

Communications in  
**Mathematical  
Physics**

Volume 105 1986

Chief Editor A. Jaffe, Cambridge, MA

Editorial Board L. Alvarez-Gaumé, Genève  
H. Araki, Kyoto  
J.-P. Eckmann, Genève  
M. E. Fisher, Ithaca, NY  
J. Fröhlich, Zürich  
R. Haag, Hamburg  
J. L. Lebowitz, New Brunswick, NJ  
J. Mather, Princeton, NJ  
K. Osterwalder, Zürich  
G. Parisi, Roma  
B. Simon, Pasadena, CA  
Ya. G. Sinai, Moscow  
T. Spencer, New York, NY  
C. H. Taubes, Cambridge, MA  
S.-T. Yau, La Jolla, CA

Advisory Board 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publication, the authors agree to automatic transfer of the copyright to the publisher; and that the manuscript will not be published elsewhere in any language without the consent of the copyright holders.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 1986

Springer-Verlag GmbH & Co KG 1000 Berlin 33

# Contents

Arkeryd, L.: On the Boltzmann Equation in Unbounded Space far from Equilibrium, and the Limit of Zero Mean Free Path .....	205
Burzlaff, J., O'Murchadha, N.: Global Existence of Time-Dependent Yang-Mills-Higgs Monopoles	85
Cazenave, T., Vazquez, L.: Existence of Localized Solutions for a Classical Nonlinear Dirac Field	35
Chayes, J. T., Chayes, L.: Bulk Transport Properties and Exponent Inequalities for Random Resistor and Flow Networks .....	133
Chayes, J. T., Chayes, L.: Ornstein-Zernike Behavior for Self-Avoiding Walks et All Noncritical Temperatures .....	221
Chayes, L., see Chayes, J. T. ....	133
Chayes, L., see Chayes, J. T. ....	221
Christodoulou, D.: The Problem of a Self-Gravitating Scalar Field .....	337
Colin de Verdiere, Y.: L'asymptotique de Weyl pour les bouteilles magnétiques .....	327
Donald, M. J.: On the Relative Entropy .....	13
Driessler, W., Summers, S. J., Wichmann, E. H.: On the Connection Between Quantum Fields and von Neumann Algebras of Local Operators .....	49
Esteban, M. J.: A Direct Variational Approach to Skyrme's Model for Meson Fields .....	571
Goodman, R., Wallach, N. R.: Classical and Quantum Mechanical Systems of Toda-Lattice Type. III. Joint Eigenfunctions of the Quantized Systems .....	473
Hardin, D. P., Massopust, P. R.: The Capacity for a Class of Fractal Functions .....	455
Hardt, R., Kinderlehrer, D., Lin, F.-H.: Existence and Partial Regularity of Static Liquid Crystal Configurations .....	547
Hurtubise, J.: Instantons and Jumping Lines .....	107
Ichinose, T., Tamura, H.: Imaginary-Time Path Integral for a Relativistic Spinless Particle in an Electromagnetic Field .....	239
Illner, R., Pulvirenti, M.: Global Validity of the Boltzmann Equation for a Two-Dimensional Rare Gas in Vacuum .....	189
Israel, R. B.: Some Examples Concerning the Global Markov Property .....	669
Kinderlehrer, D., see Hardt, R., et al. ....	547
King, C.: Deconfining Phase Transition in the U(1) Model with Wilson's Action .....	675
Laanait, L., Messenger, A., Ruiz, J.: Phases Coexistence and Surface Tensions for the Potts Model	527
Lafon, A.: Hausdorff Dimension of Attractors for the Two-Dimensional Navier-Stokes Equations with Boundary Conditions .....	519
Lin, F.-H., see Hardt, R., et al. ....	547
Lüscher, M.: Volume Dependence of the Energy Spectrum in Massive Quantum Field Theories. II. Scattering States .....	153
Marchioro, C.: An Example of Absence of Turbulence for any Reynolds Number .....	99
Martirosian, D. H.: Translation Invariant Gibbs States in the $q$ -State Potts Model .....	281
Massopust, P. R., see Hardin, D. P. ....	455
Messenger, A., see Laanait, L., et al. ....	527
Nahm, W.: A Classification of Open String Models .....	1
Nicolò, F., Renn, J., Steinmann, A.: On the Massive Sine-Gordon Equation in all Regions of Collapse .....	291
O'Murchadha, N., see Burzlaff, J. ....	85
Ovid'ko, I. A., Romanov, A. E.: Methods of Topological Obstruction Theory in Condensed Matter Physics .....	443
Petz, D.: Sufficient Subalgebras and the Relative Entropy of States of a von Neumann Algebra .	123
Pillet, C.-A.: Asymptotic Completeness for a Quantum Particle in a Markovian Short Range Potential .....	259

Pohlmeyer, K.: The Invariant Charges of the Nambu-Goto Theory in WKB-Approximation: Renormalization .....	629
Pohlmeyer, K., Rehren, K.-H.: Algebraic Properties of the Invariant Charges of the Nambu-Goto Theory .....	593
Pulvirenti, M., see Illner, R. ....	189
Radin, C.: Crystals and Quasicrystals: A Continuum Model .....	385
Rehren, K.-H., see Pohlmeyer, K. ....	593
Ren, H.-C.: A Rigorous Upper Bound of a Scalar Self-propagator in a Random Lattice Ensemble in Higher Dimensions .....	363
Renn, J., see Nicolò, F., et al. ....	291
Reyman, A. G., Semenov-Tian-Shansky, M. A.: A New Integrable Case of the Motion of the 4-Dimensional Rigid Body .....	461
Rogers, A.: Graded Manifolds, Supermanifolds and Infinite-Dimensional Grassmann Algebras .	375
Romanov, A. E., see Ovid'ko, I. A. ....	443
Rosly, A. A., Schwarz, A. S.: Supersymmetry in a Space with Auxiliary Dimensions .....	645
Ruiz, J., see Laanait, L., et al. ....	527
Schwarz, A. S., see Rosly, A. A. ....	645
Semenov-Tian-Shansky, M. A., see Reyman, A. G. ....	461
Smoller, J. A., Wasserman, A. G.: Symmetry-Breaking for Solutions of Semilinear Elliptic Equations with General Boundary Conditions .....	415
Steinmann, A., see Nicolò, F., et al. ....	291
Summers, S. J., see Driessler, W., et al. ....	49
Tamura, H., see Ichinose, T. ....	239
Vasquez, L. see Cazenave, T. ....	35
Wallach, N. R., see Goodman, R. ....	473
Wasserman, A. G., see Smoler, J. A. ....	415
Wichmann, E. H., see Driessler, W., et al. ....	49
Windey, P.: Super-Kac-Moody Algebras and Supersymmetric $2d$ -Free Fermions .....	511
Wojtkowski, M.: Principles for the Design of Billiards with Nonvanishing Lyapunov Exponents	391

Indexed in *Current Contents*

Evaluated and abstracted for *PHYS* on *STN*

# Communications in Mathematical Physics

Volume 105 Number 4 1986

P. Windey Super-Kac-Moody Algebras and Supersymmetric  $2d$ -Free Fermions 511

A. Lafon Hausdorff Dimension of Attractors for the Two-Dimensional Navier-Stokes Equations with Boundary Conditions 519

L. Laanait, A. Messenger, J. Ruiz Phases Coexistence and Surface Tensions for the Potts Model 527

R. Hardt, D. Kinderlehrer, F.-H. Lin Existence and Partial Regularity of Static Liquid Crystal Configurations 547

M. J. Esteban A Direct Variational Approach to Skyrme's Model for Meson Fields 571

K. Pohlmeyer, K.-H. Rehren Algebraic Properties of the Invariant Charges of the Nambu-Goto Theory 593

K. Pohlmeyer The Invariant Charges of the Nambu-Goto Theory in WKB-Approximation: Renormalization 629

A. A. Rosly, A. S. Schwarz Supersymmetry in a Space with Auxiliary Dimensions 645

R. B. Israel Some Examples Concerning the Global Markov Property 669

C. King Deconfining Phase Transition in the  $U(1)$  Model with Wilson's Action 675

Indexed in *Current Contents*

Evaluated and abstracted for *PHYS* on *STN*



Springer-Verlag  
Berlin Heidelberg New York Tokyo

# 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 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.

**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:**

*Prof. L. Alvarez-Gaumé*, until August 31, 1987: Theory Group, CERN, CH-1211 Genève 23, Switzerland. After September 1, 1987: Department of Physics, Boston University, Boston MA 02215, USA

*Gravitation, field theories and geometry*

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

*Mathematical methods with direct relevance to physics*

*Prof. J.-P. Eckmann*, Département de Physique Théorique, Université de Genève, 32, Boulevard d'Ivoy, CH-1211 Genève 4, Switzerland

*Dynamical systems*

*Prof. M. E. Fisher*, Baker Laboratory, Department of Chemistry, Cornell University, Ithaca, NY 14850, USA

*Statistical physics*

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

*General statistical mechanics*

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

*Conceptual structure*

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

*Chief Editor*

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

*Nonequilibrium statistical mechanics*

*Prof. J. Mather*, Department of Mathematics, Fine Hall, Princeton University, Princeton, NJ 08544, USA

*Classical dynamical systems*

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

*Constructive quantum field theory and general theory of quantized fields*

*Prof. G. Parisi*, Dipartimento di Fisica, Università di Roma II, Tor Vergata, I-00173 Roma, Italy

*General theoretical physics*

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

*Schrödinger operators and atomic physics*

*Prof. Ya. G. Sinai*, L. D. Landau Institute for Theoretical Physics, ul. Kosygina, dom 2, SU-117334 Moscow, V-334, USSR

*Statistical physics and dynamical systems*

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

*Disordered systems*

*Prof. C. H. Taubes*, Department of Mathematics, Harvard University, 1 Oxford Street, Cambridge, MA 02138, USA

*Partial differential equations*

*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. 102-107, (4 issues each) will appear in 1986. **North America.** Annual subscription rate: US \$ 1206.00, single issue price \$ 60.00 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 023 125 994. 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 3252.00, plus carriage charges. Volume price: DM 542.00, single issue price: DM 162.60, 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