MATSCIENCE SYMPOSIA PUBLISHED BY PLENUM PRESS, NEW YORK

The most important annual event at MATSCIENCE were the Anniversary Symposia. These were held in January each year from 1963 onwards because MATSCIENCE was inaugurated on January 3, 1962. MATSCIENCE had a steady flow of visitors throughout the year, but the greatest concentration was in connection with the Anniversary Symposia. In 1964, Earl M. Coleman, the President of Plenum Press, New York, visited Madras, and met Alladi Ramakrishnan. He expressed a desire to publish the lectures delivered at the Anniversary Symposia in a book series entitled "Matscience Symposia on Theoretical Physics", edited by Ramakrishnan. In some of these volumes, lectures by visiting scientists delivered outside of the Anniversary Symposia were included, such as lectures given at the Matscience Summer Schools. A total of ten volumes were published by Plenum Press and in what follows, we provide the Table of Contents for each volume. From Volume 6 onwards, the title was changed to "Symposia in Theoretical Physics and Mathematics".

- *Krishnaswami Alladi*

MATSCIENCE SYMPOSIA ON THEORETICAL PHYSICS

VOLUMES I-X**

Published by Plenum Press, New York

Edited by Alladi Ramakrishnan

LIST OF PAPERS

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"Symmetries and Resonances", T. K. RADHA, *Matscience, Madras, India*

"Group symmeteries and R-Invariance", R. E. MARSHAK, *University of Rochester, Rochester, New York, USA*

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"On Regge poles in perturbation theory and weak interactions", K. RAMAN, *Matscience, Madras*

"Determination of spin-parity of resonances", G. RAMACHANDRAN, *Matscience, Madras, India*

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"Pion-nucleon resonances", K. VENKATESAN, *Matscience, Madras, India*

"The influence of pion-nucleon resonance on elastic scattering of charged pions by deuterons", V. DEVANATHAN, *University of Madras, Madras, India*

"Pion-hyperon resonances", R. K. UMERGEE, *Matscience, Madras, India*

"Some remarks on recent experimental data and techniques", E. SEGRE, *University of California, Berkeley, California, USA*

"On new resonances", B. MAGLIC, *CERN, Geneva, Switzerland*

"The higher resonances in the pion-nucleon system", G. TAKEDA, *Tohuku University, Sendai, Japan*

The lecture of Professors Segre was delivered not at the Anniversary Symposium, but during the academic year 1962-63 at Matscience. The lectures of Professor Takeda were delivered at the First Matscience Summer School in Kodaikanal in 1963.

**Starting from Volume 6, the series was renamed

SYMPOSIA IN THEORETICAL PHYSICS AND MATHEMATICS

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"Construction of the invariants of the simple Lie groups", L. O'RAIFEARTAIGH, *Dublin Institute for Advanced Studies, Dublin, Ireland*

"On peratization methods", N. R. RANGANATHAN, *Matscience, Madras, India*

"Large angle elastic scattering at high energies", R. HAGEDORN, *CERN, Geneva, Switzerland*

"Crossing relations and spin states", M. JACOB, Saclay, France and Matscience, Madras, India

"The multipheral model for high energy processes", K. VENKATESAN, *Matscience, Madras, India*

"Regge poles in weak interactions and form factors", K. RAMAN, *Matscience, Madras, India*

"Effective range approximations based on Regge poles", B. M. UDGAONKAR, *Tata Institute of Fundamental Research, Bombay, India*

"Some applications of separable potentials in elementary particle physics", A. N. MITRA, *University of Delhi, Delhi, India*

"Form factors of the three nucleon systems ^3H and ^3He", T. K. RADHA, *Matscience, Madras, India*

"Muon capture by complex nucleii", V. DEVANATHAN, *University of Madras, Madras, India*

"Electrodynamics of superconductors", B. ZUMINO, *New York University, New York, USA*

"Temperature cutoff in quantum field theory and renormalization", S. P. MISRA, *Regional Engineering College, Roorkee, India*

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"Introduction to quantum statistics of degenerate Bose systems", F. MOHLING, *University of Colorado, Boulder, Colorado, USA*

"Some current trends in mathematical research", M. H. STONE, *University of Chicago, Chicago, Illinois, USA*

"Semi-group methods in mathematical physics", A. T. BARUCHA-REID, *Wayne State University, Detroit, Michigan, USA*

"Recent mathematical developments in cascade theory", S. K. SRINIVASAN, *Indian Institute of Technology, Madras, India*

"Theory of a general quantum system interacting with a linear dissipating system", R. VASUDEVAN, *Matscience, Madras, India*

Volume 3 (1967)

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"Partial muon capture in light nucleii", A. FUJII, *Sophia University, Tokyo, Japan*

"Quantum guage transformations", J. LUKIERSKI, *University of Wroclaw, Wroclaw, Poland*

"Theories of particles of arbitrary spins", K. VENKATESAN, *Matscience, Madras, India*

"Bethe-Salpeter equation and conservation laws in nuclear physics", W. BRENIG, *Max-Planck Institute for Physics, Munich, Germany*

"On a class of Markovian processes and its application to the theory of short noise and Barkhausen noise", S. K. SRINIVASAN, *Indian Institute of Technology, Madras, India*

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"Conserved vector currents and broken symmetries", PH. MEYER, *University of Paris, Orsay, France*

"Multiplet structure and mass sum rules in the $SU(6)$ symmetry scheme", V. SINGH, *Tata Institute of Fundamental Research, Bombay, India*

"A new approach to scattering theory", R. BLANKENBECLER, *Princeton University, Princeton, New Jersey, USA*

"Equivalent potential approach for strong interactions", L. A. P. BALASZ, *Tata Institute of Fundamental Research*

"Repulsive potential approach to pio resonances", A. N. MITRA, *University of Delhi, Delhi, India*

"A model of a unitary S-matrix for peripheral interactions", K. DIETZ, *CERN, Geneva, Switzerland*

"The renormalizability of higher spin theories", J. LUKIERSKI, *University of Wroclaw, Wroclaw, Poland*

"Group representation for complex angular momentum", K. VENKATESAN, *Matscience, Madras, India*

"Muon capture by complex nuclei", V. DEVANATHAN, *University of Madras, Madras, India*

"Comments on sum rules", P. T. LANDSBERG and D. J. MORGAN, *University College, Cardiff, Wales*

"Inelastic neutron scattering and dynamics in solids and liquids", A. SJÖLANDER, *Institut för Mekanik, Goteborg, Sweden*

"Axioms and Models", M. H. STONE, *University of Chicago, Chicago, Illinois, USA*

"Characters of semi-simple Lie groups", HARISH-CHANDRA, *Institute for Advanced Study, Princeton, New Jersey, USA*

"Sequent correlations in evolutionary stochastic point processes", S. K. SRINIVASAN, *Indian Institute of Technology, Madras, India.*

Volume 5 (1967)

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"Lectures on nested Hilbert spaces", A. GROSSMAN, *CIMS & IHES, France*

"Elementary homology theory", N. R. RANGANATHAN, *Matscience, Madras, India*

"Applications of algebraic topolgy to Feynman integrals", V. L. TEPLITZ, *Massachusetts Inbstitute of Technology, Cambridge, Massachusetts, USA*

"Weak interactions", R. J. OAKES, *Stanford University, Palo Alto, California, USA*

"Fundamental multiplets", A. RAMAKRISHNAN, *Matscience, Madras, India*

"The ground states of He^3 and H^3", K. ANANTHANARAYANAN, *Matscience, Madras, India*

"Remarks of the present state of general relativity", S. KICHENASSAMY, *Institut Henri Poincare, Paris, France*

"On the conformal group and its equivalence with the hexadimensional pseudo-Euclidean group", M. BHAKTAVATSALOU, *Institut Henri Poincare, Paris, France*

"Certain extremal problems", K. R. UNNI, *Matscience, Madras, India*

"Fluctuating density fields and the Fokker-Planck equations", S. K. SRINIVASAN, *Indian Institute of Technology, Madras, India*

"Contraction of Lie groups and Lie algebras", K. VENKATESAN, *Matscience, Madras, India*

"A pattern in functional analysis", K. R. UNNI (From a lecture by J. L. Kelly*), *University of California, Berkeley, California, USA*

"Correspondence principles in dynamics", R. A. ARENS*, *University of Californis, Los Angeles, California, USA*

Both John Kelly and Richard Arens gave these talks during their visits to Matscience in December 1965, and not at the Summer School. Since Matscience had just initiated a program in mathematics, it was decided to include the lectures of Kelly and Arens in this volume.

Volume 6 (1968)

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"On locally compact groups and Cartan-Stiefel diagrams", B. GRUBER, *Instituto Nationale Fisica Nucleare, Seziona di Napoli, Italy*

"Linear response, Bethe-Salpeter equation, and transport coefficients", L. PICMAN, *Institute for Noclear Research "J. Stefan", Ljubljana, Yugoslavia*

"The description of particles of arbitrary spin", P. M. MATHEWS, *University of Madras, Madras, India*

"Relative corrections of β-decay", G. KÄLLEN, *University of Lund, Lund, Sweden*

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"Normalization of the Bethe-Salpeter wave equation", Y. TAKAHASHI, *Dublin Institute for Advanced Studies, Dublin, Ireland*

"Non-Langrange theories and generalized conservation laws", Y. TAKAHASHI, *Dublin Institute for Advanced Studies, Dublin, Ireland*

"Cosmic X-rays, γ-rays, and electrons", R. R. DANIEL, *Tata Institute of Fundamental Research, Bombay, India*

"β-decay and μ-capture coupling constants", S. C. K. NAIR, *Matscience, Madras, India*

"Functions of exponential type", K. R. UNNI, *Matscience, Madras, India*

"A model for processing visual data with applications to the Bubble Chamber picture recognition (Summary)", R. NARASIMHAN, *Tata Institute of Fundamental Research, Bombay, India*

"On functional methods in S-matrix theory", J. RZEWUSKI, *Institute of Theoretical Physics, Wroclaw, Poland*

"An impact parameter formalism", T. KOTANI, *Tokyo Metropolitan University, Tokyo, Japan*

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"The photoproduction and scattering of pions from H^3 and He^3", K. ANANTHANARAYANAN, Matscience, Madras, India

"Relativistic extensions of $SU(6)$", H. RUEGG, *CERN, Geneva, Switzerland*

"A survey of $\pi - N$ scattering and the $T = \frac{1}{2}$ amplitude", B. MOYER, *University of California, Berkeley, USA and Indian Institute of Technology, Kanpur, India*

Volume 7 (1968)

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"Some notions of local differential topology", F. PHAM, *C.E.N., Saclay, France*

"Formal aspects of potential theory", M. SCADRON, *Imperial College of Science and Technology, London, England*

"Some simple bootstrap models", B. UDGAONKAR, *Tata Institute of Fundamental Research, Bombay, India*

"Quark model for Baryons and resonances", A. N. MITRA, *University of Delhi, Delhi, India*

"The Riemann mapping theorem", S. K. SINGH, *Karnatak University, Dharwar, India*

"The field of Mikusinski operators", S. K. SINGH, *Karnatak University, Dharwar, India*

"On the cosine functional equation", P. L. KANNAPPAN, *University of Waterloo, Waterloo, Canada*

"A novel approach to the kinetic theory of fluids - onset of turbulent motion", S. K. SRINIVASAN, *Indian Institute of Technology, Madras, India*

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"On the unification of physical theories", A. MERCIER, *University of Bern, Bern, Switzerland*

"A note on the representation of Dirac groups", A. RAMAKRISHNAN and I. V. V. RAGHAVACHARYULU *Matscience, Madras, India*

"Relativistic wave equations for higher spin and their quantization", P. M. MATHEWS, *University of Madras, Madras, India*

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"Variational methods in scattering theory", C. J. JOACHIM, *Universite Libre de Bruxelles, Brussels, Belgium*

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"Muon capture as a proble for nuclear structure", M. RHO, *C.E.N. Saclay, France*

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"Generalized analytic continuation", H. S. SHAPIRO, *University of Michigan, Ann Arbor, Michigan, USA*

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"asymptotic seroes and weak baryon form facors", P. P. DIVAKARAN, *Tata Institute of Fundamental Research, Bombay, India*

"Implications of current algebra and η-decay - a summary", R. RAMACHANDRAN and A. KUMAR, Tata Institute of Fundamental Research, Bombay, India

"Can $Y_0^*(1405)$ be a bound state for three quarks?", G. RAJASEKHARAN, *Tata Institute of Fundamental Research, Bombay, India*

"The zero temperature Heisenberg ferromagnet as a field theory", D. A. DUBIN, *Imperial College of Science and Technology, London, England*

"Electromagnetic interaction of particles with spin", R. H. GOOD, Jr., *Iowa State University, Ames, Iowa, USA*

"On the algebra of L-Matrices", A. RAMAKRISHNAN, *Matscience, Madras, India*

"L-Matrices and propogators with imaginary parameters", A. RAMAKRISHNAN, *Matscience, Madras, India*

"A hierarchy of idempotent matrices", A. RAMAKRISHNAN and R. VASUDEVAN, *Matscience, Madras, India*

Applications of Mathematical Methods

"Photon statistibs and coherence in light beams", R. VASUDEVAN, *Matscience, Madras, India*

"Stochastic integrations and differential equations - physical approach", S. K. SRINIVASAN, *Indian Institute of Technology, Madras, India*

"Some aspects of Operational Research", A. M. LEE, *Air Canada, Montreal, Canada*

Pure Mathematics

"Nevanlinna theory and gap series", W. H. J. FUCHS, *Cornell University, Ithaca, New York, USA*

"Uniform distribution aqnd dnsities of locally compact Abelian groups", L. A. RUBEL, *Institute for Advanced Study, Princeton, New Jersey, USA and University of Illinois, Urbana, Illinois, USA*

"Lectures on vector spaces of analytic functions", L. A. RUBEL, *Institute for Advanced Study, Princeton, New Jersey, USA and University of Illinois, Urbana, Illinois, USA*

Volume 10 (1970)

Lectures presented at the 1969 Seventh Anniversary Symposium

"The contributions of Ramanujan to mathematics", S. ABHYANKAR, *Purdue University, Lafayette, Indiana, USA*

"Regularly varying functions and Poincare's theorem on difference equations", T. H. GANELIUS, *Cornell University, Ithaca, New York, USA and University of Göteborg, Göteborg, Sweden*

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"Ramanujan's function $\tau(n)$", R. A. RANKIN, *University of Glasgow, Glasgow, Scotland*

"Fixed point theorems", K. SRINIVASACHARYULU, *University of Montreal, Montreal, Canada*

"Unitary generalization of Pauli matrices", A. RAMAKRISHNAN, *Matscience, Madras, India*

"Generalized Clifford basis and infinitesimal generators of unitary groups", A. RAMAKRISHNAN and I. V. V. RAGHAVACHARYULU, *Matscience, Madras, India*

"L-Matrices and the fundamental theorem of spinor theory", A. RAMAKRISHNAN, T. S. SANTHANAM, and P. S. CHANDRASEKHARAN, *Matscience, Madras, India*

"Some new results on non-relativistic many-body scattering theory", F. RIAHI, *Aria-Mehr University, Tehran, Iran*

"On a group theoretical connection among physical hierarchies", A. SANKARANARAYANAN, *Douglas Advanced Research Laboratories, Long Beach, California, USA*

"Phase shifts at low energy determined from the peripheral model", J. R. FULCO, *University of California, Santa Barbara, USA* and G. L. SHAW *University of California, Irvine, USA*

"Effects of short range corrections in nuclei on some reaction processes", V. DEVANATHAN, *University of Madras, Madras, India*

"Nuclear effects on the emitted pion in photo-pion reactions", V. DEVANATHAN, *University of Madras, Madras, India*

"The theory of particles travelling faster than light - I", E. C. G. SUDARSHAN, *Syracuse University, Syracuse, New York, USA*

matscience symposia on theoretical physics

Lectures presented at the
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Edited by
ALLADI RAMAKRISHNAN
Director of the Institute

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Preface

The MATSCIENCE Institute holds two scientific meetings a year, an anniversary symposium in January to commemorate its birth in 1962 and a three-week summer school in August. The proceedings of the first three meetings were initially made available for private circulation as cyclostyled notes. Professor Rosenfeld, the editor of *Nuclear Physics*, expressed the view that such material, which represented the cooperative effort of the scientists from various countries who participated in the visiting program of our Institute, should be published in a "more permanent form" to reach a wider community of readers.

We were given the opportunity to do this by Mr. Earl Coleman, President of Plenum Press, who made the spontaneous offer, during his visit to Madras just a year ago to publish these proceedings as a continuing series. It was also decided to include in each volume certain lectures delivered during the year, though not at the meeting itself, if they were relevant to the subject matter of the symposium.

The handsome effort of Plenum Press to bring out the series beginning with the very first symposium has been matched by the willing cooperation of our visiting scientists, who have made this an international endeavor, the wholesome consequences of which will be felt beyond the domain of science.

In particular, for the preparation of the first volume, our grateful thanks are due to Professors Segre and Takeda and Dr. Maglic for allowing us to include their lectures in the volume, to Professor Zemach and the publishers of the *Physical Review* for permission to summarize and reproduce figures from his paper in that journal, and to Professor A. H. Rosenfeld for the inclusion of the table of elementary particles from a UCRL Report.

Alladi Ramakrishnan

Madras
November 1965