

Radio Research Committee

Council of Scientific & Industrial Research
Department of Industries and Supplies
GOVERNMENT OF INDIA

CHAIRMAN: Prof. M. N. Saha, D.Sc., F.R.S.

University College of Science
92, Upper Circular Road
CALCUTTA

~~Prof. S. K. MITRA, M.A., Ph.D., F.R.S.~~

No. RR/Com.....

Dated the 14th June, 1948

Sir K.S. Bhatnagar
for me

To
MS 26/6
Sir S.S. Bhatnagar, K.T., F.R.S.,
Director of Scientific & Industrial Research,
Central Secretariat, North,
New Delhi.

13/26/6

Re. Research Scheme on Microwaves.

Sir M.S. Krishna

My dear Bhatnagar,

I am sorry to say that I have not as yet received any reply to my letter No.50/19 A, dated, May 19, 1948. Will you be kind enough to look into the matter and send me a reply as early as possible ?

Yours sincerely,

M. N. Saha

INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE

K. S. KRISHNAN, D. Sc.

Mahendralal Sircar Professor of Physics

210, BOWBAZAR STREET,

CALCUTTA.

27th Feb, 1930

Dear Professor Saha,

I shall be much obliged if you can lend an epidiascope for ~~the~~ use at the Association in connection with the annual meeting and the Mahendralal Sircar Memorial Lecture tomorrow. Thanking you and with best regards,

Yours sincerely
K. S. Krishnan

X lantern for
them and they did it.
I would suggest to you
to do the same thing. If necessary
I can ask them to do it. I
hope you won't mind
the refusal.

Dear Dr. Krishnan, Yours M. N. Saha

I would have very much liked to lend you our lantern, but the demand on it has been increasing & of late I have been systematically refusing to send it outside. Whenever I have done so, it has come back with some damage, for which it is difficult to get any compensation. As a matter of fact, I declined to lend it to the Royal Asiatic Society for my own lecture. At my suggestion they asked the Scientific Inst Co. to set up a X

INDIAN SCIENCE NEWS ASSOCIATION

CONDUCTING THE MONTHLY JOURNAL, SCIENCE AND CULTURE

Phone B. B. 2224

92, UPPER CIRCULAR ROAD,

Calcutta January 7, 1941.

Ref. No.

Prof. K. S. Krishnan, F.R.S.,
Indian Association for the Cultivation
of Science,
210, Bowbazar Street,
Calcutta.

My dear Dr. Krishnan,

listened with great interest and appreciation to
I understand that you have delivered a lecture

your lecture on "Earth as a big Magnet" during the 28th session of
the Indian Science Congress. I shall be glad if you can
kindly send it to us for publication in "Science and
Culture".

Yours sincerely,

M. N. Saha

Your letter did not reach me till after the closing date for proposals for this year.

OBSERVATORY,
CAMBRIDGE.

1943 Feb 15

My dear Saha

I have decided to propose Kothari and Jeans is seconding him. I shall be able to get the necessary six signatures in England, so will send the certificate to the Royal Society. Will you get the Indian representatives to send the necessary authority to the Secretaries; the closing date is November, so that there is plenty of time.

Will you send me Kothari's full names, which are needed for the proposal. I cannot find them anywhere.

With kind regards and grateful remembrances of my visit to you.

Yours sincerely

A. T. Eddington

UNIVERSITY COLLEGE OF SCIENCE
PHYSICS DEPARTMENT
92, UPPER CIRCULAR ROAD, CALCUTTA.

June 10, 1943

My dear *Krishnan*

I have not heard from you for a long time. I hope that you are doing well.

I am enclosing 'photographic facsimile' of a letter from Sir Arthur Eddington who wishes to propose Prof. D. S. Kothari, Professor of Physics in the Delhi University for the Fellowship of the Royal Society. As you will see from the letter, Sir James Jeans is seconding him and the following British scientists are supporting him - Prof. C. G. Darwin, Director, National Physical Laboratory, Prof. E. A. Milne, Oxford University, Prof. R. H. Fowler, Cambridge. I learn from a letter of Prof. Darwin (copy of which I enclose) that Eddington has already filled up the nomination papers, and submitted it to the Royal Society.

Sir A. Eddington desires, as you will see from his letters, that his proposal should be backed by as many Indian Fellows of the Royal Society as possible. I shall be glad if you can kindly support his candidature. I am enclosing a printed brochure giving a short account of his works.

P.T.O.

My dear Kothari

I have not heard from you for a long time. I hope that I have no doubt that you will agree. I shall request

you either to cable your support of Kothari's candidature to the Secretary of the Royal Society, or to send an aéro-graph letter. I am suggesting forms for both :-

Name - Secretary

Address - Royal Society, Burlington House

Place - London

Support gladly Eddington proposing

DaulatSingh Kothari for Fellowship

Royal Society

Hoping you are all right,

Yours sincerely

M. N. Saha

Suggested form of Aerograph Letter

To
The Secretary,
The Royal Society.

Dear Sir,

I have learnt with great pleasure that Sir Arthur S. Eddington has proposed Prof. Daulat Singh Kothari for Fellowship of the Royal Society, and that Sir James Jeans has seconded the candidature and a number of other Fellows is supporting him. I shall be glad if you would kindly sign on my behalf his nomination paper as a supporter. I know him personally.

Yours faithfully

Copy

Bershy House
Teddington.

Jan. 31. 43.

Dear Prof. Saha,

This is to acknowledge your letter of Oct. and to let you know that I have duly signed the proposal of Kothari for the R.S. having received the form from Eddington. It is of course too late for this election since the papers have to go in in November, but that gives plenty of time for the next one.

Please give my kind regards to any of my Indian friends that you see. With best wishes for 1943.

Yours sincerely,

Sd/- Charles Darwin.

A BRIEF STATEMENT OF THE RESEARCH WORK DONE BY D. S. KOTHARI

KOTHARI has so far published over fifty papers on quantum statistics, properties of degenerate matter, internal constitution of the stars, energy generation and related subjects in various journals including the Proceedings of the Royal Society, the Monthly Notices, Zeitschrift fur Physik, Physical Review, etc.

In his earlier papers* Kothari determined the electrical and thermal conductivities of dense degenerate matter and showed that in degenerate matter the transport of energy is mostly by conduction and not by radiation. He also discussed the relation between opacity and electrical conductivity.

He has written a number of papers on the theory of pressure ionization and its applications. He has shown that a stellar body composed of degenerate matter cannot be larger in size than Jupiter, and his theory brings out a connection between planets and white dwarf stars.†

Kothari has studied in detail the relation between neutrons, degeneracy and white dwarfs, and has also determined the energy-generation in degenerate matter due to H-H reaction.

He has published papers on energy levels of an Oscillator subject to an artificial boundary condition, uncertainty principle,

* This work is summarised in Hund's article on "Materie unter sehr hohen Drucken und Temperaturen": *Ergebnisse der exakten Naturwissenschaften*, 15, 1936.

† Kothari's work on pressure ionization has been referred to by Sir A. S. Eddington in his address at the Harvard Tercentenary celebrations (*The Scientific Monthly*, U. S. A., 43, 1936); by Sir James Jeans in "March of Science, a quinquennial Review (1931-35)"; and others. This also formed the subject of Professor A. Sommerfeld's address at the Galvani bicentenary celebrations, (*Nuovo Cimento.*, 15, 14-22, 1938). A popular account is given in Gamow's "Birth and Death of the Sun", (Chapter VIII).

and such subjects ; and several papers on quantum statistics taking account of relativity.

A list of his more important papers is given below.

Kothari has also guided the work of many persons. A brief list of the papers published by persons who did their work under Kothari's supervision is given.

Lastly a few published opinions on Kothari's work are included.

List of some of the more important papers published by Kothari. He has so far published over fifty papers.

1. Doppler effect and the hypothesis of radiation quanta. *Phil. Mag.* 8, 55, 1929.
2. Thermal Ionization and Degeneracy, (Kothari and Majumdar). *Zs. f. Phy.* 61, 712.
3. Theory of stellar absorption co-efficient and degeneracy, (Kothari and Majumdar). *Astro. Nachr.* 244, 65, 1931.
4. Equilibrium between Radiation and Matter, *Phil. Mag.* 12, 657.
5. White dwarfs and the Electrostatic correction. *Phil. Mag.* 12, 665, 1931.
6. Transport phenomena in a Degenerate gas. *Phil. Mag.* 13, 361, 1932.
7. Applications of degenerate statistics to stellar matter. *Monthly Notices of R. A. S.* 93, 61, 1932.
8. The Problem of stellar structure. *Bull. Nat. Acad. Sci. (India)*, 6, 129-156, 1934.
9. The Internal constitution of the planets. *Monthly Notices, of R. A. S.* 96, 833-843, 1936.
10. Quantum statistics and internal constitution of the planets, (Kothari and Majumdar). *Nature*, 137, 157-8, 1936.
11. Neutrons, degeneracy and white dwarfs. *Proc. Roy. Soc.*, 162, 521-528, 1937.
12. The Relation of gas pressure and radiation pressure in degeneracy and non-degeneracy, (Kothari and Singh). *Zeit. f. Astro.* 15, 143-153, 1938.

13. The theory of pressure Ionization and its application. *Proc. Roy. Soc.* 165, 486-500, 1938.
14. The Meson and its transformation into heavy particles, (Majumdar and Kothari). *Nature*, 143, 796, 1939.
15. Mass radius relation for a white dwarf star. *Nature*, 146, 24, 1940.
16. Bose-Einstein Statistics and degeneracy, (Kothari and Singh). *Proc. Roy. Soc.* 178, 135, 1941.
17. Degenerate gas and the motion of a particle in a uniform field, (Kothari and Auluck). *Proc. Nat. Inst. Sci.*, 8, 157, 1942.
18. Fermi-Dirac Statistics and relativistic degeneracy, (Kothari and Singh). *Proc. Roy. Soc.* (In Press).
19. Flow of energy in thermal transpiration for a Bose-Einstein and a Fermi-Dirac gas, (Gogate and Kothari). *Phy. Rev.*, 61, 349, 1942.

**List of some of the papers published by persons
who did their work under the supervision of
D. S. Kothari.**

1. F. C. Auluck The Theory of pressure ionization
and the constitution of the white
dwarf stars. *Monthly Notices of*
R. A. S., 99, 239-247, 1939.
- " " Energy Levels of an Artificially
Bounded Linear Oscillator. *Proc.*
Nat. Inst., 7, 133-140, 1941.
- " " The Artificially Bounded Relati-
vistic Linear Oscillator ; *Proc. Nat.*
Inst. 7, 383-391, 1941.
- " " White Dwarf Star and Harmonic
Oscillator. *Proc. Nat. Inst.*, 8,
147-156, 1942.
2. Dr. D. V. Gogate .. Effusion phenomena in relativistic
quantum statistics. *Phil. Mag.*,
29, 85-92, 1940.
3. Pritam Sen A note on the internal constitution
of planets. *Zeits. f. Astro.*, 16,
297-303, 1938.
4. Dr. B. N. Srivastava : Effusion and thermal transpiration
in quantum statistics. *Proc. Roy.*
Soc., 171, 469-484, 1939.
- " " Effusion phenomena in relativistic
thermodynamics. *Proc. Roy. Soc.*,
167, 484-499, 1938.
- " " Thermal transpiration of a disso-
ciating gas. *Proc. Roy. Soc.*, 175,
474-483, 1940.
- " " Influence of radiation on ionization
equilibrium. *Proc. Roy. Soc.*,
167, 484-499, 1938.
5. B. N. Singh Scattering of light in Bose-Einstein
and Fermi-Dirac gas. *Phil. Mag.*,
28, 635-641, 1939.

Some published opinions on the work done by Kothari.

(a) *Sir A. S. Eddington, F.R.S.*

Extract from the address on "Constitution of the Stars" given at the Harvard Tercentenary Conference of Arts and Science in the symposium on 'Physical Science'. [*The Scientific Monthly (U. S. A.)*, 43, 385-95, 1936.]

"I mentioned that we only gradually came to realise that ionization could be produced by high pressure as well as by high temperature. I think the first man to state this explicitly was D. S. Kothari. Stimulated by some work of H. N. Russell, Kothari has made what I think is an extremely interesting application. The relation of ionization to pressure is a curious one, at low pressure we decrease the ionization by increasing the pressure; but the ionization must have a minimum for at high pressure the Fermi-Dirac complication steps in and the ionization ultimately increases with pressure. No one seems to have bothered much about this revised ionization law; they have been content to recognise or I think rather to guess that in white dwarfs the ionization would be pretty high. Kothari, however, has treated it seriously and worked out the degree of ionization in various conditions, including comparatively small masses in which the pressure is relatively low and the ionization is not very high."

(b) *Sir James Jeans, F.R.S.*

(i) Extract from "March of Science", a first quinquennial review (1931-35), issued under the authority of the Council of the British Association for the Advancement of Science.

"In 1935 D. S. Kothari and R. C. Majumdar, of the University of Delhi, calculated the sizes corresponding to various different masses. The radii they calculate for ordinary white dwarf stars, such as the famous Sirius B, prove to be somewhat less than those actually observed, but this is not surprising or disconcerting, since the actual stars are very hot, while the idealized black dwarfs which figure in the calculations are supposed to be completely cold. They next consider black dwarfs of far smaller masses, equal only to those of Jupiter and Saturn, and find that such stars would have radii comparable with, although again somewhat smaller than, those of these planets. This has led them to suggest that the physical constitution of the planets may be merely that of black dwarf stars having masses which are only a few millionths of the masses of ordinary stars. If they are right, the nearest dwarf stars are very near home indeed, and through their studies of the depths of space and explorations in the very heart of modern theoretical physics, the physicists have stumbled upon the solution of a very old problem and one very near home—the structure of the interiors of the Earth and the other planets."

(ii) Extract from the Presidential address at the joint meeting of the Indian Science Congress and the British Association for the Advancement of Science. (Reproduced in *Nature*, 141, 68, 1938).

"The mathematicians and physicists will probably find their thoughts turning, as mine do, to the strangely intuitive genius of Ramanujan and to the remarkable discoveries he made in pure mathematics before death snatched him prematurely away; to the work of Sir Venkata Raman in Physics, and especially his discovery of the effort which is known by his name all the world over; to many investigations in sound and the theory of music made by Raman and a host of others; to the work of Saha in astrophysics, which give us our first clear understanding of the meaning of Stellar Spectra, and so unlocked the road to vast new fields of astronomical knowledge; and to the work of many Indians, among whom I would specially mention Chandrasekhar and Kothari, on conditions in the interior of the Stars."

(c) *Professor A. Sommerfeld, Director, Institute of Theoretical Physics, Munich University.*

At the Galvani bicentenary celebrations (Oct. 1937) Prof. Sommerfeld presented an address on Kothari's theory of pressure ionization. (*Nuovo Cimento de Linci*, Rome, 15, 14-22, 1938).

"Wahrend in der Zeit von Galileo and Kepler die Planeten im Mittelpunkt des astronomischen Interesses standen, sind sie in der Entwicklung der letzten Jahrzehnte von den sonnenartigen Sternen und den Spiralnebeln verdrängt worden. Es ist nun bemerkenswert, dass der Inder D. S. Kothari einen kühnen Zusammenhang hergestellt hat zwischen den altmodischen planeten und den erst kürzlich entdeckten, allermodernsten Himmelskörpern den weissen Zwergen."

(d) *Professor E. A. Milne, F.R.S., Rouse Ball Professor of Mathematics in the University of Oxford.*

Extract from the 1932 Halley Lecture on the White Dwarf Stars (Clarendon Press, Oxford).

"It has been shown by Kothari that a degenerate gas has also high thermal conductivity. These properties of high conductivity and low opacity render it incapable of supporting appreciable temperature gradients."

"Again, it is possible, following Jeans' hypothesis, that at sufficiently high temperatures matter may dissolve (reversibly) into radiation, and the energy of radiation coalesce into matter; such an aggregate in dissociative equilibrium will have yet another equation of state. These possibilities have been exhaustively investigated by Chandrasekhar, Kothari, Starke, Majumdar and others."

(e) *Dr. M. C. Johnson, University of Birmingham, (Observatory, 61, 74-83, 1938)* has given a critical review of Kothari's work on neutrons and white dwarf stars.

Extract from Johnson's paper:—

"A paper has recently appeared (Kothari, *Proc. Roy Soc.*, Oct. 15, 1937) introducing somewhat dramatically into astrophysics the Neutron, which has been familiar in atomic research since 1932. Kothari's

conclusion can be summarised in a few sentences, but the foundations are necessarily omitted from his brief publication and can only be found scattered in several branches of science. With some of these the majority of astronomers and many physicists are not critically familiar. There seems justification for an analysis outlining the evidence which must be assumed to underlie his paper and its possible sequels."

(f) Dr. W. A. Wildhack (*Physical Review*, 57, 81, 1940) has given a discussion on Kothari's work on energy generation in white dwarf stars.

(g) Professor F. Hund (Leipzig) has given in his article on 'Materie unter sehr hohen drucken und Temperaturen' (*Ergebnisse der exakten Naturwissenschaften*, 15, 1936) a full account of Kothari's work on the thermal and electrical conductivity of dense matter.

(h) Professor G. Gamow, Professor of Theoretical Physics, George Washington University, New York. Prof. Gamow has given in his recent book 'The Birth and Death of the Sun' (Macmillan, 1941) a chapter on the theory and applications of pressure ionization (chapter VIII).

"To find the largest mass at which a body can still be considered solid, in the ordinary sense of the word, we must first of all estimate the numerical value of the pressure necessary to crush atoms. This can easily be done. On the basis of the calculations of the Indian astrophysicist D. S. Kothari, this critical atom-crushing pressure amounts to 150 million atmospheres.

UNIVERSITY COLLEGE OF SCIENCE
PHYSICS DEPARTMENT
92, UPPER CIRCULAR ROAD, CALCUTTA.

NOV 18 / 1943

My dear Dr. Krishnan

I hope you received the list of applications for the post of Secy. to the Glass Committee, and you will be soon expressing your opinion on the subject. I am enclosing a copy of my recommendation. This is not to influence you in any way, but I thought that as I have given considerable thought to this question, I may bring my views to the notice of my colleagues. Dr. P. R. Roy agrees with me.

I hope you are coming to Bangalore, & I shall have the pleasure of meeting you there. I wish to thank you for the nice reception I had at Allahabad.

Hoping you are all right,

Yours sincerely
M. N. Saha

UNIVERSITY COLLEGE OF SCIENCE
DEPARTMENT OF PHYSICS

22, UPPER CIRCULAR ROAD
CALCUTTA

August 3, 1948.



299
/ 914

My dear Bhatnagar,

*Sir K.S. Krishnan
for committee report
10/8/48*

This is with reference to the Committee* appointed by the B.S.I.R. to "formulate plans as to how best and how soon the manufacture of radio valves could be undertaken in this country" at its meeting held on 9.2.48 (vide also letter No.137 Bd.XI(3)/47 dated July 3,1948 from the Secretary, C.S.I.R.).

In order that the Report may be finalised it is necessary that we have the opinion of Krishnan on the subject. I shall be glad if you kindly ask Krishnan to send his views as early as possible.

It was suggested to Krishnan that we would meet when he came here on 2.8.48 in connection with a meeting of the Applied Physics Committee. Unfortunately he could not meet us for a discussion on the subject.

The matter may please be treated as urgent.

* Members of the Committee

1. Prof. M. N. Saha
2. Prof. S.K.Mitra
3. Sir K.S. Krishnan

Yours sincerely,

M. N. Saha

Sir S. S. Bhatnagar, Kt., F.R.S.,
Director, Scientific & Industrial Research,
Central Secretariat, North,
New Delhi.

Sir P. C. Ray

Eightieth Birthday Celebration Committee

Chairman :
Sir N. N. Sircar, K. C. S. I.

Secretaries :
Prof. M. N. Saha
Prof. B. C. Guha

Telephone Regent 160

Treasurer :
Dr. N. N. Law

Telephone B.B. 2

92, Upper Circular Road,

Calcutta August 5, 1941

Dear Dr. Krishnan,

The celebration of the eighty-first birthday of Sir P. C. Ray in which so many thousands participated on the 2nd August at the Senate House, testifies to the deep affection and veneration in which he is held by his countrymen. We feel, however, that a really fitting tribute to Sir P. C. Ray will consist not only in presenting him with addresses and paying public homage to him on his birthday, but that it should take the form of a really large fund for the promotion of scientific and industrial research in this country, a cause which has always been dearest to the heart of Sir P. C. Ray. That alone can be an abiding tribute to him, as has been explained in the appeal previously issued by the Sir P. C. Ray Eightieth Birthday Celebration Committee under the Chairmanship of Sir N. N. Sircar. A copy of the appeal is enclosed herewith.

As you are one of those who participated in this public homage paid to Sir P. C. Ray on 2nd August, may we request you to be so good as to contribute a suitable sum to this fund, which the organisers feel should not total less than Rs.500,000/-? We rely on your kind and hearty co-operation. We have also drawn up a scheme for the utilisation of the fund, and if you have any suggestions to make on that, we shall be glad to call on you at your convenience.

Dr. K. S. Krishnan, F.R.S.

Yours sincerely,

M. N. Saha

INDIAN SCIENCE NEWS ASSOCIATION

OFFICE OF The SCIENCE AND CULTURE

92, UPPER CIRCULAR ROAD, CALCUTTA

Telephone : B.B. 2224

March 4, 1942.

Prof. K. S. Krishnan, D.Sc., F.R.S.,
Indian Association for the Cultivation of Science,
210, Bowbazar Street,
Calcutta.

Dear Prof. Krishnan,

I shall be glad if you would kindly arrange to send me the copy of the report of the Indian Association for the Cultivation of Science during the period 1877 to 1903. We are arranging to publish Sir Upendranath's address at the last Mahendralal Sarkar Anniversary and it is essential that the statements with regard to Dr. Mahendralal Sarkar should be verified before they are put in print.

Yours sincerely,

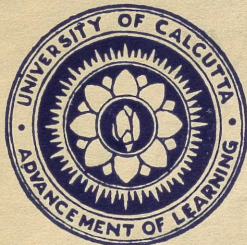
M-N-Saha

UNIVERSITY COLLEGE OF SCIENCE

DEPARTMENT OF PHYSICS

92, UPPER CIRCULAR ROAD
CALCUTTA

August 2, 1941.



Prof. K.S.Krishnan, F.R.S.,
Indian Association for the Cultivation of Science,
210, Bowbazar Street,
Calcutta.

Dear Dr. Krishnan,

Thanks for your letter of the 2nd August. I shall be quite willing to lend you our monochromator for your use as long as you ~~do not~~ require it and provided you send me a letter that for any damage done to it, you will be held yourself *personally* responsible. Further I would also suggest that whenever this apparatus is used in any scientific work, an acknowledgment should be made to the Palit Laboratory. You can send your mechanic to take it over on Monday.

I am also sending my mechanic to inspect the welding set of The Indian Association. He has been instructed to report *to* me on its present usefulness. I shall be glad if you kindly allow him to inspect it.

Yours sincerely,

M. N. Saha

To

Prof. M. N. Saha, D.Sc., F.R.S., F.N.I.,
Member Sectional Committee for Physics,
National Institute of Sciences of India.

Dear Sir,

The following candidates have been nominated for the Ordinary Fellowship of the National Institute. Herewith I am enclosing a statement of their qualifications. I write to consult you regarding the suitability of the candidates for election, and if you consider more than one candidate as suitable may I request you to arrange them in order of preference.

Yours faithfully,

K. Krishnan

Secretary and Convener of the
Sectional Committee.

*I think that all of them
are suitable for election
as Fellows of the N.I.S. I
would arrange them in the
order*

- (1) Bhabha*
- (2) Majumder*
- (3) Sohoni*

M. N. Saha
May 3 / 1941