

JOURNAL OF PLASMA PHYSICS

VOLUME 56
1996



CAMBRIDGE
UNIVERSITY PRESS

EDITORS

PROFESSOR R A CAIRNS, *School of Mathematical and Computational Sciences, University of St Andrews, St Andrews, Fife KY16 9SS, Scotland,*
jpp@st-andrews.ac.uk

PROFESSOR GEORGE H MILEY, *Fusion Studies Laboratory, University of Illinois, 103 S Goodwin Avenue, Urbana IL 61801, USA,*
g-miley@uiuc.edu

ASSOCIATE EDITORS

DR ROBERT L BINGHAM, *Space Science Department, Rutherford Appleton Laboratory, Chilton, Didcot, Oxfordshire OX11 0QX, England,*
rbi@vk.rl.ac.uk

DR MARCO BRAMBILLA, *Max-Planck-Institut für Plasmaphysik, Postfach 1533, D-85740 Garching, Germany,*
mab@ipp-garching.mpg.de

PROFESSOR ERYK INFELD, *Soltan Institute, Hoza 69, PL-00681 Warsaw, Poland,*
Eryk.Infeld@fuw.edu.pl

PROFESSOR P K KAW, *Institute for Plasma Research, Bhat, Gandhinagar 382 424, Gujarat, India,*
Kaw@plasma.ernet.in

PROFESSOR D B MELROSE, *Research Centre for Theoretical Astrophysics, School of Physics, The University of Sydney, Sydney NSW 2006, Australia,*
melrose@physics.su.oz.au

PROFESSOR EDWARD C MORSE, *Nuclear Engineering Department, University of California Berkeley, Berkeley CA 94720, USA,*
Morse@nuc.berkeley.edu

DR RICHARD A NEBEL, *T-15, Los Alamos National Laboratory, MS K717, Los Alamos NM 87545, USA,*
rick@ctrss2.lanl.gov

PROFESSOR G J PERT, F.R.S., *Department of Physics, University of York, Heslington, York YO1 5DD, England,*
gjp1@redeyes.york.ac.uk

DR PADMA K SHUKLA, *Institut für Theoretische Physik IV, Ruhr-Universität Bochum, D-44780 Bochum, Germany,*
ps@tp4.ruhr-uni-bochum.de

DR GARY P ZANK, *Bartol Research Institute, University of Delaware, Newark DE 19716-4793, USA,*
zank@bartol.bartol.udel.edu

Dr John P Dougherty, Founding Editor, 1967–1994

JOURNAL OF PLASMA PHYSICS (ISSN 0022-3778) is published eight times a year in January, February, April, May, July, August, October and November, by Cambridge University Press, The Edinburgh Building, Shaftesbury Road, Cambridge CB2 2RU and Cambridge University Press, Journals Department, 40 West 20th Street, New York, NY 10011-4211.

Four parts form a volume. The subscription price (excluding VAT, but includes postage) of Volumes 57 and 58 (1997) is £350.00 (US \$640.00 in the USA, Canada and Mexico) for institutions; £199.00 (US \$380.00) for individuals. Single parts cost £49.00 each (US \$88.00 in the USA, Canada and Mexico) plus postage. All orders must be accompanied by payment.

EU subscribers (outside the UK) who are not registered for VAT should add VAT at their country's rate. VAT registered subscribers should provide their VAT registration number.

Japanese prices for institutions are available from Kinokuniya Company Ltd, P.O. Box 55, Chitose, Tokyo 156, Japan. Prices include delivery by air.

Copies of the journal for subscribers in the USA, Canada and Mexico are sent by air to New York to arrive with minimum delay. Periodicals postage paid at New York, NY, and at additional mailing offices. *POSTMASTER*: send address changes in USA, Canada and Mexico to *Journal of Plasma Physics*, Cambridge University Press, 110 Midland Avenue, Port Chester, New York, NY 10573-4930.

Information on *Journal of Plasma Physics* and all other Cambridge journals can be accessed via <http://www.cup.cam.ac.uk/> and in North America via <http://www.cup.org/>.

CONTENTS TO VOLUME 56

PART 1 AUGUST 1996

Professor Daniel Bershader: 1923–1995	1
Electron transport in the stochastic fields of the reversed-field pinch MYUNG HEE KIM and ALKESH PUNJABI	3
Ion-acoustic solitary waves in a weakly relativistic warm plasma at the critical phase velocity S. K. EL-LABANY, H. O. NAFIE and A. EL-SHEIKH	13
Effect of electroacoustic waves on radiation properties of microstrip matched coaxial termination A. M. SALEM, D. BHATNAGAR and J. M. GANDHI	25
Kinetic Alfvén solitons in a low- β plasma under the influence of electron drift motion B. C. KALITA and N. DEVI	35
Transport equations on different time scales for intermediately and strongly collisional regimes J. W. EDENSTRASSER and M. M. M. KASSAB	45
Large-amplitude ion-acoustic waves in a plasma with a relativistic electron beam YASUNORI NEJOH	67
Refined theory of tearing growth rates. Part 2. Plasma models with stability threshold W. BARBULLA and E. REBHAN	77
Debye length in a kappa-distribution plasma D. A. BRYANT	87
Quantum plasmadynamics: role of the electron self-energy and the vertex correction D. B. MELROSE and S. J. HARDY	95
Unified theory of damping of linear surface Alfvén waves in inhomogeneous incompressible plasmas M. S. RUDERMAN and M. GOOSSENS	107
Collective effects in bremsstrahlung in plasmas V. N. TSYTOVICH, R. BINGHAM, U. DE ANGELIS and A. FORLANI	127

Non-inductive current drive via helicity injection by Alfvén waves in low-aspect-ratio tokamaks S. CUPERMAN, C. BRUMA and K. KOMOSHVILI	149
Stability of solitary waves in a magnetized non-thermal plasma A. A. MAMUN and R. A. CAIRNS	175
Nonlinear interaction of electrostatic ion-cyclotron and drift waves in plasmas O. A. POKHOTILOV, L. STENFLO and P. K. SHUKLA	187
PART 2 OCTOBER 1996	
Momentum-space diffusion due to resonant wave-wave scattering of electromagnetic and electrostatic waves in a relativistic magnetized plasma R. SUGAYA	193
Nonlinear coupling of a superluminal electromagnetic wave to a relativistic electron beam N. BISAI, A. SEN and K. K. JAIN	209
Effect of simultaneous presence of collisions and ion temperature on modulational instability of ion acoustic waves IJAZ-UR-RAHMAN DURRANI	221
Effect of ion temperature and inhomogeneity on modulational instability of ion acoustic waves IJAZ-UR-RAHMAN DURRANI	229
Quasimode decay of a lower-hybrid wave in a two-electron-temperature plasma A. SUDARSHAN and S. K. SHARMA	237
Magnetohydrodynamic parametric instabilities driven by a standing Alfvén wave in low- β plasma L. P. L. OLIVEIRA and A. C.-L. CHIAN	251
Resistive tearing-mode instability in a magnetic-field-reversing current sheet with coplanar viscous stagnation-point flow JUSTIN T. C. IP and BENGT U. Ö. SONNERUP	265
Dissipative instability of the MHD tangential discontinuity in magnetized plasmas with anisotropic viscosity and thermal conductivity M. S. RUDERMAN, E. VERWICHTE, R. ERDÉLYI and M. GOOSSENS	285
Electron holes and their role in the dynamics of current-carrying weakly collisional plasmas. Part I. Immobile ions J. KORN and H. SCHAMEL	307

Electron holes and their role in the dynamics of current-carrying weakly collisional plasmas. Part 2. Mobile ions J. KORN and H. SCHAMEL	339
Almost-invariant surfaces for magnetic field-line flows S. R. HUDSON and R. L. DEWAR	361
Announcement: Special Issue in Honour of David Montgomery	383
PART 3 DECEMBER 1996	
Dedication	385
Plasma physics: a personal perspective DAVID MONTGOMERY	387
Symmetries in hydrodynamic turbulence and MHD dynamo theory GEORGE KNORR	391
Vortex dynamics in perfect fluids YVES POMEAU	407
Absolute equilibrium entropy JOHN V. SHEBALIN	419
Modelling of a solar coronal loop V. KRISHAN	427
The theory of nonlinear ion-acoustic waves revisited W. MALFLIET and E. WIEËRS	441
Turbulent transport in magnetic confinement: how to avoid it M. W. BINDERBAUER and N. ROSTOKER	451
Inverse cascades in incompressible fluid and magnetofluid turbulence MURSHED HOSSAIN	467
Stochasticity in the Josephson map Y. NOMURA, Y. H. ICHIKAWA and A. T. FILIPOV	493
Bifurcations of magnetic topology by the creation or annihilation of null points E. R. PRIEST, D. P. LONIE and V. S. TITOV	507
States of minimum dissipation in magnetohydrodynamics: a review LEE PHILLIPS	531
On the most probable states of two-dimensional plasmas C. E. SEYLER	553

The simple map for a single-null divertor tokamak ALKESH PUNJABI, ARUN VERMA and ALLEN BOOZER	569
Coherent drift-wave structures in toroidal plasmas W. HORTON, T. TAJIMA, J.-Y. KIM, Y. KISHIMOTO and M. OTTAVIANI	605
Inverse cascades of angular momentum SHUOJUN LI, DAVID MONTGOMERY and WESLEY B. JONES	615
Ion parallel viscosity and anisotropy in MHD turbulence SEAN OUGHTON	641
Phenomenology of hydromagnetic turbulence in a uniformly expanding medium WILLIAM H. MATTHAEUS, GARY P. ZANK and SEAN OUGHTON	659
Instability of magnetic modons and analogous Euler flows A. Y. K. CHUI and H. K. MOFFATT	677
AUTHOR INDEX TO VOLUME 56	693

Instructions for Authors

Editorial policy: The journal welcomes submissions in any of the areas of plasma physics. Its scope includes experimental and theoretical work on basic plasma physics, the plasma physics of magnetic and inertial fusion, laser-plasma interactions, industrial plasmas, plasma devices and plasmas in space and astrophysics. This list is, of course, merely illustrative of the wide range of topics on which papers are invited, and is not intended to exclude any aspect of plasma physics that is not explicitly mentioned.

Authors are urged to ensure that their papers are written clearly and attractively, in order that their work will be readily accessible to readers. Manuscripts must be written in English. *Journal of Plasma Physics* employs a rigorous peer-review process whereby all submitted manuscripts are sent to recognized experts in their subjects for evaluation. The Editors' decision on the suitability of a manuscript for publication is final.

Submission of manuscripts: Papers may be submitted to any of the Editors or Associate Editors. Three copies should be sent accompanied by the author's address, telephone and fax number, and if possible, an electronic mailing address. Submission of a paper is taken to imply that it has not been previously published and that it is not being considered for publication elsewhere. Upon acceptance of a paper, the author will be asked to transfer copyright to the publisher.

The publisher encourages submission of manuscripts written in LaTeX for which a JPP style file can be obtained using anonymous FTP from the internet address `ftp.cup.cam.ac.uk`. Go into the directory `/pub/texarchive/journals/latex/` where you will find a concatenated file called `jpp.all`. This contains `readme.txt`, `jpp.sty` and `jppguide.tex`. If you use `jppguide.tex` you will get a full set of instructions for using the style file. In case of difficulties obtaining these files, there is a help-line available via e-mail; please contact `texline@cup.cam.ac.uk`. The publisher may also be able to typeset papers submitted on disc in ordinary LaTeX or plain TeX using 'article style'.

On final acceptance of a paper, authors should send the LaTeX source code including all author-defined macro and style files, on disc to the Editor, together with a hard copy produced using the same file. Discs should be in Apple Mac or PC format and will not be returned. It is not possible to accept final versions of papers via e-mail. The publisher reserves the right to typeset any article by conventional means if the author's TeX code presents problems in production.

Layout of manuscripts: Papers should be typewritten using **double spacing throughout**, on one side of the paper, allowing generous margins on all sides of the paper. Please avoid footnotes if possible. Papers should begin with an abstract of not more than 300 words and should end with a brief concluding section. The title and section headings should be concise and descriptive. All measurements should be given in SI units.

Illustrations: Figures should be drawn in black Indian ink on white paper or produced from a high quality laser printer. A list of captions should be attached separately, and as far as possible, information relating to a figure should be placed in the caption rather than on the figure. Each figure should be marked on the back, in pencil, with the author's name and the figure number. The top of each figure should be identified in pencil.

Tables should be typewritten on separate sheets of paper. A descriptive title should be given to each table. If possible, very wide tables should be avoided.

References: The Harvard system of references should be used. References should be listed in alphabetical order at the end of the main text. The reference should be in the order: author's surname, initials; year; journal name; volume number; page numbers. In the full references, a listing of all authors' names is preferred to the use of *et al.* If one author or group of authors has multiple papers published in the same year, the letters *a*, *b*, *c*, etc. should be appended after the year to distinguish the individual references. For books and conference proceedings, publisher and place of publication (and Editor(s) if appropriate) should be included. In the text, references should be cited as name (date) or (name date).

Proof Reading: Only typographical or factual errors may be changed at proof stage. The publisher reserves the right to charge authors for correction of non-typographical errors.

Offprints: 50 offprints of each article will be supplied free to each first named author. Extra offprints may be purchased from the publisher if ordered at proof stage. No page charge is made.

Copying: This journal is registered with the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923. Organizations in the USA who are also registered with C.C.C. may therefore copy material (beyond the limits permitted by sections 107 and 108 of US copyright law) subject to payment to C.C.C. of the per copy fee of \$11.00. This consent does not extend to multiple copying for promotional or commercial purposes. Code 0022-3778/96 \$11.00 + .10.

ISI Tear Sheet Service, 3501 Market Street, Philadelphia, Pennsylvania 19104, USA, is authorized to supply single copies of separate articles for private use only.

Organizations authorized by the Copyright Licensing Agency may also copy material subject to the usual conditions.

For all other use, permission should be sought from Cambridge or the American Branch of Cambridge University Press.

JOURNAL OF PLASMA PHYSICS

Volume 56 Part 3 December 1996

CONTENTS

Dedication	385
Plasma physics: a personal perspective DAVID MONTGOMERY	387
Symmetries in hydrodynamic turbulence and MHD dynamo theory GEORGE KNORR	391
Vortex dynamics in perfect fluids YVES POMEAU	407
Absolute equilibrium entropy JOHN V. SHEBALIN	419
Modelling of a solar coronal loop V. KRISHAN	427
The theory of nonlinear ion-acoustic waves revisited W. MALFLIET and E. WIEËRS	441
Turbulent transport in magnetic confinement: how to avoid it M. W. BINDERBAUER and N. ROSTOKER	451
Inverse cascades in incompressible fluid and magnetofluid turbulence MURSHED HOSSAIN	467
Stochasticity in the Josephson map Y. NOMURA, Y. H. ICHIKAWA and A. T. FILIPOV	493
Bifurcations of magnetic topology by the creation or annihilation of null points E. R. PRIEST, D. P. LONIE and V. S. TITOV	507
States of minimum dissipation in magnetohydrodynamics: a review LEE PHILLIPS	531
On the most probable states of two-dimensional plasmas C. E. SEYLER	553
The simple map for a single-null divertor tokamak ALKESH PUNJABI, ARUN VERMA and ALLEN BOOZER	569
Coherent drift-wave structures in toroidal plasmas W. HORTON, T. TAJIMA, J.-Y. KIM, Y. KISHIMOTO and M. OTTAVIANI	605
Inverse cascades of angular momentum SHUOJUN LI, DAVID MONTGOMERY and WESLEY B. JONES	615
Ion parallel viscosity and anisotropy in MHD turbulence SEAN OUGHTON	641
Phenomenology of hydromagnetic turbulence in a uniformly expanding medium WILLIAM H. MATTHAEUS, GARY P. ZANK and SEAN OUGHTON	659
Instability of magnetic modons and analogous Euler flows A. Y. K. CHUI and H. K. MOFFATT	677
AUTHOR INDEX TO VOLUME 56	693

CAMBRIDGE
UNIVERSITY PRESS



0022-3778(199612)56:3;1-M