

(No. 13-14.)

No. 1075T. (File 4C/23-5)

To the Secretary to the Government of Bengal  
General Department.

Dated Darjeeling, the 16<sup>th</sup> June 1896

Sir,

In previous correspondence I have communicated to Government my opinion of the value of the scientific researches pursued at the Physical Laboratory of the Presidency College, Calcutta by Professor J.C. Bose, M.A., grant of Rs 10000 for the promotion of general scientific work in the laboratory, and a personal grant of Rs 2500 a year to Mr. Bose towards the cost of his own independent researches. Mr. Bose is now very anxious to go to England for six months, in order, in the first place, to attend the meeting of the British Association in September, and if possible, in the second place, to visit the chief laboratories of England and the Continent, with the object of gaining knowledge which will be useful for his future work. I beg to submit for the favorable consideration of Government the proposal that instead of taking furlough for this purpose, he should be deputed to visit Europe for six months on the public service under Article 103 of the Civil Service Regulations. In order to justify this proposal, it is necessary for me to submit a brief account of the original work on which Mr. Bose has recently been engaged, and of the gratifying recognition which it has received from various scientific authorities in Europe.

2. It is a matter of common knowledge that by the invention of what may be called artificial organs of perception, new forces or modes of action, hitherto undetected, may be and are being discovered. The Röntgen rays are one example of such a discovery. It is to the investigation of the invisible electric waves that Mr. Bose has specially applied himself, and with remarkable results. These rays are found to travel through space with immense velocity, and to traverse obstacles hitherto regarded as opaque. To render them visible, something analogous to an "electric eye" has to be constructed. An improved form of apparatus for this purpose has been devised by Mr. Bose; and the *Electrician* of the 27<sup>th</sup> December 1895 drew attention to the great practical use of such an apparatus in light-house signalling. (See Appendix A.)

3. In order to propel the invisible electric waves to great distances without serious diminution of intensity, special lenses are required. With this object the refracting properties of different objects for the electric ray were for the first time fully worked out by Mr. Bose at the Presidency College by a newly invented method. The results obtained were judged of sufficient importance to be accepted by the Royal Society (See Appendices B, C, and D). The Royal Society, through its secretary, expressed a desire to assist in the continuation of these researches by a donation from the Parliamentary grant made to the Society. But as the Government of Bengal had by this time made, as above stated, an annual grant for the same purpose, Mr. Bose contended himself with asking for a nominal grant from the Society.

4. The Royal Society also asked for particulars about the lines of work in which Mr. Bose was engaged. In answer to this inquiry, he submitted the following list of subjects: -

- (1) Determination of the Indices of Refraction of the Electric Ray by the Interference Method;
- (2) Determination of the Dielectric Constant;
- (3) Determination of Wave Length of Electric Radiation by a method of unaffected by the peculiarity of the Receiver;
- (4) Polarization of the electric ray by crystalline substances;
- (5) Study of Magnetic Rotations and analogous phenomena;
- (6) Photo-electric effects of light and of electric radiation.

Of these, No. 3 and 4 have been for the first time successfully carried out by Mr. Bose; Nos. 1, 2, 5 and 6 are in progress and require the invention and construction of very delicate apparatus.

5. With regard to No. 3 in the above list, the subject dealt with has long been regarded as of very great importance, attempting as it does the complete specification of the unknown forces involved, by determining the length of the invisible wave and also the exact number of vibrations which give rise to the wave. The problem was attempted by Hertz, and subsequently by many continental physicists; but the results obtained were very contradictory. Mr. Bose has recently succeeded in solving the problem with entirely satisfactory results; and a copy of the paper embodying his solution was sent to the University of London as thesis for the degree of Doctor of Science. I should explain that, before being admitted to the examination for that degree, a candidate has to produce a dissertation embodying the results of original research in

some branch of science. On acceptance of the dissertation by the University, the candidate has in general to undergo a further examination. There is, however, a proviso, in the D.Sc. Regulations that a candidate may at the discretion of the University be exempted from further examination, provided the paper submitted is of special excellence. Mr. Bose received, on the 27<sup>th</sup> May, a telegram from the Registrar informing him that his thesis was accepted and his presence at the examination excused.

I inclose three pamphlets containing the results of some Mr. Bose's investigations, including the paper read before the Royal Society.

6. I would also solicit attention to the subjoined extract from the Presidential Address delivered at the Annual Meeting of the Asiatic Society of Bengal in February 1896 by Mr. A. Peddler, F.R.S. (Appendix E), in which an account is given of Professor Bose's researches; and more particularly to the letter, dated 14<sup>th</sup> April, 1896, from Lord Kelvin, late President of the Royal Society (Appendix F), in which he speaks of the "wonder and admiration" with which he has read a pamphlet sent him by Mr. Bose. To go further afield, I may mention that Mr. Bose has received a letter from Professor Sadowsky of Russia, expressing the great interest with which he has read the papers in the *Electrician* "sur vos belles recherches" and asking for particulars about the construction and dimensions of the "Receiver."

7. From the above, I hope it will be clear that Professor Bose is an investigator of exceptional originality and power, and that he deserves all that encouragement that the Government can give him. In advocating his deputation to Europe on duty, I have in mind not merely his own personal benefit, but also the resulting advantage to science. Mr. Bose writes: - "There is still a large amount of work of great importance, which I venture to hope will be successfully worked out at the Presidency College. It will, however, require a perfect organization of the laboratory to bring the different investigations to a successful conclusion within a reasonable time. I have hitherto worked in complete isolation, with very imperfect mechanical and instrumental appliances. It would be of inestimable advantage for the success of future work, and in planning an efficient laboratory, to visit similar institutions (perfected by long experience and mutual example) in Great Britain, France, Switzerland and Germany. Should the Government be pleased to send me on a deputation to Europe for six months only, I hope to be able to plan a highly efficient laboratory at a small cost to the Government. I venture to hope that such a laboratory would within a short time be able to obtain recognition by carrying

out a large number of investigations of permanent value to science." Lord Rayleigh has told Mr. Bose in a private letter that "a visit occasionally to Europe would be of great service to your work." His work is not merely the education of candidates for University degrees, but the promotion of physical science in a line which he has made peculiarly his own. To help him in that is to promote the cause of science all over the world; and this, I assume, falls properly within the functions of Government. At the meeting of the British Association, where Mr. Bose proposes to read a paper, he will be thus enabled to make the acquaintance of the leading physicists of Europe, and to visit under very favourable conditions the laboratories under their control. It is true that Mr. Bose has almost made up his mind to go to Europe even on furlough pay; but since, as a Native of India, he is entitled to only two-thirds of the maximum pay of Class IV, or Rs 500 a month, it would be of great help to him to be allowed to draw, under Article 103, two-thirds instead of one-half of that reduced rate, which would give him pay while on deputation at the rate of Rs 4,000 a year instead of Rs 3,000. The difference would enable him to visit some of the chief laboratories of the Continent, which otherwise, he tells me he would be unable to do. I have little doubt that the increased efficiency of his work as a College Professor and a scientific inquirer would be cheaply purchased at an outlay of Rs. 500.

8. I may also state that Mr. Bose's presence in England would enable him to select, after consultation with experts, the exact apparatus required for the magnetic observations to be instituted at the Presidency College, for which among other things, as above mentioned, a grant of Rs 10,000 has recently been sanctioned by the Government. It has also been stated in the papers that the Government has referred the question of the electric supply of Calcutta to a committee of experts in England. As you are aware, Mr. Bose has recently been consulted by the Corporation of Calcutta on the electric lighting of the city; and he has made a special study of the peculiar physical conditions which prevail there, and which have been found to affect so injuriously the steadiness and brilliance of the street lights. His report on the subject was lately published. If the statement in the newspapers be true, I believe that Mr. Bose's advice and assistance would be of great value to the Committee.

9. I have consulted Mr. Pedler, the Principal of the Presidency College, on the subject; and we have come to the conclusion that it will be possible to dispense with Mr. Bose's services for six months, without serious detriment to the work of the College. Proposals for temporary arrangements will be submitted thereafter.

I have the honour to be,  
Sir,  
Your most obedient servant,  
A.Croft,  
Director of Public Instruction, Bengal.

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### Appendix A.

*“Electrician,” 27<sup>th</sup> December, 1895.*

We publish this week an interesting set of papers by Professor J.C. Bose, dealing with the subject of electro-magnetic radiation. It was suggested by some years ago in these columns, *àpropos* of the *Eider*, which, it will be remembered, ran ashore in a dense fog almost at the foot of the Catherine’s light, that it would be a useful and a remunerative job for some practically-minded man to devise a practicable system of the electro-magnetic “light” houses, the receivers on boardship being some electrical equivalent of the human eye. The evolution of a suitable generating apparatus would, we thought, present little difficulty; that of a suitable receiver, on the other hand, seemed likely to give considerable trouble. In this connection we would draw attention to the substantial and workmanlike form of “Coherer” devised by Professor Bose, and described by him at the end of his paper “On a New Electro-Polarisation Scope.” The sensibility and range of this type of “Coherer” would appear to leave little to be desired, and it is certainly more likely to withstand, with equanimity, the thousand and one shocks that the flesh is heir to at sea, than any of the forms hitherto brought out.

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### Appendix B.

TERLING PLACE,  
WITHAM ESSEX,  
*November 11<sup>th</sup>, 1885*

DEAR PROF. BOSE,

I COMMUNICATED your last paper to the Royal Society, and I hope it may soon be read.

It occurs to me that possibly some help might be given you for apparatus from the "Government Grant Fund" administered by the Royal Society, or, if only a small sum (under £20) were needed, from the "Donation Fund."

I will ask Mr. Rix to send you a form of application in case you are disposed to try.

Yours faithfully,  
RAYLEIGH

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### Appendix C.

*Government Grant of £4,000.*

THE ROYAL SOCIETY  
BURLINGTON HOUSE, LONDON, W.

Sir,

IN pursuance of the Regulations of the Government Grant Committee with regard to applications for aid from the Grant, we have to request that you will fill up the annexed form, and return it here on or before the last day of January, 1896.

We remain, Sir,  
Your obedient Servants,  
M. FOSTER, - *Secretary*, R.S.

RAYLEIGH, - *Secretary*, R.S.

PROF. BOSE

*Presidency College,  
Calcutta.*

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1. The nature of the researches in which you desire to engage, and the scientific results expected to follow therefrom
2. The amount asked for.

3. Whether you have received any previous grant from any source for the same object, and if so, with what results.
4. Whether any portion of the grant is to be devoted to your own personal expenses and if so, what portion.
5. What apparatus, if any, of permanent value will be required, and whether any of the instruments in the endorsed schedule can be utilized.

#### **Appendix D.**

TERLING PALACE  
WITHAM, ESSEX;  
*December 17<sup>th</sup>, 1985*

DEAR PROF. BOSE,

FROM the enclosed proof, which I have corrected (I hope adequately) for Press, you will see that I communicated your paper to the Royal Society in October, and that it has been read.

Yours very truly,  
RAYLEIGH

#### **Appendix E.**

*From the Presidential Address, Asiatic Society of Bengal – February 1896.*

The present year has been marked by some interesting researches made on the Physical Science subject of electric radiation by Professor J.C. Bose of the Presidency College. The first important work done in this direction was in connection with polarization of the electric ray by certain crystals. It was found that crystals belonging to the Rhombic, Rhombohedral, Triclinic and Monoclinic systems produce double refraction of the electric ray, and that the transmitted beam is subsequently published in the *Journal*. Great difficulty was at first experienced in constructing an apparatus for the generation of electric waves having short-wave lengths, and a suitable receiver for detecting them; but it appears that this has been very successfully

overcome. The latest radiating apparatus devised by Mr. Bose is of the size of only a 6-in. cube, and is on light. A flash of radiation is produced by merely pressing a key; the waves are only about an inch in length; while the receiver is so sensitive that it responds to the feeblest electric radiation. The whole apparatus is very portable; the receiver is certain in its action, and possessed of a wide range of sensibility.

Two subsequent papers, one on "Double Refraction of the Electric Ray by a strained Dielectric" and the other on "A new Electro-polariscope," were published in the "The Electrician" of the 27<sup>th</sup> December last. The first treats of the double refraction of the electric ray by a dielectric, which is strained either by mechanical compression or by unequal heating. The other paper describes a new form of apparatus with which the electric ray may be polarized, and the various phenomena of polarized electric radiation studies. Certain crystals were discovered which possess the remarkable property of absorbing one and transmitting the other of the two polarized beams. In one type of apparatus of Nemalite, a fibrous variety Brucite, is used to for the construction of the analyzer and the polarizer.

A very interesting polariscope has also been made who analyzer and polarizer are both made of jute.

Professor Bose's next paper, which was on "The Indices of Electric Refraction," was communicated to the Royal Society by Lord Rayleigh, and was read at a meeting of that Society on the 13<sup>th</sup> December last. The index of refraction could hitherto be determined for light rays in the case of transparent substances only; the new method, however, applies to opaque bodies as well, and it is easy to see what a vast field of investigation is opened up by it. As, moreover, the new method deals with electric rays for which the wave-lengths are comparatively large, it might be possible to obtain by means of it not only an experimental verification of the formula  $\mu_x = \sqrt{k}$ , which theory tells us is the relation between the dielectric constant of a substance and its refractive index for long waves, but also the dielectric constant themselves. The work in question in this respect is, therefore, of great scientific importance, and is likely to lead to very interesting results.

A series of experiments is now in progress at the Physical Laboratory of the Presidency College for the direct determination of the dielectric constants in a rapidly alternating field of force, the rate of alternation being of the same order of magnitude as the frequency of the

vibrations employed for ascertaining the value of  $\mu$ . Investigations are also being made for the determination of the lengths of electric waves by a new method, the results obtained from which will not be affected by the peculiarity of the receiver, as is the case with the results obtained by the old methods.

A public demonstration was given a year ago, at the Presidency College, to show the possibility of signalling by ether vibration. The ether waves falling on a sensitive receiver placed at a distance upset a delicately balanced electric circuit, thus causing the explosion of a pistol, or the ringing of an electric bell. Cylindrical lenses of Sulphur have since been constructed from the accurate knowledge of its index of refraction obtained by the method indicated above. With these it is possible to send the electric rays as a parallel beam to a considerable distance without any great diminution of intensity.

## Appendix F.

From – LORD KELVIN, late President of the Royal Society

I THANK you for your letter of March, 18<sup>th</sup>, and for the exceedingly interesting pamphlet describing your experimental researches in the Physical Laboratory of your Presidency College which you have kindly sent me, and which I have received to-day. I have found time to look all through it, although not yet to learn all its contents; but I have seen enough to fill me literally with wonder and admiration, and to allow me to ask you to accept my congratulations for so much success in the difficult and novel experimental problems which you have attacked. As a slight expression of my thanks I am sending you by post, along with this, separate copies of a few papers of my own.

THE UNIVERSITY GLASGOW

*April 14<sup>th</sup>, 1896*

(No. 15)

(File 4C/23-6)

No. 387T.G. dated Darjeeling, the 30<sup>th</sup> June. 1896.

From – M. FINUCANE, Esq., Offg. Secy. to the Government of Bengal, Genl. Dept.,  
To – The Secretary to the Government of India, Home Department

I am directed to submit, for the favourable consideration and orders of the Government of India, the accompanying copy of a letter from the Director of Public Instruction, Bengal No. 1075T., dated the 16<sup>th</sup> June 1896, in which he recommends that Mr. J.C. Bose, MA., B.SC., Professor of the Presidency College, and an officer of class IV of the Educational Service, be deputed for six months on the public service to visit the chief laboratories of England and the Continent, with object of gaining knowledge which will be of use to him both in teaching and in continuing the original researches which has commenced with such success. I am to request that Mr. Bose's deputation may be sanctioned, and that while on deputation, he be allowed, as a special case, to draw, under article 103 of the Civil Service Regulations, two thirds instead of one-half of the maximum pay of class IV, to which as a native of India he is entitled.

2. The Lieutenant-Governor strongly advocates the grant of the concession asked for. His Honour has done what he could to encourage and advance Mr. Bose's researches, as he thinks it is the duty of a great Government to do when it has a man of such exceptional qualifications on its staff, and he attaches much importance to Mr. Bose visiting Europe and conferring with the leaders of scientific enquiry there.

**(No. 16)**

(File 4C/23-7)

Telegram dated the 13<sup>th</sup> August 1896

From -Simla	To – Calcutta
From -Home	To – Bengal, General

No. 250 Education. Your letter 387 T.G., dated 30<sup>th</sup> June. Bose's deputaion sanctioned. Letter follows.

**(No. 17)**

(File 4C/23-8)

From – C.H.A. Hill, Esq, Under-Secy. to the Govt of India, Home Dept.  
To- The Secretary to the Government of Bengal, General Department

I AM directed to acknowledge the receipt of your letter No. 387T.G., dated the 30<sup>th</sup> June 1896, recommending the deputation of Mr. J.C. Bose, Professor, Presidency College, to Europe for the purpose of visiting the chief laboratories of England and the Continent, under article 103 of the Civil Service Regulations.

2. In reply, I am to say that under the special circumstances stated in your letter, His Excellency to the Governor-General in Council recommended the proposals to the Secretary of State who has now conveyed his sanction to them.

**(No. 18)**

(File 4C/23-9)

No. 2751

Copy, with copy of the letter to which this is a reply, forwarded to the Director of Public Instruction for information, with reference to his letter No. 1075T., dated the 16<sup>th</sup> July 1896.

No. 2752-53.

Copy, with copy of the letter to which this is a reply, forwarded to the (1) Accountant-General, Bengal, and (2) the Appointment Department of this office for information.

By order of the Lieutenant-Governor of Bengal

E.M. KONSTAM

*Under-Secretary to the Govt. of Bengal.*

CALCUTTA,

*The 26<sup>th</sup> August, 1896.*

(No. 19.)

(File 4-C/23-10)

No. 4551, dated Calcutta, the 22<sup>nd</sup> August 1896.

From – SIR ALFRED CROFT, K.C.I.E., Director of Public Instruction, Bengal,  
To – The Secretary to the Government of Bengal, General Department.

In reference to paragraph 9 of my letter No. 1075T., dated the 16<sup>th</sup> June 1896, I have the honour to recommend that, during the absence of deputation to Europe of Professor J.C. Bose for six months, Babu Jyoti Bhusan Bhandari, M.A., may be appointed temporarily to act as a Lecturer in the Presidency College on a salary of Rs 200 a month, with effect from the afternoon of the 21<sup>st</sup> July 1896, the date on which he received charge of Professor Bose's duties as Lecturer in Physics in that College.

2. Babu Jyoti Bhusan Bhaduri is a distinguished student of Science, having been a Premchand Roychand Scholar, and his work in the Presidency College in succession to Professor Bose is of a very important and responsible character. As the acting allowance which would be admissible to Babu Jyoti Bhusan Bhaduri, were he appointed to act as in class IV of the Superior Branch of the Bengal Educational Service vice Mr. Bose, would be limited under article 158 of the Civil Service Regulation to Rs 166-10-8, which is not an adequate remuneration of for his duties, I would propose that an extra appointment on a salary Rs. 200 a month may be temporarily created for him for six months with effect from the 22<sup>nd</sup> July 1896, the charge of being met from savings in the budget grant of the College arising from the absence on leave of Messrs. Griffiths and Bose.

3. In submitting the above proposal, I have in mind the orders of Government contained in paragraph 2 of Under-Secretary Mr. Konstam's letter No. 2425, dated the 29<sup>th</sup> July last. But before the receipt of those orders, I permitted Babu Jyoti Bhushan Bhaduri, on the recommendation of Mr. Pedler, to relieve Mr. Bose on the afternoon of the 21<sup>st</sup> idem, in anticipation of Government sanction, as the need was urgent. Even if the orders were received earlier, I could not possibly recommend on this occasion any arrangement restricting the salary of the officiating incumbent to the amount of the acting allowance admissible under the rules

in force. It will be remembered that I am precluded from recommending to Government any native officer to act in Class IV of the Bengal Educational Service for officiating for an officer on the graded list of that service; and unless an officer is appointed to act in that class in the present case, he will not be entitled to draw any acting allowance for officiating for Mr. Bose in the Presidency College. Nor would there be a saving to Government in case the officer who might be transferred to the Presidency College were appointed to act in Class IV of the Bengal Educational Service, as besides paying his acting allowance, Government would have to ultimately create an appointment on a salary of not less than Rs. 150 a month, for an outsider who will succeed the officer so transferred, since the services of a qualified candidate cannot ordinarily be secured on half the pay of the post of a Lecturer in a College which generally Rs.150 or Rs. 200 a month.

**(No. 20)**

(File 4C/23-11)

No. 418T.G., dated Darjeeling, the 11<sup>th</sup> September 1896.

From- M. FINUCANE, Esq., Offg Secy. to the Government of Bengal, General Dept.,  
To- The Director of Public Instruction, Bengal.

WITH reference to your letter No. 4551, dated the 22<sup>nd</sup> August 1896, I am directed to convey the sanction of the Lieutenant Governor to the creation of a temporary appointment on Rs. 200 a month, for six months, to be held with effect from the afternoon of the 21<sup>st</sup> July last, by Babu Jyoti Bhushan Bhaduri, M.A., who has been appointed to act as a Lecturer in the Presidency College, during the absence on deputation to Europe of Professor J.C. Bose. The charge will, as proposed by you, be met from savings in the budget grant of the College arising from the absence on leave of Messrs. Griffiths and Bose.

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No. 419 T.G.

COPY forwarded to the Financial Department of this office, for information and communication to the Accountant-General, Bengal.

By order of the Lieutenant-Governor of Bengal

M. FINUCANE

Offg. Secretart to the Govt. of Bengal

DARJEELING

The 11<sup>th</sup> September 1896.