VOLUME 33 NUMBER 1 JANUARY 1996

BULLETIN (NEW SERIES) OF THE AMERICAN MATHEMATICAL SOCIETY

EDITORS

Research-Expository Surveys Nolan R. Wallach

Research Reports Haynes R. Miller
Managing Editor

Book Reviews Murray H. Protter

PROVIDENCE, RHODE ISLAND USA

ISSN 0273-0979

Bulletin (New Series) of the American Mathematical Society

This journal is devoted to articles of the following types:

Research-Expository Surveys

These are, by definition, papers that present a clear and insightful exposition of significant aspects of contemporary mathematical research. Gibbs lectures, Progress in Mathematics lectures, and retiring presidential addresses will be included in this section.

Research Reports

These are brief, timely reports on important mathematical developments. They are normally solicited and often written by a disinterested expert.

Book Reviews

Book Reviews are accepted for publication by invitation only. Unsolicited manuscripts will not be considered.

Subscription information. *Bulletin* (*New Series*) *of the American Mathematical Society* is published quarterly. The *Bulletin* is also accessible electronically, starting with the January 1992 issue, from e-MATH via the World Wide Web at the URL `http://www.ams.org/publications/`. For paper delivery, subscription prices for Volume 33 (1996) are $252 list, $202 institutional member, $151 individual member. The subscription price for members is included in the annual dues. A late charge of 10% of the subscription price will be imposed upon orders received from nonmembers after January 1 of the subscription year. Subscribers outside the United States and India must pay a postage surcharge of $8.00; subscribers in India must pay a postage surcharge of $13.00. Expedited delivery to destinations in North America $12; elsewhere $21.

Back number information. For back issues see the *AMS Catalog of Publications*.

Subscriptions and orders should be addressed to the American Mathematical Society, P.O. Box 5904, Boston, MA 02206-5904. *All orders must be accompanied by payment.* Other correspondence should be addressed to P.O. Box 6248, Providence, RI 02940-6248.

Copying and reprinting. Material in this journal may be reproduced by any means for educational and scientific purposes without fee or permission with the exception of reproduction by services that collect fees for delivery of documents and provided that the customary acknowledgment of the source is given. This consent does not extend to other kinds of copying for general distribution, for advertising or promotional purposes, or for resale. Requests for permission for commercial use of material should be addressed to the Assistant to the Publisher, American Mathematical Society, P. O. Box 6248, Providence, RI 02940-6248. Requests can also be made by e-mail to `reprint-permission@ams.org`.

Excluded from these provisions is material in articles for which the author holds copyright. In such cases, requests for permission to use or reprint should be addressed directly to the author(s). (Copyright ownership is indicated in the notice in the lower right-hand corner of the first page of each article.)

Bulletin (*New Series*) *of the American Mathematical Society* is published quarterly by the American Mathematical Society at 201 Charles Street, Providence, RI 02904-2213. Second class postage is paid at Providence, Rhode Island, and additional mailing offices. Postmaster: Send address changes to Bulletin, American Mathematical Society, P.O. Box 6248, Providence, RI 02940-6248.

© 1996 American Mathematical Society. All rights reserved.

This journal is indexed in *Science Citation Index*®, *SciSearch*®, *Research Alert*®, *CompuMath Citation Index*®, and *Current Contents*®/*Physical, Chemical & Earth Sciences*.

Printed in the United States of America.

⊗ The paper used in this journal is acid-free and falls within the guidelines established to ensure permanence and durability.

10 9 8 7 6 5 4 3 2 1 01 00 99 98 97 96

Editorial Board for Research-Expository Surveys

John C. Baez
David Donoho
David Eisenbud
Richard S. Palais
Kenneth A. Ribet
Nolan R. Wallach, Chair

Editorial Board for Research Reports

Gregory L. Cherlin
Eric Friedlander
Carlos Kenig
Robert Lazarsfeld
Robert MacPherson
Haynes R. Miller, Chair
Donald Ornstein
Daniel Ruberman
Richard Schoen
David Vogan

Editorial Board for Book Reviews

Martin D. Davis
Jim Douglas, Jr.
Jens C. Jantzen
Murray H. Protter, Chair
Alec J. Wilkie
Ruth J. Williams
Wolfgang Ziller

Managing Editor: Haynes R. Miller

Editorial Information

As of October 31, 1995, the backlog for this journal was approximately 0 issues. This estimate is the result of dividing the number of manuscripts for this journal in the Providence office that have not yet gone to the printer on the above date by the average number of articles per issue over the previous twelve months, reduced by the number of issues published in four months (the time necessary for editing and composing a typical issue).

A Copyright Transfer Agreement is required before a paper will be published in this journal. By submitting a paper to this journal, authors certify that the manuscript has not been submitted to nor is it under consideration for publication by another journal, conference proceedings, or similar publication.

Information to Authors and Editors

For Research-Expository Surveys and Research Reports, the first page must consist of a *descriptive title*, followed by an *abstract* that summarizes the article in language suitable for workers in the general field (algebra, analysis, etc.). The *descriptive title* should be short but informative; useless or vague phrases such as "some remarks about" or "concerning" should be avoided. The *abstract* should be a brief technical description of the new material. Then, for Research Reports there should be an introductory section addressed to nonexperts describing the motivation, background, and significance of the results announced. Following the statement of results, there should be a sketch of proofs that may be addressed to experts. For Research-Expository Surveys and Research Reports, included with the footnotes to the paper, there should be the 1991 *Mathematics Subject Classification* representing the primary and secondary subjects of the article. This may be followed by a list of *key words and phrases* describing the subject matter of the article and taken from it. A list of the numbers may be found in the annual index of *Mathematical Reviews*, published with the December issue starting in 1990, as well as from the electronic service e-MATH [**telnet e-MATH.ams.org** (or **telnet 130.44.1.100**). Login and password are **e-math**.] For journal abbreviations

used in bibliographies, see the list of serials in the latest *Mathematical Reviews* annual index. Authors are encouraged to supply electronic addresses when available. These will be printed after the postal address at the end of each article.

TEX files available upon request. Authors may request a copy of the TEX files of their papers by sending e-mail to `file-request@ams.org` or by contacting the Editorial Department, American Mathematical Society, P.O. Box 6248, Providence, RI 02940-6248. The request should include the title of the paper, the name(s) of the author(s), the name of the publication in which the paper has or will appear, and the volume and issue numbers if known. The TEX file will be sent to the author making the request after the article goes to the printer. If the requestor can receive Internet e-mail, please include the e-mail address to which the file should be sent. Otherwise please indicate a diskette format and postal address to which a disk should be mailed. **Note:** Because TEX production at the AMS sometimes requires extra fonts and macros that are not yet publicly available, TEX files cannot be guaranteed to run through the author's version of TEX without errors. The AMS regrets that it cannot provide support to eliminate such errors in the author's TEX environment.

Electronically prepared manuscripts. The AMS encourages submission of electronically prepared manuscripts in $\mathcal{AMS}$-TEX or $\mathcal{AMS}$-LATEX because properly prepared electronic manuscripts save the author proofreading time and move more quickly through the production process. To this end, the Society has prepared author packages for each AMS publication. Author packages include instructions for preparing electronic manuscripts, the *AMS Author Handbook*, samples, and a style file that generates the particular design specifications of that publication series for both $\mathcal{AMS}$-TEX and $\mathcal{AMS}$-LATEX.

Those authors who make use of these style files from the beginning of the writing process will further reduce their own efforts. Electronically submitted manuscripts prepared in plain TEX or LATEX are normally not acceptable due to the high amount of technical time required to insure that the file will run properly through the AMS in-house production system. Users of plain TEX should have little difficulty learning $\mathcal{AMS}$-TEX, and LATEX users will find that $\mathcal{AMS}$-LATEX is the same as LATEX with additional commands to simplify the typesetting of mathematics.

Authors with FTP access may retrieve an author package from the Society's Internet node `e-MATH.ams.org` (130.44.1.100). For those without FTP access, the author package can be obtained free of charge by sending e-mail to `pub@ams.org` (Internet) or from the Publication Division, American Mathematical Society, P.O. Box 6248, Providence, RI 02940-6248. When requesting an author package, please specify $\mathcal{AMS}$-TEX or $\mathcal{AMS}$-LATEX, Macintosh or IBM (3.5) format, and the publication in which your paper will appear. Please be sure to include your complete mailing address.

At the time of submission, authors should indicate if the paper has been prepared using $\mathcal{AMS}$-TEX or $\mathcal{AMS}$-LATEX and provide the Editor with a paper manuscript that matches the electronic manuscript. The final version of the electronic manuscript should be sent to the Providence office immediately after the paper has been accepted for publication. The author should also send the final version of the paper manuscript to the Editor, who will forward a copy to the Providence office. Editors will require authors to send their electronically prepared manuscripts to the Providence office in a timely fashion. Electronically prepared manuscripts can

be sent via e-mail to pub-submit@ams.org (Internet) or on diskette to the Editorial Department, American Mathematical Society, P.O. Box 6248, Providence, RI 02940-6248. When submitting an electronic manuscript, please be sure to include a message indicating in which publication the paper has been accepted. No corrections will be accepted electronically. Authors must mark their changes on their proof copies and return them to the Providence office. Complete instructions on how to submit files are included in the author package.

Electronic graphics. Figures may be submitted to the AMS in an electronic format. The AMS recommends that graphics created electronically be saved in Encapsulated PostScript (EPS) format. This includes graphics originated via a graphics application as well as scanned photographs or other computer-generated images.

If the graphics package used does not support EPS output, the graphics file should be saved in one of the standard graphics formats—such as TIFF, PICT, GIF, etc.—rather than in an application-dependent format. Graphics files submitted in an application-dependent format are not likely to be used. No matter what method was used to produce the graphic, it is necessary to provide a paper copy to the AMS.

Authors using graphics packages for the creation of electronic art should also avoid the use of any lines thinner than 0.5 points in width. Many graphics packages allow the user to specify a "hairline" for a very thin line. Hairlines often look acceptable when proofed on a typical laser printer. However, when produced on a high-resolution laser imagesetter, hairlines become nearly invisible and will be lost entirely in the final printing process.

Screens should be set to values between 15% and 85%. Screens which fall outside of this range are too light or too dark to print correctly.

Copies of the paper should be sent directly to the appropriate Editor, and the author should keep one copy. For Research-Expository Surveys two copies of the manuscript should be submitted to Professor Nolan R. Wallach, Department of Mathematics, University of California, San Diego, La Jolla, CA 92093-0001. For Research Reports, four copies of the manuscript should be submitted to Professor Haynes R. Miller, Room 2-237, Massachusetts Institute of Technology, Cambridge, MA 02139-4307. Research Reports can also be submitted electronically in $\mathcal{AMS}$-TEX or $\mathcal{AMS}$-LATEX to bams@math.mit.edu.

Any inquiries concerning a paper that has been accepted for publication should be sent directly to the Editorial Department, American Mathematical Society, P. O. Box 6248, Providence, RI 02940-6248.

Research-Expository Surveys

This section is intended for reasonably broad expository surveys of a currently active area of mathematical research. To stress this fact, the name of the section has been changed from "Research-Expository Papers" to "Research-Expository Surveys". The level of exposition is expected to be such that a graduate student—or a research mathematician from a remote area—will be able to read an article in order to get an overview of a subject. A well-written article will include motivating problems and examples, some indication of the historical development of the subject, and of course the results and open problems that make it an interesting and exciting area of mathematics. In most cases proofs should be at most briefly sketched, and there should be a good bibliography whose main aim should be helping those

wishing to pursue the subject further. Usually Research-Expository Surveys will be at most 40 pages long.

Certain of the Society's Lecture Series, including the Gibb's Lectures, Colloquium Lectures, and Progress in Mathematics Lectures, traditionally appear in the Research-Expository Surveys, and those invited to give these lectures are informed of this tradition and of the above guidelines. Research-Expository Surveys are also frequently solicited by the Editorial Board, but unsolicited manuscripts are also encouraged; in particular, those invited to give invited hour addresses at meetings of the Society should consider writing up their lecture in a manner that meets the requirements of the preceding paragraph and submitting their manuscripts for consideration by the Editorial Board for the Research-Expository Surveys.

Research Reports

In August 1993, the Council of the AMS voted to replace the Research Announcements with a new category of articles, to be called Research Reports. The *Bulletin* stopped accepting submissions of Research Announcements on January 31, 1994. The Editor for Research Announcements will continue to serve as Editor for Research Reports.

A Research Report is a timely, short (4–8 pages) report on a recent accomplishment in mathematical research. It should be written so as to be understandable by mathematicians who are not experts in the subject matter of the Report. The context giving significance to the research being reported on should be made clear, and the consequences or potential consequences should be described. Usually only the barest hint of the methods of proof should be given, although elements of the proof which are novel should be included. In any case, references should be given so that an interested reader can find the details. It is expected that Research Reports will frequently be written by specialists other than the individuals immediately involved in the research. Approximately twenty-four Reports will be published each year.

Research Reports are normally solicited by the Editor for Research Reports and the Board of Associate Editors. They cordially invite suggestions for topics and reporters. Unsolicited manuscripts, submitted to the Editor for Research Reports, will also be considered.

BULLETIN OF THE AMERICAN MATHEMATICAL SOCIETY

CONTENTS

Volume 33, No. 1 January 1996

RESEARCH-EXPOSITORY SURVEYS

V. S. Varadarajan, Linear meromorphic differential equations: A modern point of view 1

Kenneth A. Ribet, Erratum to "Galois representations and modular forms" 43

RESEARCH REPORTS

S. K. Donaldson, The Seiberg-Witten equations and 4-manifold topology 45

BOOK REVIEWS

Andrew J. Majda (Reviewer), Vorticity and turbulence by Alexandre Chorin 71

Wilhelm P. A. Klingenberg (Reviewer), Affine differential geometry by Katsumi Nomizu and Takeshi Sasaki 75

Audrey A. Terras (Reviewer), Families of automorphic forms by Roelof W. Bruggeman 77

James Rovnyak (Reviewer), Sub-Hardy Hilbert spaces in the unit disk by D. Sarason 81

Daniel W. Stroock (Reviewer), Dirichlet forms & symmetric Markov processes by M. Fukushima, Y. Oshima, and M. Takeda; Dirichlet forms by Zhi-Ming Ma and Michael Rockner 87

Shmuel Weinberger (Reviewer), Algebraic L-theory and topological manifolds by A. A. Ranicki 93

P. Libermann (Reviewer), Nonlinear Poisson brackets, geometry and quantization by N. V. Karasev and V. P. Maslov 101

Greg Kuperberg (Reviewer), Quantum invariants of knots and 3-manifolds by V. G. Turaev 107

Nils A. Baas (Reviewer), Cobordisms and spectral sequences by V. V. Vershinin 111

Pierre Schapira (Reviewer), Hyperfunctions on hypo-analytic manifolds by Paulo D. Cordaro and Francois Trèves 115

H. I. Freedman (Reviewer), Periodic motions by Miklos Farkas 119

Jay Shapiro (Reviewer), Compatibility, stability and sheaves by J. L. Bueso, P. Jara, and A. Verschoren 121

Rafe Mazzeo (Reviewer), Heat kernels and Dirac operators by N. Berline, E. Getzler, and M. Vergne 125

Charles K. Chui (Reviewer), Wavelets and operators by Yves Meyer; A friendly guide to wavelets by Gerald Kaiser 131

0273-0979(199601)33:1;1-T