Mathematical Physics

Volume 86 Number 1 1982

M. Aizenman Geometric Analysis of ϕ^4 Fields and Ising Models. Parts I and II 1

I. Kaplansky The Virasoro Algebra 49

A. Ashtekar, On the Symplectic Structure of General Relativity 55 A. Magnon-Ashtekar

J. M. Cohen, R. T. Powers The General Relativistic Hydrogen Atom 69

J. Fröhlich, A. Mardin, V. Rivasseau Summability of the 1/N Expansion for the N-Vector O(N) Non-Linear σ Models 87

S. J. Summers Normal Product States for Fermions and Twisted Duality for

CCR- and CAR-Type Algebras with Application to the Yukawa₂ Quantum Field Model 111

C. Borell Brownian Motion in a Convex Ring and Quasi-Concavity 143

Indexed in Current Contents

Evaluated for Physics Briefs and INKA-PHYS data base



Springer-Verlag Berlin Heidelberg New York

Communications in Mathematical Physics

Copyright. It is a fundamental condition that submitted manuscripts have not been published and will not be simultaneously submitted or published elsewhere. By submitting a manuscript, the authors agree that the copyright for their article is transferred to the publisher if and when the article is accepted for publication. The copyright covers the exclusive rights to reproduce and distribute the article, including reprints, photographic reproductions, microform or any other reproductions of similar nature, and translations. Photographic reproduction, microform, or any other reproduction of text, figures, or tables from this journal is prohibited without permission obtained from the publisher.

While the advice and information in this journal is believed to be true and accurate at the date of its going to press, neither the authors nor the editors nor the publisher can accept legal responsibility for errors or omissions that may have been made. The publisher makes no warranty, express of implied, with respect to the material contained herein.

Special Regulations for the USA. The Article Fee Code on the first page of an article in this journal indicates the copyright owner's consent that in the USA copies may be made for personal or internal use, provided the stated fee for copying beyond that permitted by Section 107 or 108 of the United States Copyright Law is paid through the Copyright Clearance Center, Inc., 21 Congress Street, Salem, MA 01970, USA. If a code does not appear, copies of the article may be made without charge, provided permission is obtained from the pub-

The copyright owner's consent does not extend to copying for general distribution, for promotion, for creating new works, or for resale. Specific written permission must be obtained from the publisher for such copying.

Authors should mark manuscripts according to the "Instructions to Authors." They should be aware that manuscripts which are not properly marked require additional time for publication. Manuscripts should be

Prof. H. Araki, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, 606, Japan

Prof. J. Fröhlich, ETH-Hönggerberg, CH-8093 Zürich, Switzerland

Prof. J. Glimm, Courant Institute, New York University, 251 Mercer Street, New York, NY 10012, USA

Prof. R. Haag, II. Institut für Theoretische Physik, Luruper Chaussee 149, D-2000 Hamburg 50, Federal Republic of Germany

Prof. S. Hawking, Department of Applied Mathematics and Theoretical Physics, University of Cambridge, Silver Street, Cambridge CB3 9EW, England

Prof. A. Jaffe, Lyman Laboratory of Physics, Harvard University, Cambridge, MA 02138, USA

Prof. O. Lanford, until December 1, 1982: Department of Mathematics, University of California, Berkeley, CA 94720, USA, after December 1, 1982: I. H. E. S., F-91440 Bures-sur-Yvette, France

Prof. J. Lascoux, Physique Théorique, Ecole Polytechnique, F-91120 Palaiseau, France

Prof. J. L. Lebowitz, Department of Mathematics, Rutgers University, New Brunswick, NJ 08903, USA

Prof. G. Mack, II. Institut für Theoretische Physik, Luruper Chaussee 149, D-2000 Hamburg 50, Federal Republic of Germany

Prof. K. Osterwalder, E.T.H. Zentrum, CH-8092 Zürich, Switzerland

Prof. B. Simon, Department of Mathematics, California Institute of Technology, Pasadena, CA 91125, USA

Prof. Ya. G. Sinai, L. D. Landau Institute for Theoretical Physics, Academy of Sciences, Vorobyevskoe Shosse, 2, 117334 Moscow, USSR

Prof. T. Spencer, Courant Institute, New York University, 251 Mercer Street, New York, NY 10012, USA

Prof. R. Stora, CERN, Theory Division, CH-1211 Geneva 23, Switzerland Prof. S.-T. Yau, School of Mathematics, The Institute for Advanced Study, Princeton, NJ 08540, USA

Mathematical methods with direct relevance to physics

Equilibrium statistical mechanics

Fluid mechanics

Conceptual structure

Gravitation and field theories

Chief Editor

Dynamical systems

Nonequilibrium statistical mechanics

Quantum field theory and statistical mechanics

Constructive quantum field theory and general theory of quantized fields

Schrödinger operators and atomic physics

Statistical physics and dynamical systems

Disordered systems

Lagrangian quantum field theory Relativity; geometry and physics

100 offprints of each article will be supplied to the author free of charge and additional copies may be obtained at cost price if ordered before the issue goes to press.

Subscription Information. Vols. 82-85, plus Volume 86 (4 issues each) will appear in 1982. Information about obtaining back volumes and microform editions available upon request.

Change of address. Six weeks should be allowed for all changes to become effective. All communications should include both old and new addresses (with postal codes) and should be accompanied by an address label from a recent issue.

North America. Annual subscription rate: US \$855.00, plus \$213.75 including postage and handling. Subscriptions are entered with prepayment only. Orders should be addressed to: Springer-Verlag New York Inc., Service Center Secaucus, 44 Hartz Way, Secaucus, NJ 07094, USA, Telephone (201) 348-4033, Telex 0023125994.

Members of the International Association of Mathematical Physics (IAMP) are entitled to receive the journal strictly for their own personal use at a special reduced rate. The orders must be placed through the IAMP.

All Other Countries. Annual subscription rate: DM 1416.00, plus DM 354.00 plus postage and handling. Airmail delivery on request only. For Japan, postage (Surface Airmail Lifted) and handling is DM 134.40. — Orders for all countries except North America can either be placed with your bookdealer or sent directly to: Springer-Verlag, Heidelberger Platz 3, D-1000 Berlin 33.

Springer-Verlag, Journal Department I, Postfach 105 280, D-6900 Heidelberg 1, Tel. (062 21) 487-0, Telex 04-61723 Springer-Verlag, Heidelberger Platz 3, D-1000 Berlin 33, Tel. (030) 8207-1, Telex 01-83319

Springer-Verlag, New York Inc., 175 Fifth Avenue, New York, NY 10010, Tel. (212) 460-1500, Telex 232235



A Note to Subscribers and Authors

An unexpectedly large increase in the number of high-quality manuscripts submitted to our journal in recent months makes it necessary to publish an additional volume (Vol. 86) in 1982. Even though this decision was made with considerable hesitation, our primary concern was not to delay the appearance of these papers, because our authors and readers are equally appreciative of the rapid publication of scientific data.

We hope that our authors will appreciate this decision and also that our subscribers will lend us their continuing support.

Springer-Verlag