Communications in

Mathematical Physics

Volume 124 1989

Chief Editor A. Jaffe, Cambridge, MA

Editorial Board M. Aizenman, New York, NY

L. Alvarez-Gaumé, Genève

H. Araki, Kyoto

A. Connes, Bures-sur-Yvette

J.-P. Eckmann, Genève

M. E. Fisher, College Park, MD

J. Fröhlich, Zürich

K. Gawedzki, Bures-sur-Yvette

J. L. Lebowitz, New Brunswick, NJ

J. Mather, Princeton, NJ

G. Parisi, Roma

B. Simon, Pasadena, CA

Ya. G. Sinai, Moscow

T. Spencer, Princeton, NJ

S.-T. Yau, Cambridge, MA

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 International

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publication, the authors agree to automatic transfer of the copyright to the publisher; and that the manuscript will not be published elsewhere in any language without the consent of the copyright holders.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

Springer-Verlag Berlin Heidelberg New York Tokyo Hong Kong Printers: Brühlsche Universitätsdruckerei, Giessen Printed in Germany — © Springer-Verlag Berlin Heidelberg 1989 Springer-Verlag GmbH & Co KG, D-1000 Berlin 33

Contents

- Antonowicz, M., Fordy, A. P.: Factorisation of Energy Dependent Schrödinger Operators:
 Miura Maps and Modified System 465
- Antonowicz, M., Fordy, A. P.: Super-Extensions of Energy Dependent Schrödinger Operators 487
- Aoki, K., Periwal, V.: Twisted Non-Abelian Determinants on Riemann Supersurfaces 301
- Ashbaugh, M. S., Benguria, R. D.: Optimal Bounds for Ratios of Eigenvalues of One-Dimensional Schrödinger Operators with Dirichlet Boundary Conditions and Positive Potentials 403
- Avron, J. E., Sadun, L., Segert, J., Simon, B.: Chern Numbers, Quaternions, and Berry's Phases in Fermi Systems 595
- Baez, J. C., Zhou, Z.-F.: Analyticity of Scattering for the φ^4 Theory 9
- Benguria, R. D., → Ashbaugh, M. S. 403
- Campanino, M., Perez, J. F.: Singularity of the Density of States for One-Dimensional Chains with Random Couplings 543
- Cecotti, S.: Homogeneous Kähler Manifolds and *T*-Algebras in *N*=2 Supergravity and Superstrings 23
- D' Hoker, E., Phong, D. H.: Functional Determinants on Mandelstam Diagrams 629
- Dobrev, V. K.: New Weyl Groups for $A_1^{(1)}$ and Characters of Singular Highest Weight Modules 319
- Dobrev, V. K.: A Weyl Group for the Virasoro and *N*=1 Super-Virasoro Algebras 501
- Dorlas, T. C., Lewis, J. T., Pulé, J. V.: The Yang-Yang Thermodynamic Formalism and Large Deviations 365
- Dreifus, H. von, Klein, A.: A New Proof of Localization in the Anderson Tight Binding Model 285

- Eskin, G., Ralston, J.: The Inverse Backscattering Problem in Three Dimensions 169
- Felder, G., Fröhlich, J., Keller, G.: On the Structure of Unitary Conformal Field Theory. I. Existence of Conformal Blocks 417
- Felder, G., Fröhlich, J., Keller, G.: Braid Matrices and Structure Constants for Minimal Conformal Models 647
- Figueroa-O' Farrill, J. M., Kimura, T.: The BRST Cohomology of the NSR String: Vanishing and "No-Ghost" Theorems 105
- Fordy, A. P. → Antonowicz, M. 465, 487 Fröhlich, J., → Felder, G., et al. 417, 647
- Hurd, T. R.: A Renormalization Group Proof of Perturbative Renormalizability 153
- Iagolnitzer, D., Iagolnitzer, L.: Non-Holonomicity of the *S* Matrix and Green Functions in Quantum Field Theory: A Direct Algebraic Proof in Some Simple Situations 79
- Iagolnitzer, L., → Iagolnitzer, D. 79 Ikeda, K., → Uneo, K., et al. 57
- Jackiw, R., → Sousa Gerbert, P. de 229
- Keller, G., → Felder, G., et al. 417, 647 Kimura, T., → Figueroa O' Farrill, J. M. 105 Klein, A., → Dreifus, H. von 285
- Langlands, R. P.: The Factorization of a Polynomical Defined by Partitions 261
- Lewis, J. T., \rightarrow Dorlas, T. C., et al. 365
- Lindsay, J. M., Parthasarathy, K. R.: Cohomology of Power Sets with Applications in Quantum Probability 337
- Nieuwenhuizen, P. van, → Shoutens, K., et al. 87

- Parthasarathy, K. R. → Lindsay, J. M. 337
- Penrose, O.: Metastable States for the Becker-Döring Cluster Equations 515
- Perez, J. F., → Campanino, M. 543
- Periwal, V., → Aoki, K. 301
- Phong, D. H., → D' Hoker, E. 629
- Pulé, J. V., → Dorlas, T. C., et al. 365
- Raikov, G. D.: Spectral Asymptotics for the Schrödinger Operator with Potential which Steadies at Infinity 665
- Ralston, J., → Eskin, G. 169
- Rosso, M.: An Analogue of P. B. W. Theorem and the Universal *R*-Matrix for $U_h sl$ (N+1) 307
- Ruijsenaars, S. N. M.: Index Formulas for Generalized Wiener-Hopf Operators and Boson-Fermion Correspondence in 2*N* Dimensions 553
- Sadun, L., → Avron, J. E., et al. 595
- Schonmann, R. H.: Projections of Gibbs Measures May Be Non-Gibbsian 1

- Schoutens, K., Sevrin, A., Nieuwenhuizen, P. van: Quantum BRST Charge for Quadratically Nonlinear Lie Algebras 87
- Segert, J., → Avron, J. E., et al. 595
- Sevrin, A., → Schoutens, K., et al. 87
- Simon, B., → Avron, J. E., et al. 595
- Sousa Gerbert, P. de, Jackiw, R.: Classical and Quantum Scattering on a Spinning Cone 229
- Stojanov, L.: An Estimate from Above of the Number of Periodic Orbits for Semi-Dispersed Billiards 217
- Uneo, K., Yamada, H., Ikeda, K.: Algebraic Study in the Super-KP Hierarchy and the Ortho-Symplectic Super-KP Hierarchy 57
- Wu, S.: Determinations of Dirac Operators and Thirring Model Partition Functions on Riemann Surfaces with Boundaries 133
- Yamada, H., \rightarrow Uneo, K., et al. 57
- Zhou, Z.-F., → Baez, J. C. 9

Indexed in *Current Contents*Evaluated and abstracted for *PHYS* on *STN*

Communications in Mathematical Physics

Volume 124 Number 4 1989

O. Penrose

Metastable States for the Becker-Döring Cluster Equations 515

M. Campanino, J. F. Perez

Singularity of the Density of States for One-Dimensional Chains with Random Couplings 543

S. N. M. Ruijsenaars

Index Formulas for Generalized Wiener-Hopf Operators and Boson-Fermion Correspondence in 2*N* Dimensions 553

J. E. Avron, L. Sadun, J. Segert, B. Simon Chern Numbers, Quaternions, and Berry's Phases in Fermi Systems 595

E. D'Hoker, D. H. Phong

Functional Determinants on Mandelstam Diagrams 629

G. Felder, J. Fröhlich, G. Keller Braid Matrices and Structure Constants for Minimal Conformal Models 647

G. D. Raikov

Spectral Asymptotics for the Schrödinger Operator with Potential which Steadies at Infinity 665

Contents of Vol. 124

Indexed in Current Contents

Evaluated and abstracted for PHYS on STN



Springer International

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 copyring for general distribution, promotion, new works, or resale. In these cases, specific written permission must first be obtained from the publisher.

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. M. Aizenman, Courant Institute of Mathematical Sciences, 251 Mercer Street, New York, NY 10012, USA

Prof. L. Alvarez-Gaumé, Theory Division, CERN, CH-1211 Genève 23, Switzerland

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

Prof. A. Connes, I.H.E.S., F-91440 Bures-sur-Yvette, France

Prof. J.-P. Eckmann, Département de Physique Théorique, Université de Genève, 32, Boulevard d'Ivoy, CH-1211 Genève 4, Switzerland Prof. M. E. Fisher, Institute for Physical Science and Technology, University of Maryland, College Park, MD 20742, USA

Prof. J. Fröhlich, ETH-Hönggerberg, CH-8093 Zürich, Switzerland Prof. K. Gawedzki, I.H.E.S., F-91440 Bures-sur-Yvette, France

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

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

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

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

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, ul. Kosygina, dom 2, SU-117334 Moscow, V—334, USSR

Prof. T. Spencer, School of Mathematics, Institute for Advanced Study, Princeton, NJ 08540, USA

Prof. S.-T. Yau, Department of Mathematics, Harvard University, 1 Oxford Street, Cambridge, MA 02138, USA

Statistical physics

Gravitation, field theories and geometry

Mathematical methods with direct relevance to physics Quantum physics and differential geometry Dynamical systems

Statistical physics

General statistical mechanics Quantum field theory and statistical mechanics Chief Editor

Chief Editor

Nonequilibrium statistical mechanics

Classical dynamical systems

General theoretical physics

Schrödinger operators and atomic physics

Statistical physics and dynamical systems

Disordered systems

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. 119-125, (4 issues each) will appear in 1989. North America. Annual subscription rate: US \$ 2387 00, single issue price \$ 105 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, FAX (2011) 348-4505. 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 4249 00, plus carriage charges: Federal Republic of Germany: DM 62.92 incl. value added tax; all other countries: DM 12.80 except for the following countries to which SAL delivery (Surface Airmall Lifted) is mandatory. Japan DM 868 80, India DM 203.00, Australia/New Zealand DM 303 80. Airmail delivery to all other countries is available upon request]. Volume price DM 607.00, single issue price: DM 182.10 plus carriage charges. 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, FAX (0)30/821 4091. 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 Arbr, 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 87-5 25, Telex 04 61 723, FAX (0)6221/4 39 82