

*Die Grundlage der allgemeinen Relativitätstheorie.*

*A. Prinzipielle Erwägungen zum Postulat der Relativität.*

# BULLETIN

of the

AMERICAN MATHEMATICAL SOCIETY



Editors

Articles

Susan Friedlander  
Chief Editor

Book Reviews

Robert L. Devaney

*A. Prinzipielle Erwägungen zum Postulat der Relativität.*

*Remerkungen zu der*

*§1. Die speziellen Relativitätstheorie.*

*Die speziellen Relativitätstheorie liegt ~~zusammen~~ folgendes Postulat zugrunde, welches auch durch die Galilei-Newton'sche Mechanik Genüge geleistet wird. Man wähle ein Koordinatensystem  $K$  so gewählt, dass in Bezug auf dasselbe die physikalischen Gesetze in ihrer einfachsten Form gelten, so gelten dieselben Gesetze auch in Bezug auf jedes andere Koordinatensystem  $K'$ , das relativ zu  $K$  in gleichförmiger Translationsbewegung begriffen ist. Das Postulat nennen wir  $R_0$ , spezielles Relativitätsprinzip. Durch das Wort, "speziell" soll angedeutet werden, dass das Prinzip auf dem*

VOLUME 46

NUMBER 1

JANUARY 2009

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

## Bulletin (New Series) of the American Mathematical Society

The *Bulletin* publishes expository articles on contemporary mathematical research written in a way that gives insight to mathematicians who may not be experts in the particular topic. The *Bulletin* publishes, by invitation only, reviews of selected books in mathematics and short articles in the “Mathematical Perspectives” section.

---

**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.** *Bulletin (New Series) of the American Mathematical Society* is published quarterly. The *Bulletin* is also accessible electronically, starting with the January 1992 issue, from [www.ams.org/journals/](http://www.ams.org/journals/). For paper delivery, subscription prices for Volume 46 (2009) are US\$457 list, US\$366 institutional member, US\$274 individual member, US\$411 corporate 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 US\$8; subscribers in India must pay a postage surcharge of US\$15. Expedited delivery to destinations in North America is US\$12; elsewhere US\$40.

**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 USA. *All orders must be accompanied by payment.* Other correspondence should be addressed to the American Mathematical Society, 201 Charles Street, Providence, RI 02904-2294 USA.

**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, 201 Charles Street, Providence, RI 02904-2294 USA. Requests can also be made by email 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.)

---

*Bulletin (New Series) of the American Mathematical Society* (0273-0979) is published quarterly by the American Mathematical Society at 201 Charles Street, Providence, RI 02904-2294 USA. Periodicals postage is paid at Providence, Rhode Island, and additional mailing offices. POSTMASTER: Send address changes to *Bulletin*, American Mathematical Society, 201 Charles Street, Providence, RI 02904-2294 USA.

© 2009 American Mathematical Society. All rights reserved.

This journal is indexed in *Mathematical Reviews*, *Science Citation Index*<sup>®</sup>, *Science Citation Index*<sup>TM</sup>-Expanded, *ISI Alerting Services*<sup>SM</sup>, *CompuMath Citation Index*<sup>®</sup>, and *Current Contents*<sup>®</sup>/*Physical, Chemical & Earth Sciences*. This journal is archived in *Portico*.  
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      14 13 12 11 10 09

BULLETIN OF THE AMERICAN MATHEMATICAL SOCIETY

CONTENTS

Vol. 46, No. 1

January 2009

ARTICLES

Terence Tao, <a href="#">Why are solitons stable?</a> .....	1
Gregory F. Lawler, <a href="#">Conformal invariance and 2D statistical physics</a> ....	35
Allan Greenleaf, Yaroslav Kurylev, Matti Lassas, and Gunther Uhlmann, <a href="#">Invisibility and inverse problems</a> .....	55
Antonella Grassi, <a href="#">Birational geometry old and new</a> .....	99

MATHEMATICAL PERSPECTIVES

Alicia Dickenstein, <a href="#">About the cover: A hidden praise of mathematics</a> ...	125
<a href="#">Selected Mathematical Reviews</a> .....	133

BOOK REVIEWS

Michael Larsen (Reviewer), <a href="#">Moments, monodromy, and perversity: Diophantine perspective</a> , by Nicholas M. Katz .....	137
Eric M. Opdam and Jasper V. Stokman (Reviewers), <a href="#">Double affine Hecke algebras</a> , by Ivan Cherednik .....	143
Derek F. Holt (Reviewer), <a href="#">Theory of finite simple groups</a> , by Gerhard Michler .....	151
Robert L. Benedetto (Reviewer), <a href="#">The arithmetic of dynamical systems</a> , by Joseph H. Silverman .....	157
Darrell Duffie (Reviewer), <a href="#">Stochastic calculus for finance</a> , by Steven E. Shreve .....	165

ERRATA

V. S. Varadarajan, <a href="#">Erratum to the review of "Lie groups. An approach through invariants and representations"</a> .....	175
--	-----

### Editorial Board for Articles

Persi Diaconis	Barry Mazur
Lawrence Craig Evans	Robert A. Oliver
Edward Frenkel	Paul H. Rabinowitz
Susan Friedlander, Chair	Panagiotis E. Souganidis
Mark Goresky	Yuri Tschinkel
Andrew J. Granville	Michael Wolf
Bryna R. Kra	

### Editorial Board for Book Reviews

Jonathan L. Alperin	Ken Ono
Robert L. Devaney, Chair	Philip E. Protter
Steven G. Krantz	Lisa Traynor
Peter Kuchment	

### Consultants to the Editors

Gerald L. Alexanderson  
Jane Kister

**Chief Editor:** Susan Friedlander

### Editorial Information

Information on the backlog for this journal can be found on the AMS website starting from <http://www.ams.org/bull>.

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 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 form 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

The *Bulletin* publishes expository articles on contemporary mathematical research written in a way that gives insight to mathematicians who may not be experts in the particular topic. The first page must consist of a short *descriptive title*, followed by an *abstract* that summarizes the article in language suitable for mathematicians in the general area. 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.

A well-written expository 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 is to help those wishing to pursue the subject further. Articles reporting on recent mathematical research should include 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, including elements of the proof which are novel. References should be given so that an interested reader can find the details.

Each paper should include a footnote with 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/msnhtml/serials.pdf](http://www.ams.org/msnhtml/serials.pdf). 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.

Unsolicited manuscripts are encouraged. In particular, those giving lectures (Gibbs Lectures, Colloquium Lectures, and Progress in Mathematics Lectures) or invited hour addresses at meetings of the Society are encouraged to write up their lectures using the guidelines for expository articles described above. Unsolicited submissions will be reviewed by the Editorial Board for Articles, and authors will be notified of its decision.

Book Reviews are by invitation only. The first page must include the title of the book being reviewed; the name(s) of the author(s); publisher; city of publication; year of publication; number of pages, including front matter; price if known; and ISBN. There should also be a footnote with the 2000 *Mathematics Subject Classification* representing the primary and secondary subjects of the book under review. The classifications are accessible from [www.ams.org/msc/](http://www.ams.org/msc/) and are also available in print starting with the 1999 annual index of *Mathematical Reviews*. 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/).

**Initial submission.** Authors of articles may submit manuscripts for consideration as PDF files at <http://www.ams.org/peer-review/submission.pl>. Manuscripts must be a single file with images embedded. Authors will have a chance to view the manuscript and data entered before releasing the manuscript into the system. Two-digit 2000 *Mathematics Subject Classification* numbers are included in a pull-down menu; classifications are accessible from <http://www.ams.org/msc/>. Complete author instructions are available at the site.

Authors who cannot supply a PDF file may submit a paper copy of their manuscript to *Bulletin*/Peer-Review Manuscript Submissions, 201 Charles Street, Providence, RI 02904-2294 USA. These submissions will be scanned into a PDF file and entered by AMS staff into the peer-review system. All the data required in the submission form must be provided to avoid delays in posting the manuscript.

The *Bulletin* Chief Editor will be notified as new submissions arrive. The Editor will collect these submissions and assign them to subject area specialists for peer review. Queries concerning the status of submissions should be sent to the Editor at [bulletin@math.uic.edu](mailto:bulletin@math.uic.edu).

**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 TeX should have the foundation for learning  $\mathcal{A}\mathcal{M}\mathcal{S}$ -L<sup>A</sup>T<sub>E</sub>X.

Authors may retrieve an author package for the *Bulletin of the AMS* from [www.ams.org/bull/bullauthorpac.html](http://www.ams.org/bull/bullauthorpac.html) 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 from the author package link. The author package can also be obtained free of charge by sending email to [tech-support@ams.org](mailto:tech-support@ams.org) (Internet) or from the Publication Division, American Mathematical Society, 201 Charles Street, Providence, RI 02904-2294 USA. When requesting an author package, please specify  $\mathcal{A}\mathcal{M}\mathcal{S}$ -L<sup>A</sup>T<sub>E</sub>X or  $\mathcal{A}\mathcal{M}\mathcal{S}$ -T<sub>E</sub>X and the publication in which your paper will appear. Please be sure to include your complete email address.

**After acceptance.** The final version of the electronic manuscript should be sent to the Providence office immediately after the paper has been accepted for publication. Authors should indicate if the paper has been prepared using  $\mathcal{A}\mathcal{M}\mathcal{S}$ -L<sup>A</sup>T<sub>E</sub>X or  $\mathcal{A}\mathcal{M}\mathcal{S}$ -T<sub>E</sub>X. Electronically prepared manuscripts can be submitted via the Web at [www.ams.org/submit-book-journal/](http://www.ams.org/submit-book-journal/), sent via email to [pub-submit@ams.org](mailto:pub-submit@ams.org) (Internet), or sent on diskette to the Electronic Prepress Department, American Mathematical Society, 201 Charles Street, Providence, RI 02904-2294 USA. When sending a manuscript electronically via email or diskette, 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 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.

The final file of an accepted Article should also be sent by email to both [bulletin@math.uic.edu](mailto:bulletin@math.uic.edu) and [susan@math.northwestern.edu](mailto:susan@math.northwestern.edu).

**Electronic graphics.** Comprehensive instructions on preparing graphics are available from [www.ams.org/authors/journals.html](http://www.ams.org/authors/journals.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 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 only by submitting a traditional

errata to the Editor. The errata 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.** 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/). An explanation of each production step is provided on the Web through links from the manuscript tracking screen. Questions may be sent to [bull-query@ams.org](mailto:bull-query@ams.org).

**T<sub>E</sub>X files available upon request.** Authors may request T<sub>E</sub>X files by sending email to [file-request@ams.org](mailto:file-request@ams.org) or by contacting the Electronic Prepress Department, American Mathematical Society, 201 Charles Street, Providence, RI 02904-2294 USA. The request should include the title of the paper, the name(s) of the author(s), the name of the publication publishing the paper, 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 has gone to the printer. Authors who can receive Internet email should include the email address to which the file should be sent. Otherwise a diskette format and a postal mailing address should be indicated. **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 [bull-query@ams.org](mailto:bull-query@ams.org) or directly to the Electronic Prepress Department, American Mathematical Society, 201 Charles Street, Providence, RI 02904-2294 USA.

BULLETIN OF THE AMERICAN MATHEMATICAL SOCIETY  
CONTENTS

Vol. 46, No. 1

January 2009

ARTICLES

Terence Tao, Why are solitons stable? .....	1
Gregory F. Lawler, Conformal invariance and 2D statistical physics ....	35
Allan Greenleaf, Yaroslav Kurylev, Matti Lassas, and Gunther Uhlmann, Invisibility and inverse problems .....	55
Antonella Grassi, Birational geometry old and new .....	99

MATHEMATICAL PERSPECTIVES

Alicia Dickenstein, About the cover: A hidden praise of mathematics ...	125
Selected Mathematical Reviews .....	133

BOOK REVIEWS

Michael Larsen (Reviewer), Moments, monodromy, and perversity: Diophantine perspective, by Nicholas M. Katz .....	137
Eric M. Opdam and Jasper V. Stokman (Reviewers), Double affine Hecke algebras, by Ivan Cherednik .....	143
Derek F. Holt (Reviewer), Theory of finite simple groups, by Gerhard Michler .....	151
Robert L. Benedetto (Reviewer), The arithmetic of dynamical systems, by Joseph H. Silverman .....	157
Darrell Duffie (Reviewer), Stochastic calculus for finance, by Steven E. Shreve .....	165

ERRATA

V. S. Varadarajan, Erratum to the review of “Lie groups. An approach through invariants and representations” .....	175
---	-----



0273-0979(200901)46:1;1-C