Arnold Sommerfeld – The supporter of Indian physics in Germany

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The German physicist Arnold Sommerfeld was a great admirer and supporter of Indian physics. This aspect of his life is explored in this paper. Sommerfeld visited India in the second half of 1928. The motives for the journey and its outcome are discussed.

Arnold Sommerfeld, who was awarded the honorary Doctorate of Science degree by the University of Calcutta[1] and the Foreign Membership of the Indian Academy of Sciences in Bangalore, visited India between September and October 1928. Different German authors such as Michael Eckert[2] and Ulrich Benz[3] have referred to this journey. An authentic document is Sommerfeld's article entitled 'Indische Reiseeindrücke' (Impressions of an Indian Journey), which appeared in 1929 in the periodical *Zeitwende*[4].

At the death anniversary of the great physicist, it would be worthwhile to inform the Indian readers about this journey. The literature appeared in German, and therefore it is not well known in India. However, the main objective of this article is to explore the issue of the scientific work of the Indian physicists in the first three decades and its reception by some of the German physicists, who were rather critical. The role of Sommerfeld to defend the work of Indian scientists will be explored.

To start with, Sommerfeld's short biography is given. It is largely based on the article by Paul Forman and Armin Hermann in *Dictionary of Scientific Biography*[5].

Arnold Johannes Wilhelm Sommerfeld (1868–1951)

Arnold Sommerfeld was born on 5 December 1868 in Königsberg, Prussia (now known as Kaliningrad, Russia). After his schooling, he joined the University of Königsberg. In 1892, he qualified himself as a gymnasium teacher and completed his dissertation on 'the arbitrary functions in the mathematical physics'. Instead of becoming a teacher, he decided to go to Göttingen and became assistant to the mathematician Felix Klein (1849–1925). Due to the latter's connections, Sommerfeld, though a mathematician, got the full Professorship in Technical Mechanics at the *Technische Hochschule* of Aachen. Soon, he was able to show that pure mathematics can be useful to engineers. Because of the recommendations of eminent physicists Hendrik Antoon Lorentz (1853–1928), Ludwig Boltzmann (1844–1906) and Wilhelm Wien (1864–1928), he was called to take the newly created chair of theoretical physics at the University of Munich in 1906 (ref. 6). Here he resumed his early work on the electron theory. To check his theories, he directed a considerable research programme towards experimentation. The result, in 1912, namely the discovery of diffraction of X-rays by crystals by his *Privatdozent* Max von Laue (1879–1960) and two experimentalists, Walter Friedrich (1883–1968) and Paul Knipping, is a widely known fact.

Sommerfeld was one of the early supporters of Einstein's theory of relativity, though somewhat sceptical about the latter's concept of the quantum nature of radiation. In 1913, after the publication of the Danish physicist Niels Bohr's important paper on the 'Constitution of Atoms and Molecules', Sommerfeld tried to apply this model in the field of spectroscopy. Sommerfeld's work assisted in the acceptance of Bohr's theory. Forman and Hermann wrote, His 'Atombau und Spektrallinien', of which the first edition appeared late in 1919, immediately became the Bible of atomic physics and its successive editions, appearing almost annually in the early 1920s, chronicled the progress of this field up to the eve of the introduction of quantum mechanics (see ref. 5). In 1916, Sommerfeld's school formulated the quantum theory of normal Zeeman and Stark effects, i.e. splitting of spectral lines in the presence of magnetic and electric fields, respectively. Michael Eckert gives more details of Sommerfeld's scientific achievements[7,8].

Sommerfeld, though he did not belong to the founders of the 'new quantum mechanics', was one of the physicists to apply it to the calculation of energies and rates of atomic processes, and the macroscopic properties of matter resulting from it.

Sommerfeld's best contribution to physics was the training of many young physicists. The first, pre-war generation of doctorates included (. . .) Peter Debye, Ludwig Hopf, Wilhelm Lenz, Paul S. Epstein, Alfred Landé; the second, early post-war generation included Erwin Fues, Gregor Wentzel, Wolfgang Pauli, Werner Heisenberg, Helmut Hönl, Otto Paporte; the third, post quantum-mechanical generation included Hans Grimm, Albrecht Unsöld, Walter Heitler, Hans Bethe, Herbert Fröhlich (see ref. 5). Out of them, Werner Heisenberg (1901–1976), Wolfgang Pauli (1900–1958), Hans Albrecht Bethe and Peter Debye won Nobel Prizes (see ref. 6). In 1935, he reached the age of obligatory retirement. During the Second World War, he occupied himself with the publication of his lectures on theoretical physics.

Beginning of Indian contacts

In the first two decades of the 20th century, the publications of Raman's papers on acoustic and optics were abstracted in the *Beiblätter zu den Annalen der Physik*[9] – a mouthpiece of the German Physical Society. They attracted the attention of German physicists, and a few years later Raman became the only non-European who was invited to contribute an article to the famous *Handbuch der Physik* (see, The Annual Report of the Indian Association for the Cultivation of Science, 1926, p. 268). His contribution, 'Musikinstrumente und ihre Klänge' (Musical Instruments and their Tones), dealt with the physical characteristics of the musical tones emitted by string, wind, and percussion instruments[10]. In an earlier chapter in the same volume of the

Handbuch, the work of Raman and his collaborators was cited extensively[11].

In the 1920s, Satyendra Nath Bose's (1894–1974) paper on quantum statistics[12], Meghnad Saha's research on astrophysics[13], Bidhu Bhusan Ray's (1894–1944) work on X-ray spectroscopy[14] appeared in the newly founded (i.e. 1920) (ref. 15) German journal, *Zeitschrift für Physik*. Other Indians who also communicated to this journal were Goverdhan Lal Datta, who studied in Göttingen under James Frank (1882–1964) (ref. 16), Debendra [Mohan] Bose, who between 1914 and 1918 did his dissertation in Berlin[17], Satyendra Ray from the University of Lucknow[18] and R. N. Ghosh from the University of Allahabad[19]. Presumably, the German scientific community took notice of Indian scientists. However, as we shall see below, there existed misconceptions about the quality of Indian work.

As far as the connections between Sommerfeld and Indian physicists are concerned, it would be worthwhile to mention the case of the astrophysicist Meghnad (often abbreviated as M.N.) Saha (1893–1956). In the beginning of the 1920s he made his name among western physicists when he derived an equation, which later came to be known as Saha ionization equation, and came up with the theory of thermal ionization, which explained the structure of stars under given conditions. From 1917 until 1924, i.e. the year of his nomination to the Royal Society (to which he was elected in 1927), Saha wrote 27 original scientific papers[20]. Saha, who was on deputation, spent some months in England. In the Cavendish laboratory, the facilities for high temperature research which he required to verify his ionization theory, were not available; he was advised by his host Alfred Fowler to contact Walther Nernst (1864–1941) at the University of Berlin. The latter agreed to take Saha, though *the First World War had just ended and naturally feelings ran high in Germany against the British and their subjects*[21].

From Berlin, Saha sent a copy of his paper 'On a physical theory of stellar spectra' to Sommerfeld[22]. It attracted Sommerfeld's attention, and on 18 April 1921 he wrote to Saha that, 'Your work on the Sun spectral lines are very interesting. If you know good German, may I request you to give a colloquium on it'. Saha thanked him for the invitation but informed Sommerfeld that although his papers were in German, his pronunciation was not good (Saha to Sommerfeld, dated April 1921). It is clear from the book *Professor Meghnad Saha – His Life, Work and Philosophy* (pp. 15–16), brought out by the editor S. N. Sen in 1954 on Saha's sixtieth birthday, that he accepted Sommerfeld's invitation in the end and delivered a lecture. In 1927, their next meeting took place in Como (Italy) on the occasion of the 200th birth anniversary of Volta[23] (see Figure 1), where Sommerfeld made provisional arrangement to visit Allahabad (Sommerfeld to Raman, letter dated 28 February 1928).

In early 1928, when Raman came to know about Sommerfeld's journey to USA, he sent a telegram and invited Sommerfeld to deliver lectures at the University of Calcutta. The details of the Raman–Sommerfeld interaction have already been published[24].

On 25 April 1928, Saha informed Sommerfeld that he had received a letter forwarded by Raman. The communication also shows that after perusal of Debendra Mohan Bose's letter from Munich and consulting with Raman, Saha proposed the following visiting places for Sommerfeld: Madras, Calcutta, Darjeeling, Dacca, Patna, Benares, Allahabad, Agra, Delhi, Lahore and Bombay.

Benz[3] observed that on 18 August 1928 Sommerfeld left for Geneva to take a steamer, *and after a peaceful journey the steamer docked at Calcutta, the first destination of the visit*. The information is not quite correct, as Sommerfeld first went to Colombo, and from there to the next place, namely Madras (in South India), which is closer to Ceylon. Also, a letter dated 25 April 1928 from Saha to Sommerfeld confirms this version.

Purpose of the visit, reception and impressions

It is a well-known fact that to get financial support from a government or any other institute, one has to give the causes for the journey. That is what Sommerfeld did in his letter dated 1 May 1928 to the ministry, where he wrote that together with Raman he believed to have explained the change in colour of the scattered light observed by Raman in Calcutta. In Allahabad, Saha worked partially on the astrophysical objects, and partially on the atomic spectra. In particular, in the latter case, he (Sommerfeld) could co-operate with the Indian physicist[25]. Though it was an official version on the scientific level, the aim of the German government to finance such a journey was to promote German culture and political interests.

Figure 1. Participants of the Como (Italy) Conference, September 1927. In the third row (left), Debendra Mohan Bose and Arnold Sommerfeld; second person (right) Meghnad Saha. Courtesy: Niels Bohr Archive, Copenhagen.

Michael Eckert[2] explores the political and cultural aspects of the journey in detail. Here we quote one example and omit the details. Particularly in China, where the Germans lost political power, there were still relics of German culture. Sommerfeld's 'official feelings' as found in the annual report of the technical faculty of the State Tung-Chi University of Woosung (China) are quoted by Eckert as follows: 'If Germany's enemies of those days have thought to eradicate German influence from roots in China, they must have been deeply disappointed, as they had to see, how the new Woosung school came into existence due to the sympathy of Chinese folk'[26]. There was also a talk about lucky Chinese students who had the honour to be taught by German teachers.

After ending his journey Sommerfeld wrote an article in *Zeitwende*, in which he gave the following reason for visiting India: 'The study shoots of modern physics have sprung up in the recent years on this ancient and cultural soil and scientific research in India has suddenly begun to compete on equal terms with research in Europe and America'. He continues and appreciated two Indian physicists as follows: 'No discovery in Physics during the last year has caused so much excitement and . . . admiration in the entire world as the spectroscopic effect found by Professor C. V. RAMAN in Calcutta . . .; and no discovery in astrophysics has been found to be as fruitful for our understanding of the stellar system as the theory formulated by MEGHNAD SAHA, at present Professor in Allahabad. The international importance of these two men is emphasized by the fact that they have been chosen members of the Royal Society of London, that old and venerable Academy of Science'[4].

During his visit, Sommerfeld delivered lectures at the Universities of Madras and Bangalore. From there he moved to Calcutta (see Figure 2), the 'scientific centre of India', as he observed. A local newspaper in an article entitled 'Prof. Sommerfeld – Distinguished scientist for Calcutta' stated as follows: 'A DISTINGUISHED visitor arrives in Calcutta to-day in the person of Prof. Arnold Sommerfeld, one of the greatest pioneers in the development of modern physics . . . He has delivered lectures in Madras and in Bangalore. . . . There is no branch of physics, classical or modern, in which he has not contributed something outstanding and original. His greatest achievement is in the realm of spectroscopy, and his book, containing mostly his own contributions *Atomic Structure and Spectral Lines* has been called the Bible of 20th century in the scientific world'. Another newspaper, *The Englishman*, dated 5 October 1928, informed its readers that Sommerfeld gave tributes to Indian science and described Calcutta as the centre of scientific life in India. He also appreciated the achievements of the Indian physicists Raman and J. C. Bose of Calcutta, Saha of Allahabad and S. N. Bose of Dacca. The latter's work on statistical physics was greatly appreciated by Einstein. Similarly *The Statesman*, of 5 October 1928, quoted Sommerfeld as follows: 'It is a great privilege for me to be acquainted with Indian workers and watch the development of physics in this country. During my stay in Calcutta I hope to study the new development of "Raman-effect" (. . .), and make some contributions to the theoretical explanation of this phenomenon. It is really one of the most interesting discoveries we have had in physics during the last few years'. The newspaper also informed that Sommerfeld would lecture on 'Modern Ideas of Atomic Structure' and give one technical lecture for experts (presumably one of the Lectures on Wave Mechanics, which was delivered by Sommerfeld and later published by the Calcutta University[27]).

Allahabad, where Saha was teaching, was one of Sommerfeld's destinations where he shared his scientific views. What he did there is not clear. But the *Zeitwende* article gives us the following information regarding his cultural activities in India.

In Madurai and Trichinopoly he saw huge temples from the 15th and 16th century. Their layout '*corresponds to the Proto-Aryan fortified village with four gates in the four celestial directions*', observed Sommerfeld. Another remarkable observation regarding the 'Aryan' in India is: 'In South India . . . many Brahmins – the majority of scholars are from this caste – have names ending in 'arya', 'aier', 'ashar'. It seems that the Aryans, having migrated from the North and being thinly scattered in the South wanted to keep their identity separate from the indigenous population of Dravidians through their names. The Brahmins have a fair complexion, more so in the north than in the south, while the Dravidians generally have a dark brown complexion'[4]. Sommerfeld discussed this issue with the Indian Nobel Laureate in literature, [Rabindranath] Tagore (1861–1941), as is evident from the *Zeitwende* article. How seriously Sommerfeld believed this theory, is difficult to say. But it must have reminded him of the debate on 'German or Aryan physics' vs 'Jewish Physics' in his own country. Philipp Lenard (1862–1947), the author of the famous *Deutsche Physik* (German Physics) that was published in four volumes, and

Figure 2. Arnold Sommerfeld with K. S. Krishnan (left) and C. V. Raman (right). Courtesy: Raman Research Institute, Bangalore.

Johannes Stark (1874–1957), two highly-ranked physicists, were supporters of the 'Aryan Physics'. As far back as 1915, Stark labelled Arnold Sommerfeld as 'energetic executive secretary of the Jewish and philo-Semitic circle of mathematicians and theoretical physicists'[5].

From Calcutta Sommerfeld went to Benares, which he named as 'India's Rome', as he saw a huge number of people bathing in the river Ganga. There was a Golden Temple which he was not allowed to enter, being a non-Hindu. From there he moved to Sarnath, he named as 'Wittenberg near Rome', as Budda preached first in Sarnath. He had also the chance to visit the famous Taj Mahal.

In the article, Sommerfeld makes careful remarks on the political relation between the Indians and the British. For instance, he wrote: 'We sincerely wish the Indian people improvement of their economic conditions and fulfilment of their political aspirations, not out of animosity against England, but out of the conviction that it would be a gain to human civilization when a people with extraordinary talents, oriental folk, the upper stratum of which is closely related to us, . . ., could take part in the civilized competition of nations on equal terms and counteract the increasing materialism of the West by its speculative, transcendental world-view which shuns transitory moments of success.[4]'

Now, in the following discussion we come to our next issue, namely the reception of Indian scientific work in Germany.

Reception and misconception of the Indian work

On 20 July 1925 Max von Laue wrote to Sommerfeld that Max Carl Werner Wien (1866–1938), the chairman of the German Physical Society (henceforth GPS), and Karl Scheel (1866–1936), the secretary of the GPS and the editor of the *Zeitschrift für Physik*, had a dispute over Bose's paper. The question was raised as to whether or not a non-German communication should be published in German physical journals. Laue stated further that 'as the famous work of Bose appeared in English, not only [Philip] Lenard, but also other members of the German Physical Society complained to M. Wien. Scheel, who was questioned by Wien had to accept that he did not give much importance to foreign language publications and in the case of Bose the "mistake" happened due to over-burden of work. Wien who was not happy with this explanation, and was also pushed by Lenard's group wanted to have the explanation in writing' (translated from German).

From a historical point of view, the above letter is of importance and hints at why the second paper of Bose was translated by Albert Einstein (1879–1955). As far as the first paper[12] is concerned, on 4 June 1924 Bose sent a manuscript to Einstein and asked for his opinion on it, and further that if Einstein found that the paper was worth publishing, to get it translated and arrange for its publication in *Zeitschrift für Physik*. Einstein saw the potential of the paper, translated it and sent it to the journal with good remarks. On 2 July 1924, he informed Bose about this.

Now, let us come to the second letter of Bose which was written on 15 June 1924. Bose sent another manuscript with a similar appeal. This paper was received by the editor of *Zeitschrift für Physik* on 7 July 1924 as is evident from the August–September 1924 issue of the journal[12]. There are two particular points to be noted in the publication. Firstly, the German version consists of 9 pages, and secondly, in the translated version Einstein made two critical comments of one page length. Obviously, he did not quite agree with the paper and most probably thought the translation was not worthwhile. The length of the manuscript is an important point. To translate nine pages means a lot of work. Presumably he forwarded the manuscript to the editor without translating, who tried to publish it as it was, which led to a dispute in the GPS, as is evident from Laue–Sommerfeld correspondence. However, since the final paper had been published in German and not in English (as mentioned in Laue's letter), obviously the editor asked Einstein to take the responsibility, as he was the person who sent the manuscript. Einstein was too nice to send the manuscript back and took the trouble to translate it. Another evidence, namely that the editor sent the reprints to Einstein (Einstein to Bose, dated 3 November 1924) and not to the author, Bose, also indicates that Einstein was held responsible for the paper.

It should be pointed out here that Bose's paper was only a pretext. In fact, it was a part of the quarrel between the Jewish and German physicists. It took a worse form after Adolf Hitler came to power in 1933. Many of the Jewish physicists were forced to resign their positions and to leave their country – a well known part of history, that need not be explained here.

How far Sommerfeld entered into this dispute (on Bose's paper) is uncertain. But what we can see from his writings is that he was interested in the work of Indian physicists and in particular he appreciated Raman and Saha, as quoted earlier.

Although, the work of Indian physicists was recognized to some extent, there was often under-toned criticism and scepticism. For instance, one of Sommerfeld's letters reveals the following story: A paper was sent by one Indian physicist named Ray, in which he dealt with the 'Dynamical theory of string developed by Raman'. Otto Blumenthal, a mathematician at Göttingen, after reading that manuscript became sceptical about Raman's theory. However, Sommerfeld's arguments in favour of Raman convinced him that Ray's treatment of the theory was 'rubbish'. In the end, the paper was rejected with the argument that the readers of *Mathematische Annalen* are not able to judge whether the physical fundamental approach used in this case was correct (Sommerfeld to Blumenthal, dated 19 February 1927).

The story of a theoretical physicist at the University of Jena–Georg Jakob Christof Goos (1894–1959) – who was sceptical of the discovery of the Raman effect, its unsuccessful repetition at the University of Munich, and support by Sommerfeld to Raman's results is given in a separate article[24]. In the following, a rather less dramatic case about the opinion of an average German physicist – Richard Martin Gans is given.

Richard Gans' papers, which were referred to by Raman, evidently show that he was working in the field of light scattering[28–30]. In 1922, Raman, in his landmark paper, had shown that the blue colour of the sea is due to molecular scattering. He broke the old myth that the colour of the sea is due to sky reflection or caused by suspended particles[31]. Raman's observations and calculations were valid only for the normal incident

light, whereas Gans developed the general theory[32]. He also gave a theory to calculate the mean molecular distance between the molecules, which was later refuted by Raman[33].

Gans had a negative opinion about Indian scientists. For example, the historian E. Swinne tells us that for years Gans had a sceptical attitude towards the quality of the publications by Indian physicists[34]. In 1937, while talking about light scattering in liquids, he told the author, Swinne, that a few years ago at the physicists' conference in Prague, he had told Sommerfeld that the Indian physicists are not reliable[34]. Then he observed Sommerfeld's reaction as follows: 'He (Sommerfeld) jumped up. It was lucky that the car in which we sat was open – otherwise he would have hurt his head.[34]'

At first glance, one might interpret Gans' behaviour as arrogance or a result of Raman's criticism of the former's work. This does not explain the reaction of others, who were equally critical or sceptical. In my opinion, the reasons are to be found elsewhere. Firstly, the famous, already quoted theoretical work of Bose and Saha were individual efforts and rare cases. They set a high standard for the following works as well as high expectations for the Western physicists, who had little idea about the development of physics in India. Most probably, they did not know that theoretical physics (where Germans were very strong) had no roots in India. The first paper from India in this field appeared in 1917 (ref. 35). In the following years, the situation did not become better. The best and richest research institute, i.e. the Indian Institute of Science (IISc), Bangalore, even in the late 1930s did not possess a Chair for Theoretical Physics, though the director felt its need. A committee (named as Irvine Committee) which was established to suggest different reforms regarding the departments and financial aspects, reported that the Institute could not afford such a chair due to financial stringency, and also observed that 'Modern mathematical physics, with its attractive fields of speculation and experiment, has little direct contact with industry, and in this respect cannot compete with Chemistry as a subject likely to be of service of India' (Second Quinquennial Reviewing Committee of the IISc, Bangalore 1936, p. 10).

Another major drawback in India was that it did not possess an organization like the German Physical Society or the Royal Society of London, to coordinate the research work. It is a well-known fact that the Indian academies came into existence in 1930s. So, as far as the coordination of mathematics and theoretical physics was concerned, the Indian Physico-Mathematical Society was established in the 1930s for this purpose[36].

It seems that German physicists took the least interest to understand the conditions under which the Indian scientists had to work. They were interested only in the physical results. Persons like Sommerfeld, who had the chance to interact with Indians, understood the situation better.

Aftermath of Sommerfeld's visit: Indo-German cooperation

From an Indian point of view, Sommerfeld's visit had positive aspects. A reporter of the periodical *The Modern Review* from Calcutta, in its October 1932 issue, wrote as follows: 'About three years ago, I had the pleasure of discussing the possibilities of Indo-German cultural co-operation with Professor Sommerfeld of the University of Munich, who has been in India as a visiting professor of Calcutta University. This distinguished German scholar told me that in the field of pure science, India has made a tremendous progress during the last quarter of a century'. The reporter further quoted Sommerfeld as follows: 'We wish that some of the very best and only the very best Indian scientists should visit German universities as research scholars. Achievements of Indian scientists are removing much of the misconception about the ability of the Indian people'. The reporter also informed his readers about a brilliant young person, Ramesh Chandra Majumdar, who had done his M Sc at Calcutta University to perform research at the University of Jena, had been awarded the Zeiss Scholarship following a recommendation of the *Deutsche Akademie* (German Academy).

Another person named Sures Chandra Sen, wrote an article for the November 1932 issue of *The Modern Review* and informed his readers about the inspiring atmosphere at the University of Munich and the help which Indian students were getting from Walther Gerlach, Thierfelder who is referred to as 'the friend, philosopher and guide to the Indian students in Germany', and Schmauss, Professor of Meteorology, 'who is extremely generous-hearted and possesses the traditional virtues of a true Indian "Guru" (preceptor). It is perhaps for this reason that he has quite a number of Indian students in his class'. And of course, the author did not forget to mention his interview with Sommerfeld, who 'speaks slowly but with inspiring earnestness and penetrating conviction which invests his personality with a halo of reverence'.

Sommerfeld's visit to India, and later Raman's visit to Munich after the reception of the Nobel Prize[37] was evidence enough that they had good contacts. This led the young Rudolf Ernst Peierls (1907–) to ask Sommerfeld to write a recommendation letter for the post of assistant professor at IISc, where Raman was director. In the letter, Sommerfeld gives his views about Peierls. But at the same time he recommended Ludwig Hopf (1884–1939), a previous student of Sommerfeld, more strongly (Sommerfeld to Raman, letter dated 1 February 1934).

Now, it will be worthwhile to explore the Sommerfeld–Peierls episode in some detail, as my conclusions regarding the rejection of Peierls's application are different from those to be found in the earlier literature. For instance, the editor of Pauli's letters, while discussing the short recommendations of Pauli, stated that they were a formal matter as the physicists community was small. However, the recommendations failed as soon as they were sent outside the circle. In footnote number 10, the author gave the Sommerfeld–Peierls case[38].

From the foregoing discussion it is clear that Raman was not outside the well-known circle, at least not for Sommerfeld. But we have still to explain why the recommendation failed.

After Raman became the Director of IISc, in a letter dated 27 January 1934 he informed Max Born (1882–1970) that he wanted to have 'a first-rate Mathematical Physicist who could guide and inspire the work of the Institute on the theoretical side'. The letter also suggests that the Council of the IISc agreed to create an assistant professorship of theoretical physics. But the salary was very low (ca. 800 rupees, i.e. nearly 60 British

pounds) to attract a first-class man from Europe. Raman's intention was to convert this post to a readership or full professorship with higher salary, if the institute could get a highly qualified person. Raman, who first asked Born to suggest names of theoretical physicists, later said 'whether you could possibly think of coming to Bangalore if a full professorship of theoretical physics were created and offered to you' (Raman to Born, letter dated 27 January 1934). At the first instance, Born refused on the grounds of being too old. But he proposed that if a permanent job was offered he might think about it, and also he wished to visit for a short time to judge the situation. (Born to Raman, letter dated 18 February 1934). In the same letter he wrote, 'I would be glad if I could help you to find a younger man for your university. There are excellent people: Peierls, Nodheim, Heitler, Bethe and others'. In the end, according to Born's wish, a special Readership in Theoretical Physics for a period of six months, i.e. from October 1935 onwards was offered (Raman to Born, letter dated 10 December 1934). It is well known that he availed of this opportunity. So there was no chance for younger people. Apart from that, it is shown above that the Institute had no money for 'theoretical physics', as even Born had to leave after six months.

Obviously, Sommerfeld's recommendation letter, whether short or long, had neither effect nor a chance under these conditions.

Conclusion

It is suggested that misconceptions among some of the German physicists about the quality of Indian physicists' work were due to lack of knowledge about the conditions under which they worked. Arnold Sommerfeld, who was better informed, did not have such views and tried to support Indian physicists.

Rudolf Peierls's application was turned down for an assistant professorship at IISc, as the director gave the opportunity to a senior and renowned person, Max Born. He also left the Institute after completing his six-month tenure. Peierl's rejection had nothing to do with the 'short recommendation' letter by Sommerfeld, as contended in the literature.

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