MATSCIENCE

INSTITUTE OF MATHEMATICAL SCIENCES
MADRAS, INDIA

ANNUAL REPORT 1964

THE INSTITUTE OF MATHEMATICAL SCIENCES,

MADRAS

" THE PURSUIT OF SCIENCE IS AT ITS BEST

WHEN IT IS PART OF A WAY OF LIFE"

ANNUAL REPORT 1964

PATRON :

Mr. C. Subramaniam, Union Minister for Food and Agriculture.

CHAIRMAN OF THE BOARD OF GOVERNORS :

Mr. R. Venkataraman,

Minister for Industries, Government of Madras.

DIRECTOR :

Professor Alladi Ramakrishnan.

HONORARY PROFESSOR, ASTROPHYSICS :

Professor S. Chandrasekhar, F.R.S.

Distinguished Service Professor, Enrico Fermi Institute of Nuclear Studies,

University of Chicago, Chicago, Illinois, U.S.A.

Board of Governors

1.	Mr. R. Venkataraman, Minister for Industries, Government of Madras, Madras.	Chairman
2.	Mr. V. Balasundram, I.A.S., Secretary to Government, Education & Public Health Department, Government of Madras, Madras.	Member
3.	Professor H. J. Bhabha, F.R.S. Secretary to Government of India, Department of Atomic Energy and Chairman, Atomic Energy Commission, Bombay.	,,
4.	Professor Alladi Ramakrishnan, Director, The Institute of Mathematical Sciences, Madras.	,,
5.	Dr. R. Vasudevan, Permanent Member, The Institute of Mathematical Sciences, Madras.	,,
6.	Professor G. N. Ramachandran, Department of Physics, Univertity of Madras, Madras.	,,

Finance Committee

1.	Mr. V. Balasundram, I.A.S., Secretary to Government, Education and Public Health Department, Government of Madras, Madras.	Chairman
2.	Mr. G. Ramachandran, I.A.S., Joint Secretary to Government, Finance Department, Government of Madras, Madras.	Member
3.	Professor Alladi Ramakrishnan, Director, The Institute of Mathematical Sciences, Madras.	,,
4.	Dr. R. Vasudevan, Permanent Member, The Institute of Mathematical Sciences, Madras.	,,

Academic Council

1.	Professor Alladi Ramakrishnan, Director, The Institute of Mathematical Sciences, Madras.	Chairman
2.	Dr. R. Vasudevan, Permanent Member, The Institute of Mathematical Sciences, Madras.	Member
3.	Dr. N. R. Ranganathan, Associate Member, The Institute of Mathematical Sciences, Madras.	,,
4.	Dr. T. K. Radha, Associate Member, The Institute of Mathematical Sciences, Madras.	,,

The aims and objects

1. To create and provide an atmosphere and environment suitable for creative work and the pursuit of knowledge and advanced learning in the Mathematical Sciences for their own sake,

2. To promote and conduct research and original investigation in fundamental sciences in general, with particular emphasis in Mathematics, Applied Mathematics, Theoretical Physics and Astrophysics,

3. To foster a rigorous mathematical discipline, to stimulate a zest for creative work and cultivate a spirit of intellectual collaboration among academic workers in pure and applied branches of science,

4. To arrange lectures, meetings, seminars and symposia in pursuance of its academic work and for the diffusion of scientific knowledge,

5. To invite scientists in India and abroad actively engaged in creative work to deliver lectures and participate in its academic activity.

Facilities will be offered to visiting scientists to spend considerable time in the Institute and work in collaboration with the members of the permanent staff. In the first instance it is proposed to have four faculties: Theoretical Physics, Astrophysics, Mathematics and Applied Mathematics. The permanent staff will consist of professors and members in these faculties whose duty will be to pursue research and participate in discussions, lectures and symposia.

THE INSTITUTE OF MATHEMATICAL SCIENCES

The year 1964 in retrospect

An eventful year

The third year has run its eventful course; this Institute which had outgrown its infancy soon after its birth is now well set on its forward career of creative activity with hope and confidence.

The Annual Symposium

Customary to our tradition, the year opened with a symposium on high energy physics, presided over by Professor L. Rosenfeld of Copenhagen, our second Niels Bohr Professor and inaugurated by the Hon'ble Mr. C. Subramaniam, the Patron of our Institute. Professor Marshall H. Stone, Distinguished Service Professor of the University of Chicago accepted the Ramanujan Professorship and graced the symposium with his presence and participation by giving supplementary lectures.

Our permanent staff

It has been a year of very fruitful scientific activity - a claim we make, excusably with a trace of immodest enthusiasm. The small and select band of three permanent members of our staff have made a great effort in stimulating an atmosphere of intense activity which has attracted, a steady stream of young aspirants to research careers to seek opportunities in our Institute. Their research contributions have been in keeping with the quality of work from similar institutions elsewhere in the world. We are keenly aware that in so competitive a domain as theoretical physics we cannot make compromises in standards and we have to demand excellence both in effort and in achievement. Our task is rendered more onerous since we have to reckon with the real and present danger of an exodus of talent seeking for more lucrative opportunities in affluent countries like the United States. By a fortuitous circumstance, the entire team of workers associated with us seems to be of one nature and substance bred and has imbibed in good measure the spirit and ideals of this new institution.

Visiting scientists

To their efforts have been added a new surge of strength and impulse far stronger than anything known upto this time in the history of scientific education in our country. The visiting scientists programme which had received additional support through the assent of our late beloved Prime Minister provided the main channel for the flood of new ideas and increased incentive for scientific effort. All creative work is the product of effort that takes by storm instead of by slow laborious and elaborate approaches. Our Institute provides a suitable forum for such a clash of intellects out of which should emerge work of originality and invention which alone can enforce the attention of the scientific world.

Our generous sponsors

To reach our aims we need the wholehearted and unstinted support from the administrators on the one hand and the scientific community in India on the other. The Madras Government has been generous to an extent which has matched the fine response we are having from the international community of scientists. The Atomic Energy Commission is meeting a third of our financial demands while the Council of Scientific and Industrial Research is supporting us with fellowships and *ad hoc* grants for the summer school. The academic groups from various Universities and research institutions have just begun to realise the depth and extent of this endeavour and have slowly begun to collaborate in our scientific meetings and symposia. We hope that within a few years, the spirit of collaboration will spread and become part of our academic way of life.

Our local habitation

When the Institute was started, it was just an idea – a soul without a body, for we did not even have a place under the sun. We wish to express our gratitude to the Government of Madras and to the Department of Technical Education in particular, for having given us this temporary but very comfortable venue for work. The day does not seem to be for off, when we will have our own permanent buildings with residential accommodation for our visitors from outside India who are coming at great personal inconvenience to themselves in ready response to our invitations. Their never complaining nature has embarrassed us, all the more when they praise the weather of Madras to induce their colleagues from Naples and Paris to visit us.

Our aims

Here and there, some unhelpful criticisms were raised, garnished of course with restrained praise, that our efforts were confined only to theoretical physics and should extend to the wider domain of mathematical sciences. To such critics, our only reply is that our Institute, like poetic fancy, has been conceived as a whole and is being executed in parts.

International collaboration

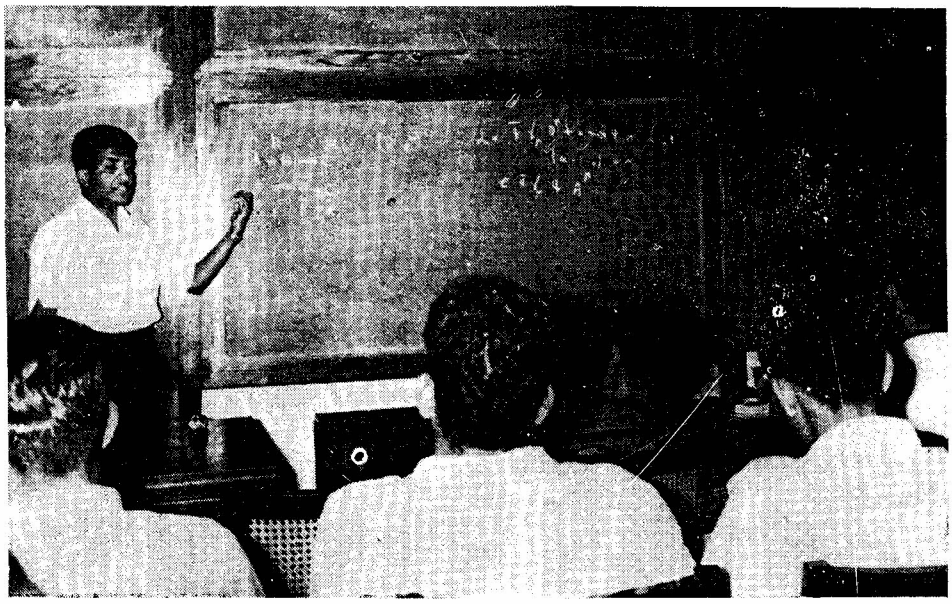
We are guided in our efforts by the solicitous interest and advice of leaders of scientific groups in various centres of research in the world to-day. In particular I wish to reiterate our grateful thanks to Professor Schiff at Stanford, Professor Marshak at Rochester, Professor Watson at Berkeley, Dr. Jacob from Saclay and Professor Caianiello at Naples for offering opportunites to our academic staff to spend sometime in their institutions. Presently we will be establishing contact with the International Centre for Theoretical Physics at Trieste with the valued assistance of its eminent Director, Professor Abdus Salam. The keen interest which the Director-General of CERN is showing in our progress implies that our contact with CERN, already close through our association with some of its representatives who have visited us, will grow in the years to come.

Equally exciting is the new stimulus from the research centres in the Soviet Union especially after the Dubna conference this year when I had the pleasure of watching the work of two of our members being presented by their collaborators in the United States.

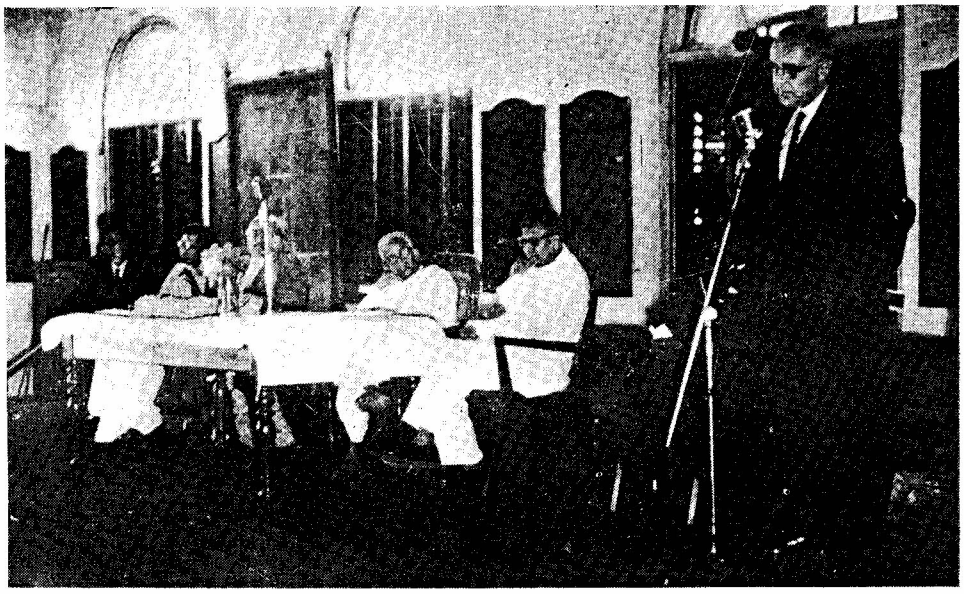
Future prospect

A new entrant to theoretical Physics could not have hoped for a more propitious time to commence his research career. New results of experimental work are pouring forth from the great laboratories of the world like Brookhaven, CERN, Berkeley and Stanford in such sequent succession and heady currance that our imagination plays with hitherto, forbidden concepts of fractional charges and fictitious particles; A triple strangeness has hit our senses; Out of the riot of fancy and imagination the scientist hopes, there will emerge a view of the physical world, unitary, symmetric, with that touch of sweet disorder and weak deviation which marks out the mathematical sciences as a special group of intellectual endeavours to enable us to comprehend the structure and content of the universe in which we live.

ALLADI RAMAKRISHNAN



Professor E. C. G. Sudarshan lecturing in the Second Anniversary Symposium, 1964



Professor McCrea Hazlett delivering the Second Anniversary address, Hon'ble Mr. M. Bakthavatsalam, Chief Minister, presiding.

News of the Institute

The Institute entered the third year of its activities this year. The Second Anniversary was celebrated on Pongal day the 13th January, 1964. The Hon'ble Sri M. Bhakthavatsalam, Chief Minister of Madras, presided over the function and the Hon'ble Sri R. Venkataraman, Minister for Industries and Chairman, Board of Governors of the Institute, welcomed the gathering. Professor McCrea Hazlett, Vice-President of the University of Rochester, U.S.A., delivered the Anniversary address.

Professor L. Rosenfeld, NORDITA, Copenhagen, was the Second Nields Bohr Visiting Professor. Professor M. H. Stone, Distinguished Service Professor of Mathematics, Chicago University, was the First Ramanujan Visiting Professor.

A symposium, under the Chairmanship of Professor L. Rosenfeld, Second Niels Bohr Visiting Professor, on 'Recent Trends in Theoretical Physics' was organised from 3rd January to 7th January 1964. It was inaugurated by the Hon'ble Sri C. Subramaniam, then Union Minister for Steel, Mines and Heavy Engineering.

Besides the members of MATSCIENCE, Prof. R. Hagedorn, Germany; Prof. B. Zumino, U.S.A. Dr. Jacob, France, Dr. F. Mohling, U.S.A., from abroad and Dr. Udgaonkar, Tata Institute of Fundamental Research; Dr. A. N. Mitra, Delhi University and Dr. S. P. Misra, Roorkee University, from India participated in the symposium.

The first MATSCIENCE Summer School was organised at Bangalore from 24th August to 13th September, 1964. The invited lecturers were:

Professor R.Oehme, Chicago, U.S.A.
Professor E.R. Caianiello, Naples, Italy.
Professor K. Symanzik, New York, U.S.A,
Professor W.Brenig, Munchen, W. Germany.
Dr.F.Calogero Rome, Italy.
Dr. A. Fujii, Tokyo, Japan.
D. J. Lukierski, Wroclaw, Poland.
Professor M. Venkataraman, Madras University, Madurai.
Dr. S. K. Srinivasan, Indian Institute of Technology, Madras.
Dr. V. Devanathan, University of Madras, Madras.
Dr. R. Vasudevan, MATSCIENCE, Madras.
Dr. N. R. Ranganathan, MATSCIENCE, Madras.
Dr. T. K. Radha, MATSCIENCE, Madras.
Dr. K. Venkatesan, MATSCIENCE, Madras.

Student participants came from MATSCIENCE, the Tata Institute of Fundamental Research, Bombay and University of Roorkee. Also lecturers from the educational institutions in Madras and Bangalore availed themselves of this opportunity to attend the Summer School.

Under the visiting scientists programme supported by Government of Madras and Council of Scientific and Industrial Research, distinguished scientists of established reputation as well as younger scientists of great promise have visited the Institute to deliver lectures, participate in seminars, symposia and summer school and also to actively collaborate with the members of the Institute. A list of visiting scientists under the above schemes for the year 1964 with the period of their visit and the titles of the lectures delivered by them is given at the end of this report.

One of the happy features in this year was the recruitment of about ten students under the Research Training Scheme, purpose of which is to train promising young people fresh from M. Sc., classes in the methods of research and to provide them with facilities for attending lectures and seminars at the Institute.

The publications of the Institute include research papers based on work carried out by members of MATSCIENCE and the visiting scientists, MATSCIENCE Reports and Seminar Lectures. The monthly report on recent experimental data was continued as it is found very useful. As a companion to above, a monthly report on recent theoretical developments was also introduced this year.

Arrangements were concluded with the Plenum Press, New York, U.S.A., for the publication of the proceedings o the annual MATSCIENCE symposia and proceedings of the summer school.

The Institute moved to the new premises at the beginning of this year. Because of of the availablity of adequate space, both staff and students have excellent working conditions. Visiting scientists are now provided with separate cubicles. to enable them to spend most of their time in the Institute.

Delegations

Professor Alladi Ramakrishnan was invited as a participant to the International Conference on High Energy Physics held at Dubna (U.S.S.R.) from 4th to 15th August, 1964. He was chairman for one of the sessions on Pion Physics during the conference. Two papers in which Dr. T. K. Radha and Mr. T. S. Santhanam of the Institute had collaborated with Professor Schiff's group of Stanford and Professor Sudarshan's group at Rochester respectively, were presented at the conference.

On his way to Russia, the Director spent a week at the Physics Department at Saclay, France at the invitation of Professors C. De. Dominicis and M. Jacob. He acquainted himself with the experimental work being done on high energy physics, on the 'Saturne' accelerator. He visited the CERN, Geneva, particularly to meet the experimenters in the Laboratory.

Dr. T. K. Radha, Associate Member, spent a year at the Physics Department, Stanford University, doing post-doctoral research under Professor L. I. Schiff, the executive head of the Department. She did work in collaboration with Professor Schiff and N. T. Meister on "Three body wave functions" and in collaboration with N. T. Meister on weak interactions.

During her stay at Stanford, she was invited to various universities in U. S. A. to give seminars and talks. After attending the Brookhaven Conference on Weak Interactions, she was invited by Professor R. E. Marshak to spend a week at the Physics Department of the University of Rochester, Rochester, New York. She gave seminars on her research work at the Physics Department, University of Colorado, Boulder at the invitation of Professor Saltzman; at the Physics Department, University of California, Berkeley at the invitation of Professor S. Goldhaber; at the Physics Department, University of Washington, Seattle at the invitation of Professor Wilets; at the Physics Department, University of California, Los Angeles at the invitation of Professor N. Byers and at the Physics Department, Stanford University. On her way back to India, she visited the Yukawa Hall, Kyoto (Japan) on the invitation of Dr. E. Yamada and the Tokyo University, Tokyo on the invitation of Professor Miyamoto to give lectures summarising her recent work.

She resumed her duty at Matscience in July.

The Director is a member of:

1. The Editorial Board of the 'Journal of Mathematical Analysis and Applications. (US)
2. Cosmic Ray Committee (A. E. C., India)
3. Physical Research Committee (C. S, and I. R., India).

The Faculty of Theoretical Physics

The Director of the Institute, Professor Alladi Ramakrishnan, is the Professor of this faculty. At the end of the year, the staff of this faculty consisted of a Permanent Member, Two Associate Members, a Temporary Member, short term Temporary Members and nine Research Fellows.

There were nineteen visiting scientists under the visiting scientists programme.

Research Activity:

The research work carried out in this faculty was mainly in two fields: Elementary Particle Physics (including general quantum field theory) and many body problems.

ELEMENTARY PARTICLE PHYSICS

Quantum mechanics and quantum field theory:

1. R. Vasudevan and N. R. Ranganathan have used the Pfaffian techniques to evaluate some Dirac spurs.
2. J. Lukierski has carried out an investigation on the Lagrangian theory for arbitrary spin particle.
3. F. Calogero has studied the necessary conditions of the existence of bound states.
4. R. Vasudevan and N. R. Ranganathan are looking into the different aspects ot the renormalization programme with regard to interactions involving vector mesons or four fermions.
5. J. Lukierski has made investigation on the quantum variables and the proper choice of the subsidiary condition for non-Abelian gauge field and on some gauge properties of propagators in the quantum theory of non-Abelian vector gauge fields.
6. R. Vasudevan, N. R. Ranganathan and G. Jagannathan are studying the Peratisation methods in field theory and the allied problems of solving Schrodinger equations with singular potentials.

Electromagnetic and Strong Interactions:

1. Alladi Ramakrishnan, K. Raman and R. K. Umerjee continued their earlier work on Isobar production in nucleon-nucleon collisions and have also studied the polarization effects.
2. E. C. G. Sudarshan, L. O'Raifeartaigh and T. S. Santhanam have made investigations on the Origin of internal symmetry and charge conservation in strong interactions.
3. T. S. Shankara has studied the unified solution for scattering and bound states of a Dirac particle in coulomb field.

4. K. Raman has made some study on scalar $K\pi$-resonances.
5. L. O'Raifeartaigh and B. Gruber carried out an investigation on the construction of the invariants for the simple Lie groups.
6. T. S. Santhanam has made an observation on the charge structure of the members of the basic triplet of SU_3.
7. T, S. Santhanam has made a study on the fractional quantum numbers occuring in unitary symmetry.

Weak Interactions:

1. T. K. Radha and N. T. Meister made calculations on the electric dipole moment of a nucleon assuming T violation in weak interactions.
2. Alladi Ramakrishnan and T. K. Radha are making estimates on the electric dipole moments of leptons.

Cosmic Rays:

1. Alladi Ramakrishnan, R. Vasudevan and S. K. Srinivasan of the Indian Institute of Technology, Madras continued their study on the new mathematical features in cascade theory.

Nuclear Physics:

1. G. Ramachandran and R. K. Umerjee have studied the helicity of the final electron in electron-deuteron scattering.
2. R. K. Umerjee has made some calculations on the deuteron polarization following elastic scattering of positive pions.
3. L. I. Schiff, T.K. Radha and N.T. Meister have studied slow neutron capture by deuterium to understand the structure H^3 using gaussian wave functions for H^3.
4. T. K. Radha and N. T Meister enlarged the above study using Irving and Irving - Gunn wave functions also for H^3.
5. G. Ramachandran and K. Ananthanarayanan have studied the photoproduction of charged pions from deuterons.
6. G. Ramachandran and K. Ananthanarayanan carried out some investigation on the photoproduction and scattering of pions from He^3 and H^3,
7. R. K. Umerjee has investigated the scattering of pions from complex nuclei.

Many Body Problems:

1. R. Vasudevan, N. R. Ranganathan and K. Venkatesan are studying phase Transitions in case of Ising Model and other allied phenomena.
   R. Vasudevan and N. R. Ranganathan have done investigations in the following topics.
2. Use of Variational principles obtained through renormalization procedure for different many body systems like condensed Bose gas, and inhomogeneous electron gas.
3. New and improved methods of partial summation of graphs occuring in many body theory by using techniques based on pfaffians and hafnians.

List of Matscience Reports

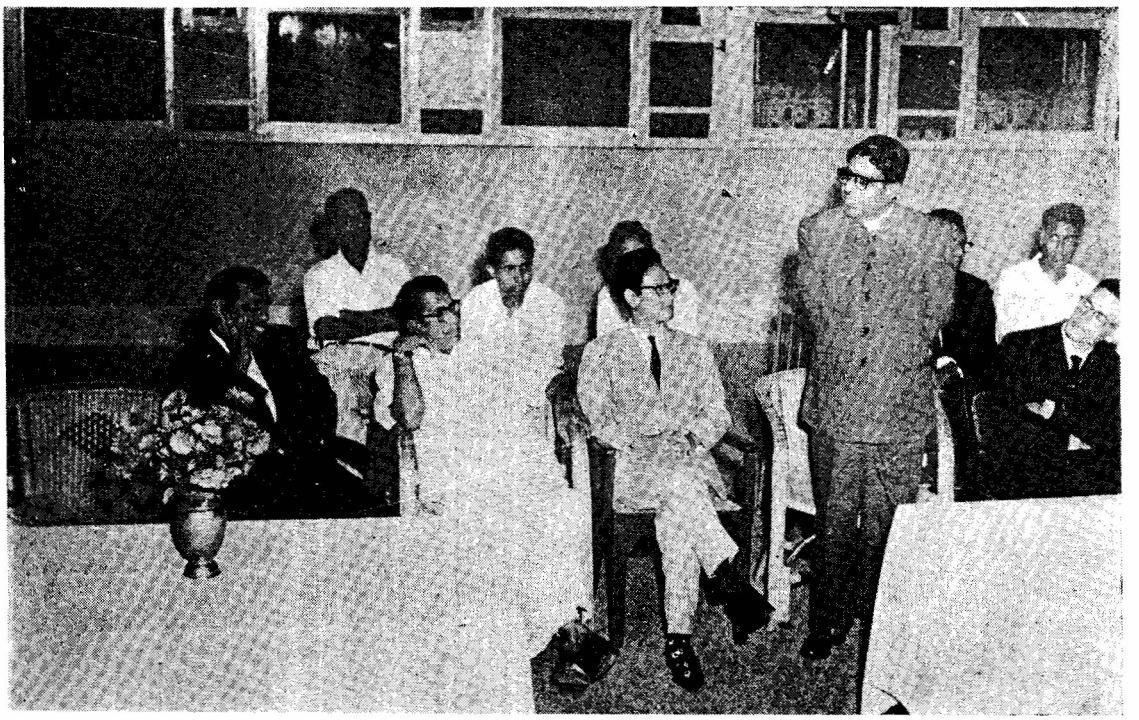
Author	*Title*
Marshak (R E)	Lectures on Weak interactions.
Sudarsan (E C G)	Lectures on foundations of quantum mechanics and field theory.
Roman (P)	Lectures on an introduction to dispersion relation techniques.
...	Proceedings of the Second anniversary symposium January 1964.
Hagedorn (R)	Lectures on the relativistic kinematics and polarization.
Jacob (M)	Lectures on the theory of strong interactions.
Kamefuchi (S)	Lectures on parastatistics.
Raifeartaigh (L 'O)	Lectures on local lie groups and their representations.
Stapp (Henry P)	Lectures on analytic S-matrix theory.
Yamada (E)	Lectures on broken symmetry and Goldstone Boson.
Zumino (B)	Lectures on magnetic properties of a super conductor.
Mohling (F)	Introduction to quantum statistical mechanics of degenerate Bose systems.
Zumino (B)	Lectures on gauge invariance and mass of vactor Bosons.
Sudarshan (E C G)	Lectures on origin of symmetries.
Lukierski (Jerzy)	Lectures on gauge transformations in quantum field theory.

Pre-print List

Author	*Title*
Prof. E. C. G. Sudarshan, Prof. L. O' Raifeartaigh and T. S. Santhanam.	The origin of internal symmetry and charge conservation in strong interactions.
Prof. L. O' Raifeartaigh and Prof. B. Gruber	Construction of the invariant for the simple lie groups.
R. K. Umerjee	Deuteron polarization following elastic scattering of positive pions.
G. Ramachandran and K. Ananthanarayanan	Photo-production of charged pions from Deutrons.
T. S. Santhanam	Unified solution for scattering and bound states of a Dirac particle in a coulomb field.
K. Raman	On scalar K. $-\pi$ resonances.
G. Ramachandran and K. Ananthanarayanan	Photo-production of pions from H^3 and He^3.
G. Ramachandran and K. Ananthanarayanan	Scattering of poins from H^3 and He^3.
R. K. Umerjee	Scattering of pions from complex nuclei.
T. K. Radha and N. T. Meister	Thermal neutron capture-by deutrium and three-body wave functions.
N. R. Ranganathan and R. Vasudevan	Remarks on Dirac spurs and Pfaffians.
G. Ramachandran and R. K. Umerjee	Helicity of the final electron in electron-deutron scattering.
Alladi Ramakrishnan, K. Raman and R. K. Umerjee	Isobar production in nucleon-nucleon collisions II. Polarization effects.
Dr. J. Lukierski	The quantum variables and the proper choice of the subsidiary condition for non-Abelian Gauge fields.
Dr. J. Lukierski	Gauge properties of propagators in the quantum theory of non-Abelian gauge fields.
T. S. Santhanam	Unitary symmetry and fractional quantum numbers.
T. S. Santhanam	A note on the charge structure of Basic triplets of the SU (3) Model.

Re-prints List

Author	*Title*
G. Ramachandran and V. Devanathan	Nuclear polarization following photo-production of pions from nuclei (I). [Nuclear Physics, Vol. 48/3, pp. 369–374]
G. Ramachandran and V. Devanathan	Nuclear polarization following photo-production of pions from nuclei (II). [Nuclear Physics, Vol. 50, pp. 593–598]
S. K. Srinivasan and K. Venkatesan	The strip approximation and the photo-production of pions on pions. [Nuovo Cimento 30 (1963) pp. 151–162]
G. Ramachandran and R. K. Umerjee	Deutron polarization following neutral pion photo-production. [Nuclear Physics, 54 (1964) pp. 665–672]
Alladi Ramakrishnan, K. Venkatesan and V. Devanathan	A note on the use of Wick's theorem. [Journal of Mathematical Analysis and applications. Vol. 8, 2 (1964) pp. 345–349]
V. Devanathan and K. Ananthanarayanan	Photo-production of charged pions from deutrons. [Nuovo Cimento 32 (1964) pp. 723–726]
R. E. Marshak, C. Ryan, T. K. Radha and K. Raman	Universal theory of Semi-weak interactions. [Nuovo Cimento 32 (1964) pp. 408–432
Matscience	Some recent trends in theoretica l physics. [Journal of Scientific and Industrial Research, (1964) 23.5 p. 174]
T. K. Radha and N. T. Meister	Electric dipole moment of a nucleon, [Phys. Rev. 135, B 769 (1964)]
L. I. Schiff, T. K. Radha and N. T. Meister	Slow neutron-deutron capture and the structure of He^3 and H^3. [Phys. Review Letter 12, 509 (1964)]



Hon'ble Mr. C. Subramaniam, Patron, MATSCIENCE addressing the first MATSCIENCE Summer School, Bangalore.

Professor H. J. Bhabha, Chairman, Atomic Energy Commission (India) and Member, Board of Governors, MATSCIENCE, talking to students.

First Matscience Summer School

First MATSCIENCE Summer School on Theoretical Physics was recently held in Bangalore for three weeks from 24th August to 13th September 1964. When the idea of a summer school was proposed, the Council of Scientific and Industrial Research not only welcomed it but also extended financial support through a generous grant. Professor Alladi Ramakrishnan was the Director of the summer school and the entire organisation as well as academic matters were left in the hands of the authorities of MATSCIENCE.

The school was inaugurated on the evening of 24th August by Professor S. Husain Zaheer, Director-General, CSIR. The academic session started in earnest from the morning of 25th August with four one hour sessions a day. Hon'ble Minister C. Subramaniam, patron of MATSCIENCE was kind enough to visit the summer school in spite of great demand on his time due to pressing national problems. He evinced keen interest not only in meeting all the participants of the summer school but he also attended the lecture by the Director on recent developments in high energy physics.

The summer school mainly consisted of invited lectures by seven foreign and eight Indian scientists. The foreign scientists who participated in the first MATSCIENCE summer school were Professor R. Oehme, University of Chicago (USA); Prof. K. Symanzik, New York University, (USA); Prof. E. R. Caianiello, Director, Institute for Theoretical Physics, Naples (Italy); Prof. W. Brenig, Max-Plank Institute (West Germany); Prof. F. Calogero, University of Rome (Italy); Dr. A. Fujii, School of Science and Technology, Sophia University (Japan); and Dr. J. Lukierski, University of Wroclaw (Poland). All of them were visiting scientists at MATSCIENCE. The invited Indian scientists are: Prof. A. Ramakrishnan, Dr. R. Vasudevan, Dr. T. K. Radha, Dr. N. R. Ranganathan, and Dr. K. Venkatesan (of MATSCIENCE), Dr. V. Devanathan (Madras University), Prof. M. Venkataraman (Madras University, Madurai Centre) and Dr. S. K. Srinivasan (Indian Institute of Technology, Madras).

The other participants at the summer school comprised mainly of the research students of MATSCIENCE, lecturers from educational institutions in Madras, students from Tata Institute of Fundamental Research and from University of Roorkee. Besides these, quite a few scientists and research workers from educational institutions in Bangalore also attended the lectures regularly. In the new conference hall at the Madras Woodlands Hotel, Bangalore most of the participants stayed.

During the week-ends excursions to places of cultural and historical importance in and around Bangalore city were arranged. These provided the much needed relaxation after the strenuous academic sessions during the week and the foreign scientists enjoyed very much the visits to some of our finest temples, pride of Indian heritage. Also these excursions afforded many opportunities for the scientists to get to know each other better and to discuss problems which did not come up during the lectures and seminars in the summer school.

The proceedings of the summer school are being edited and Plenum Press, New York, U.S.A. has offered to publish the proceedings of the summer school.

The following is the list of the lectures delivered at the Summer School

Name	*Title of the Lectures*
Prof. E. R. Caianiello	Renormalization
Prof. K. Symanzik	Many particle structure of Green's functions.
Prof. R. Oehme	On High Energy Scattering and On Weak Interactions.
Prof. W. Breing	Conservation laws and Bethe Salpeter equation
Dr. F. Calogero	Phase approach to potential scattering
Dr. A. Fujii	μ-capture in light nucleii
Dr. J. Lukierski	Quantum gauge transformation for non-abelian gauge fields.
Prof. A. Ramakrishnan	Report on the Proceedings of the Dubna Conference
Dr. R. Vasudevan	Kubo's formalism
Dr. N. R. Ranganathan	On some recent development in many body theory
Dr. T. K. Radha	Three body wave functions and Electric depole moment of nucleons
Dr. K. Venkatesan	Theories of particles of arbitrary spin.
Dr. S. K. Srinivasan	A Class of non-Markovian processes.
Dr. V. Devanathan	Photo-production of charged pions from complex nuclei.

Faculty of Applied Mathematics

Professor A. T. Bharucha-Reid of the wayne State University, U.S.A. who was a visiting scientist, gave a series of lectures on the following topics in mathematics.

(1) Banach Spaces

(2) Semi-group of operators

(3) Random equations.

Professor A. Ramakrishnan, Dr. R. Vasudevan, Dr. S. K. Srinivasan of the Indian Institute of Technology, Madras completed a paper on "Some new mathematical features in cascade theory".

The following are the reports and research papers published during the year :—

MATSCIENCE REPORTS :

Bharucha-Reid (A.T.)		Lectures on semi-group of operators (Matscience Report 30)
Bharucha-Reid (A.T.)	...	Lectures on Theory of Randam equations (Matscience Report 31)

RESEARCH PAPER :

Ramakrishnan (A) Vasudevan (R) and Srinivasan (S. K)	Some new mathematical features in cascade theory.

Faculty of Pure Mathematics

Professor M. H. Stone, Distinguished Service Professor of Mathematics, Chicago, who was the 'First Ramanujan Visiting Professor' of the Institute in 1963 and gave a series of lectures on "Hilbert Space and functional analysis" renewed his contact with the Institute and visited it in the last week of December 1964.

Dr. K. Srinivasacharyulu, Department of Mathematics, University of Maryland, U.S.A. stayed during July-August as a temporary member.

The following is the report published during the year:

Matscience Report :

Stone (M. H) ... Functional analysis (Matscience Report 19).

Faculty of Astrophysics

Professor S. Chandrasekhar, Distinguished Service Professor, Enrico Fermi Institute for Nuclear Studies, University of Chicago, U.S.A., is an honorary professor of Astrophysics at the Institute.

Library

Books and Bound Periodicals

During the period under report (January-December 1964) 1400 books (including bound-periodicals) were added to the Library, bringing the total stock of the library to 3,600, many of them recent publications. Back numbers of some important periodicals like " Physical Review, American Journal of Physics, Journal of Mathematical Physics, Journal of Applied Physics, Applied Physics letters, Soviet physics (DOKLADY), Soviet Physics, (JETP) and Sovient Physics (USPEKHI)" were added to the Library recently.

Journals

Twenty five new journals were subscribed during the period bringing the total number of periodicals received on subscription basis to 60 (sixty). We are receiving on exchange basis publications from important institutions from all over the world. The list of such institutions and respective journals are given below.

List of Exchange addresses and Journals

Institutions	*Journal*
Library of Congress, U.S.A.	Books etc.
United States Atomic Energy Commission, U.S.A.	Nuclear Science abstracts and Technical translations.
Duke University Library, U.S.A.	Duke Mathematical Journal.
Massachusetts Institute of Technology, U.S.A.	Journal of Mathematics and Physics.
Rice University, U.S.A.	Rice Institute Phamplet and Rice University Studies.
Bowling Green State University, U.S.A.	Mathematics Teacher.
McGill University, Canada.	Canadian Mathematical Bulletin.
Tohoku University, Japan.	Tohoku Mathematical Journal.
Hiroshima University, Japan.	Journal of the Science of the Hiroshima University.
Osaka University, Japan.	Osaka Mathematical Journal.
University of Osaka prefecture, Japan.	Mathematica Japonica.
Science Council of Japan, Japan.	Japanese Journal of Mathematics.
Nagoya University, Japan.	Nagoya Mathematical Journal.

Institutions—(contd.)	*Journal*—(contd.)
Nordita, Denmark.	Lecture notes, publications.
Mathematisk Institute, Denmark.	Mathematica Scandinavica.
Institute for Theoritical Physics, Denmark.	Publications, reports, preprints, and lecture notes.
Institute Di Fisica Teorica, Italy.	All publications.
Institute De Mathematiques, France.	All publications.
Institute for Scientific Information of Soviet Academy of Sciences, USSR.	All publications.
Library of the Academy of Sciences, USSR, USSR.	All publications.
Library of the Royal Swedish Academy of Sciences, Sweden.	Arkiv fur Matematik.
Journal of the Indian Institute of Sciences, India.	Journal of the Indian Institute of Science.
Indian statistical institute, India.	Sankhya.

During the year, some of the issues of the following journals have been received as gifts.

Bell Laboratories Record.
Bell System Technical Journal.
Bibliography of current reports.
Bulletin of the American Mathematical Society
Endeavour (English Ed.).
Journal de Physique.
Journal of Indian Mathematical Society.
The Mathematics Student.
Nucleus.
Philips Research Reports with supplements.
Science and Technology.
Scientific American.

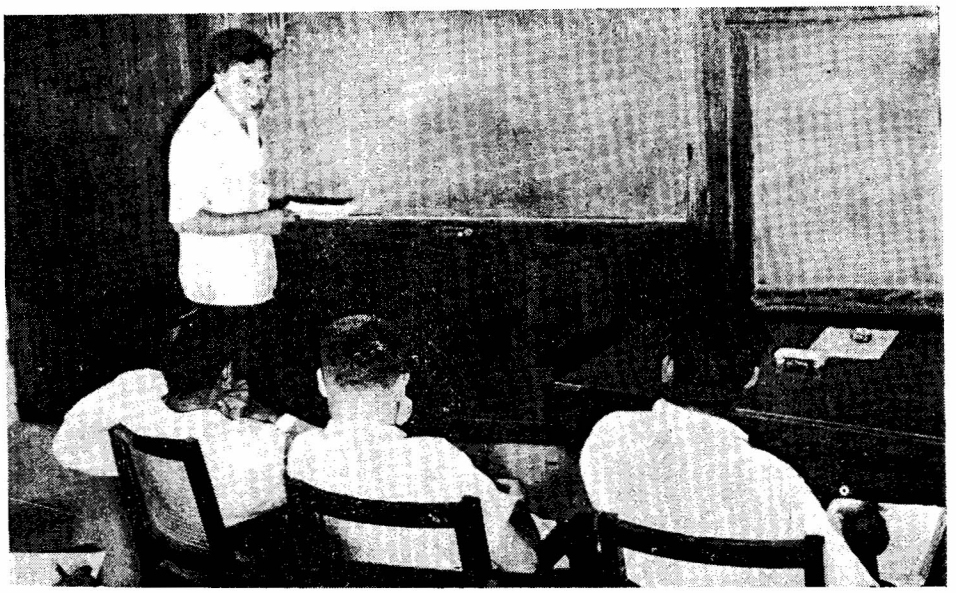
The Library was shifted to its new spacious premises during February, 1964. With the neat arrangements of book shelfs, periodicals racks, tables, and also due to the introduction of bay guides, the Library is more inviting than it was in its old premises. Visiting scientists and staff of the Institute are provided with cubicles inside the Library. The Library is now able to accommodate at least thirty readers.

We are now circulating to some of the important post-graduate institutions, a monthly list of new additions to the institute library. We are also bringing out fortnightly list of preprints and reprints received from various institutions and individuals.

Lecture Courses by Visiting Scientists

Visiting Scientist	*Period of Visit*	*Title of lecture course*
Dr. L. O'Raifeartaigh, Institute for Advance Study, Dublin, (Ireland)	December — February 1964	On lie algebras.
Professor B. Zumino, Department of Physics, New York University, New York, U.S.A.	January — February 1964	Lectures on the magnetic properties of a superconductor.
do.	January — February 1964	Gauge invariance and mass of vector bosons.
Dr. Jerzy Lukierski, Courant Institute of Mathematical Science, New York University, USA and Wroclaw University (Poland)	April — September 1964	Gauge transformations in quantum field theory.
do.	November 1964	Singular integral equations.
Professor Henry P. Stapp, Lawrence Radiation Laboratory, University of California, Berkeley, California, USA.	March — May 1964	Axiomatic S-matrix theory.
Professor E.R. Caianiello, Director, The Institute for Theoretical Physics, University of Naples, Naples, Italy.	July — September 1964	Perturbation expansions and equations for propagators.
Dr. F. Calogero, Department of Physics, University of Rome, Rome, (Italy).	August — September 1964	Analytitcity properties of the scattering matrix in the case of potential scattering. An elementary review.
Professor W. Brenig, Max Planck Institute for Physics and Astrophysics, Munich, W. Germany.	September—October 1964	Interacting quasi - particles in many-particle systems.

Professor K. Symanzik, Department of Mathematics, New York University, New York, U.S.A.	July — September 1964	A modified model of Euclidean quantum field theory,
Professor A. Fujii, Institute for Nuclear Study, Tokyo University, Tokyo, Japan.	July — August 1964	Lectures on Fermi dynamics.
Professor E. Yamada, Research Institute for Foundamental Physics, Kyoto University, Sakyo-ku, KYOTO, Japan.	January — March 1964	Lectures on Broken Symmetry and Goldstone Boson.
Dr. K. Dietz, CERN, Geneva, Switzerland	December 1964	Peripheral interaction
Professor Ph. Meyer, Faculty of Sciences, University of Paris, Orsay, France.	,,	Selected topics in weak interactions.
Professor M. Gourdin, Faculty of Sciences, University of Paris, Orsay, France.	,,	Mathematical introduction to unitary symmetry.
Professor C. De Dominicis, Department Theoretical Physics, C. E. N., Saclay, France.	,,	Renormalization in equilibrium statistical mechanics.



Professor Yu. V. Novozhilov, University of Leningrad, U.S.S.R. giving a seminar.

Dr. Henry P. Stapp and Dr. E. Yamada with Hon'ble Mr. R. Venkataraman, Chairman, Board of Governors of MATSCIENCE.

Invited Lectures

Scientist	*Date*	*Title of the lecture*
J. B. Keller	20-1-1964	The random equations and wave propagations in stochastic media.
„	25-1-1964	Diffraction Scattering and Regge Poles.
V. Novozhilov	31-3-1964	Elementary and Composite particles in Lagrangian Formalism.
„	„	Analytic properties of scattering amplitudes in non-local theory and possible experimental manifestations.
„	„	On the particle origin of Isospin symmetries.
Henry P. Stapp	20-4-1964	Space-time and elementary particles.
R. Inglis	20-5-1964	Some special phenomena in α-particle scattering.
E. R. Caianiello	20-8-1964	Towards a mathematical theory of the brain.

Lecture course by the staff of the Institute

Lecturer	*Duration*	*Title of the lecture*
N. R. Ranganathan, Associate Member, Matscience.	Two months from 20-2-1964	Perturbation theory in many-body problem quantum statistical mechanics.
do	Two months from 20-2-1964	Some topics in mathematical physics.
do	From 1st October '64	Topics in Scattering Theory.

Student Seminars

	Date	*Title of lecture*
T. S. Santhanam	10-7-1964	Unitary symmetry and weak Interactions.
,,	15-7-1964	Bosons and Baryonic charge.
,,	16-10-1964	Fractional quantum numbers and unitary symmetry.
,,	23-10-1964	Triality and its generalization in unitary symmetry.
,,	11-11-1964	Unitary symmetry and weak interactions.
,,	13-11-1964	Broken symmetries and weak interactions.
R. K. Umerjee	21-10-1964	Particle-Antiparticle interactions in electro-dynamics.
,,	19-11-1964	Meson exchange effects in electron-deutron scattering.
,,	23-11-1964	Symmetries and electro-magnetism.

Seminar Lectures

	Date	*Title of the lecture*
A. Ramakrishnan, Director, MATSCIENCE.	25-1-1964	Causality in deterministic stochastic and quantum mechanical processes.
,,	17-2-1964	,,
R. Vasudevan, Permanent Member, MATSCIENCE.	20-6-1964 22-6-1964	The theory of Green's functions in many-body theory.
N. R. Ranganathan, Associate Member, MATSCIENCE.	2-2-1964	Broken symmetry.
T. K. Radha, Associate Member, MATSCIENCE.	26-10-1964	Octet enhancement.
,,	4-12-1964	CP violation in weak interactions.
,,	11-12-1964	The symmetry group of vector and exial-vector current.
K. Venkatesan, Temporary Member, MATSCIENCE.	March 1964	The Wigner distribution and some applications.
,,	4-6-1964	Feynman rules for higher spin particles.
,,	8-10-1964	High energy nucleon-nucleon scattering.
,,	17-11-1964	Mass sum rule.
,,	21-11-1964	Relativistic limit of particle equations.
G. Ramachandran, MATSCIENCE.	10-6-1964	Some aspects of nuclear structure.
,,	10-6-1964	Photo-production of charged particles.
,,	19-10-1964	Configuration mixing in nuclai.
,,	12-12-1964	On some recent studies in Lorentz group.
B. Ramachandran, Pool Officer.	1-6-1964	Complex variables.
,,	1-6-1964	Fourier transforms.
V. Devanathan, A. C. College of Technology, Madras.	9-6-1964	Complex angular momentum and scattering theory.

Pre-print List

Author	*Title*
E. C. G. Sudarshan, L. O' Raifeartaigh and T. S. Santhanam.	The origin of internal symmetry and charge conservation in strong interactions.
L. O' Raifeartaigh and B. Gruber	Construction of the invariants for the simple lie groups.
R. K. Umerjee	Deuteron polarization following elastic scattering of positive pions.
Alladi Ramakrishnan, K. Raman and R. K. Umerjee	Isobar production in nucleon-nucleon, collision I.
G. Ramachandran and K. Ananthanarayanan	Photo-production of charged pions from Deutrons.
T. S. Shankara	Unified solution for scattering and bound states of a Dirac particle in a coulomb field.
Alladi Ramakrishnan, R. Vasudevan and S. K. Srinivasan	Some new mathematical features in cascade theory.
K. Raman	On scalar K – π resonances.
G. Ramachandran and K. Ananthanarayanan	Photo-production of pions from H^3 and He^3.
G. Ramachandran and K. Ananthanarayanan	Scattering of poins from H^3 and He^3.
R. K. Umerjee	Scattering of pions from complex nuclei.
T. K. Radha and N. T. Meister	Thermal neutron capture-by deutrium and three-body wave functions.
N. R. Ranganathan and R. Vasudevan	Remarks on Dirac spurs and Pfaffians.
G. Ramachandran and R. K. Umerjee	Helicity of the final electron in electron-deutron scattering.
Alladi Ramakrishnan, K. Raman and R. K. Umerjee	Isobar production in nucleon-nucleon collisions II. Polarization effects.
J. Lukierski	The quantum variables and the proper choice of the subsidiary condition for non-Abelian Gauge fields.
J. Lukierski	Gauge properties of propagators in the quantum theory of non-Abelian vactor gauge fields.
T. S. Santhanam	A note on the charge structure of Basic triplets of the SU (3) Model.
T. S. Santhanam	Unitary symmetry and fractional quantum numbers.

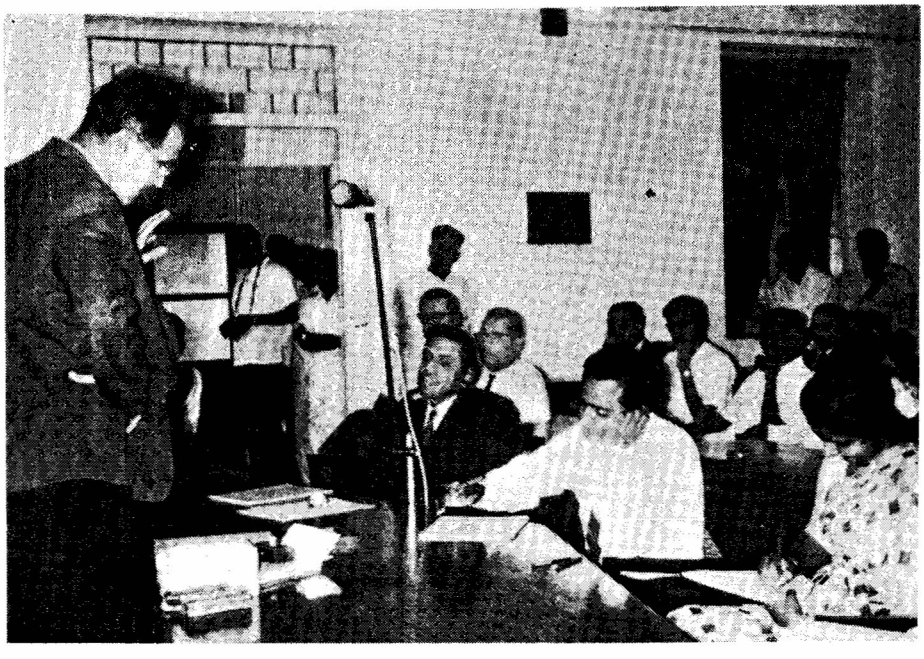
Re-prints List

	Author	*Title*
1.	G. Ramachandran and V. Devanathan	Nuclear polarization following photo-production of pions from nuclei (I). [Nuclear Physics, Vol. 48/3, pp. 369–374]
2.	G. Ramachandran and V. Devanathan	Nuclear polarization following photo-production of pions from nuclei (II). [Nuclear Physics, Vol. 50, pp. 593–598]
3.	S. K. Srinivasan and K. Venkatesan	The strip approximation and the photo-production of pions on pions. [Nuovo Cimento 30 (1963) pp. 163–170]
4.	S. K. Srinivasan and K. Venkatesen	Photo-production of pions from nucleons in the strip approximation. [Nuovo Cimento 30 (1963) pp. 151–162]
5.	Alladi Ramakrishnan, K. Venkatesan and V. Devanathan	A note on the use of Wick's theoren. [Journal of Mathematical Analysis and applications. Vol. 8 ; 2 (1964) pp. 345–349]
6.	G. Ramachandran and R. K. Umerjee	Deutron polarization following neutral pion photo-production. [Nuclear Physics, 54 (1964) pp. 665–672]
7.	V. Devanathan and K. Ananthanarayanan	Photo-production of charged pions from deutrons. [Nuovo Cimento 32 (1964) pp. 723–726]
8.	R. E. Marshak, C. Ryan T. K. Radha and K. Raman	Universal theory of Semi-weak interactions. [Nuovo Cimento 32 (1964) pp. 408–432]
9.	Matscience	Some recent trends in theoretical physics. [Journal of Scientific and Industrial Research, (1964) 23.5 p. 174]
10.	T. K. Radha and N. T. Meister	Electric dipole moment of a nucleon, [Phys. Rev. 135, B 769 (1964)]
11.	L. I. Schiff, T. K. Radha and N. T. Meister	Slow neutron-deutron capture and the structure of He^3 and H^3. [Phys. Rev. Lett. 12, 509 (1964)]

List of Matscience Reports (1963 — 1964)

Report No.	*Author*	*Title*
10.	Marshak (R E)	Lectures on Weak interactions.
11.	Sudharshan (E C G)	Lectures on foundations of quantum mechanics and field theory.
12.	Krishnamurti (K V)	Notes on elementary particle transfer process in solution chemistry-electron transfer reactions.
13.	Bharucha-Reid (A T)	Notes on Banach spaces. Basic definitions and theorems and related topics.
14.	Kamefuchi (S)	Lectures on Stueckelberg formalism of vector meson fields.
15.	Thunga (S) and Venkatesan (K)	Lectures on quantum electro-dynamics.
16.	Durr (Peter)	Lectures on the non linear spinor theory of elementary particles.
17.	Venkatesan (K)	Report on recent experimental data. (1963)
18.	...	Collected seminar lectures on elementary particles.
19.	Stone (M H)	Functional Analysis.
20.	Roman (P)	Lecture on an introduction to dispersion relation techniques.
21.	...	Proceedings of the Second anniversary symposium (January 1964)
22.	Hagedorn (R)	Lectures on the relativistic kinematics and polarization.
23.	Jacob (M)	Lectures on the theory of strong interactions.
24.	Kamefuchi (S)	Lectures on parastatistics.
25.	Raifeartaigh (L 'O)	Lectures on local lie groups and their representations.
26.	Stapp (Henry P)	Lectures on analytic S-matrix theory.
27.	Yamada (E)	Lectures on broken symmetry and Goldstone Boson.
28.	Zumino (B)	Lectures on magnetic properties of a superconductor.
29.	Mohling (F)	Introduction to quantum statistical mechanics of degenerate Bose systems.
30.	Bharucha-Reid (A T)	Lectures on semi-group of operators.
31.	do.	Lectures on theory of random equations.
32.	Zumino (B)	Lectures on gauge invariance and mass of vactor Bosons.
33.	Sudarśhan (E C G)	Lectures on origin of symmetries.
34.	Lukierski (Jerzy)	Lectures on gauge transformations in quantum field theory.

Hon'ble M. Bhaktavatsalam, Chief Minister of Madras, visited the Institute to meet the participants in the symposium



Professor Weisskopf inaugurating the third anniversary symposium

Third Anniversary Symposium (January 3-10, 1965)

List of Invited Participants

Professor Victor Weisskopf	Director-General, CERN, Geneva-23.	Visiting Scientist, MATSCIENCE
Professor P. T. Landsberg	Cardiff, U. K.	,,
Professor C. De Dominicis	Saclay, France.	,,
Professor M. Gourdin	Orsay, France.	,,
Professor Ph. Meyer	Orsay, France.	,,
Dr. K. Dietz	CERN, Geneva-23.	,,
Professor Alf Sjolander	Argonne National Laboratory, Illinois, U.S.A.	,,
Professor R. Blankenbecler	Princeton University, U.S.	,,
Dr. A. P. Louis Balazs	Now at the Tata Institute of Fundamental Research, Bombay.	,,
Dr. J. Lukierski	Wroclaw, Poland.	,,
Dr. J. J. De Swart	Institute for Theoretical Physics, Catholic University, Nijmegen, Holland.	,,
Professor M. H. Stone	Distinguished Service Professor, University of Chicago, Chicago, U.S.A.	,,
Professor Harish Chandra	Institute for Advanced Study, Princeton, N. J., U.S.A.	,,
Professor Alladi Ramakrishnan	Director.	,,
Dr. R. Vasudevan	Member.	,,
Dr. N. R. Ranganathan	Member.	,,
Dr. T. K. Radha	Member.	,,
Dr. K. Venkatesan	Member.	,,
Dr. S. K. Srinivasan	Indian Institute of Technology, Madras.	
Dr. V. Devanathan	A. C. College, University of Madras.	
Dr. A. N. Mitra	Delhi University.	
Dr. Virendra Singh	Tata Institute of Fundamental Research, Bombay.	

The proceedings of the symposium will be published as a part of the series by the Consultants Bureau Inc., Plenum Press, New York, U.S.A.

Academic Group 1964

Permanent Staff :

1. Professor Alladi Ramakrishnan	Director
2. Dr. R. Vasudevan	Permanent Member
3. Dr. N. R. Ranganathan	Associate Member
4. Dr. T. K. Radha	,,

Temporary Members :

1. Dr. K. Venkatesan	Temporary Member
2. Mr. M. Ramachandra Setty	,, (from 17-11-64)
3. Dr. B. Ramachandran	Pool Officer, C. S. & I. R. (upto 14-8-1964)

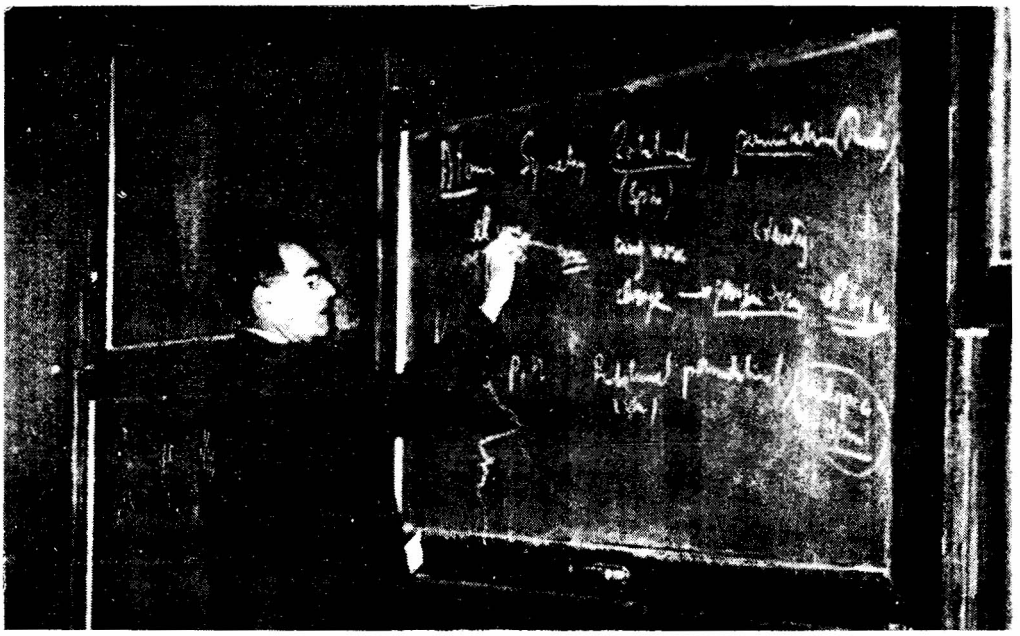
Research fellows :

1. Mr. K. Raman	Senior Research Fellow, Department of Atomic Energy (upto 31-8-1964)
2. Dr. G. Ramachandran	Senior Research Fellow, Department of Atomic Energy (upto 28-2-1964) and Senior Research Fellow, C. S. & I. R. (from 1-3-1964)
3. Mr. R. K. Umerjee	Junior Research Fellow, C. S. & I. R.
4. Mr. K. Anantanarayanan	,,
5. Mr. G. Jagannathan	,,
6. Mr. T. S. Santhanam	Senior Research Assistant, C. S. & I .R.
7. Mr. T. S. Shankara	Junior Research Assistant, C. S. & I. R.

Research Trainees :

1. Mr. K. Srinivasa Rao	M. Sc. (Madras University).
2. Mr. A. Sundaram	M. Sc. (I. I. T., Madras).
3. Mr. R. Sridhar	M. Sc. (I. I. T., Madras).
4. Mr. C. C. Appana Sastri	M. Sc. (Andhra University).
5. Mr. M. R. Advani	M. Sc. (Karnatak University).
6. Mr. G. N. Kesavamurthi	M. Sc. (Mysore University).
7. Mr. C. R. Anandapadmanabha Rao	M. Sc. (Mysore University).
8. Mr. A. R. Prasanna	M. Sc. (Mysore University).

Professor Weisskopf listening to a lecture at the symposium



The Director-General of CERN delivering the introductory lecture

The following resolution was passed at Matscience on the 30th May 1964 mourning the passing away of our beloved Prime Minister

—o—

It was with speechless anguish and sorrow we heard the news of the passing away of our most loved and most honoured Prime Minister Pandit Jawaharlal Nehru. Even the universality of grief is an inadequate expression of the gratitude which humanity owes to one of the greatestmen of all time.

Few lives in the history of mankind have shone with such many-splendoured hues. Born to wealth and prosperity he became the idol of peasant India, its hope and its redeemer. Educated in the most exclusive of English institutions he stood against the might of the British Empire with dauntless courage and in open defiance. He emerged a victor after decades of travail and remained the staunchest friend of England, its people and its gracious Queen. As the architect of a new republic he designed it within the stable structure of the great commonwealth. Rational in his beliefs to the limit of secularism, he wore the mantle of Gandhi, the man of God, with grace and dignity. He had irrepressible faith in a socialistic economy but his very name is synonymous with the freedom of the human spirit. His patriotism was a flaming passion which burnt out the vestiges of foreign rule from our sacred land ; yet he was true citizen of the world that his counsels were sought in the United Nations. An individualist in thought, he loved people to an extent that every child looked to him as a father and every Indian felt his benign influence His princely graces set him apart from our too common mould-but he was the darling of modern India, and there is no single home from the southern Cape to the Himalayan heights where the very mention of his name did not inspire love and affection.

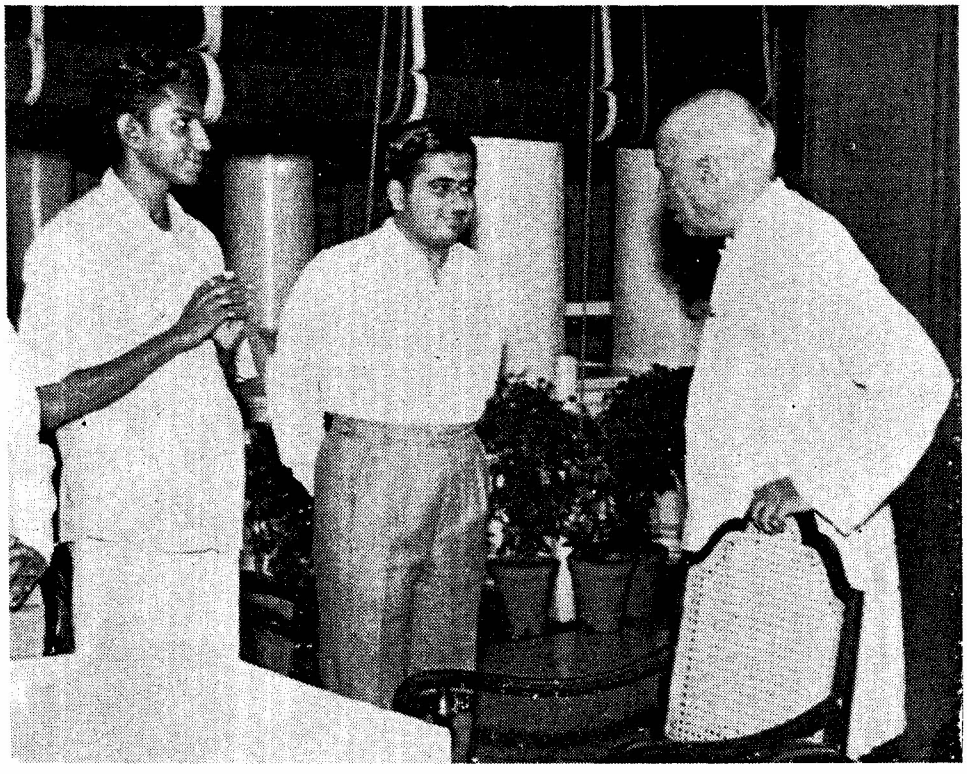
The best years of his youth were spent in isolation behind prison bars; but that was the period he wrote his dearest letters, transmitted the warmest feelings and nourished the most sanguine hopes. Those years left no wrinkle on that handsome brow which age could not wither nor anxieties strain.

His life was dedicated to improving the standard of life of the common man; but he remained a restless intellectual, a votary for the advancement of science in our country. Amidst the tumult of politics and the anxieties of administration, he found time to exhort scientists to greater achievement and the aspirant youth to the pursuit of knowledge.

It is not for us to attempt to pay tribute to so glorious a life. The Nehru epoch spans the past and the future of this ancient country ; he is part of the legend of the human race. His task is done and he has entered the immortal domain of the Gods. But what shall we do without him whose every smile lit up a thousand hopes in our otherwise too, too human lives ?

In this tragic hour, among the millions, we here, should in particular pledge ourselves to the ideals so dear to his heart for this Institute was started under his aegis, with his support and generous blessings. May his immortal spirit continue to guide us in the years to come.

" Amidst the tumult of politics and anxieties of administration, he found time to exhort scientists to greater effort....."



" .... we here, should in particular pledge ourselves to the ideals so dear to his heart, for this Institute was started under his aegis, with his support and generous blessings."

That Magic Moment*

The world is so worshipful of greatness that we rarely wait to think of its true source strength and sustenance. It lies in the manner in which it touches the individual lives of those who feel the depth and extent of its influence. Such is the quality of the greatness of our beloved Prime Minister whose life has almost directed our way of life.

It was in 1947, during the eventful days of the Constituent assembly, that I had the privilege of feeling his benign presence and watching that handsome face with pleasure and wonder. Even my great father who was entrusted with the task of drafting our constitution could not hold his attention, for the distant look in his eyes seemed to peer into the uncharted future and was oblivious of the immediate environment. It was unbelievable that an occasion would arise fifteen years later when by a fortuitous circumstance, I would be called upon to place before him, in person, a proposal which is to affect the lives of young scientists in the years to come. I cherish that moment with blatant delight and the best homage I can pay to so noble a soul is to transmit the magic of that momentous interview to my fellow scientists. To estimate the significance of that event I have to describe the background against which it took place.

Ever since the war, there was so much discussion about the migration of Indian scientists abroad and the difficult conditions that inhibited the growth of creative work in India. This looked paradoxical, particularly when the same period saw the establishment of various Governmental organisations to stimulate and support scientific research. While there was basic agreement among the academic community and the organisers of scientific endeavour that something should be done to vivify and vitalise the atmosphere, there was considerable conflict of opinion as to how this could be done. Of course, there was the very conventional view that higher learning should be pursued in the universities since creative work could only be sustained in consonance with a teaching programme. On the other hand, the need for spealised institutes and laboratories was too obvious since the financial resources available had to be conserved and their magnitude demanded direct support from the Central Government.

The mathematical sciences demanded a combination of these two modes of organisation. It is too well-known that the advances in physics in the last decade were comparable with the progress in physical sciences over a century before, for, with the development of giant accelerators and new experimental techniques, the physicist became aware of new particles and new phenomena associated with them, not anticipated even by the creators of quantum mechanics and relativity.

The American Universities, true to the pioneering traditions of that great nation, adjusted themselves to the rapid changes in the scientific scene by creating semi-autonomous and highly specialised institutions within their expanding framework. Unfortunately, nothing like this had happened in India and was likely to happen, in view of the repeated emphasis on insurmountable difficulties and too firmly established conventions. A break-through was necessary and therefore it was suggested that an autonomous institution should be created

---

* Excerpts from this article have been published as a contribution to the Nehru Commemoration number of the *Science Reporter* under the aegis of the Council of Scientific and Industrial Research, New Delhi.

and supported by the Government but which would actively collaborate in academic work with the Universities. It was a miraculous sequence of events that culminated in the decision of our then Finance Minister of the Government of Madras, Mr. C. Subramaniam, to create an institute of this kind. Even 'this man of steel' required the support and assent of our Prime Minister since this idea was considered almost revolutionary in the domain of our scientific education. To whom else could we submit such a proposal than to one who had effected the greatest revolution in our minds — the desire for a free and independent India which was achieved within his own life-time?

Indeed this suggestion of consulting the Prime Minister was put forward by an Americian physicist, Dr. M. M. Shapiro who visited Madras as a guest of the theoretical physics group here. In the course of a casual conversation when the Finance Minister complained of various difficulties and obstacles, the professor interposed and said, "Why not let the Prime Minister see the members of the theoretical physics group during his visit to Madras and find out his reactions"?

In spite of a crowded series of official engagements for the Prime Minister, it was found possible by the Hon'ble Subramaniam to arrange an interview at the Raj Bhavan at 9. 30 p. m. after an official dinner, to which my wife and I were invited to have a preliminary occasion to meet the Prime Minister. I need hardly describe my trepidation and anxiety, for so much was to depend upon a few minutes' conversation — almost the dreams and aspirations of a whole scientific community hung on the smiling lips of our Prime Minister. Ten minutes before the close of the dinner, he summoned me and all the students gathered to have a personal interview with him. It was strange feeling for me to do all the talking with a man who held almost unquestioned sway over the destinies of our country. At the end, he asked me only one question: "Are you really convinced that we should have an Institute of the kind you are insisting upon?". I naturally said 'yes' with all the emphasis at my command and he just smiled.

Two months later, the Finance Minister decided to obtain the formal assent of the Prime Minister. We waited with bated breath at the Madras airport as Mr. Subramaniam came across the tarmac and said with his inevitable smile, "It is going to be all right. The Prime Minister has consented to be our patron". Later on, he recounted to us what a miracle it was to succeed in directing the attention of the Prime Minister to this question. It was the day on which the decision for military action in Goa was being taken that the Prime Minister agreed to be the patron of the Institute.

Sixteen months latter, I met him again to report on the progress of the Institute. He just asked, "Do you want anything particular to be done now?". It was too valuable an opportunity to miss and I stressed the need for extending the visiting programme to young post-doctoral workers of outstanding promise. Through his aegis has now been set in motion an international collaboration in science which in the words of Niels Bohr, "offers so great opportunities for understanding among the peoples of the world" — a cause nearest to Nehru's mind and heart.

The triumph of Nehru's life is the triumph of imagination over prejudice and ignorance — the characteristic feature of all scientific endeavour. To this ideal, aspirant members of the Indian scientific community should dedicate themselves.

ALLADI RAMAKRISHNAN