulties to procure the apparatus. Saha also tried to purchase a magnet from England for making a powerful spectrometer but without any success. Professor Scherrer had suggested him that whatever was required could be done by M/S Brown Boverie, a big engineering firm from Switzerland and M/S Oerlikon of Geneva, which made high-class magnets.Prof Scherrer, according to the letter, had promised Saha that he would secure the materials and training of one of Saha's student , Ambuj Mukherjee as a research scholar. Saha was very much interested in sending his son Ajit and his student Ambuj Mukherjee to work for some time with Professor Scherrer. Saha wanted a grant for Ajit from, The Atomic Energy Committee so that he could travel to Europe for a year and also get his apparatus to India. Bhabha in his reply to Saha on 25th August 1947 agreed to Saha's proposal regarding the grant for his son's visit to

Europe. He also touched upon certain agreements by pointing out that both Saha and Bhabha were essentially theorists, who were not yet ready to provide detailed "advice on matter of experimental techniques" therefore he thought it to be prudent to invite scientists from foreign countries to get excellent experiments and also suggested Saha to do the same as Bhabha thought that it would "give the experimental work in nuclear physics and cosmic rays a great fillip".[22]The importance of leading scientist from foreign countries were thus encouraged, in Indian Institutions, with a view in keeping in mind the latest development in the scientific field, which would help Indian scientists.

Saha held different reasons for the lack of development of experimental techniques in India. According to him, the real bottlenecks were the dearth of good mechanics and laboratory men, unavailability of significant engineering and manufacturing firms producing machinery and electrical appliances, scientific instruments and chemicals. He also remarked that Professor Scherrer in Zurich Polytechniqueinstitute had an excellent and efficient laboratory, but smaller compared to American standards. The nuclear physics laboratory, in Zurich consisted of Cyclotron, Betatron, beta ray spectrograph, mass spectrograph,etc. Professor Scherrer had promised to tender instruments made by leading manufacturerslike Messrs Brown, Boveri, Oerlihon and others. Saha was well aware of the development of the nuclear laboratories around the world. The machinery for cyclotron and Betatron in England were made in the workshops of Metropolitan, Mullards,etc., in Switzerland by Brown, Boveri and Oerlihen and the same was the case in the USA. Saha also ordered the instruments from USA and England in 1945. According to Saha organising first class workshops and technicians was the supreme necessity for India. The apparatus for the cyclotron were all bought in the USA in 1941 by Dr B.D. Nagchaudhuri through the Radiation Laboratory in California, where he was working

under Professor E. Lawrence but few important parts like valves and pumps did not arrive owing to outbreak of war with Japan, and this had considerably hampered Saha's and his team progress. Saha and his team tried to make the valves and the pumps in their laboratory, but they gavemany troubles. They firstly made two types of pumps with a grant received from Council of Scientific and Industrial Research. The vacuum could not be made on account of difficulties in procuring largebrass tube, and were not able to make them big enough for their purposes. In the course of his (Saha) trip to the USA in 1941-45, Meghnad Saha was able to place an order for oscillating valves, in spite of the prohibition due to Atomic Secrecy rules that did not allow the sale of the cyclotron parts, which arrived in India by the end of 1946. In his trip to the UK in 1946, Saha tried to procure these pumps in England, but later found out that pumps were imported from the USA for their cyclotron. USA being the most technologically advanced nation to manufacture pumps and valves, Saha finally placed orders for mechanical pumps. In this regard Saha in a letter to Bhabha dated 17th February 1947 stated: "we hope to overcome these difficulties, with the large pump which we expect from America and get the beam high energy particle out."[23]Owing to the costs and the expenses required for the construction of the laboratories machine, Saha had requested to the Atomic Energy committee a grant of Rs.40000, lying with CSIR to be placed to Saha and his Institute on a permanent basis.

SAHA AND BHABHA

Saha's correspondence with Bhabha reflected a love and hate relationship between them. Both by 1946 established themselves as leading scientists of India. In a letter dated June 1st, 1946, Saha expressed his disagreement on the report of Atomic Research Committee meeting held on 15th May 1946. He opposed the selection of

Bombay as site for the construction of "central station" for Nuclear Energy Research, which according to Saha was not strategically wise as"Bombay with its exposed position appears to be quite unsuitable to be the proper site for such an institution".[24] This report might had come as a blow to Saha, because a similar proposal was presented by Saha's student, Dr Nag Chowdhury for establishing a similar central Nuclear Physics Station, which was not discussed by the Atomic Research Committee, owing to the prematurity of considering the founding of a central Nuclear Physical Laboratory in India. Naturally the report and its resolutions according to Bhabha were not disputable.[25] The contestation among the leading scientists thus became an important discourse that became manifested in the course of time, where Saha felt like being sidelined to the periphery. In the same report, the committee appreciated the measures taken up by the state of Travancore to preserve Thorium and set-up a subcommittee to draw up proposals to carry out a chemical geological survey of the Uranium bearing minerals in India. The committee too noted that the atomic research and development was of prime importance for the defence of the country, and for the production of atomic energy.

The development of nuclear energy was encouraged by the committee for security and the development of large scale industries in India. The next recommendation that was made was to establish a Betatron which would produce 200 million volt rays at the Tata Institute of Fundamental Research with a team of 10 scientists for its operation. It was the phase where it seems that Saha was losing his earlier influence yet Saha was not kept outside and his work onthe cyclotron was taken up by the committee which provided grants to cover the expenses of his project.

The correspondence between Bhabha and Saha also reflected scientific and personal exchanges, that they shared with each other. In a letter, Saha mentioned about his son Ajit. He had worked on spectroscopy and according to Saha was in touch with

the exact theories of emission and of associated Nuclear Isomerism, and had surveyed the whole work on beta rays, According to Saha "There are 500 artificial nuclei but even in the most frequently investigated nuclei...we are not in possession of sufficiently accurate knowledge in which the sound theories can be built".[26]Thus Saha being aware of his son's capabilities suggested Ajit fit for planning the Nuclear experiments. In doing so he was pushing for his son's career based on merit and not nepotism.

CRITICISM OF THE ATOMIC ENERGY PROGRAM

As the process of decolonization set in, the tides blew against Meghnad Saha. Already mentioned earlier Saha had by this time realised the ongoing decline of his position and the elevation of Homi J. Bhabha along with Shanti Swarup Bhatnagar. Saha in a letter dated 22nd May 1947, made a scathing attack on the Atomic EnergyCommittee. He was of the view that "the committee should define in precise language the ground it wanted to cover, regions of interest, the effort required and should propose the lines of action, and steps to be taken in order of priority to implement the plans, like the Atomic Energy Committee of USA, UK and other countries have done, and should define its attitude with respect to the requirements of the defense department as well as the peacetime utilization of Atomic energy". He also held that the committee should draw up plans for a central Atomic Research Institute on the lines of Canadian, British or French Institutes. Thus the ideas to order the research Institute was thus seriously thought out in these correspondences, at the time when India was going through political upheaval. These discussions and discourses thus not only give information about them but at another level, it opens upon the ideas of the scientific communities, that was crucial for the future development of India and thus reflects on the scientific institutions and projects that

developed in course of time, whichNehru termed as the "Temples of Modern India". However, notwithstanding that, at the same time, Saha shared certain differences with the Atomic Energy board. By this time the power of the Board was beyond the radar of Meghnad Saha. One case exemplifies this where one of his student and colleague Dr A.K. Saha, had proposed a schema regarding the beta ray activity to which the Atomic Energy Board discussed on August 26, 1947, and pointed out certain problems in the proposal, which they had published in the minute report. Saha had raised certain objections to the resolution on the Schema as recorded in the minutes and was thus not satisfied with the decision of the Board. However, lateron, after consultation with DrA.K. Saha, an element that had featured earlier in the proposal, the Mass Spectro Meter was omitted from the Schema. This case though not of so much significance but gives us hints how Saha's position was not as same as earlier. Saha had stopped climbing at a certain point in a mid way but young scientists like Bhabha was quick to keep proper channels and climb up at every opportunity.

BREAKING DOWN WITH NEHRU AND ATOMIC COMMITTEE

The strain in the relationshipbetween Saha and Nehru can be traced back to 1942 when Saha submitted his resignation from the membership of the Board of scientific and Industrial Research since according to Saha it was "being awfully managed and his resignation was an expression of his protest." [27]This was just before the establishment of the Council of scientific and industrial research that was established in India and headed by Shanti Swarup Bhatnagar in 1942.

By 1952 Saha, with Nehru had reached a low ebb, but this was more to do with the differences that he had with CSIR and its head Shanti Swarup Bhatnagar. Moreover, he expresses his differences in a letter to Nehru dated 23rd April 1952, where he

writes,"I had submitted to you my resignation from the Advisory Board of the Glass and Ceramic Research Institute as a protest against Bhatnagar's uncalled for remarks in the meeting of the Governing Body of CSIR".

The split between the two scientists was a known fact, but by 1952 it had escalated to a great extent. Nehru was the prime minister and also the chairman of CSIR, so Saha complained about various aspects of malfunctioning of CSIR. He writes "I believe that every National Laboratory should have a strong and active advisory committee, if it is to be useful to the nation. It ought to be composed of non-officials scientists, industrialist and also officers and commercial men, otherwise the Director and his staff would be living in an ivory tower, cut off from realities of life and from contact with the people interested in the promotion of the industry on the science represented by the National Laboratory , this view was debated , in the council before the National Government came and was accepted and I had a hand in drafting the duties of the Advisory Committee ...I do not think they had ever been liked byBhatnagar, for he thinks Advisory committee are brakes to his power".[27]

Saha felt that the situation in the laboratories was deploring day by day and it was important to get away from the "lepers", which had turned out to be a bone of contention for the proper functioning of the National Laboratories. This letter also brought out the feeling of extreme dislike that Saha had towards Bhatnagar, he writes, that Bhatnagar wanted to work as Dictator in all respects as far as the laboratories and research committees of the CSIR are concerned. Bhatnagar was accusedof being authoritarian when it came in term of making appointments and policy of the National Laboratories, which was paving the way for jeopardising the future of CSIR by using his power for distributing his patronage. To substantiate his position, Saha also mentioned that Dr Bhabha had remained in the post of the

chairman of the Atomic Energy board for over eight years and "Dr D.N. Wadia has remained chairman of the geological Age Committee for over seven years. Thus he accused Bhatnagar of being extremely "power loving".[28]This expression might hint to the frustration that Saha had because of the inability of Saha to establish his laboratory as the centre for nuclear research in India, but Saha's accusations werenot without reasons and his critique does shed lights on the lacunae of the functioning of CSIR. So merely analysing these letters as a sign of Saha's marginalisation is a bit problematic. In the field of Nuclear research too, Saha was quite upset with the functioning of the Atomic Energy commission. The dissatisfaction continues when in another letter dated 23rdMay 1953 he writes about the problems that plagued the Nuclear research and development in India. He writes, "The atomic Energy Act of 1948, which gave the central Government the right to control the development of Industries connected with the production and the use of Atomic Energy, mentioned Uranium, Thorium, Plutonium, Beryllium and their respective compounds as the prescribed substances, which came under the purview of the Act".[29]

This he felt was quite problematic as the elements Plutonium (94), and Neptunium (93) mentioned in the notification did not occur in nature but had to be produced by massive efforts in Production Piles. They were maufactured in USA, Britain, and USSR as raw materials for the Atom Bomb in Plant costing several hundred million dollars, and according to him, India had no resources to produce them "within the fifty years at the present tempo (1952)" of technological development. He mentioned about the decisions that he finds quite unpractical for he says "extension of controlof radium, deuterium and lithium is questionable." Radium was not manufactured in India during the early 1950s and no large bodies of Uranium had yet been discovered, which allowed its manufacturer to sell them on a commercial scale. So

for Saha, the control of unit production was meaningless. He mentioned that Deuterium was not produced in bulk in India, and would be impossible to be produced unless there wasextensive hydro-electric work. He also shared discrepancies regarding the ban on lithium and stated that "we cannot understand why lithium should come under the ban. Lithium is probably used for Hydrogen Bomb, but it is not really like Beryllium. It occurs in plenty in other parts of the world, so control on its production has no meaning." The criticism was, directed towards the Atomic Energy Act. Saha in his criticism not only touched upon the policies that was taken up the AEC, for the promotion of Atomic Energy but was quite ambivalent about how the government was distancing the mechanism of the AEC from the general public and masses, i.e. a notion of "secrecy" had engulfed the AEC programs and its functioning.

SAHA AGAINST SECRECY

Saha had reservations and "misgivings" towards the AEC. In a letter he mentioned," The AEC has now been in operation for five years" and it had "enveloped itself" within a "cloud of secrecy" which according to him was extremely undesirable. Saha was against this notion of secrecy that government of India was advocating. This letter which he was addressing to Nehru, was written on behalf of "many eminent scientists interested in Atomic Energy". The major issue that troubled Saha was the idea of Secrecy, he held that the Atomic Energy Commission of other countries was not as secret as that of India. He questioned the ground on which the government was keeping the progress of commission secret, "as if secrecy was from foreign countries" as there was hardly anything to keep back from any other countries. There was also no military or technical secrets involved which had to beproteceted, as Saha states "our government have no military ambition and have no intention of

developing atomic energy for military purpose".[30]At the same time, Saha left no stones unturned to criticiseBhabha. He stated that Cosmic Ray research had great importance for knowledge of fundamental particles but nowhere in the world was the Cosmic Ray research included in Atomic Research Commission. Even major countries like "UK, USA and all other countries, had a separate body to deal with cosmic Ray Research. Nucleonics, a journal dealing with Nuclear Science featured no issue, which dealt concerning the cosmic ray, included in the atomic energy commission of any countries. In a direct scathing attack to Bhabha, he states "the chairman i.e. Homi Bhabha wanted to create the impression that India's efforts have achieved very great work in cosmic Ray physics is good news, but the public would like to know what it is and how it has furthered atomic energy development in this or any other countries".[31]

CONCLUSION

The paper has centred around the ideas and views of Meghnad Saha taken from his correspondences. The story of Meghnad Saha according to Jhanvi Phalkey is the "story of marginalization". The points that I have referred above in the paper too corresponds to this argument, but this would be a reductive analysis. Meghnad Saha till the end of his lifetime, continued to be critical of government's policies. He was also elected as the Member of the Parliament in the first general election of 1952. The dissatisfaction and the criticism that his letters reflected, a separate episode where a prominent scientist was very critical to the scientific development of his own country. It certainly brings out the democratic structure within the picture, and participation of the scientists in the deliberations concerning the planning of Scientific Institutions in India.

Saha had long term relations with Jawaharlal Nehru, Homi J. Bhabha, Shanti Swarup Bhatnagar and also other leading scientific and political personalities. He had maintained relations with Nehru and other scientists all along his life. His scathing criticism of the government policies regarding the Atomic Energy Commission directly addressed to Prime Minister cannot be taken as his marginalization but can be argued as the importance as a Scientist he held, that made his voice more vocal, where the criticism brought out real issues. It is true that Saha's institution in Calcutta was not chosen by the government to establish as the Nodal centreof Nuclear Research, and this had upset Saha, but this cannot be linked with the assumption that it was the major reason for his dislike towards Bhabha or Bhatnagar. The dislike that reflected in the letter, cannot assume to be grounded on their personal conflicts as the letters are limited to scientific debates, the disagreement regarding the policies, its implementation and the functioning of the institutions.Thus it would be prudent it to premise it within a discourse, where each problem and criticism that Saha expressedshould be taken up as "scientific critique".

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