INDEX TO VOLUME 12 (1999)

Acquistapace, F., Andradas, C., and Broglia, F.  Separation of semialgebraic sets, 703
Agler, J., and Young, N. J.  A converse to a theorem of Adamyan, Arov and Krein, 305
Andradas, C.  See Acquistapace, F.
Baik, Jinho, Deift, Percy, and Johansson, Kurt.  On the distribution of the length of the longest increasing subsequence of random permutations, 1119
Bourgain, J.  Global wellposedness of defocusing critical nonlinear Schrödinger equation in the radial case, 145
Bourgain, Jean.  See Friedgut, Ehud
Bridson, Martin R.  Fractional isoperimetric inequalities and subgroup distortion, 1103
Broglia, F.  See Acquistapace, F.
Carbery, Anthony, Christ, Michael, and Wright, James.  Multidimensional van der Corput and sublevel set estimates, 981
Cherbonnier, Frédéric, and Colmez, Pierre.  Théorie d’Iwasawa des représentations $p$-adiques d’un corps local, 241
Christ, Michael.  See Carbery, Anthony
Colmez, Pierre.  See Cherbonnier, Frédéric
Conrad, Brian, Diamond, Fred, and Taylor, Richard.  Modularity of certain potentially Barsotti-Tate Galois representations, 521
Deift, Percy.  See Baik, Jinho
Diamond, Fred.  See Conrad, Brian
Faltings, Gerd.  Integral crystalline cohomology over very ramified valuation rings, 117
Fenley, Sérgio R.  Foliations with good geometry, 619
Fomin, Sergey, and Zelevinsky, Andrei.  Double Bruhat cells and total positivity, 335
Ford, Kevin B.  Addendum and corrigendum to “The representation of numbers as sums of unlike powers. II”, 1213
Friedgut, Ehud, and an appendix by Bourgain, Jean.  Sharp thresholds of graph properties, and the $k$-sat problem, 1017
Ginzburg, David, Rallis, Stephen, and Soudry, David.  On a correspondence between cuspidal representations of $GL_{2n}$ and $Sp_{2n}$, 849
Goncharov, Alexander.  Volumes of hyperbolic manifolds and mixed Tate motives, 569
Green, Barry, and Matignon, Michel.  Order $p$ automorphisms of the open disc of a $p$-adic field, 269
Hoffmann, Detlev W.  Pythagoras numbers of fields, 839
Johansson, Kurt.  See Baik, Jinho
Kawamata, Yujiro.  Deformations of canonical singularities, 85
Klainerman, Sergiu, and Tataru, Daniel.  On the optimal local regularity for the Yang-Mills equations in $\mathbb{R}^{3+1}$, 93
Knutson, Allen, and Tao, Terence.  The honeycomb model of $GL_n(\mathbb{C})$ tensor products I: Proof of the saturation conjecture, 1055
Kollár, János.  Real algebraic threefolds II. Minimal model program, 33
Lapad, Erez.  See Jacquet, Hervé
Lempert, László.  The Dolbeault complex in infinite dimensions II, 775
Liebeck, Martin W., and Shalev, Aner.  Simple groups, permutation groups, and probability, 497
Lind, Douglas, and Schmidt, Klaus.  Homoclinic points of algebraic $\mathbb{Z}^d$-actions, 953
Liu, Tai-Ping, and Yang, Tong.  $L_1$ stability for $2 \times 2$ systems of hyperbolic conservation laws, 729
Matignon, Michel.  See Green, Barry
Nazarov, F., Treil, S., and Volberg, A.  The Bellman functions and two-weight inequalities for Haar multipliers, 909
Rallis, Stephen.  See Ginzburg, David
Rogawski, Jonathan.  See Jacquet, Hervé
Schilling, Anne.  See Andrews, George E.
Schmidt, Bernhard.  Cyclotomic integers and finite geometry, 929
Schmidt, Klaus.  See Lind, Douglas
Schoen, Chad.  On the image of the $l$-adic Abel-Jacobi map for a variety over the algebraic closure of a finite field, 795
Shalev, Aner.  See Liebeck, Martin W.
Sogge, Christopher D.  Concerning Nikodym-type sets in 3-dimensional curved spaces, 1
Soudry, David.  See Ginzburg, David
Spivakovsky, Mark.  A new proof of D. Popescu’s theorem on smoothing of ring homomorphisms, 381
Tao, Terence.  See Knutson, Allen
Tataru, Daniel.  See Klainerman, Sergiu
Taylor, Richard.  See Conrad, Brian
Todorcević, Stevo.  Compact subsets of the first Baire class, 1179
Trel, S.  See Nazarov, F.
Villadsen, Jesper.  On the stable rank of simple $C^*$-algebras, 1091
Volberg, A.  See Nazarov, F.
Warnaar, S. Ole.  See Andrews, George E.
Wright, James.  See Carbery, Anthony
Wu, Sijue.  Well-posedness in Sobolev spaces of the full water wave problem in 3-D, 445
Yang, Tong.  See Liu, Tai-Ping
Young, N. J.  See Agler, J.
Zelevinsky, Andrei.  See Fomin, Sergey
This journal is devoted to research articles of the highest quality in all areas of 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 e-MATH. Articles are posted individually to e-MATH before appearing in an issue.

Subscription information. The Journal of the American Mathematical Society is published quarterly. Beginning January 1996 the Journal of the American Mathematical Society is accessible from e-MATH via the World Wide Web at the URL http://www.ams.org/publications/. Subscription prices for Volume 12 (1999) are as follows: for paper delivery, $199 list, $159 institutional member, $179 corporate member, $119 individual member; for electronic delivery, $179 list, $143 institutional member, $161 corporate member, $107 individual member. Upon request, subscribers to paper delivery of this journal are also entitled to receive electronic delivery. If ordering the paper version, add $8 for surface delivery outside the United States and India; $18 to India. Expedited delivery to destinations in North America is $15; elsewhere $40. 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 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.)

The Journal of the American Mathematical Society is published quarterly by the American Mathematical Society at 201 Charles Street, Providence, RI 02904-2213 and is mailed from Providence, Rhode Island. Periodicals postage is paid at Providence, Rhode Island. Postmaster: Send address changes to Journal of the AMS, American Mathematical Society, P.O. Box 6248, Providence, RI 02940-6248.

© 1999 by the 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.
**Vol. 12, No. 1 January 1999**

Christopher D. Sogge, *Concerning Nikodym-type sets in 3-dimensional curved spaces* ................................................. 1

János Kollár, *Real algebraic threefolds II. Minimal model program* ..... 33

Sergiu Klainerman and Daniel Tataru, *On the optimal local regularity for the Yang-Mills equations in $\mathbb{R}^{4+1}$* ................................ 93

J. Bourgain, *Global wellposedness of defocusing critical nonlinear Schrödinger equation in the radial case* ...................... 145

Hervé Jacquet, Erez Lapid, and Jonathan Rogawski, *Periods of automorphic forms* .......................................................... 173

Frédéric Cherbonnier and Pierre Colmez, *Théorie d'Iwasawa des représentations $p$-adiques d’un corps local* ................. 241

Barry Green and Michel Matignon, *Order $p$ automorphisms of the open disc of a $p$-adic field* ...................................... 269

**Vol. 12, No. 2 April 1999**

J. Agler and N. J. Young, *A converse to a theorem of Adamyan, Arov and Krein* .............................................................. 305

Sergey Fomin and Andrei Zelevinsky, *Double Bruhat cells and total positivity* ................................................................. 335

Mark Spivakovsky, *A new proof of D. Popescu's theorem on smoothing of ring homomorphisms* .................................... 381

Sijue Wu, *Well-posedness in Sobolev spaces of the full water wave problem in 3-D* ............................................................. 445

Martin W. Liebeck and Aner Shalev, *Simple groups, permutation groups, and probability* ............................................... 497

Brian Conrad, Fred Diamond, and Richard Taylor, *Modularity of certain potentially Barsotti-Tate Galois representations* .... 521

Alexander Goncharov, *Volumes of hyperbolic manifolds and mixed Tate motives* ............................................................... 569

**Vol. 12, No. 3 July 1999**

Sérgio R. Fenley, *Foliations with good geometry* ......................... 619

F. Acquistapace, C. Andradas, and F. Broglia, *Separation of semialgebraic sets* .......................................................... 703
Tai-Ping Liu and Tong Yang, *$L_1$ stability for $2 \times 2$ systems of hyperbolic conservation laws* ........................................ 729
László Lempert, *The Dolbeault complex in infinite dimensions II* .......... 775
Chad Schoen, *On the image of the $l$-adic Abel-Jacobi map for a variety over the algebraic closure of a finite field* .................... 795
Detlev W. Hoffmann, *Pythagoras numbers of fields* ...................... 839
David Ginzburg, Stephen Rallis, and David Soudry, *On a correspondence between cuspidal representations of $GL_{2n}$ and $Sp_{2n}$* ........ 849

**Vol. 12, No. 4 October 1999**

F. Nazarov, S. Treil, and A. Volberg, *The Bellman functions and two-weight inequalities for Haar multipliers* .......................... 909
Bernhard Schmidt, *Cyclotomic integers and finite geometry* .............. 929
Douglas Lind and Klaus Schmidt, *Homoclinic points of algebraic $\mathbb{Z}^d$-actions* ................................................................. 953
Anthony Carbery, Michael Christ, and James Wright, *Multidimensional van der Corput and sublevel set estimates* ...................... 981
Ehud Friedgut and an appendix by Jean Bourgain, *Sharp thresholds of graph properties, and the $k$-sat problem* ....................... 1017
Allen Knutson and Terence Tao, *The honeycomb model of $GL_n(\mathbb{C})$ tensor products I: Proof of the saturation conjecture* .................. 1055
Jesper Villadsen, *On the stable rank of simple $C^*$-algebras* ............ 1091
Martin R. Bridson, *Fractional isoperimetric inequalities and subgroup distortion* ................................................................. 1103
Jinho Baik, Percy Deift, and Kurt Johansson, *On the distribution of the length of the longest increasing subsequence of random permutations* 1119
Stevo Todorčević, *Compact subsets of the first Baire class* ............... 1179
Kevin B. Ford, *Addendum and corrigendum to “The representation of numbers as sums of unlike powers. II”* ............................ 1213
Editors
Benedict H. Gross
Department of Mathematics
Harvard University
Cambridge, MA 02138-2901
gross@math.harvard.edu

Ingrid Daubechies
Department of Mathematics & PACM
218 Fine Hall
Princeton University
Princeton, NJ 08544-1000
ingrid@math.princeton.edu

Bernd Sturmfels
Department of Mathematics
University of California at Berkeley
Berkeley, CA 94720-0001
bernd@math.berkeley.edu

Associate Editors
James G. Arthur, University of Toronto
Alexander Beilinson, University of Chicago
F. Michael Christ, University of California, Berkeley
Constantine M. Dafermos, Brown University
Lawrence C. Evans, University of California, Berkeley
Michael J. Hopkins, Massachusetts Institute of Technology
Ehud Hrushovski, Hebrew University of Jerusalem
Henryk Iwaniec, Rutgers University
A. J. de Jong, Princeton University
Robert Lazarsfeld, University of Michigan
Grigori A. Margulis, Yale University
Curtis T. McMullen, Harvard University
Marina Ratner, University of California, Berkeley
Richard Schoen, Stanford University
Richard Stanley, Massachusetts Institute of Technology
W. Hugh Woodin, University of California, Berkeley
Efim Zelmanov, Yale University

Assistant to the Editorial Board
Laurie Talbo
Department of Mathematics
University of Chicago
Chicago, IL 60637-1514
laurie@math.uchicago.edu

Editorial Information
As of June 30, 1999, 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). In an effort to make articles available as quickly as
possible, articles are posted to e-Math individually before they appear 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 a Consent to Publish and Copyright Agreement to all authors of the
paper. 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 for Authors

Initial submission. Two copies of the paper should be sent directly to one of
the Editors and the author should keep one copy. *IF an editor is agreeable*, an
electronic manuscript prepared in \TeX or \LaTeX may be submitted by pointing to
an appropriate URL on a preprint or e-print server.

The first page must contain a *descriptive title* that is short, but informative;
useless or vague phrases such as “some remarks about” or “concerning” should be
avoided. Although an abstract is not required upon initial submission, upon ac-
ceptance authors will be requested to supply an abstract for the electronic version
of this journal. The AMS offers free worldwide access to the electronic abstracts.
An abstract should be at least one complete sentence and at most 300 words. No
abstracts will appear in the printed journal starting in 1998. Included with the
footnotes to the paper, there should be the 1991 *Mathematics Subject Classifica-
tion* 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 classifications may be found in the an-
nual index of *Mathematical Reviews*, published with the December issue starting
in 1990. Journal abbreviations used in bibliographies are also listed in the latest
*Mathematical Reviews* annual index. The classifications and the journal abbrevi-
ations are accessible from e-MATH via the World Wide Web through the URL
http://www.ams.org/publications/. When the manuscript is submitted, au-
thors 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 \texttt{AMS-\LaTeX}. To this end, the So-
ciety has prepared \texttt{AMS-\LaTeX} 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 specifica-
tions of that publication series. Articles properly prepared using the \texttt{AMS-\LaTeX}
style file automatically provide hypertext linking to the bibliography and other el-
ements of the article for searching electronically on the World Wide Web. Because
linking must often be added manually to electronically prepared manuscripts in
other forms of \TeX, using \texttt{AMS-\LaTeX} also reduces the amount of technical in-
tervention once the files are received by the AMS. This results in fewer errors in
processing and saves the author proofreading time. \texttt{AMS-\LaTeX} papers also move
more efficiently through the production stream, helping to minimize publishing
costs.

\texttt{AMS-\LaTeX} is the highly preferred format of \TeX, but author packages are also
available in \texttt{AMS-\TeX}. 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 \texttt{\LaTeX} or plain \TeX 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. \LaTeX users will find that \texttt{AMSTeX} is the same as \LaTeX with additional commands to simplify the typesetting of mathematics, and users of plain \TeX should have the foundation for learning \texttt{AMSTeX}.

Authors may retrieve an author package from e-MATH via the World Wide Web through the URL \url{http://www.ams.org/tex/} or via FTP to \url{ftp.ams.org} (login as \texttt{anonymous} and enter username as password). The author package can also be obtained free of charge by sending e-mail to \texttt{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 \texttt{AMSTeX} or \texttt{AMSTex}, 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 \texttt{AMSTeX} or \texttt{AMSTex} 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 \texttt{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.** Figures may be sent 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 sent 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.

**\TeX files available.** Beginning with the January 1992 issue of the \textit{Bulletin} and the January 1996 issues of \textit{Transactions}, \textit{Proceedings}, \textit{Mathematics of Computation}, and the \textit{Journal of the AMS}, \TeX files can be downloaded from e-MATH, starting from URL \url{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\TeX\ files are available upon request for authors without Web access by sending e-mail to 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\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 T\TeX\ production at the AMS sometimes requires extra fonts and macros that are not yet publicly available, T\TeX\ files cannot be guaranteed to run through the author’s version of T\TeX\ without errors. The AMS regrets that it cannot provide support to eliminate such errors in the author’s T\TeX\ environment.

Any inquiries concerning a paper that has been accepted for publication should be sent directly to the Electronic Prepress Department, American Mathematical Society, P.O. Box 6248, Providence, RI 02940-6248.
F. Nazarov, S. Treil, and A. Volberg, The Bellman functions and two-weight inequalities for Haar multipliers .......................... 909
Bernhard Schmidt, Cyclotomic integers and finite geometry .................. 929
Douglas Lind and Klaus Schmidt, Homoclinic points of algebraic \( \mathbb{Z}^d \)-actions ........................................................... 953
Anthony Carbery, Michael Christ, and James Wright, Multidimensional van der Corput and sublevel set estimates ...................... 981
Ehud Friedgut and an appendix by Jean Bourgain, Sharp thresholds of graph properties, and the \( k \)-sat problem ........................................... 1017
Allen Knutson and Terence Tao, The honeycomb model of \( GL_n(\mathbb{C}) \) tensor products I: Proof of the saturation conjecture .................. 1055
Jesper Villadsen, On the stable rank of simple \( C^* \)-algebras .............. 1091
Martin R. Bridson, Fractional isoperimetric inequalities and subgroup distortion .............................................................. 1103
Jinho Baik, Percy Deift, and Kurt Johansson, On the distribution of the length of the longest increasing subsequence of random permutations .................................................. 1119
Stevo Todorčević, Compact subsets of the first Baire class .................. 1179
Kevin B. Ford, Addendum and corrigendum to “The representation of numbers as sums of unlike powers. II” ............................... 1213