# Communications in Mathematical Physics

## Volume 98 1985 A. Jaffe, Cambridge, MA

Chief Editor Editorial Board

Advisory Board

H. Araki, Kyoto M. E. Fisher, Ithaca, NY J. Fröhlich, Zürich R. Haag, Hamburg S. Hawking, Cambridge O. Lanford, Bures-sur-Yvette J. L. Lebowitz, New Brunswick, NJ G. Mack, Hamburg J. Mather, Princeton, NJ L. Nirenberg, New York, NY K. Osterwalder, Zürich G. Parisi, Roma B. Simon, Pasadena, CA Ya. G. Sinai, Moscow T. Spencer, New York, NY S.-T. Yau, LaJolla, CA M. F. Atiyah, Oxford F. Hirzebruch, Bonn G. 't Hooft, Utrecht

R. Schrieffer, Santa Barbara, CA I. Singer, Cambridge, MA C. N. Yang, Stony Brook, NY



Springer-Verlag Berlin Heidelberg New York Tokyo

### Copyright

Submission of a manuscript implies: that the work described has not been published before (except in the form of an abstract or as part of a published lecture, review, or thesis); that it is not under consideration for publication elsewhere; that its publication has been approved by all coauthors, if any, as well as by the responsible authorities at the institute where the work has been carried out; that, if and when the manuscript is accepted for publication, the authors agree to automatic transfer of the copyright to the publisher; and that the manuscript will not be published elsewhere in any language without the consent of the copyright holders.

All articles published in this journal are protected by copyright, which covers the exclusive rights to reproduce and distribute the article (e. g., as offprints), as well as all translation rights. No material published in this journal may be reproduced photographically or stored on microfilm, in electronic data bases, video disks, etc., without first obtaining written permission from the publisher.

The use of general descriptive names, trade names, trademarks, etc., in this publication, even if not specifically identified, does not imply that these names are not protected by the relevant laws and regulations.

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, the editors, nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

### Special regulations for photocopies in the USA:

Photocopies may be made for personal or in-house use beyond the limitations stipulated under Section 107 or 108 of U.S. Copyright Law, provided a fee is paid. This fee is US \$ 0.20 per page, or a minimum of US \$ 1.00 if an article contains fewer than five pages. All fees should be paid to the Copyright Clearance Center, Inc., 21 Congress Street, Salem, MA 01970, USA, stating the ISSN 0010-3616, the volume, and the first and last page numbers of each article copied. The copyright owner's consent does not include copying for general distribution, promotion, new works, or resale. In these cases, specific written permission must first be obtained from the publisher.

#### Other regulations:

Authors publishing in this journal can, under certain conditions, benefit from library and photocopy fees collected by VG WORT. Authors of German nationality and those resident in the Federal Republic of Germany or Berlin (West), as well as citizens of Austria, Switzerland and member countries of the European Community, may apply to Verwertungsgesellschaft WORT, Abteilung Wissenschaft, Goethestraße 49, D-8000 München 2, for detailed information.

Springer-Verlag Berlin Heidelberg New York Tokyo Printers: Brühlsche Universitätsdruckerei, Giessen Printed in Germany — © Springer-Verlag Berlin Heidelberg 1985 Springer-Verlag GmbH & Co KG 1000 Berlin 33

# Contents

Bałaban, T.: Averaging Operations for Lattice Gauge Theories	53
Bismut, JM.: Index Theorem and Equivariant Cohomology on the Loop Space Bricmont, J., Fröhlich, J.: Statistical Mechanical Methods in Particle Structure Analysis of Lattice Field Theories. II. Scalar and Surface Models	
Bunce, L. J., Wright, J. D. M.: Quantum Measures and States on Jordan Algebras Carey, A. L., Hurst, C. A.: A Note on the Boson-Fermion Correspondence and Infinite Dimen-	187
sional Groups	435
eter of the Averaged Green's Function for Gaussian Disorder Corrigan, E., Wainwright, P. R., Wilson, S. M. J.: Some Comments on the Non-Self-Dual Nahm	203
Equations	
Reduction Dinaburg, E. I., Sinai, Ya. G.: An Analysis of ANNNI Model by Peierl's Contour Method DiPerna, R. J., Majda, A.: The Validity of Nonlinear Geometric Optics for Weak Solutions of	79 119
Conservation Laws Enter, A. C. D. van, Fröhlich, J.: Absence of Symmetry Breaking for N-Vector Spin Glass Models in Two Dimensions	
Fefferman, C.: The Thermodynamic Limit for a Crystal	
Feynman Graphs Friedlander, L.: An Invariant Measure for the Equation $u_{tt} - u_{xx} + u^3 = 0$ Fröhlich, J., see Enter, A. C. D. van	273 1 425
Fröhlich, J., see Bricmont, J Grundling, H. B. G. S., Hurst, C. A.: Algebraic Quantization of Systems with a Gauge Degene-	553
racy Henneaux, M., Teitelboim, C.: Asymptotically Anti-de Sitter Spaces	391
Hurst, C. A., see Carey, A. L. Imbrie, J. Z.: The Ground State of the Three-Dimensional Random-Field Ising Model	435
Jadczyk, A., see Coquereaux, R	203
Krámli, A., Szász, D.: The Problem of Recurrence for Lorentz Processes Lüscher, M., Weisz, P.: On-Shell Improved Lattice Gauge Theories (Erratum) MacKay, R. S., Percival, I. C.: Converse KAM: Theory and Practice	433
MacKay, R. S., Percival, I. C.: Converse KAM: Theory and Practice	
nuous Systems Majda, A., see DiPerna, R. J.	313
Manin, Yu.I., Radul, A.O.: A Supersymmetric Extension of the Kadomtsev-Petviashvili Hierarchy Mansfield, P.: Solution of the Initial Value Problem for the sine-Gordon Equation Using a Kac- Moody Algebra.	65 525
Martinelli, F., Scoppola, E.: Remark on the Absence of Absolutely Continuous Spectrum for <i>d</i> -Dimensional Schrödinger Operators with Random Potential for Large Disorder or Low Energy (Erratum)	
Miyamoto, M.: Recurrence of Random Walks in the Ising Spins	253
Okabe, Y.: A Generalized Fluctuation-Dissipation Theorem for the One-Dimensional Diffusion Process	
Percival, I. C., see MacKay, R. S	105 349
Radul, A. O., see Manin, Yu. I.   Ravenel, D. C., Zee, A.: Spin and Statistics of Solitons and J-Homomorphism   Rivasseau, V., see Feldman, J., et al.	239
Nivasseau, v., see I cicilially J., et al	415

Scharffenberger, U., see Constantinescu, F., et al.	203
Scoppola, E., see Martinelli, F	579
Sénéor, R., see Feldman, J., et al	
Sinai, Ya. G., see Dinaburg, E. I	
Sohnius, M. F., see Pilch, K., et al 1	105
Streater, R. F.: Convergence of the Quantum Boltzmann Map	177
Szász, D., see Krámli, A	539
Szczerba, A. M.: Spins and Fermions on Arbitrary Lattices	513
Tamura, H.: Regularized Determinants for Quantum Field Theories with Fermions	355
Teitelboim, C., see Henneaux, M.	391
Tucker, R. W., see Benn, I. M.	53
Wainwright, P. R., see Corrigan, E., et al	259
Weisz, P., see Lüscher, M.	133
Wilson, S. M. J., see Corrigan, E., et al	259
Wright, J. D. M., see Bunce, L. J.	87
Zeell, Á., see Ravenel, D. C	239

Indexed in Current Contents Evaluated for Physics Briefs and INKA-PHYS data base

# Communications in Mathematical Physics

# Volume 98 Number 1 1985

L. Friedlander	An Invariant Measure for the Equation $u_{tt} - u_{xx} + u^3 = 0$ 1	
T. Balaban	Averaging Operations for Lattice Gauge Theories 17	
I. M. Benn, R. W. Tucker	The Dirac Equation in Exterior Form 53	
Yu. I. Manin, A. O. Radul	A Supersymmetric Extension of the Kadomtsev-Petviashvili Hierarchy 65	
R. Coquereaux, A. Jadczyk	Symmetries of Einstein-Yang-Mills Fields and Dimensional Reduction 79	
K. Pilch, P. van Nieuwenhuizen, M. F. Sohnius	De Sitter Superalgebras and Supergravity 105	
E. I. Dinaburg, Ya. G. Sinai	An Analysis of ANNNI Model by Peierl's Contour Method 119	

Indexed in Current Contents Evaluated for Physics Briefs and INKA-PHYS data base



Springer-Verlag Berlin Heidelberg New York Tokyo

220 Commun. Math. Phys. ISSN 0010-3616 CMPHAY 98 (1) 1-144 (1985)

# Communications in Mathematical Physics

Copyright. Submission of a manuscript implies: that the work described has not been published before (except in the form of an abstract or as part of a published lecture, review, or thesis); that it is not under consideration for publication elsewhere; that its publication has been approved by all coauthors, if any, as well as by the responsible authorities at the institute where the work has been carried out; that, if and when the manuscript is accepted for publication, the authors agree to automatic transfer of the copyright to the publisher; and that the manuscript will not be published elsewhere in any language without the consent of the copyright holders.

All articles published in this journal are protected by copyright, which covers the exclusive rights to reproduce and distribute the article (e.g., as offprints), as well as all translation rights. No material published in this journal may be reproduced photographically or stored on microfilm, in electronic data bases, video disks, etc., without first obtaining written permission from the publisher.

The use of general descriptive names, trade names, trademarks, etc., in this publication, even if not specifically identified, does not imply that these names are not protected by the relevant laws and regulations.

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, the editors, nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

Special regulations for photocopies in the USA: Photocopies may be made for personal or in-house use beyond the limitations stipulated under Section 107 or 108 of U.S. Copyright Law, provided a fee is paid. This fee is US \$ 0.20 per page, or a minimum of US \$ 1.00 if an article contains fewer than five pages. All fees should be paid to the Copyright Clearance Center, Inc., 21 Congress Street, Salem, MA 01970, USA, stating the ISSN 00103616, the volume, and the first and last page numbers of each article copied. The copyright owner's consent does not include copying for general distribution, promotion, new works, or resale. In these cases, specific written permission must first be obtained from the publisher.

Other regulations: Authors publishing in this journal can, under certain conditions, benefit from library and photocopy fees collected by VG WORT. Authors resident in the Federal Republic of Germany or in West Berlin can apply to Verwertungsgesellschaft WORT, Abteilung Wissenschaft, Goethestraße 49, D-8000 München 2, for detailed information.

### 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 sent to:

<i>Prof. H. Araki,</i> Research Institute for Mathematical Sciences, Kyoto University, Kyoto, 606, Japan	Mathematical methods with direct relevance to physics
<i>Prof. M. E. Fisher</i> , Baker Laboratory, Department of Chemistry, Cornell University, Ithaca, NY 14850, USA	Statistical physics
Prof. J. Fröhlich, ETH-Hönggerberg, CH-8093 Zürich, Switzerland	Equilibrium statistical mechanics
<i>Prof. R. Haag,</i> II. Institut für Theoretische Physik, Luruper Chaussee 149, D-2000 Hamburg 50, Federal Republic of Germany	Conceptual structure
<i>Prof. S. Hawking,</i> Department of Applied Mathematics and Theoretical Physics, University of Cambridge, Silver Street, Cambridge CB3 9EW, England	Gravitation and field theories
<i>Prof. A. Jaffe</i> , Lyman Laboratory of Physics, Harvard University, Cambridge, MA 02138, USA	Chief Editor
Prof. O. Lanford, I. H. E. S., F-91440 Bures-sur-Yvette, France	Dynamical systems
<i>Prof. J. L. Lebowitz,</i> Department of Mathematics, Rutgers University, New Brunswick, NJ 08903, USA	Nonequilibrium statistical mechanics
<i>Prof. G. Mack,</i> II. Institut für Theoretische Physik, Luruper Chaussee 149, D-2000 Hamburg 50, Federal Republic of Germany	Quantum field theory and statistical mechanics
<i>Prof. J. Mather,</i> Department of Mathematics, Fine Hall, Princeton University, Princeton, NJ 08544, USA	Classical dynamical systems
<i>Prof. L. Nirenberg,</i> Courant Institute, New York University, 251 Mercer Street, New York, NY, 10012, USA	Partial differential equations
Prof. K. Osterwalder, E.T.H. Zentrum, CH-8092 Zürich, Switzerland	Constructive quantum field theory and general theory of quantized fields
<i>Prof. G. Parisi</i> , Dipartimento di Fisica, Università di Roma II, Tor Vergata, I-00173 Roma, Italy	General theoretical physics
<i>Prof. B. Simon,</i> Department of Mathematics, California Institute of Technology, Pasadena, CA 91125, USA	Schrödinger operators and atomic physics
<i>Prof. Ya. G. Sinai,</i> L. D. Landau Institute for Theoretical Physics, ul. Kosygina, dom 2, SU-117334 Moscow, V—334, USSR	Statistical physics and dynamical systems
<i>Prof. T. Spencer,</i> Courant Institute, New York University, 251 Mercer Street, New York, NY 10012, USA	Disordered systems

Prof. S.-T. Yau, Department of Mathematics, University of California at San Diego, La Jolla, CA 92093, USA

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 97-101, (4 issues each) will appear in 1985 North America. Annual subscription rate: US \$ 797.00, single issue price \$ 48.00 including carriage charges. 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 0023 125 994. 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 2130.00, plus carriage charges. Volume price: DM 426.00, single issue price: DM 127.80, plus carriage charges. Airmail delivery on request only. Carriage charges for SAL (Surface Airmail Lifted) to Japan, India, Australia and New Zealand are available on request. – 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. Tel. 0 30/82 07-1, Telex 01 83 319. Changes of Address: Allow six weeks for all changes to become effective. All communications should include both old and new addresses (with Postal Codes) and should be accompanied by a mailing label from a recent issue. Back Volumes. Prices are available on request. Microform: Microform editions are available from: University Microfilms International, 300 N. Zeeb Road, Ann Arbor, MI 48106, USA.

### Production

Journal Production Department I, Springer-Verlag, Postfach 10 52 80, D-6900 Heidelberg 1, Federal Republic of Germany, Tel. 0 62 21/4 87-3 25, Telex 04 61 723