



THE INDIAN ASSOCIATION
FOR THE
CULTIVATION OF SCIENCE

Annual Report for the year 1943

PRESIDENTIAL ADDRESS

ANNUAL ADDRESS 1943

Ladies and Gentlemen, one year has rolled away since I addressed you at our last Annual Meeting. My speech this afternoon will be very short. I would only refer to some of the salient features of our activities.

The Chemical Laboratory of our Association has been renovated and equipped for Research work. A sum of nearly Rs. 3,000/- has been spent for the purpose of its equipment and another sum of Rs. 3,000/- has been provided for in the budget estimates for 1944. The Brahmachari Research Scholar has already been appointed and we hope that he will begin his work as soon as he is relieved of his present duties, and that his work on indigenous drugs of India will lead to important results. An advertisement has already been issued by us for the appointment of two Sir P. C. Ray - Bengal Chemical Research Fellows and as soon as proper applicants are available, they will be appointed immediately.

It has been the custom of our Association to invite noted British and foreign Scientists to deliver one or two lectures on some scientific subjects when they happen to come to India. In accordance with this custom we invited Prof. A. V. Hill to visit our Laboratory and he delivered an interesting lecture on "Some Aspects of Physiology of Athletics", I am glad to inform you that we have admitted him as an Honorary Fellow of our Association and awarded him Joy Kissen Mukerjee Medal. In addition to the above we awarded our first Bimala Churn Law Gold Medal to Sir Henry Dale, President of the Royal Society of London for his conspicuously important contribution in Science and he has very gladly accepted our offer by wiring to me that he gratefully and proudly accepted our award of the same. The medal was awarded out of a generous donation of Rs. 5175 by Dr. Bimala Ch. Law M. A. Ph. D. D. Lit.

Our awards of Joy Kissen Mookerjee Medals now stand as follows: Sir E. J. Russell, F. R. S., for 1936, Sir James H. Jeans, F. R. S., for 1937 Prof. F. W. Aston, F. R. S., for 1938, Prof. A. Millikan for 1939 and Prof A. V. Hill for 1943.

The work done by our research workers have been fully dwelt upon by our Honorary Secretary. I shall not dilate upon them, except referring to an important discovery by our Mahendralal Sircar Professor of a new-type of sharp reflections in Laue photographs which is expected to throw considerable light on the structural imperfections in crystals.

Among our recently appointed Professors are Sir Lewis Fermor, F.R.S. and Sir Arthur Hill, F.R.S. as our Ripon Professors and Prof. J. E. Lennard-Jones, F. R. S. as our Coochbehar Professor.

Among our recently created Honorary Fellows are Sir Henry Dale, F. R. S., President of the Royal Society, Sir Robert Robinson, F.R.S. Prof. J. L. Simonsen, F.R.S. Sir L. L. Fermor, Prof. R. B. Sewell, and Prof. A. V. Hill, F.R.S., Sec. R. S.

Our newly elected Ordinary Fellows are Prof. K. Banerjee and Prof P. Ray.

Our Ordinary Members enlisted in the year under review number fortyone and already we have enlisted upto now twenty-five members in 1944. Our Life Members enlisted in the year under review number thirteen and in 1944 we have already enlisted eleven in three months' time. All this is very encouraging, but there is no doubt that both more Ordinary and Life Members are necessary to be created and for this, I appeal to everyone of you to exert yourself in this direction.

Our Research Endowment Fund has increased to nearly Rs. 20,000/- plus a scholarship of Rs. 100/- per month. The response to our appeal for this fund is most encouraging but I shall not be satisfied till we have collected at least a lac of Rupees for this fund and I have reason to believe that we shall be successful. A generous donation of Rs. 5175/- was received from Dr. Bimala Ch. Law for the creation of a gold medal in the name of the donor.

May we hope that we shall be able to create a Professorship through the generosity of some rich donors who may donate us sufficient funds for this purpose and fulfil one of the fondest wishes of our illustrious founder.

Our sincerest thanks are due to Dr. J. N. Mukherjee, our retiring Secretary for the excellent work that he has done during his term of office for nearly eight years and I welcome Dr. Meghnad Saha our Secretary for the year 1944 with great pleasure.

We have recommended to you the appointment of Dr. Mahendralal Sircar Professor as our Joint Secretary and have suggested certain changes in our rules for this purpose which I hope will be accepted by you. There is no doubt that the appointment of a Joint Secretary will relieve the Secretary of his ordinary daily routine work.

We hope that during the term of office of Prof. M. N. Saha our Association will be able to increase our activities in various directions and that increased funds will be available for Research in the various departments of Science.

May He, without whose aid every attempt of being useful is lost, help us to live and to prosper.

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THE
INDIAN ASSOCIATION
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Annual Report for the year 1943

Report of the Committee of management for 1943

At the beginning of the year there were 157 members of whom 122 were life members, 4 non-resident and 31 ordinary members. During the year 12 life members, 4 non-resident and 41 resident ordinary members were enrolled. The Association has suffered great loss through death of one of its life members and former president, Sir Nilratan Sircar. The total number of members at the end of the year was 213 of which 133 are life members, 8 non-resident and 72 resident ordinary members.

The Committee of management expressed its high appreciation of the active interest taken by the President in enlisting the support of these new members.

CHANGES IN RULES AND REGULATIONS

The rules and regulations have been amended during the year by the Committee of Management so as to provide for the election of persons eminent in Science as Fellows of the Association and also as Honorary Fellows.

The designations of Foreign members of the Association elected upto 1942 have been changed to Honorary Fellows.

Ordinary Fellows not exceeding 25 and Honorary Fellows not exceeding 25, at any time shall be elected.

FELLOWSHIP

The following were elected as *Ordinary Fellows* of the Association

1. Dr. S. K. Banerjee, O. B. E., D. Sc.,
2. Sir U. N. Bramhachari, Kt., M. A., M. D., Ph. D.,
3. Dr. D. M. Bose, M. A., Ph. D.,
4. Sir Cyril S. Fox, Kt., D.Sc.,
5. Sir J. C. Ghosh, Kt., D. Sc., F. N. I.,
6. Prof. P. N. Ghosh, M. A., Ph. D., Sc. D.,
7. Prof. K. S. Krishnan, D. Sc., F. R. S.,
8. Prof. S. K. Mitra, M. B. E., D. Sc.,
9. Prof. J. N. Mukherjee, C. B. E.,

D. Sc., 10. Sir P. C. Ray, Kt., 11. Sir C. V. Raman, Kt., D. Sc., F. R. S. N. L., 12. Prof. M. N. Saha, D. Sc., F. R. S., 13. Prof. B. Sahni, D. Sc. F. R. S., 14. Prof. N. R. Sen, D. Sc.,

Dr. S. P. Mookerjee, M. A., B. L., D. Litt., Bar-at-Law was elected as a Fellow under Clause 7(b).

The following were elected as Honorary Fellows

1. Sir Henry H. Dale, G. B. E., P. R. S., 2. Prof. J. L. Simonsen, D. Sc., F. R. S., 3. Sir L. L. Fermor, O. B. E., D. Sc., F. R. S., 3. Prof. H. R. Robinson, D. Sc., F. R. S., 5. Prof. R. B. Seymour Sewell, C. I. E., Sc. D., F. R. S., 6. Prof. A. V. Hill, O. B. E., M.P., F.R.S., N.L.

DONATIONS

The following donations were received and were credited to the newly created *Research Endowment Fund*

1. Mr. H. Datta	...	...	Rs 1,000/-
2. Dr. P. N. Brahmachari	...	...	250/-
3. Mr. N. K. Bramhachari	...	...	250/-
4. Dr. A. K. Basu	...	...	250/-
5. Messrs. Bengal Chemical and Pharmaceutical Works, Ltd.			15,000/-

The donations have been gratefully acknowledged by the Committee of Management.

Sir U. N. Brahmachari Research Studentship—A contribution of Rs 100/- per month to the Research Endowment Fund was offered by Sir U. N. Brahmachari Kt., M.A., M.D., Ph.D., F.R.A.S.B., F.N.I., F.I.A.S., for the creation of a studentship to be called Sir Upendra Nath Bramhachari Studentship to carry out research in some branch of Chemistry.

MEDALS

Dr. Bimala Churn Law Gold Medal—A donation of Rs 5,000/- was received through the President from Dr. Bimala Churn Law, M.A., B.L., Ph.D., D.Litt., for the creation of a gold medal in the name of the donor to be awarded annually to a person who has made conspicuously important contributions to science including Medicine. The donor very kindly also offered the cost of the medal for 1943 and that of the dice.

The committee of management made its first award to Sir Henry H. Dale, G.B.E., P.R.S.

Dr. Sircar Research Medal—Dr. Mahendra Lal Sircar Research medal for 1938 was awarded to Dr. N. N. Das Gupta, Ph. D., for his researches on Cosmic Rays.

RESEARCH PERSONNEL

Mahendra Lal Sircar Professor—Dr. K. Banerjee, D. Sc., F. N. I., Reader in Physics, University of Dacca, was offered the post of Mahendra Lal Sircar Professor and joined the appointment on probation for two years on March 1st, 1943.

Reader in Physics—The Committee of Management appointed Dr. S. C. Sirkar, D. Sc., F. N. I., as Reader in Physics temporarily for six months to look after the laboratory, workshop and library pending the appointment of M. L. S. Professor and then for a further period upto December 31st, 1943.

Facilities were offered to the research workers to carry out X-ray investigations on jute fibres financed by the Indian Central Jute Committee in the laboratories of the Association under Dr. Sirkar. The apparatus required for this work was very kindly lent by the University of Calcutta.

Research Assistants—On the resignation of Mr Akshayananda Bose, M. Sc., Mr. Asutosh Mookherji, M.Sc. a research Fellow was appointed in his place on Rs. 150/- per month. He was then assigned the duties of Assistant Secretary and Librarian.

Mr. Ranjit kumar Sen, M. Sc., was appointed a research Assistant on Rs. 125/- per month mainly to assist the M. L. S. Professor in his research.

Research Scholars—Applications for research Scholarships were invited by advertisement at different parts of India, the Scholarship was raised from Rs. 50/- to Rs. 75/- per month and the Scholarships were awarded to the following persons

- *1. Mr. T. S. A. Padmanabhan, M. Sc.—Cochin State
- *2. Mr. K. Krishnamurti, M. Sc.—Andhra
3. Mr. Ajit Kumar Dutta, M. Sc.—Bengal
4. Mr. D. V. Kamat, M. Sc.—Bombay
5. Mr. Bijoy Sankar Basak, M. Sc.—Bengal
6. Mr. Bhuban Mohan Bishui, M. Sc.—Bengal
- *7. Mr. V. C. Varghese. M. A.—Trivandrum
8. Mr. Bihuti Bhusan Bhattacharya, M. Sc.—U. P.

Research Workers—In addition to the above the following gentlemen also worked in the laboratory without any remuneration from the Association.

1. Mr. S. C. Ganguly, M. Sc.
2. Mr. P. B. Mitra, M. Sc.
3. Mr. N. M. Saha, M. Sc.
4. Mr. S. K. Sanyal, M. Sc.
5. Mr. R. M. Rudra, M. Sc.
6. Mr. N. N. Saha, M. Sc.
7. Mr. J. Dhar, M. Sc.
8. Dr. Abdul Haque, M. Sc., Ph. D (Lond).

RESEARCH WORK DURING THE YEAR 1943

An account of the research work carried out in the laboratories of the Association is given in Appendix I.

* Resigned securing permanent appointments elsewhere.

SCIENTIFIC MEETINGS

A Scientific meeting was held in the Association Hall on the 6th April. Sir U. N. Brahmachari, Kt., M. A., M. D., Ph. D., F. R. A. S. B., F. N. I., F. I. A. S., presided. The following papers were read.

1. Standard State of Desiccation of Dried Blood Plasma and the Advantages of Desiccation in the Region of Molecular Flow—By J. N. Mukherjee and B. R. Majumdar.
2. Effect of Sand on the Viscosity Yield value and Thixotropic Gelation of Mud Suspensions—By J. N. Mukherjee and B. R. Majumdar.
3. On the Fluorescence of Anthracene in presence of Naphthacene—By S. C. Ganguly.
4. Magnetic Studies on Permanganates—By A. Mookherji.

Prof. P. Ray, M. A., delivered a lecture on the 16th September on the Theoretical basis of Stereochemistry to the members of the Association.

LECTURES IN PHYSICS AND CHEMISTRY

For the benefit of the Students of the Calcutta Medical School a regular course of lectures in Physics and Chemistry was delivered at the lecture hall with the aid of the apparatus and demonstrators of the Association.

POPULAR LECTURE

A lecture on 'Television Developments' was delivered by Prof. S. K. Mitra M. B. E., D. Sc, F. R. A. S. B., F. N. I., F. I. A. S. on the occasion of the death Anniversary of Dr. Mahendra Lal Sircar.

LIBRARY

A sum of Rs 1,900/- was provided for in the Budget Estimates of which Rs 1,719-13-6 was actually spent. The Library Reserve Fund amounting to Rs 3,675/- has been earmarked for the purchase of Journals and books after the War. All instruments, books and journals sent to Krishnagar were brought back. Journals and other publications received through subscriptions and in exchange of our publications are given in Appendix II.

MISCELLANEOUS

Compressor of the liquid Air Plant, lent last year to Officer Commanding No. 274(6) Wing R. A. F. was retained for war purposes by the said officer.

The A. R. P. Organisation, who were using with the permission of the Committee of Management the Lecture Hall and Honorary Secretary's Room as Wardens' Post vacated in November.

Sub-Divisional Officer's Training School of the Eastern Army—At the request of the Officer Commanding, Eastern Army facilities have been given for the training of Sub-Divisional Officers.

PUBLICATIONS

Indian Journal of Physics and Proceedings of Indian Association for the Cultivation of Science—Five issues of the Indian Journal of Physics and Proceedings of the Indian Association for the cultivation of Science were published during the year. A list of papers which appeared in these issues is given below.

Total number of subscribers during the year is 238 including 110 members of the Indian Physical Society. A sum of Rs 1,909-5-6 was received as subscription and total expenditure was Rs 2,283-13-6.

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OBITUARY

Prof. P. Zeeman

The Committee place on record their deep sense of sorrow for the loss they have sustained due to the death on the 9th October 1943 at the age of 78 of Prof. Pieter Zeeman who was an Honorary Foreign Member and an Honorary Fellow of our Association.

P. Zeeman was the son of a clergyman and was born at Zonnemaire in Zeeland on the 25th May 1865. He studied under Kammerling Onnes and H. A. Lorentz at the University of Leyden. He became a member of the staff of that University first as an assistant and then as a privatdozent. He took his doctor's degree in 1893 by writing a thesis on the Kerr effect. Later in 1896 he made his memorable discovery of the splitting of the spectral lines in a magnetic field. This discovery which is aptly called Zeeman effect yielded considerable insight into the interior of the atoms. It yielded one of the strongest evidences of the existence of electron in atoms and with its help a very accurate determination of the ratio of charge to mass of an electron was made possible. Thus it created a landmark in the development of atomic physics.

He joined the Amsterdam University in 1897 and three years later he became the professor of experimental physics there. He was awarded the Nobel Prize in Physics in 1902. His contributions to science was very widely recognised and he was made a Knight of the Order of the Nether-

lands Lion and a Commander of the Order of Orange of Nassau in his own country and Foreign Fellows of a number of Scientific Societies outside his native land including the Royal Society of London. He was made an Honorary Foreign Member of our Association in 1938 and Honorary Fellow in 1943.

Sir Nilratan Sircar

The Committee place on record their deep sense of sorrow for the loss they have sustained by the death of Sir Nilratan Sircar, Kt., M. A., M. D., LL. D. (Oxon) who was President of the Association for eight years.

Sir Nilratan Sircar was born on 1st October 1861 at Netra in the 24 Parganas. As a boy he showed great practical aptitude, and it was expected that he would take up the profession of Engineering. The death of his mother from a long painful illness however made such a deep impression on the mind of the boy of fourteen that he resolved to take up the study of medicine and to devote his life to the alleviation of human suffering. After passing the Entrance Examination from Jaynagar in 1876 he came to Calcutta for higher studies. His medical education commenced in the Cambell Medical School and was completed in the Medical College ; at the same time he continued his non-medical studies in the Metropolitan Institution. In 1889 he obtained both the M. A. and the M. D. degrees of the Calcutta University. During this period he had to maintain himself out of his own earnings which included a period of house-surgeonship in the Mayo Hospital. His success as a Physician was immediate, and within a short period he became the leader of his profession. The love he bore towards his fellow beings found its deepest expression in his activities as physician, in the healing of their maladies and in the alleviation of their sufferings. He had however enough energy to spare to partake in other nation building activities, including University, medical and technical education and the starting of industries.

He was a member of the Senate of the Calcutta University since 1893 ; for many years he was a Syndic, Deans of the faculties of Medicine and Science, Presidents of the Council of Post Graduate Teaching in Science and Arts, and Vice Chancellor from 1919 to 1921. He represented his University in the Empire Universities Conference in Oxford in 1920, and was the recipient of honorary degrees from the Universities of Oxford and Edinburgh. He was actively associated in the founding of the Viswa Bharati and of the Bose Institute. Of the former he was a Trustee and a Pradhana, and of the latter a Trustee and a member of the Governing Body. He was also a Trustee of the Indian Museum, and President of the Indian Association for the cultivation of Science from 1933 to 1941.

His contributions towards the improvement of Medical Education and research were notable. He was actively associated with the development

of non-official medical schools like the College of Physician and Surgeons, the Calcutta Medical School; these were ultimately amalgamated into the Carmichael Medical College, which was affiliated to the Calcutta University in 1917. He was President for a large number of years of the Medical Society of Bengal, the Chittaranjan Seva Sadan, the Jadavpur Tuberculosis Sanatorium, and of other Medical Societies. Not less important were his contributions towards the development of technical education in Bengal. He was actively associated with the founding of the National Council of Education at the time of the *Swadeshi* movement. For many years he was the Secretary in charge of Scientific and technical educations imparted in the Bengal Technical Institution, which latter developed into the College of Engineering and Technology, Jadavpur.

Also about this time Sir Nilratan became inrerested in the development of industries in Bengal. He started the National Soap Factory, the National Tannery, a couple of Tea Gardens and a colliery. He had neither the time nor the temperament necessary for the supervision of the working of such concerns, and he suffered heavy financial losses thereby.

Sir Nilratan was endowed with uncommon good health and nerves and great physical energy. Increasing financial worries and the death of his wife after a lingering illness in 1939 ultimately undermined his health. In January 1940 he had a stroke which compelled him to withdraw from all forms of activities. He passed away in Giridih on the 18th May 1943.

ACKNOWLEDGMENT

The Committee of Management have great pleasure in recording grateful thanks to :

- (a) The Government of India for their generous contribution of Rs 18,000/- for the year 1943-44.
- (b) The University of Calcutta for printing the Indian Journal of Physics free of cost.
- (c) The Corporation of Calcutta for exemption of Municipal Taxes for Premises No 210 Bowbazar Street (i.e. the Lecture Hall and Laboratory buildings of the Association)

They also express their grateful appreciation of the honorary services rendered by

- (a) Messrs. J. N. Basu, N. C. Chunder and J. C. Pal, as Trustees of the Association and of Science Association Employees' Provident Fund.
- (b) Messrs. B. N. Basu & Co. Solicitors on legal matters.
- (c) Mr K. C. Banerjee, B. E., C. E., on Engineering matters.

- (d) Prof. J. N. Mukherjee, C. B. E., D. Sc., F. R. A. S. B., F. N. I., F. I. A. S., as Honorary Secretary of the Association.
- (e) Prof. P. N. Ghosh, M. A., Ph. D., Sc. D., F. R. A. S. B., F. N. I., F. I. A. S., Honorary Secretary, Editorial Board, Indian Journal of Physics and Proceedings of the Indian Association for the Cultivation of Science.

In presenting this report on behalf of the Committee of Management the Honorary Secretary places on record appreciation of the help received from the President and other members of the Committee of Management.

J. N. Mukherjee

Honorary Secretary.

Indian Association for the Cultivation of
Science

210, Bowbazar Street, Calcutta.

ACKNOWLEDGMENT

The Committee of Management have great pleasure in recording grateful thanks to :

- (a) The Government of India for their generous contribution of Rs. 18000 for the year 1953-54.
- (b) The University of Calcutta for providing the Indian Journal of Physics free of cost.
- (c) The Corporation of Calcutta for exemption of Municipal Taxes for premises No. 210 Bowbazar Street (the Lecture Hall and Laboratory buildings of the Association).

They also express their grateful appreciation of the honorary services rendered by

- (a) Messrs. J. N. Mukherjee, C. B. E., D. Sc., F. R. A. S. B., F. N. I., as Honorary Secretary of the Association and of Science Association.
- (b) Messrs. P. N. Ghosh, M. A., Ph. D., Sc. D., F. R. A. S. B., F. N. I., F. I. A. S., as Honorary Secretary, Editorial Board, Indian Journal of Physics and Proceedings of the Indian Association for the Cultivation of Science.
- (c) Mr. K. C. Panigrahi, B. E., C. E., as Honorary Secretary.

APPENDIX I

Report on the Scientific work of the Association by the Mahendra Lal Sircar Professor of Physics.

1. Study of Primary Extra Reflections in Laue Photographs

In recent years a very great interest has been aroused in the study of the extra reflections that was observed by Friedrich in 1913. The experimental results of Friedrich have been extended by a large number of workers particularly Laval, Preston, Zachariasen and Wadlund, Raman and Nilakantan, Venkateswaran and Lonsdale and Smith. As the theses of these workers were mainly to support one or the other of the proposed theories, the results were extensive but mainly qualitative. Attempts are therefore being made in this laboratory to make quantitative intense studies of this phenomenon in a few number of selected crystals. The points that are being studied are (1) the exact location of the absolute maximum of each extra spot at different orientations of a crystal, (2) the spread of the intensities of the spots along different directions (3) change of maximum intensity with variation of the angle of incidence and (4) deviation of the direction of maximum intensity from the planes of incidence. In order that a much larger number of spots may be studied an innovation has been introduced namely the use of a cylindrical camera for the Laue photographs. This method has further removed the geometrical asymmetry of the spread of spots along the equatorial directions and also reduced it in other directions. As the usual method of gnomonic projection cannot be applied for the identifications of the reflections, formulae have been deduced by which the reflecting planes may be indexed. Photographic photometric methods have been used for accurately locating the positions of the maxima and also the values of the intensities. R. K. Sen and the present writer have obtained some very interesting results. The investigation is in progress.

2. Secondary Extra Reflections in Laue Photographs

The extra reflections described in the previous section are more or less diffuse but it was pointed out by Raman and Nilakantan that diamond gives rise to sharp extra reflections which were recognised by them as distinct from the reflections described in the previous section. But later Lonsdale and Smith obtained very beautiful sharp reflections from diamond over and above the usual diffuse type and designated them as secondary extra reflections, but they concluded that these are due to strain in the diamond crystal, a conclusion that will be easily seen to be untenable from simple considerations. However, the discovery of a set of sharp extra reflections from phloroglucine crystals by C. R. Bose and the present

writer has opened up the possibility of investigating into the nature of this type of extra reflections. It has been found by the present writer that this type of reflections originate from vibrations or derangements along sharply definite directions of the crystal. In the case of diamond these directions are the three cubic axes as was pointed out by Pisharoty, while in phloroglucine dihydrate this is along the c-axis of the crystal. In some Laue photographs of benzil published by Lonsdale and Smith, a number of fairly sharp lines and spots have been observed. On closer study of these lines and spots at different orientations of the crystal R. K. Sen and the present writer have concluded that these reflections are also of the secondary type and they originate from the lattice degradations along the trigonal and the diagonal axes. Further investigations of this effect in benzil are in progress. In phloroglucine we have thus the advantage that the derangement is along a single direction and consequently the study of the phenomenon becomes much simpler. It has also been found that in a single crystal of phloroglucine dihydrate only the borders give rise to the effect and not the central part. This shows that just as there are two varieties of diamond, the border and the central part in the case of this crystal constitute two different varieties in the same crystal. Further investigations on this effect are being continued here.

3. X-ray Investigation of the Atomic Arrangements in Benzil Crystal

The results mentioned in the previous section show the importance of the determination of the atomic arrangements in benzil and phloroglucine dihydrate. This determination in the case of benzil is complicated due to absence of a centre of symmetry in this crystal. Thus Lonsdale was unable to arrive at any conclusion as to the structure from her X-ray measurements. On the basis of the preliminary determination of the structure, made by B. S. Bysak and the writer attempts are being made to obtain accurate values of the atomic parameters by a two-dimensional Fourier analysis.

4. Magnetic behaviour of Rare Earth Ions in Crystals at low temperatures.

According to Curie-Weiss law at all ordinary temperatures magnetic anisotropy should increase with the fall of temperature. But according to Van Vleck's theory of crystalline electric field under suitable condition anisotropies may decrease; because the lowest of the stark patterns split by the crystalline electric field may not always correspond to larger magnetic moment. The decrease in anisotropy may happen even without crystalline splitting in cases where the natural multiplets are narrow. Experimental verification of the above ideas is offered by the measurement of the temperature variation of the anisotropy by A. Mookerji on $\text{Pr}_2(\text{SO}_4)_3 \cdot 8\text{H}_2\text{O}$ and $\text{Sm}_2(\text{SO}_4)_3 \cdot 8\text{H}_2\text{O}$ crystals. He finds that anisotropy of $\text{Pr}_2(\text{SO}_4)_3 \cdot 8\text{H}_2\text{O}$ rises with the fall of temp. reaches a maximum at about 130°K and then decreases anisotropies of $\text{Sm}_2(\text{SO}_4)_3 \cdot 8\text{H}_2\text{O}$ behave similarly having a maximum at about 130°K . In case of Pr^{+++} the basic

state 3H_4 splits under a crystal field of cubic symmetry into three levels the lowest of which is single and corresponds to a smaller magnetic moment than the higher level. In case of Sm^{+++} ions the natural multiplet width is about 930 cm^{-1} , so even at room temperature not only the state with $J=5/2$ but also the state with $J=7/2$ should be considered.

Numerical calculations according to a theory developed by Jordahl to explain the change of the direction of principal paramagnetic susceptibilities of crystals with temperature, showed that the maximum rotation of magnetic axes is about 5° when the difference of temperature is about 100° C . So, it is of considerable interest that measurements by A. Mookerji on the single crystals of $Pr_2(SO_4)_3 \cdot 8H_2O$, $Nd_2(SO_4)_3 \cdot 8H_2O$ and $Ce(NH_4)(SO_4)_2 \cdot 4H_2O$ give rotations of 63.4° , 7° and 15.3° respectively as the temperature is lowered from 300° K to 85° K . If the rotation is attributed to polymorphic inversion one should expect an abrupt change in the crystal anisotropy. But the results of temperature variation of anisotropy rule out this possibility.

A freely rotating group as contemplated by Pauling to explain λ points, even if it is anisotropic will acquire spherical symmetry and will be isotropic, so rotations or oscillations will not account for the above results.

Hence A. Mookherji concludes that the paramagnetic units do not change with the change of temperature but the angle between the various paramagnetic units in the unit cell of these crystals changes as the temperature changes.

5. Magnetic Studies in relation to Crystal Structure.

An interesting example of the application of the magnetic method to structural problem is offered by the Magnetic Study of single crystals of $KMnO_4$. On the basis of X-ray studies of $KMnO_4$ crystals Mn is found to be at the centre of a nearly regular tetrahedron formed by four oxygens. Three of these oxygens are disposed at almost equal distances from the Manganese, while the fourth is differently placed. As a result the crystalline electric field deviates slightly from cubic symmetry. One should therefore expect 1) feeble magnetic anisotropy for the crystal, 2) the magnetisation along one of the axes should be greater than the other two which should be almost equal, though the external symmetry of the crystal is orthorombic. All the above predictions from the fine structure study have been experimentally verified by A. Mookherji.

6. Investigations on the Hall effect of Molybdenite.

For semi-conductors in which the conductivity has been proved to be electronic, it is very important to know whether the current is carried by electrons in a nearly empty band or by holes in a band nearly filled with electrons. Since the holes behave in many ways like positive electrons, this question can be settled by measuring any quantity which depends

on the first power of the charge of the carrier. The most important of such quantities is the Hall-Coefficient.

The substance Molybdenite (MoS_2) has been placed in a class of semi-conductors known as "Excess Conductors" i.e., here the current is mainly carried by electrons in a nearly empty band. This means that the electrons are raised from normally occupied impurity levels into the conduction band and to these electrons the substance owes its conductivity. The impurity centres are due to the stoichiometric excess of one of the constituent elements of the compound. Thus in the case of Molybdenite the conductivity is due either to the excess of Mo atoms or sulphur atoms. From the work done in this line by several workers it has been concluded that all reduction conductors are excess conductors i.e., the substances in which the conductivity is due to the presence of excess metal atoms are "Excess Conductors". But its converse is not necessarily true.

Measurements on the Hall-effect carried out by A. K. Dutta in this laboratory show it to be negative in the case of Molybdenite which we should expect theoretically in the case of excess conductors.

7. Magnetic Studies on Molybdenite.

As is well known semiconductors owe their conductivity to electrons in a nearly empty band or to "holes" in a nearly full-band where they are free to move through the lattice. If the movements of these latter electrons are more or less restricted in a certain plane, we should expect according to modern quantum mechanical ideas an enhanced diamagnetism confined in a direction normal to that plane. From the consideration of the crystal structure of molybdenite as well as the question of valency in it, the presence of one electron per atom of sulphur free to move in the sulphur plane has been found necessary. One direct consequence of this would be a considerable amount of diamagnetism confined along the hexagonal axis. From the recent magnetic measurements of A. K. Dutta on single crystals of molybdenite, this conclusion has been verified, and the magnitude of the diamagnetic anisotropy measured by A. K. Dutta is found to agree nicely with the value calculated according to Landau's method.

8. Study of Fluorescence in Crystals of Aromatic Compounds.

Pure naphthalene fluoresces very feebly whereas dilute solid solution of naphthalene in anthracene fluoresces strongly and the fluorescence of anthracene is quenched. S. C. Ganguly, working in this laboratory has shown that in a solution of a mixture of naphthalene and anthracene in alcohol no such quenching is observed. Pure naphthalene in alcoholic solution fluoresces with yellow green light; in the mixture the intensity and the positions of the fluorescence bands remain unchanged from those of the pure substances having the same concentration.

The fluorescence of anthracene crystal containing naphthacene excited by monochromatic radiation of different wave-lengths have been studied by S. C. Ganguly and the following results have been observed. (1) The position and number of fluorescence bands of Naphthacene are independent of the wavelength of the exciting radiation. (2) As the wavelength of the exciting radiation increases beyond the central part of the longest absorption band the intensity of fluorescence falls to zero very rapidly.

Report on the research work carried out by

Dr. S. C. Sirkar, D. Sc., F. N. I., Reader

in Physics during 1943

(1) Raman effect

It is well known that some new Raman lines appear in the neighbourhood of the Rayleigh line when some organic liquids are solidified. The origin of these lines was attributed to lattice oscillation by Gross and Vuks who first observed these lines in the case of some aromatic compounds. Since later it was observed by the writer of this report that in some cases these new lines are more intense than the most intense Raman lines due to intramolecular oscillations of the substances, it was suggested by him that the lines might be due to the formation of some new intermolecular bonding with the solidification of the substances at low temperatures. Investigations in this line have been pursued during the year under review and the Raman spectra of methyl, ethyl, propyl and butyl sulphide have been investigated in the solid state at the temperature of liquid oxygen and the polarisation of the Raman lines has also been studied in all these cases. The results which have been discussed in a paper (Sirkar, S. C. and Bishui, B. M., Proc. Nat. Inst. Sc., in press) which will be published very shortly show that in the case of ethyl and propyl sulphide the $\overset{\wedge}{\text{CSC}}$ group undergoes distortion in the solid state. Evidence for strong intermolecular association is also obtained in the case of ethyl, methyl and propyl sulphide and in all these cases a new line is observed at about 84 cm^{-1} . In the case of butyl sulphide some lines due to C-C oscillation disappear in the solid state showing the absence of free rotation about the C-C bond. The $\overset{\wedge}{\text{CSC}}$ group remains unchanged on solidification in this case. The Raman spectra of ethylene dibromide, ethylene chlorhydrin, propyl bromide, benzyl amine and benzyl alcohol in the solid state at low temperature have also been investigated. The results are discussed in a paper in course of preparation.

The theory put forward by Placzek indicates that the intensities of Raman lines should increase with the increase of temperature of the

substance. This theory has been put to test by several previous workers and in the case of some crystals, the experimental results are not in agreement with those calculated from the theory. The investigation of the particular problem has been extended to the case of some aromatic compounds having high boiling points, e.g. ; benzyl alcohol, benzyl amine and benzoyl chloride and it has been observed that in each case the ratios of the intensities of a few Raman lines at the room temperature with the corresponding intensities at a higher temperature, a few degrees below the boiling point of the liquid are in agreement within experimental error with the values calculated from the polarizability theory. The paper has been accepted for publication in Indian Journal of Physics (vide Sirkar, S. C. and Sanyal, S. B., Ind. J. Phys, 17, part VI).

(2) X-ray analysis of jute fibre

This work has been undertaken under the auspices of the Indian Central Jute Committee and transferred to these laboratories by Prof. M. N. Saha, F. R. S. who got the scheme drawn up by him sanctioned by the said Committee. In the preliminary investigations it has been observed that although fibres of all qualities apparently produce the same diffraction pattern, careful investigation reveals differences in the details of the patterns due to fibres of different qualities. It has been possible to group the fibres into four broad classes from the criterion of the results of X-ray analysis. These results may possibly lead to the development of a method of classification of jute fibre similar to that adopted by the United States Government for the classification of cotton fibre. The results of preliminary investigations have been discussed in a paper by S. C. Sirkar, N. N. Saha and R. R. Rudra which is in course of preparation. The investigations are being continued.

Report on the research work carried out by Mr. B. C. Guha, M.Sc., Research Fellow, during 1943.

Temperature variation of anisotropies of a large number of paramagnetic ions in crystals of salts of the iron group of metals have been studied over a temperature range of 300°K to 80°K. The following results have been obtained.

Cr^{+++} ion in the single crystals of $\text{Cr}[(\text{CH}_3\text{CO})_2\text{CH}]_3(\text{NH}_4)_3\text{Cr}(\text{C}_2\text{O}_4)_3 \cdot 3\text{H}_2\text{O}$ shows a small decrease in the values of the effective Bohr magneton numbers from room temperature to the temperature of the liquid air.

Mn^{++} and Fe^{+++} ions in the single crystals of $\text{Mn}(\text{NH}_4)_2(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$, $\text{Fe}(\text{CH}_3\text{CO})\text{CH}_3$ and $\text{K}_3\text{Fe}(\text{C}_2\text{O}_4)_3 \cdot 3\text{H}_2\text{O}$ are in the S-state, and they should follow simple Curie law. The magnetic moments of these ions in crystals have been found to be practically independent of temperature upto 80°K.

The temperature variation of the magnetic moment of Co^{++} ion in single crystals of $\text{CoSO}_4 \cdot 7\text{H}_2\text{O}$, $\text{CoSeO}_4 \cdot 6\text{H}_2\text{O}$, $\text{CoRb}_2(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$, $\text{CoRb}_2(\text{SeO}_4)_2$, $\text{CoCs}_2(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$, $\text{CoTl}_2(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$ and $\text{Co}(\text{CH}_3\text{COO})_2 \cdot 4\text{H}_2\text{O}$ agree well with the values calculated by Schlapp and Penny assuming a predominantly cubic field with a small rhombic component superimposed on it.

From the measurements of the temperature variation of the anisotropy of crystals of Nickel salts Krishnan, Mookherji and Bose evaluated the coefficient of the spin orbit coupling (λ) assuming the crystalline electric field constants (α) to be independent of temperature. In some of the nickel salt crystals that have been studied by the present author the value of λ comes out almost the same as calculated from spectroscopic data. Variation of λ and a change in the field constants have been detected in some cases.

The temperature variation of the principal susceptibilities of cupric Tutton salt crystals follow Curie-Weiss law with small Curie temperature in agreement with the result obtained by Krishnan and Mookherji with $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$. But in case of $2\text{NH}_4\text{Cl} \cdot \text{CuCl}_2 \cdot 2\text{H}_2\text{O}$ the deviation of the susceptibilities from the Curie law is comparatively large.

In a complex salt strong electric fields are created due to the closeness of the atoms surrounding the paramagnetic ion which produce a disruption of the coupling between the individual spin moments of the different electrons in the incomplete shell of the paramagnetic ion. One should therefore expect a very complicated magnetic behaviour of these salts as the temperature is lowered. Thus for $\text{K}_3(\text{FeCN})_6$ the susceptibility along the x_2 -direction does not follow inverse dependence of temperature, instead it decreases with decreasing temperatures. The peculiar magnetic behaviour of the crystal of $\text{Cu}(\text{CH}_3\text{COO})_2 \cdot \text{H}_2\text{O}$ in which not only the anisotropies but also the principal magnetic moments decrease with the lowering of temperature, points to the fact that unlike other Tutton salts studied by us, which are coordination compounds copper forms a complex in this salt.

List of papers published during the year.

	Page.
1. On the Raman Spectra of Methyl and Ethyl Sulphide in the Solid State—By Dr. S. C. Sirkar and B. M. Bishui, Science and Culture, Vol. 9, No. 2.	90
2. On the axial lengths of phloroglucine dihydrate—By C. R. Bose and R. K. Sen, Ind. Jour. Phys. Vol. 17,	263
3. Fluorescence of Anthracene in the presence of Naphthacene—By S. C. Ganguly, Nature, 151, ... ..	...
4. On the Raman Spectra of a few alkyl Sulphides in the solid state By S. C. Sirkar and B. M. Bishui, Proc. Nat. Inst. of Sci of India, Vol. IX,	287

5. Magnetic Studies on Permanganates—By A. Mookherji, Proc. Ind. Assoc. for Cult. Sci. Vol. 26. ... 8
6. On the fluorescence of Anthracene in presence of Naphthacene—By S. C. Ganguly, Proc. Ind. Assoc. for Cult. Sci. Vol. 26, ... 7
7. On the origin of the Secondary extra reflections—By Prof. K. Banerjee and C. R. Bose, Proceedings of the 31st Indian Science Congress (New Delhi Session) Part III, Abstracts ... 20

Seminar Lectures delivered during the year.

<i>Subject.</i>	<i>Speaker.</i>
1. Cosmic Rays ...	Dr. S. C. Sirkar.
2. Properties of Semi Conductors ...	Ajit Kumar Datta
3. Studies of paramagnetic anisotropy in aid of crystal structure determination by X-ray methods ...	Asutosh Mukherji
4. International Notations of Space Groups ...	Prof. K. Banerjee
5. Extra Laue Spots ...	B. M. Bishui
6. Preparation of Luminiscent materials with Special reference to the Sulphides of Alkaline earths and zinc ...	D. V. Kamat
7. Determination of crystal structure by the method of Fourier Series ...	B. S. Bysak
8. On the diffraction of electrons from Gold films ...	Dr. A. Haque
9. Structure of cellulose and its properties ...	N. N. Saha
10. The concept of reciprocal lattice and its application in the interpretation of oscillation rotation and Weissenberg photographs ...	R. K. Sen.
11. Extra reflections of the Secondary type in Laue photographs ...	Prof. K. Banerjee
12. Raman spectra of some alkyl Sulphides at low temperature ...	Dr. S. C. Sirkar

List of papers published during the year.

1. On the Raman spectra of Methyl and Ethyl Sulphides in the solid state—By Dr. S. C. Sirkar and B. M. Bishui, Indian Science Congress, Calcutta, Vol. 26, Part III, Abstracts, 1953.	8
2. On the axial lengths of polymorphic hydrates—By C. R. Bose and R. K. Sen, Ind. Assoc. for Cult. Sci., Vol. 26, 1953.	7
3. Fluorescence of Anthracene in the presence of Naphthacene—By S. C. Ganguly, Indian Science Congress, Calcutta, Vol. 26, Part III, Abstracts, 1953.	8
4. On the Raman spectra of a few alkyl Sulphides in the solid state—By S. C. Sirkar and B. M. Bishui, Proc. Ind. Assoc. for Cult. Sci., Vol. 26, 1953.	20

Appendix II.

1. Journals Purchased.

1. British Chemical Abstract AI, AII and AIII.
2. Nature.
3. Journal of Chemical Society, London.
4. Philosophical Magazine.
5. Philosophical Transactions of the Royal Society.
6. Proceedings of the Royal Society. A.
7. Science Abstracts. A & B.
8. Transactions of the Faraday Society.
9. Proceedings of the Royal Institution of Great Britain.
10. Astrophysical Journal.
11. Chemical Abstracts.
12. Journal of American Chemical Society.
13. Journal of Chemical Physics.
14. Journal of Physical Chemistry.
15. Physical Review.
16. Journal of Applied Physics.
17. Proceedings of the National Academy of Sciences, Washington.
18. Reviews of Modern Physics.
19. Scientific American.

2. Books Purchased

1. Metallurgy—E. L. Rhead.
2. The Mechanics of Deformable Bodies—Max Planck.
3. General Mechanics—Max Planck.
4. Treatise on Thermodynamics—Max Planck.
5. Molecular Hydrogen and its Spectrum—O. W. Richardson.
6. An Outline of Atomic Physics—Blackwood, etc.
7. Experimental Physical Chemistry—W. G. Palmer.
8. Electrons at Work—C. R. Underhill.
9. The Elements of New Quantum Mechanics—O. Halpern and H. Thirring.
10. Recent Advances in Atomic Physics. Vols. I & II,—G. Castelfranchi.
11. Machine Shop Companion—W. Bentley.
12. Introduction to Bessel Functions—F. Bowman.
13. Physical Aspects of Organic Chemistry—W. A. Waters.
14. The Mechanical Properties of Fluids—Sir George Goodwin & Others.
15. An Introduction to the Kinetic Theory of Gases—Sir J. Jeans.
16. Analytical Geometry of three Dimensions—D. M. Y. Sommerville.
17. Measurement of Radiant Energy—W. E. Forsythe.
18. Electrical Measurement and Measuring Instruments—E. W. Golding.
19. An Introduction to the Modern Theory of Valency—J. C. Speakman.
20. Thermionic Emission—T. J. Jones.
21. Some Problems in Adsorption—J. K. Roberts.
22. The Mobility of Positive Ions in Gases—A. M. Tyndall.
23. Cosmic Rays and Mesotrons—H. J. J. Braddick.
24. Modern Astronomy—Macpherson.
25. Photo Electric and Selenium Cells—T. J. Fielding.
26. Sound Film Reproduction—G. F. Jones.
27. Recent Advances in Physics—F. H. Newman.
28. Madame Curie—Eve Curie.
29. Stars and Atoms—A. S. Eddington.
30. Thermodynamics and Chemistry—F. H. Macdougall.
31. Atlas of Meteorology.
32. The Distribution of the Stars in Space—Bart J. Bok.
33. Spectra of Long Period Variable Stars—Paul W. Merrill.
34. The Masses of the Stars—Russell and Moore.
35. Strength and Structure of the Earth—R. A. Daly.
36. Internal Constitution of the Earth—Beno Gutenberg.

3. List of Journals and Periodicals received in exchange of our Proceedings and Journal.

1. Biological Bulletin.
2. Bulletin of the Calcutta Mathematical Society.
3. Communications.
4. Comptes Rendus des Seances de la Societe de Physique D'Historie Naturelle de Geneve.
5. Current Science.
6. Journal of the Council for Scientific and Industrial Research.
7. Indian Journal of Agricultural Science.
8. Industrial and Engineering Chemistry.
9. Journal of the Royal Asiatic Society of Bengal.
10. Journal of the Franklin Institute.
11. Journal of the Indian Chemical Society.
12. Journal of Mathematics and Physics
13. Journal of Research of the National Bureau of Standards.
14. Journal of Scientific Instruments.
15. Monthly Weather Review.
16. Proceedings of the Cambridge Philosophical Society.
17. Proceedings of the Indian Academy of Sciences, A. & B.
18. Proceedings of the National Institute of Sciences of India.
19. Proceedings of the Physical Society.
20. Proceedings of the Royal Society of Edinburgh.
21. Quarterly Journal of the Royal Meteorological Society.
22. Records of the Geological Survey of India.
23. Reveue Trimestrielle Canadienne.
24. Science and Culture.
25. Terrestrial Magnetism and Atmospheric Electricity.
26. University of Illinois Bulletin.
27. Journal of the Royal Aeronautical Society.
28. Revista De La Sociedad Mexicann De Historia Natural.

Appendix III

Office Bearers and Members of the Committee of Managment For the year 1943,

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Sir U. N. Brahmachari, Kt., M.A., M.D., Ph.D., F.R.A.S.B., F.N.I.
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92, Upper Circular Road, Calcutta.
11. Mr. K. C. Banerjee, B.E., C.E.,
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17. Dr. S. Bhagavantam, D.Sc.,
Andhra University, Waltair.
18. Dr. G. P. Majumdar, M.Sc., Ph.D.,
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19. Prof. P. Ray, M.A.,
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20. Dr. P. N. Brahmachari, M.Sc., M.D.,
19, Loudon Street, Calcutta.
21. Dr. L. A. Ramdas, Ph.D.,
Agricultural Meteorologist, Poona.
22. Dr. A. H. Pandya, Sc.D., A.M.I.,
Bengal Engineering College, Shibpore, Howrah.
23. Prof. K. Banerjee, D.Sc., F.N.I., (Ex-Officio),
210, Bowbazar Street, Calcutta.

Appendix IV

List of Joy Kissen Mookerjee and Dr. Bimala Churn Law Medallists, Ripon and Coochbehar Professors Since the separation of the Endowed Funds.

Joy Kissen Mookherjee Medallists

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|--|------|
| 1. Sir E. J. Russell, D.Sc., F.R.S. | 1936 |
| 2. Sir James H. Jeans, D.Sc., Sc.D., LL.D., F.I.C., F.R.S. | 1937 |
| 3. Professor F. W. Aston, F.R.S., D.Sc., Nobel Laureate | 1938 |
| 4. Professor Robert A. Millikan, D.Sc., Nobel Laureate | 1939 |
| 5. Prof. A. V. Hill, O.B.E., M.P., F.R.S., Nobel Laureate | 1940 |

Dr. Bimala Churn Law Medallist

Sir Henry H. Dale, G.B.E., P.R.S.

Ripon Professors

- | | |
|--|------|
| 1. Sir Lewis Leigh Fermor, O.B.E., D.Sc., F.R.S. | 1937 |
| 2. Sir Arthur W. Hill, K.C.M.G., Sc.D., F.R.S. | 1938 |

Coochbehar Professor

- | | |
|---|------|
| 1. Professor J. E. Lennard-Jones, D.Sc., F.R.S. | 1938 |
|---|------|

INDIAN ASSOCIATION FOR

Receipts and Payments Account for the year

RECEIPTS	Rs. As. P.	Rs. As. P.
To Opening Balance as at 1. 1. 43.		
In hand (Imprest Cash)	15 0 0	
Imperial Bank of India (Current Account) ...	21,538 3 6	
Imperial Bank of India (Savings Account) ...	5,781 9 9	
3% G. P. Notes (Cost)	4,978 12 0	
Post Office Cash Certificates (Cost)	8,460 0 0	
Fixed Deposit Imperial Bank of India	2,000 0 0	42,773 9 3
.. Government of India Grant ... ..	...	9,000 0 0
.. Subscription from Members ... ..	...	1,011 0 0
.. Rent	4,070 4 9	
.. Municipal Tax	489 6 0	4,559 10 9
.. Indian Journal of Physics ... ..	...	1,909 5 6
.. Demonstration Allowance ... ..	...	550 0 0
.. Library Deposit ... ..	...	40 0 0
.. Miscellaneous Receipts ... ..	...	225 9 0
.. Staff Income-Tax ... ..	...	754 8 0
.. Repayment from		
Victoria Prof. Fund	51 0 0	
Hare Prof. Fund	51 0 0	
Dr. Sircar Medal Fund	298 8 0	
Mahendralal Sircar Prof. and Vehariral Mitra Fund	8,125 0 0	8,525 8 0
.. Interest (General Fund) ... ..	...	681 13 0
.. Donation (Dr B. C. Law Gold Medal Fund) ...	5,000 0 0	
.. Do. as Cost of the Medal	175 0 0	
.. Suspense ... ..	...	5,175 0 0 2,359 2 0
.. Provident Fund		
Contribution	1,966 6 0	
Interest	222 6 0	
Repayment of Loan	120 3 0	
Contribution from General Fund to Prof. Krishnan	243 4 9	2,552 3 9
TOTAL Rs. ...	...	80,117 5 3

1-B, Old Post Office Street,
CALCUTTA,
15th, February, 1944.

INDIAN ASSOCIATION FOR

Balance Sheet as at

LIABILITIES				Rs. As. P.	Rs. As. P.
General Fund	...	...	...	2,14,388 10 9	
Add. depreciation reserve	...	...	...	1,69,099 10 3	
„ Investment reserve	...	...	...	6,173 8 0	3,89,661 13 0
Research Endowment Fund	...	...	...	...	16,750 0 0
Library Reserve Fund	...	...	...	...	3,675 0 0
Special Funds :					
Coochbehar Professorship Fund	...	...	...	33,000 0 0	
Ripon Professorship Fund	...	...	...	25,000 0 0	
Joykissen Mookherjee Medal Fund	...	...	...	13,400 0 0	
Building Fund	...	...	...	9,500 0 0	
Dr. Sircar Research Medal Fund	...	...	...	5,000 0 0	
Woodburn Medal Fund	...	...	...	1,500 0 0	
Victoria Professorship Fund	...	...	...	1,500 0 0	
Hare Professorship Fund	...	...	...	1,500 0 0	
Nikunja Garabini Prize Fund	...	...	...	1,000 0 0	
Mahendra Lal Sircar Professorship Fund	...	...	...	1,49,500 0 0	
Veharilala Mitra Fund	...	...	...	1,00,000 0 0	
Jatindra Chandra prize Fund	...	...	...	1,000 0 0	3,41,900 0 0
Interest on Special Funds	...	...	...	...	12,927 6 10
Deposit :					
Rent	...	...	...	122 0 0	
Library	...	...	...	60 0 0	182 0 0
Suspense	...	...	...	...	5,011 14 0
Employees' Provident Fund	...	...	...	...	9,623 10 11
TOTAL Rs.				...	7,79,731 12 9

I have examined the Balance Sheet as at 31st December, 1943 of the Indian Association. In my opinion the Balance Sheet is properly drawn up so as to exhibit a and explanations given to me, and as shown by the books of the Association.

1-B, Old Post Office Street,
CALCUTTA.
15th February, 1944.

THE CULTIVATION OF SCIENCE

31st December, 1943.

ASSETS				Rs. As. P.	Rs. As. P.
Land & Building	...	...	...	31,680	11 9
Lecture Hall & Gallery	...	...	...	23,465	5 3
Vizianagram Laboratory	...	...	...	40,900	14 0
Observatory Room	...	...	...	3,320	9 9
Range of Shops (East)	...	...	...	2,516	10 9
Range of Shops (West)	...	...	...	2,308	5 0
Servants' Quarters	...	...	...	1,024	0 0
Durwan's Quarter	...	...	...	303	13 9
Scientific Instruments	...	...	...	1,21,906	0 11
Botanical Instruments	...	...	...	2,329	6 0
Workshop Instruments	...	...	...	9,861	5 9
Tools & Implements	...	...	...	225	7 3
Furniture	...	...	...	19,671	12 6
Library	...	...	...	73,175	3 7
Investments in G. P. Notes (Face Value)					
Mahendralal Sircar Prof. Fund	...	...	1,49,500	0 0	
Veharilala Mitra Fund	...	...	1,32,000	0 0	
General Fund	...	...	16,500	0 0	
Coochbehar Prof. Fund	...	...	33,000	0 0	
Joykissen Mookherjee Medal Fund	...	...	13,400	0 0	
Ripon Professorship Fund	...	...	25,000	0 0	
Building Fund	...	...	9,500	0 0	
Dr. Sircar Research Medal Fund	...	...	5,000	0 0	
Victoria Professorship Fund	...	...	1,500	0 0	
Hare Professorship Fund	...	...	1,500	0 0	
Nikunja Garabini Prize Fund	...	...	1,000	0 0	
Woodburn Medal Fund	...	...	1,500	0 0	
Jatindra Chandra Prize Fund	...	...	1,000	0 0	
				3,90,400	0 0
Imperial Bank of India (Current A/c. of Special Funds)	...	...	...	12,927	6 10
Imperial Bank of India (Current A/c. of Research Endowment Fund)	...	...	...	16,750	0 0
Imperial Bank of India (Current A/c. of Library Reserve Fund)	...	...	...	3,675	0 0
Advance to Special Funds :					
Victoria Prof. Fund	...	...	8	8 0	
Hare Prof. Fund	...	...	7	8 0	
				16	0 0
Fluctuation on Investment A/c.					
Being the difference of Face and Market Value of Securities	...	...	...	324	1 0
Employees' Provident Fund Investments (At Cost)					
Imperial Bank of India (Savings)	...	...	2,519	14 11	
3% G. P. Notes (Face Value Rs 5,000/-)	...	...	4,978	12 0	
Fixed Deposit (Imperial Bank of India)	...	...	2,000	0 0	
				9,498	10 11
Government of India Grant A/c.	...	...	...	7,690	10 0
Cash :					
In hand (Imprest)	...	...	165	0 0	
Imperial Bank of India Current A/c.	...	...	5,595	5 9	
				5,760	5 9
TOTAL					
				7,79,731	12 9

for the Cultivation of Science set forth above with the Books and Vouchers of the correct view of the state of Association's affairs, according to the best of my information

S. N. Mukherji, F.S.A.A., R.A.

Incorporated Accountant,

Registered Accountant.

INDIAN ASSOCIATION FOR General Fund Account for the year

	INCOME		Rs. As. P.	Rs. As. P.
Fund at the beginning of the year	2,15,551 0 3
Government of India Grant Account	27,177 13 9
Subscriptions	1,011 0 0
Rent	4,070 4 9
Income-Tax	754 8 0
Indian Journal of Physics	1,909 5 6
Demonstration Allowance	550 0 0
Municipal Tax	489 6 0
Interest of General Fund	681 13 0
Miscellaneous Receipts	225 9 0
Appropriation in 1943.				
Laboratory Building Repairs	700 7 9	
Electric Charges	791 6 0	
Gas Charges	437 12 0	
Laboratory Charges	7,331 13 6	
Laboratory Contingency	379 13 0	
Research Establishment	15,012 8 9	
Workshop Charges	168 13 6	
Library	1,678 7 6	
Telephone Charges	282 12 0	
Renoyation of Electric Wiring	184 2 3	
War Emergency	209 13 6	
			27,177 13 9	
Less, Opening Balance as on 1. 1. 43.	Rs. 10,487 3 9	
Amount received in 1943 (In Part)	9,000 0 0	19,487 3 9
Balance Carried Over to Balance Sheet	7,690 10 0	
			TOTAL	2,52,420 12 3

1-B, Old Post Office Street,
CALCUTTA.
15th February, 1944.

THE CULTIVATION OF SCIENCE

ended 31st December, 1943.

P.	Rs. As. P.	OUTGO	Rs. As. P.	Rs. As. P.
3		Bank Charges	6	14 0
9		Office Establishment	2,446	9 3
0		Provident Fund Contribution	358	3 0
9		Electric Charges	791	6 0
0		Gas Charges	437	12 0
6		Printing Charges	209	9 0
0		Income-Tax	700	15 0
0		Telephone Charges	282	12 0
0		Research Establishment	15,012	8 9
0		Indian Journal of Physics	2,283	13 6
		Office Contingency	180	6 6
		Laboratory Charges	7,331	13 6
		Municipal Tax	732	7 6
		Laboratory Contingency	379	13 0
		Laboratory Building Repairs	700	7 9
		Workshop Charges	168	13 6
		Audit Fee	150	0 0
		Insurance	125	0 0
		Science Congress Ticket	12	0 0
		Donation	100	0 0
		Postage	77	6 9
		Miscellaneous Charges	24	15 0
		Renovtion of Electric Wiring	184	2 3
		War Emergency	209	13 6
		Refund of Subscription	17	0 0
		Advertisement	65	9 6
		Equipment of Chemical Laboratory	493	13 6
		stock of Paper	172	0 0
		Gratuity to a Peon	254	0 0
		Arrangement for Meeting	203	12 0
		Library Reserve Fund	3,675	0 0
		Payment to Prof. Krishnan	243	4 9
		Fund at Close	2,14,388	10 9
		TOTAL Rs.	2,52,420	12 3

Examined and found correct,
S. N. Mukherji, F.S.A.A., R.A.,
 Incorporated Accountant,
 Registered Accountant.

INDIAN ASSOCIATION FOR

Receipts and Payments Account of

RECEIPTS		Rs. As. P.	Rs. As. P.
Opening Balance as at 1-1-43	... ..	...	7,917 5 4
Dr. Sircar Research Medal Fund			
Interest	... ..	170 14 0	
Nikunja Garabini Prize Fund			
Interest	... ..	35 0 0	
Jatindra Chandra Prize Fund			
Interest	... ..	35 0 0	
Hare Professorship Fund			
Interest	... ..	52 8 0	
Joykissen Mookherjee Gold Medal Fund			
Interest	... ..	466 15 0	
Sale of Special Publication	... ..	3 3 0	
Coochbehar Professorship Fund			
Interest	... ..	770 9 0	
Building Fund			
Interest	... ..	267 2 0	
Ripon Professorship Fund			
Interest	... ..	793 13 0	
Woodburn Medal Fund			
Interest	... ..	52 8 0	
Victoria Professorship Fund			
Interest	... ..	52 8 0	
Vehari Lala Mitra Fund			
Interest	... ..	4,620 0 0	
Mahendra Lal Sircar Professorship Fund			
Interest	... ..	5,227 15 0	
Life Membership Fees	... ..	2,000 0 0	
			14,547 15 0
TOTAL Rs.			22,465 4 4

1-B, Old Post Office Street,
CALCUTTA.
15th February, 1944.

THE CULTIVATION OF SCIENCE

Special Funds for the year 1943.

PAYMENTS				Rs. As. P.		Rs. As. P.	
Dr. Sircar Research Medal Fund							
Commission	1	11 0
Repayment to General Fund	298	8 0
Nikunja Garabini Prize Fund							
Commission	0	8 0
Jatindra Chandra Prize Fund							
Commission	1	0 0
Hare Professorship Fund							
Commission	0	8 0
Repayment to General Fund	51	0 0
Joykissen Mookherjee Gold Medal Fund							
Commission	5	4 0
Coochbehar Professorship Fund							
Commission	12	2 0
Building Fund							
Commission	1	15 0
Ripon Professorship Fund							
Commission	3	8 0
Woodburn Medal Fund							
Commission	1	0 0
Victoria Professorship Fund							
Commission	1	0 0
Repayment to General Fund	51	0 0
Vehari Lala Mitra Fund							
Commission	12	4 0
Salary and Provident Fund of M.L.S. Prof.	4,062	8 0
Mahendra Lal Sircar Professorship Fund							
Commission	14	8 0
Salary and Provident Fund of M.L.S. Professor	4,062	8 10
3½% G. P. Notes (face Value Rs. 1,000/-)	957	1 6
Closing Balance as on 31.12.43.	12,927	6 10
TOTAL Rs.							
						22,465	4 4

Examined and found correct
S. N. Mukherji, F.S.A.A., R.A.
 Incorporated Accountant,
 Registered Accountant.

THE CULTIVATION OF SCIENCE

PROVIDENT FUND

31st December, 1943.

ASSETS					Rs. As. P.	Rs. As. P.
LOANS	
Mr. D. P. Roy	27 0 0
„ H. Mukherjee	1 10 0
D. N. Das	236 4 0
S. C. Das	87 10 0
Other Investments						
3% G. P. Notes (Face Value Rs. 5,000/-)	4,978 12 0
Fixed Deposit	2,000 0 0
Imperial Bank of India, Savings Account	2,519 14 11
Suspense	125 0 0
TOTAL	9,976 2 11

Examined and found correct
S. N. Mukherji, F.S.A.A., R.A.
 Incorporated Accountant,
 Registered Accountant.

APPENDIX III
INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE
BUDGET ESTIMATES FOR THE YEAR 1944

Receipts						Expenditure						
ACCOUNTS	Actuals 1941	Actuals 1942	Revised Budget Estimates 1943	Actuals 1943	Budget Estimates for 1944	ACCOUNTS	Actuals 1941	Actuals 1942	Revised Budget Estimates 1943	Actuals 1943	Budget Estimates for 1944	
	Rs. As. P.	Rs. As. P.	Rs. As. P.	Rs. As. P.	Rs. As. P.	Rs.	Rs. As. P.	Rs. As. P.	Rs. As. P.	Rs. As. P.	Rs. As. P.	
Membership Fees						1. Staff—Research Department—						
Life		3,075 8 0	1,000 0 0	2,000 0 0	2,000 0 0	(a) M. L. S. Prof. 750 (1)	9,000					
Ordinary	110 0 0	442 0 0	440 0 0	1,011 0 0	1,000 0 0	(b) Reader 350 (1)	4,200					
Indian Journal of Physics						(c) Research Assistant 150 (1)	1,800					
Reprints	60 0 0		60 0 0			(d) Research Assistant 125 (1)	1,500					
Subscription	1,429 11 0	862 2 0	850 0 0	1,249 5 6	1,200 0 0	(e) Research Scholar 75 (5)	4,500	21,607 10 3	15,365 15 6 ¹¹	23,073 0 0	21,707 15 9	22,512 0 0
Physical Society	630 0 0		1,320 0 0	660 0 0 ¹	660 0 0 ¹	(f) Laboratory Assistant 78 (1)	918				750 ¹ 0 0	4,200 0 0
Advertisement	16 0 0					(g) Library Attendant 29 (1)	336					
Rent	5,426 8 0	4,993 14 0	4,070 4 0	4,070 4 9	5,427 0 0 ²	(h) Laboratory Attendant 15 (1)	180					
Demonstration Allowance	450 0 0	700 0 0	650 0 0	550 0 0 ³	650 0 0	2. Workshop—						
Sale of Old Materials	67 7 0	11 1 0	10 0 0			Mechanics 95 (1), 60 (1), 21 (1), 40 (1)	2,586					
Staff Income Tax	733 1 0	331 10 0	699 2 0	754 8 0	874 8 0	Peon 15 (1), 15 (1)	360					
Interest on						Dearness allowance	1,332					
(a) Veharilala Mitra & (b) Mahendra Lal Sircar Prof. Funds	9,756 0 0	9,765 0 0	9,852 8 0	9,841 15 0	9,852 8 0	3. Equipment & Working Expenses of Laboratories—						
(c) General Fund	678 0 0	573 10 0	577 8 0	681 13 0	577 8 0	Non-recurring grant to M. L. S. Prof.	2,929 4 3	1,576 6 3	2,000 0 0	7,331 13 6	2,000 0 0	
Government of India Grant	18,000 0 0	18,000 0 0	18,000 0 0	9,000 0 0	18,000 0 0	Special Apparatus	1,984 11 9		8,000 0 0			12,000 0 0 ⁷
Municipal Tax, Occupiers' share	335 7 6	650 10 6	489 6 0	489 6 0	489 0 0	Provision of Chemical Apparatus	360 0 0					2,685 0 0 ²
Special Scholarship	325 0 0	260 0 0				Renovation of Laboratories	187 12 0					
Library Deposit	10 0 0			40 0 0	40 0 0	Equipment of Chemical Laboratory			3,000 0 0	493 13 6	3,000 0 0	2,507 0 0 ²
Contribution from S. D. O's School				200 0 0	1,440 0 0	Repair of Laboratory Buildings		7,218 0 0	1,000 0 0	700 7 9	100 0 0	100 0 0
Amount received from Special funds	135 12 0					Repair of Electric Fittings		501 15 9	200 0 0	184 2 3	100 0 0	100 0 0
Miscellaneous receipts		81 11 0		25 9 0		Contingent expenses	814 5 6		700 0 0	379 13 0	700 0 0	700 0 0
Suspense		687 4 0		2,359 2 0		Workshop (non-recurring)	627 6 3		250 0 0	168 13 6	308 0 0	308 0 0
Dr. Bimala Churn Law Gold Medal Fund				5,000 0 0		Gas	315 3 0		510 0 0	437 12 0	500 0 0	500 0 0
Repayment from Provident Fund Account	42 14 0	22 0 0		175 0 0		Electricity	830 10 0	485 2 0	950 0 0	791 6 0	800 0 0	800 0 0
Add proceeds from transfer of Govt. securities to different funds	4,291 14 0					4. Office Establishment—						
From M. L. S. Prof. Fund in part payment of loan advanced from General Fund		2,984 8 0			5,600 0 0	Ministerial Staff 110 (1), 34 (1)	1,686					
Contribution from Govt. of India for Dearness Allowance					570 0 0	Menials 21 (1), 15 (1), 14 (1)	600					
Repayment in part from Special Fund to General Fund		102 0 0		102 0 0		Dearness Allowance	696					
Opening Balance	27,387 4 5	26,928 12 9	26,928 12 9	27,036 12 3	13,833 0 0	Cycle allowance	12					
	42,619 15 4	43,542 14 6	38,018 12 0	38,209 15 3	58,340 8 0	2,994		2,158 1 3	2,495 13 0	2,554 0 0	2,446 9 3	2,994 0 0 ⁸
						5. Contribution to Provident Fund—		1,502 4 0	897 5 0	1,095 0 0	983 3 0 ¹⁰	1,185 8 0
						Advance to Provident Fund		22 0 0				
						6. General—						
						Telephone	225 2 0	223 7 0	300 0 0	282 12 0	280 0 0	280 0 0
						Postage	42 5 0	66 1 3	100 0 0	77 6 9	100 0 0	100 0 0
						Printing	162 3 0	188 1 3	368 8 0	209 9 0	368 0 0	368 0 0
						Audit Fee	150 0 0	150 0 0	150 0 0	150 0 0	150 0 0	150 0 0
						Insurance	125 0 0	125 0 0	125 0 0	125 0 0	125 0 0	125 0 0
						Office Stationery & Contingency	244 7 6	254 0 0	180 0 0	180 6 6 ³	240 0 0	240 0 0
						Bank Charges for General Fund	13 10 0	13 6 0	20 0 0	6 14 0	7 0 0	7 0 0
						" for V. L. M. & M. L. S. Funds	26 0 0	50 0 0	40 0 0	26 12 0	30 0 0	30 0 0
						Paper for Annual Report		249 9 0			100 0 0	100 0 0
						Provision for Paper and Stationery for office consumption			1,800 0 0	1,720 13 6		51 0 0 ²
						Indian Journal of Physics	2,681 8 0	3,093 3 0	2,620 0 0	735 0 0	1,800 0 0	1,800 0 0
						Provision for paper			2,620 0 0	735 0 0	1,800 0 0	1,885 0 0 ⁶
						7. Library—		1,546 7 0	1,262 0 3		1,678 7 6	1,200 0 0
						Journal			1,200 0 0		1,200 0 0	1,200 0 0
						Books			500 0 0		500 0 0	500 0 0
						Binding			200 0 0		200 0 0	200 0 0
						Library Reserve Fund			3,675 0 0	3,675 0 0	1,000 0 0	1,000 0 0
						Library Deposit Refund		10 0 0				
						Municipal Tax	779 10 0	1,025 14 0	1,026 0 0	732 7 6	1,026 0 0	294 0 0 ²
						Contribution to Science News Association	100 0 0	100 0 0	100 0 0	100 0 0	100 0 0	100 0 0
						Travelling Allowance	45 3 6	134 1 6	100 0 0	92 0 0	100 0 0	100 0 0
						Advertisement	14 0 0		40 0 0	65 9 6 ⁵	60 0 0	60 0 0
						Furniture	190 0 0		140 0 0	4 14 0	50 0 0	50 0 0
						Misc. Repairs	435 11 0			24 15 0		
						Special Scholarship	325 0 0	260 0 0				
						Arrangement for meetings	295 11 0	32 8 0	300 0 0	203 12 0	200 0 0	200 0 0
						Science Congress Ticket	10 0 0	10 0 0	12 0 0	12 0 0	12 0 0	12 0 0
						Staff Income Tax	773 1 0	331 10 0		700 15 0	874 8 0	874 8 0
						Suspense	235 0 0	474 8 0		2,408 0 0	(per contra)	(per contra)
						Refund of subscription		7 0 0		108 0 0		
						War emergency		1,863 14 0	200 0 0	209 13 6	200 0 0	200 0 0
						Investment of life membership fees A/c M. L. S. Prof. Fund		1,402 10 3		957 1 6		
						Amount transferred to General Fund on account of advance to M. L. S. Prof. Fund		2,984 8 0				5,600 0 0
						Investment account—						(per contra)
						Dr. Bimala Churn Law Gold Medal Fund						5,000 0 0
						Cost of Medal						175 0 0
						Portrait of Sir Nilratan Sircar						200 0 0
						Payment on account Provident Fund of Prof. Krishnan				243 4 9		
						Gratuity to a Peon				254 0 0		
						Imprest account				150 0 0		
						Closing Balance	43,148 14 0	43,434 15 0	56,528 8 0	51,419 11 6	77,639 0 0	77,639 0 0
						TOTAL Rs.	26,858 5 9	27,036 12 3	8,484 0 9	13,833 0 0	5,465 8 0	5,465 8 0
							70,007 3 9	70,471 11 3	65,012 8 9	65,252 11 6	72,173 8 0	72,173 8 0

* Rs. 2,000/- Credited to M.L.S. Prof. Fund.

¹ Rs. 660/- Arrear of 1942 realised in 1943.
660/- To be realised.

² Increase due to withdrawal of remission.

³ Included Rs. 200/- for 1942.

⁴ Rs. 300/- Arrears for 1943.

⁵ Rs. 9,000/- Balance of contribution due for 1943-44 expected to be realised 1944.

¹ The salary of M.L.S. Prof. for December 1943 paid on 23.12.43.

² Outstanding bills.

³ Increase due to an arrear bill for Rs 5-13-9

⁴ For the thorough overhaul of the Royal Typewriter,

⁵ Rs 7-8-0 on account of arrears bill for 1942 and Rs 19/- paid in anticipation of new budget.

⁶ Balance of the provision of paper for Indian Journal of physics for regrant.

⁷ As requisitioned by M.L.S. Prof.

⁸ Increase due to dearness allowance. ⁹ Increase due to enhanced rates of printing etc. (membership list, annual report including president's speech.)

¹⁰ As M.L.S. Prof. was appointed on March 1st 1943,

¹¹ Decrease due to the vacancy of M.L.S. Professorship Chair.

BANI PRESS, CALCUTTA