

---

VOLUME 130 NUMBER 5



MAY 2002

WHOLE NUMBER 515

---

# PROCEEDINGS

OF THE

---

AMERICAN MATHEMATICAL SOCIETY

---

**EDITED BY**

Mark J. Ablowitz

Joseph A. Ball

Dan M. Barbasch

Eric Bedford,

Managing Editor

Jonathan M. Borwein

Suncica Canic

Carmen C. Chicone

Bennett Chow

Richard A. Davis

Jozef Dodziuk

Alan Dow

Ronald A. Fintushel

Paul Goerss

Michael Handel

Juha M. Heinonen

Dennis A. Hejhal

Rebecca Herb

Carl G. Jockusch, Jr.

Linda Keen

David R. Larson

Martin Lorenz

Claudia M. Neuhauser

David Preiss

Mohan Ramachandran

David E. Rohrlich

Andreas Seeger

David Sharp

Mei-Chi Shaw

Lance W. Small

Stephen D. Smith

Christopher D. Sogge

John R. Stembridge

Michael Stillman

David S. Tartakoff

N. Tomczak-Jaegermann

Bernd Ulrich

Wolfgang Ziller

---

PROVIDENCE, RHODE ISLAND USA

ISSN 0002-9939

*Available electronically at*  
[www.ams.org/proc/](http://www.ams.org/proc/)

## Proceedings of the American Mathematical Society

This journal is devoted entirely to research in pure and applied mathematics.

**Submission information.** See **Information for Authors** at the end of this issue.

**Publisher Item Identifier.** The Publisher Item Identifier (PII) appears at the top of the first page of each article published in this journal. This alphanumeric string of characters uniquely identifies each article and can be used for future cataloging, searching, and electronic retrieval.

**Postings to the AMS website.** Articles are posted to the AMS website individually after proof is returned from authors and before appearing in an issue.

**Subscription information.** *Proceedings of the American Mathematical Society* is published monthly. Beginning January 1996 *Proceedings* is accessible from [www.ams.org/publications/](http://www.ams.org/publications/). Subscription prices for Volume 130 (2002) are as follows: for paper delivery, \$858 list, \$686 institutional member, \$772 corporate member, \$515 individual member; for electronic delivery, \$772 list, \$618 institutional member, \$695 corporate member, \$463 individual member. Upon request, subscribers to paper delivery of this journal are also entitled to receive electronic delivery. If ordering the paper version, add \$29 for surface delivery outside the United States and India; \$49 to India. Expedited delivery to destinations in North America is \$48; elsewhere \$118. For paper delivery a late charge of 10% of the subscription price will be imposed upon orders received from nonmembers after January 1 of the subscription year.

**Back number information.** For back issues see [www.ams.org/bookstore](http://www.ams.org/bookstore).

Subscriptions and orders should be addressed to the American Mathematical Society, P.O. Box 845904, Boston, MA 02284-5904. *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 Acquisitions Department, American Mathematical Society, P.O. Box 6248, Providence, RI 02940-6248. Requests can also be made by e-mail to [reprint-permission@ams.org](mailto: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.)

---

*Proceedings of the American Mathematical Society* is published monthly by the American Mathematical Society at 201 Charles Street, Providence, RI 02904-2294. Periodicals postage is paid at Providence, Rhode Island. Postmaster: Send address changes to *Proceedings*, American Mathematical Society, P.O. Box 6248, Providence, RI 02940-6248.

© 2002 by the American Mathematical Society. All rights reserved.

This journal is indexed in *Mathematical Reviews*, *Zentralblatt MATH*, *Science Citation Index*<sup>®</sup>, *Science Citation Index*<sup>™</sup>-*Expanded*, *ISI Alerting Services*<sup>SM</sup>, *CompuMath Citation Index*<sup>®</sup>, and *Current Contents*<sup>®</sup>/*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      07 06 05 04 03 02

## Editorial Information

To be published in the *Proceedings*, a paper must be correct, new, nontrivial, and significant. Further, it must be well written and of interest to a substantial number of mathematicians. Piecemeal results, such as an inconclusive step toward an unproved major theorem or a minor variation on a known result, are in general not acceptable for publication. *Proceedings* Editors solicit and encourage publication of worthy papers of length not exceeding 10 published pages. Published pages are the same size as those generated in the style files provided for  $\mathcal{A}\mathcal{M}\mathcal{S}$ - $\mathcal{L}^{\mathcal{A}}\mathcal{T}\mathcal{E}\mathcal{X}$  or  $\mathcal{A}\mathcal{M}\mathcal{S}$ - $\mathcal{T}\mathcal{E}\mathcal{X}$ .

Very short notes not to exceed two printed pages are also accepted, and appear under the heading SHORTER NOTES. Items deemed suitable include an elegant new proof of an important and well-known theorem, an illuminating example or counterexample, or a new viewpoint on familiar results. New results, if of a brief and striking character, might also be acceptable, though in general a paper which is merely very short will not be suitable for the SHORTER NOTES department.

As of December 31, 2001, the backlog for this journal was approximately 6 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). In an effort to make articles available as quickly as possible, articles are posted to the AMS website individually after proof is returned from authors and before appearing in an issue.

A Consent to Publish and Copyright Agreement is required before a paper will be published in this journal. After a paper is accepted for publication, the Providence office will send out a Consent to Publish and Copyright Agreement to all authors of the paper. By submitting a paper to this journal, authors certify that the results have not been submitted to nor are they under consideration for publication by another journal, conference proceedings, or similar publication.

## Information for Authors

**Initial submission.** Two copies of the paper should be sent directly to the appropriate Editor and the author should keep a copy.

**IF an editor is agreeable,** an electronic manuscript prepared in  $\mathcal{T}\mathcal{E}\mathcal{X}$  or  $\mathcal{L}^{\mathcal{A}}\mathcal{T}\mathcal{E}\mathcal{X}$  may be submitted by pointing to an appropriate URL on a preprint or e-print server.

The first page of an article 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 at least one complete sentence, and at most 150 words. Included with the footnotes to the paper should be the 2000 *Mathematics Subject Classification* representing the primary and secondary subjects of the article. The classifications are accessible from [www.ams.org/msc/](http://www.ams.org/msc/). The list of classifications is also available in print starting with the 1999 annual index of *Mathematical Reviews*. The Mathematics Subject Classification footnote may be followed by a list of *key words and phrases* describing the subject matter of the article and taken from it. Journal abbreviations used in bibliographies are listed in the latest *Mathematical Reviews* annual index. The series abbreviations are also accessible from [www.ams.org/publications/](http://www.ams.org/publications/). To help in preparing and verifying references, the AMS offers MR Lookup, a Reference Tool for Linking, at [www.ams.org/mrlookup/](http://www.ams.org/mrlookup/). When the manuscript is submitted, authors should supply the editor with electronic addresses if available. These will be printed after the postal address at the end of each article.

**Electronically prepared manuscripts.** The AMS encourages electronically prepared manuscripts, with a strong preference for  $\mathcal{A}\mathcal{M}\mathcal{S}$ - $\mathcal{L}^{\mathcal{A}}\mathcal{T}\mathcal{E}\mathcal{X}$ . To this end, the Society has prepared  $\mathcal{A}\mathcal{M}\mathcal{S}$ - $\mathcal{L}^{\mathcal{A}}\mathcal{T}\mathcal{E}\mathcal{X}$  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. Articles properly prepared using the  $\mathcal{A}\mathcal{M}\mathcal{S}$ - $\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$  style file and the `\label` and `\ref` commands automatically enable extensive intra-document linking to the bibliography and other elements of the article for searching electronically on the Web. Because linking must often be added manually to electronically prepared manuscripts in other forms of  $\mathcal{T}\mathcal{E}\mathcal{X}$ , using  $\mathcal{A}\mathcal{M}\mathcal{S}$ - $\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$  also reduces the amount of technical intervention once the files are received by the AMS. This results in fewer errors in processing and saves the author proofreading time.  $\mathcal{A}\mathcal{M}\mathcal{S}$ - $\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$  papers also move more efficiently through the production stream, helping to minimize publishing costs.

$\mathcal{A}\mathcal{M}\mathcal{S}$ - $\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$  is the highly preferred format of  $\mathcal{T}\mathcal{E}\mathcal{X}$ , but author packages are also available in  $\mathcal{A}\mathcal{M}\mathcal{S}$ - $\mathcal{T}\mathcal{E}\mathcal{X}$ . Those authors who make use of these style files from the beginning of the writing process will further reduce their own efforts. Manuscripts prepared electronically in  $\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$  or plain  $\mathcal{T}\mathcal{E}\mathcal{X}$  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.  $\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$  users will find that  $\mathcal{A}\mathcal{M}\mathcal{S}$ - $\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$  is the same as  $\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$  with additional commands to simplify the typesetting of mathematics, and users of plain  $\mathcal{T}\mathcal{E}\mathcal{X}$  should have the foundation for learning  $\mathcal{A}\mathcal{M}\mathcal{S}$ - $\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$ .

Authors may retrieve an author package from the AMS website starting from [www.ams.org/tex/](http://www.ams.org/tex/) or via FTP to [ftp.ams.org](ftp://ftp.ams.org) (login as `anonymous`, enter username as password, and type `cd pub/author-info`). The *AMS Author Handbook* and the *Instruction Manual* are available in PDF format following the author packages link from [www.ams.org/tex/](http://www.ams.org/tex/). The author package can also be obtained free of charge by sending email to [pub@ams.org](mailto: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  $\mathcal{A}\mathcal{M}\mathcal{S}$ - $\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$  or  $\mathcal{A}\mathcal{M}\mathcal{S}$ - $\mathcal{T}\mathcal{E}\mathcal{X}$ , 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  $\mathcal{A}\mathcal{M}\mathcal{S}$ - $\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$  or  $\mathcal{A}\mathcal{M}\mathcal{S}$ - $\mathcal{T}\mathcal{E}\mathcal{X}$  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 email to [pub-submit@ams.org](mailto:pub-submit@ams.org) (Internet) or on diskette to the Electronic Prepress Department, American Mathematical Society, P.O. Box 6248, Providence, RI 02940-6248. When sending a manuscript electronically, 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 send files are included in the author package.

**Electronic graphics.** Comprehensive instructions on preparing graphics are available starting from [www.ams.org/jourhtml/authors.html](http://www.ams.org/jourhtml/authors.html). A few of the major requirements are given here.

Submit files for graphics as EPS (Encapsulated PostScript) files. This includes graphics originated via a graphics application as well as scanned photographs or other computer-generated images. If this is not possible, TIFF files are acceptable as long as they can be opened in Adobe Photoshop or Illustrator. 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. Variations of screens within a graphic should be no less than 10%.

**AMS policy on making changes to articles after posting.** Articles are posted to the AMS website individually after proof is returned from authors and before appearing in an issue. To preserve the integrity of electronically published articles, once an article is individually posted to the AMS website but not yet in an issue, changes cannot be made in place in the paper. However, an “Added after posting” section may be added to the paper right before the References when there is a critical error in the content of the paper. The “Added after posting” section gives the author an opportunity to correct this type of critical error before the article is put into an issue for printing and before it is then reposted with the issue. The “Added after posting” section remains a permanent part of the paper. The AMS does not keep author-related information, such as affiliation, current address, and email address, up to date after a paper is initially posted.

Once the article is assigned to an issue, even if the issue has not yet been posted to the AMS website, corrections may be made to the paper by submitting a traditional errata article to the Editor. The errata article will appear in a future print issue and will link back and forth on the web to the original article online.

**Secure manuscript tracking on the Web and via email.** Authors can track their manuscripts through the AMS journal production process using the personal AMS ID and Article ID printed in the upper right-hand corner of the Consent to Publish form sent to each author who publishes in AMS journals. Access to the tracking system is available from [www.ams.org/mstrack/](http://www.ams.org/mstrack/) or via email sent to [mstrack-query@ams.org](mailto:mstrack-query@ams.org). To access by email, on the subject line of the message simply enter the AMS ID and Article ID. To track more than one manuscript by email, choose one of the Article IDs and enter the AMS ID and the Article ID followed by the word *all* on the subject line. An explanation of each production step is provided on the web through links from the manuscript tracking screen. Questions can be sent to [proc-query@ams.org](mailto:proc-query@ams.org).

**T<sub>E</sub>X files available.** Beginning with the January 1992 issue of the *Bulletin* and the January 1996 issues of *Transactions*, *Proceedings*, *Mathematics of Computation*, and the *Journal of the AMS*, T<sub>E</sub>X files can be downloaded from the AMS website, starting from [www.ams.org/journals/](http://www.ams.org/journals/). Authors without Web access may request their files at the address given below after the article has been published. For *Bulletin* papers published in 1987 through 1991 and for *Transactions*, *Proceedings*, *Mathematics of Computation*, and the *Journal of the AMS* papers published in 1987 through 1995, T<sub>E</sub>X files are available upon request for authors without Web access by sending email to [file-request@ams.org](mailto:file-request@ams.org) or by contacting the Electronic Prepress 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 T<sub>E</sub>X file will be sent to the author making the request after the article goes to the printer. If the requestor can receive Internet email, please include the email 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 T<sub>E</sub>X production at the AMS sometimes requires extra fonts and macros that are not yet publicly available, T<sub>E</sub>X files cannot be guaranteed to run through the author’s version of T<sub>E</sub>X without errors. The AMS regrets that it cannot provide support to eliminate such errors in the author’s T<sub>E</sub>X environment.

**Inquiries.** Any inquiries concerning a paper that has been accepted for publication that cannot be answered via the manuscript tracking system mentioned above should be sent to [proc-query@ams.org](mailto:proc-query@ams.org) or directly to the Electronic Prepress Department, American Mathematical Society, P.O. Box 6248, Providence, RI 02940-6248.

## Editors

Authors are requested to send papers directly to the appropriate Editor (the one whose area of responsibility and expertise, as described below, most closely approximates the subject field of the manuscript). Only when in doubt about an appropriate Editor, should manuscripts be sent to the Coordinating Editor responsible for the area in mathematics most closely connected to the paper. If in doubt about the area, send the manuscript to the Managing Editor, to whom all other communication about the journal should also be addressed. (All addresses should include the line “Department of Mathematics”, unless another department is indicated.)

Managing Editor: Eric Bedford, Indiana University, Bloomington, IN 47405-5701; e-mail: [bedford@indiana.edu](mailto:bedford@indiana.edu)

### 1. ODE, PDE, GLOBAL ANALYSIS, AND DYNAMICAL SYSTEMS

Coordinating Editor: Linda Keen, CUNY-Lehman College, Bronx, NY 10468; e-mail: [linda@alpha.lehman.cuny.edu](mailto:linda@alpha.lehman.cuny.edu); [keen@bers.gc.cuny.edu](mailto:keen@bers.gc.cuny.edu)

**Partial differential equations**, David S. Tartakoff, University of Illinois at Chicago, Chicago, IL 60607; e-mail: [dst@uic.edu](mailto:dst@uic.edu)

**Dynamical systems and ergodic theory**, Michael Handel, Department of Mathematics and Computer Science, Herbert Lehman College (CUNY), Bronx, NY 10468-1589; e-mail: [michael@alpha.lehman.cuny.edu](mailto:michael@alpha.lehman.cuny.edu)

**Ordinary differential equations and special functions**, Carmen C. Chicone, University of Missouri, Columbia, MO 65211-0001; e-mail: [carmen@chicone.math.missouri.edu](mailto:carmen@chicone.math.missouri.edu)

**Global analysis**, Jozef Dodziuk, Ph.D. Program in Mathematics, Graduate School and University Center (CUNY), 365 Fifth Avenue, New York, NY 10016-4309; e-mail: [jdodziuk@gc.cuny.edu](mailto:jdodziuk@gc.cuny.edu)

### 2. LIE GROUPS, TOPOLOGY, AND GEOMETRY

Coordinating Editor: Ronald A. Fintushel, Michigan State University, East Lansing, MI 48824-1027; e-mail: [ronfint@math.msu.edu](mailto:ronfint@math.msu.edu)

**Topological groups and Lie groups (symmetric spaces)**, Rebecca Herb, University of Maryland, College Park, MD 20742; e-mail: [rah@math.umd.edu](mailto:rah@math.umd.edu)

**Riemannian geometry (including affine, pseudo-Riemannian, contact, classical, and Lorentzian geometries)**, Wolfgang Ziller, University of Pennsylvania, Philadelphia, PA 19104-6317; e-mail: [wziller@math.upenn.edu](mailto:wziller@math.upenn.edu)

**Geometric analysis (geometric PDE, minimal surfaces and harmonic maps)**, Bennett Chow, University of California San Diego, La Jolla, CA 92093; e-mail: [benchow@euclid.ucsd.edu](mailto:benchow@euclid.ucsd.edu)

**Algebraic topology**, Paul Goerss, Northwestern University, Evanston, IL 60208-2730; e-mail: [pgoerss@math.nwu.edu](mailto:pgoerss@math.nwu.edu)

**Set-theoretic and general topology**, Alan Dow, University of North Carolina at Charlotte, Charlotte, NC 28223-0001; e-mail: [adow@math.uncc.edu](mailto:adow@math.uncc.edu)

**Low dimensional topology, gauge theory, 4-manifolds**, Ronald A. Fintushel

**Complex and Kähler geometry**, Mohan Ramachandran, State University of New York at Buffalo, Buffalo, NY 14260-2900; e-mail: [ramac-m@newton.math.buffalo.edu](mailto:ramac-m@newton.math.buffalo.edu)

### 3. ANALYSIS AND OPERATOR THEORY

Coordinating Editor: Christopher D. Sogge, Johns Hopkins University, Baltimore, MD 21218; e-mail: [sogge@jhu.edu](mailto:sogge@jhu.edu)

**One complex variable and potential theory**, Juha M. Heinonen, University of Michigan, Ann Arbor, MI 48109-1109; e-mail: [PAMS1@math.lsa.umich.edu](mailto:PAMS1@math.lsa.umich.edu)

**Several complex variables**, Mei-Chi Shaw, University of Notre Dame, Notre Dame, IN 46556-0398; e-mail: [mei-chi.shaw.1@nd.edu](mailto:mei-chi.shaw.1@nd.edu)

**Linear and nonlinear functional analysis**, Jonathan M. Borwein, Department of Mathematics and Statistics, Simon Fraser University, Burnaby, BC, Canada V5A 1S6; e-mail: [jborwein@cecm.sfu.ca](mailto:jborwein@cecm.sfu.ca)

**Banach spaces and linear functional analysis**, N. Tomczak-Jaegermann, University of Alberta, Edmonton, AB, Canada T6G 2G1; e-mail: [ntomczak@math.ualberta.ca](mailto:ntomczak@math.ualberta.ca); [nicole.tomczak@ualberta.ca](mailto:nicole.tomczak@ualberta.ca)

**Operator Theory**, Joseph A. Ball, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061; e-mail: [ball@math.vt.edu](mailto:ball@math.vt.edu)

**Operator algebras and wavelets**, David R. Larson, Texas A&M University, College Station, TX 77843-3368; e-mail: [larson@math.tamu.edu](mailto:larson@math.tamu.edu)

**Geometric measure theory and classical real analysis**, David Preiss, University College London, Gower Street, London WC1E 6BT, UK; e-mail: [dp@math.ucl.ac.uk](mailto:dp@math.ucl.ac.uk)

**Harmonic analysis**, Andreas Seeger, University of Wisconsin, Madison, WI 53706; e-mail: [seeger@math.wisc.edu](mailto:seeger@math.wisc.edu)

**Analytic number theory and automorphic forms**, Dennis A. Hejhal, School of Mathematics, University of Minnesota, Minneapolis, MN 55455-0488; e-mail: [hejhal@math.umn.edu](mailto:hejhal@math.umn.edu)

#### 4. ALGEBRA, NUMBER THEORY, COMBINATORICS, AND LOGIC

Coordinating Editor: Lance W. Small, University of California San Diego, La Jolla, CA 92093-0112; e-mail: [lwsma1@ucsd.edu](mailto:lwsma1@ucsd.edu)

**General number theory**, David E. Rohrlich, Boston University, Boston, MA 02215-2411; e-mail: [rohrlich@math.bu.edu](mailto:rohrlich@math.bu.edu)

**Commutative algebra**, Bernd Ulrich, Purdue University, West Lafayette, IN 47907-1395; e-mail: [ulrich@math.purdue.edu](mailto:ulrich@math.purdue.edu)

**Group theory**, Stephen D. Smith, University of Illinois at Chicago, Chicago, IL 60607; e-mail: [smiths@math.uic.edu](mailto:smiths@math.uic.edu)

**Algebraic geometry**, Michael Stillman, Cornell University, Malott Hall, Ithaca, NY 14853-4201; e-mail: [mike@math.cornell.edu](mailto:mike@math.cornell.edu)

**Combinatorics**, John R. Stembridge, University of Michigan, Ann Arbor, MI 48109-1109; e-mail: [jrs@math.lsa.umich.edu](mailto:jrs@math.lsa.umich.edu)

**Analytic number theory and automorphic forms**, Dennis A. Hejhal, School of Mathematics, University of Minnesota, Minneapolis, MN 55455-0488; e-mail: [hejhal@math.umn.edu](mailto:hejhal@math.umn.edu)

**Logic and foundations**, Carl G. Jockusch, Jr., University of Illinois, 1409 W. Green St., Urbana, IL 61801-2917; e-mail: [jockusch@math.uiuc.edu](mailto:jockusch@math.uiuc.edu)

**Lie algebras**, Dan M. Barbasch, Cornell University, Malott Hall, Ithaca, NY 14853-4201; e-mail: [barbasch@math.cornell.edu](mailto:barbasch@math.cornell.edu)

**Noncommutative rings**, Martin Lorenz, Temple University, Philadelphia, PA 19122-6094; e-mail: [lorenz@math.temple.edu](mailto:lorenz@math.temple.edu)

#### 5. APPLIED MATHEMATICS, PROBABILITY, AND STATISTICS

Coordinating Editor: Mark J. Ablowitz, Department of Applied Mathematics, Campus Box 526, University of Colorado, Boulder, CO 80309-0526; e-mail: [markjab@newton.colorado.edu](mailto:markjab@newton.colorado.edu)

**Probability**, Claudia M. Neuhauser, Department of Ecology, Evolution and Behavior, University of Minnesota, St. Paul, MN 55108; e-mail: [nhauser@cbs.umn.edu](mailto:nhauser@cbs.umn.edu)

**Statistics**, Richard A. Davis, Department of Statistics, Colorado State University, Fort Collins, CO 80523-1877; e-mail: [rdavis@stat.colostate.edu](mailto:rdavis@stat.colostate.edu)

**Applied mathematics**, David Sharp, Theoretical Division, Los Alamos National Laboratory MSB285, Los Alamos, NM 87545; e-mail: [dhs@lanl.gov](mailto:dhs@lanl.gov)

**Hyperbolic partial differential equations**, Suncica Canic, University of Houston, Houston, TX 77204-3476; e-mail: [canic@math.uh.edu](mailto:canic@math.uh.edu)

(Continued from back cover)

<b>Teresa Bermúdez and N. J. Kalton</b> , The range of operators on von Neumann algebras .....	1447
--	------

#### D. GEOMETRY

<b>Sol Schwartzman</b> , Parallel tangent hyperplanes .....	1457
<b>Luc Vrancken</b> , Minimal Lagrangian submanifolds with constant sectional curvature in indefinite complex space forms .....	1459
<b>Hubert Bray and Frank Morgan</b> , An isoperimetric comparison theorem for Schwarzschild space and other manifolds .....	1467
<b>Aart Blokhuis, Dieter Jungnickel, and Bernhard Schmidt</b> , Proof of the prime power conjecture for projective planes of order $n$ with abelian collineation groups of order $n^2$ .....	1473

#### E. LOGIC AND FOUNDATIONS

<b>Tetsuya Ishiu and Yasuo Yoshinobu</b> , Directive trees and games on posets ...	1477
<b>Péter Komjáth and Miklós Laczkovich</b> , A combinatorial property of cardinals	1487

#### F. STATISTICS AND PROBABILITY

<b>Frank N. Proske and Madan L. Puri</b> , Central limit theorem for Banach space valued fuzzy random variables .....	1493
---	------

#### G. TOPOLOGY

<b>Yuli B. Rudyak</b> , On an adjoint functor to the Thom functor .....	1503
<b>R. E. Stong</b> , Normal characteristic numbers .....	1507
<b>Katsuya Eda</b> , The fundamental groups of one-dimensional wild spaces and the Hawaiian earring .....	1515
<b>Christian Bohr</b> , Immersions of surfaces in almost-complex 4-manifolds .....	1523
<b>Michel Marias</b> , $L^p$ estimates on functions of Markov operators .....	1533
<b>Sergei M. Ageev and Dušan Repovš</b> , On a theorem of Jaworowski on locally equivariant contractible spaces .....	1539
<b>Charles Livingston</b> , New examples of non-slice, algebraically slice knots .....	1551
<b>Norihiko Minami</b> , From $K(n+1)_*(X)$ to $K(n)_*(X)$ .....	1557

A. ALGEBRA, NUMBER THEORY, AND COMBINATORICS

Stephan Klaus, A generalization of the non-triviality theorem of Serre ..... 1249

Holger Spielberg, Counting generic genus-0 curves on Hirzebruch surfaces ..... 1257

Ngô Việt Trung, Evaluations of initial ideals and Castelnuovo-Mumford regularity ..... 1265

J. H. E. Cohn, On the class number of certain imaginary quadratic fields ..... 1275

Fuad Kittaneh, Commutator inequalities associated with the polar decomposition ..... 1279

Edgar Enochs and Luis Oyonarte, Flat covers and cotorsion envelopes of sheaves ..... 1285

David Gluck and Brian D. Taylor, A new statistic for the  $3x + 1$  problem ... 1293

Alexander A. Mikhalev, Ualbai Umirbaev, and Jie-Tai Yu, Generic, almost primitive and test elements of free Lie algebras ..... 1303

Arno van den Essen and Peter van Rossum, Triangular derivations related to problems on affine  $n$ -space ..... 1311

Kaiming Zhao, Simple algebras of Weyl type, II ..... 1323

Eli Aljadeff and Jack Sonn, Relative Brauer groups and  $m$ -torsion ..... 1333

B. ANALYSIS

Yunguang Lu, Hölder estimates of solutions to a degenerate diffusion equation ..... 1339

Yongkun Li and Yang Kuang, Periodic solutions in periodic state-dependent delay equations and population models ..... 1345

H. N. Mhaskar, F. J. Narcowich, N. Sivakumar, and J. D. Ward, Approximation with interpolatory constraints ..... 1355

Leiba Rodman, Ilya M. Spitkovsky, and Hugo J. Woerdeman, Fredholmness and invertibility of Toeplitz operators with matrix almost periodic symbols ..... 1365

Michael Ruzhansky, On the failure of the factorization condition for non-degenerate Fourier integral operators ..... 1371

Abel Castorena, Critical points of the area functional of a complex closed curve on the manifold of Kähler metrics ..... 1377

Guizhen Cui and Yi Qi, Local boundary dilatation of quasiconformal maps in the disk ..... 1383

Wojciech Szymański, On semiprojectivity of  $C^*$ -algebras of directed graphs ... 1391

Mihály Bakonyi, The extension of positive definite operator-valued functions defined on a symmetric interval of an ordered group ..... 1401

Enrique Llorens-Fuster, Semigroups of mappings with rigid Lipschitz constant ..... 1407

Carlos A. Cabrelli and María Luisa Gordillo, Existence of multiwavelets in  $\mathbb{R}^n$  ..... 1413

(Continued on inside back cover)



0002-9939(200205)130:5;1-U