JOURNAL OF PLASMA PHYSICS

VOLUME 53 1995



EDITORS

PROFESSOR R A CAIRNS, School of Mathematical and Computational Sciences, University of St. Andrews, St. Andrews KY16 9SS, Fife, 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

DR JOHN P DOUGHERTY, Department of Applied Mathematics and Theoretical Physics, University of Cambridge, Silver Street, Cambridge CB3 9EW, England, jpd2@phx.cam.ac.uk

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, metrose@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, Padma. Shukla@RUBA.RZ.ruhr-uni-bochum.de

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

© Cambridge University Press 1995

JOURNAL of PLASMA PHYSICS (ISSN 0022-3778) is published once every two months in February, April, June, August, October and December, 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.

Three parts form a volume. The subscription price (excluding VAT, but including postage) of Volumes 53 and 54 (1995) is £298.00 (US \$578.00 in the USA, Canada and Mexico) for institutions; £189.00 (US \$380.00) for individuals. Single parts cost £53.00 each (US \$99.00 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 (including ASP delivery) are available from Kinokuniya Company Ltd, P.O. Box 55, Chitose, Tokyo 156, Japan.

Copies of the journal for subscribers in the USA, Canada and Mexico are sent by air to New York to arrive with minimum delay. Second class 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.

CONTENTS TO VOLUME 53

PART 1 FEBRUARY 1995

Editorial. R. A. CAIRNS and G. H. MILLEY	1
Minority-ion distribution function of a plasma under fundamental and second-harmonic ion-cyclotron heating. B. Weyssow	3
Arbitrary-amplitude electron-acoustic solitary waves in a plasma. P. Chatterjee and R. Roychoudhury	25
Anomalous temperature relaxation and particle transport in a strongly non-uniform, fully ionized, plasma in a strong magnetic field. A. H. Øien	
	31
A self-similar solution of the dissipative MHD for a jet in the boundary-layer approximation. A. G. González and M. Heyn	49
Stability of obliquely propagating plane solitons of the Zakharov-Kuznetsov equation. M. A. Allen and G. Rowlands	63
Systematic approximations for magnetized transit-time interactions. A. Melatos and P. A. Robinson	75
Simple magnetohydrodynamic waves. G. Mann	109
Part 2 April 1995	
Stimulated Brillouin scattering of an electromagnetic wave in a magnetoactive dissipative multi-ion-species plasma. M. Bose	127
Thermal effects on the dynamics of two-gas gas-puff $Z\!-\!\theta$ pinch. M. H. Nasim, M. Salahuddin and A. M. Mirza	135
Evolution of wave packets in magnetohydrodynamics. A. Pusri and S. K. Malik	145
On a possible excitation mechanism for a longitudinal wave instability in a plasma by a quasi-static electric field. A. N. KRYSHTAL and V. P. KUCHERENKO	169
Modulated electromagnetic waves in relativistic plasmas: field and kinetic equations. M. L. EKIEL-JEŻEWSKA, T. FLÅ and A. N. KAUFMAN	185

IV		Concern	5	
Theory of stimulat	ed scattering	of large-ar	nplitude waves	s. L. Stenflo
Quasi-particles in P. P. Sosenko	magnetized	plasmas:	second-order	approximation

Contonto

:--

223

213

Solitary waves in an ion-beam-plasma system. Y. NAKAMURA and K. Ohtani

235

Contribution of higher-order nonlinearity to nonlinear ion-acoustic waves in a weakly relativistic warm plasma. Part 2. Non-isothermal case. S. K. El-Labany and S. M. Shaaban

245

PART 3 JUNE 1995

M	odel	ling and	numeri	cal sim	ulation	of	microwa	ave	pulse	propa	gation	in
		air-breal	kdown	enviro	nment.	J.	Кім,	S.	P.	Kuo	and	Ρ.
	Κo	SSEY										

253

Analysis of plasma critical flow in ablative discharge capillaries with a non-constant cross-section. J. ASHKENAZY and D. ZOLER

267

Toroidal currents and radial transport driven by ponderomotive forces of fluctuations in a plasma. V. Petržílka and R. Balescu

277

Mode conversion of laser radiation in the presence of a magnetic wiggler.
J. Parashar, H. D. Pandey and R. K. Singh

285

Plasma microinstabilities driven by loss-cone distributions. D. Summers and R. M. Thorne

293

Magnetoacoustic modes in a magnetized dusty plasma. N. N. RAO

317

Raman scattering of photons in the solar interior. V. N. TSYTOVICH, R. BINGHAM and U. de Angelis

335

Wave dispersion and resonant deposition profiles of electron-cyclotron Gaussian beams in toroidal plasmas. S. CIRANT, S. NOWAK and A. OREFICE

345

Multiple scattering of electromagnetic waves by a collection of plasma drift turbulent vortices. D. Resendes

365

Relaxed states of an ideal MHD plasma with external magnetic field. G. Knorr, M. Mond and C. Grabbe

373

AUTHOR INDEX TO VOLUME 53

387

Journal of Fluid Mechanics

Editor-in-Chiefi G. K. BATCHELOR, FRS Emeritus Professor of Applied Mathematics, University of Cambridge

Journal of Fluid Mechanics publishes authoritative articles covering theoretical, numerical and experimental investigations of all aspects of the mechanics of fluids. Each of the twice monthly volumes contains papers on both the fundamental aspects of fluid mechanics, and their applications to other field, such as

- aeronautics astrophysics meteorology
- oceanography volcanology colloid science hydraulics chemical engineering
- mechanical and civil engineering acoustics

In addition to original research, the journal includes reviews of books and films relevant to the field.

Journal of Fluid Mechanics is of vital importance to all those who are working and researching in the field of fluid mechanics, an area that touches many of the engineering and geophysical disciplines.

Recent Articles

Free convection in an electrochemical system with nonlinear reaction kinetics, F. H. BARK & F. ALAVYOON

A study of non-parallel and nonlinear effects on the localized receptivity of boundary layers, J. D. CROUCH & P. R. SPALART Sedimentation and sediment flow in settling tanks with inclined walls, B. KAPOOR & A. ACRIVOS

Strongly nonlinear interfacial dynamics in core-annular flows, V. KERCHMAN
On the equilibrium and stability of a row of point vortices, H. AREF

Critical microjets in collapsing cavities, M. S. LONGUET-HIGGINS & H. OGUZ

Finite-amplitude three-dimensional instability of core-annular flow, H. H. Hu & N. PATANKAR

An experimental study of a three-dimensional pressure-driven turbulent boundary layer, S. M. Ölçmen & R. L. Simpson

Subscription details:

Volumes 282–305 twice monthly. £696 for institutions; £359 for individuals; airmail £182 per year extra. ISSN 0022-1120

-	of Fluid Mechanics
Name	
Address	

Send this coupon to: Journals
Marketing Department, Cambridge
University Press, FREEPOST*, The
Edinburgh Building, Cambridge
CB2 1BR, UK (*No postage stamp
necessary if posted in the UK)
In USA, Canada & Mexico, write to
Cambridge University Press, 40 West
20th Street, New York, NY 100114211, USA



CAMBRIDGE Plasma Physics

Now in paperback

Plasma Physics: An introductory Course

R. O. DENDY

For the last thirty years, international summer schools in plasma physics have been held at Culham Laboratory. This book has been developed from lectures given at these schools, and provides a wide-ranging introduction to the theoretical and experimental study of plasmas and their applications.

£24.95 net PB 0 521 48452 9 536 pp.

Solar and Planetary Dynamos

M. R. E. PROCTOR, P. C. MATTHEWS and A. M. RUCKLIDGE

This volume represents the most up-to-date record of research into the theory of dynamos. Topics covered include: solar magnetic field generation, dynamics of the Earths core, magnetic fields in galaxies, and papers on 'fast dynamos'.

£35.00 net HB 0 521 45470 0 378 pp.

Publications of the Newton Institute

Physics of the Pulsar Magnetosphere

VASILY BESKIN, A. V. GUREVICH and YA. N. ISTOMIN

The authors present the theory of the electrodynamic phenomena which occur in the magnetosphere of a pulsar. Fully illustrated throughout and well referenced this book will be of particular value to graduate students and researchers in astrophysics and plasma physics.

£75.00 net HB 0 521 41746 5 432 pp.

Theory of Space Plasma Microinstabilities

S. PETER GARY

This book describes the linear theory of many different waves and instabilities that may propagate in a collisionless plasma. Key points are summarised at the end of each chapter with problems to solve interspersed throughout the text.

£30.00 net HB 0 521 43167 0 200 pp. Cambridge Atmospheric and Space Science Series 7

Relativistic Non-Linear Waves

With Applications in Astrophysics and Plasma Physics

A. M. ANILE

The author provides a unified and systematic treatment of the main results and techniques of relativistic fluid dynamics. This text will be of interest to astrophysicists, plasma physicists, nuclear physicists, and applied mathematicians. £60.00 net HB 0 521 30406 7 348 pp. Cambridge Monographs on Mathematical Physics

Whistler-mode Waves in Hot Plasma

SERGEI SAZHIN

The book gives an extensive theoretical treatment of whistler-mode propagation, instabilities and damping in a hot, anisotropic and collisionless plasma. Contains problems and their solutions, and can be used as a graduate text.
£45.00 net HB 0 521 40165 8 269 pp.
Cambridge Atmospheric and Space Science Series 6

Nonlinear Magnetohydrodynamics

DIETER BISKAMP

This is a self-contained introduction to magnetohydrodynamics (MHD). Emphasis is on the physical principles rather than on special formalisms, ensuring that this book will be essential reading for theorists and experimentalists in MHD effects.

£55.00 net HB 0 521 40206 9 400 pp. Cambridge Monographs on Plasma Physics 1

Plasma Physics

An Introduction to the Theory of Astrophysical, Geophysical, and Laboratory Plasmas P. A. STURROCK

Plasma Physics presents an authoritative and wide ranging pedagogic study of the 'fourth' state of matter. The author provides an ideal introduction to this complex and fascinating field of research; balancing the theoretical and practical and preparing the student for further study.

£45.00 net HB 0 521 44350 5 416 pp. £17.95 net PB 0 521 44810 7

Cambridge books are available from good bookshops, alternatively ring 01223 325970 in the UK to order direct using your credit card. For further information please email us on science@cup.cam.ac.uk



The Edinburgh Building, Cambridge CB2 2RU, UK

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 which 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 style file can be obtained from the Editors or directly from the publisher using anonymous FTP to retrieve the file jpp.all from the Internet address cup.cam.ac.uk where the macro is in the directory /pub/texarchive/journals/latex/jpp.all. The publisher may also be able to typeset papers submitted on disk in Plain TeX or AMS TeX using the 'article style'. When submitting the revised/final version of a paper, authors should send disks (Apple Mac or PC) containing the TeX source code and any macros and other relevant details; it is not possible to accept final versions of papers via e-mail. The disk files should correspond exactly to the hardcopy manuscript accepted for publication. Disks will not be returned. 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. Wherever possible, they will be reproduced with the author's original lettering. 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. Please include the article title in the reference, which should be in the order: author's surname, initials; year; journal name; volume number; inclusive 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, place of publication and publisher (and Editor(s) if appropriate) should be included. In the text, references should be cited as 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. There is no charge for publication.

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 0022-3778/95 \$11.00 + .10.

1SI 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 53 Part 3 June 1995

CONTENTS

Modelling and numerical simulation of microwave pulse propagation in an air-breakdown environment	
J. KIM, S. P. KUO AND PAUL KOSSEY	253
Analysis of plasma critical flow in ablative discharge capillaries with a non-constant cross-section	267
J. ASHKENAZY AND D. ZOLER	267
Toroidal currents and radial transport driven by ponderomotive forces of fluctuations in a plasma	077
V. PETRŽÍLKA AND R. BALESCU	277
Mode conversion of laser radiation in the presence of a magnetic wiggler	
JETENDRA PARASHAR, H. D. PANDEY AND R. K. SINGH	285
Plasma microinstabilities driven by loss-cone distributions DANNY SUMMERS AND RICHARD M. THORNE	293
Magnetoacoustic modes in a magnetized dusty plasma N. N. RAO	317
Raman scattering of photons in the solar interior.	
V. N. TSYTOVICH, R. BINGHAM AND U. DE ANGELIS	335
Wave dispersion and resonant deposition profiles of electron-cyclotron Gaussian beams in toroidal plasmas	
S. CIRANT, S. NOWAK AND A. OREFICE	345
Multiple scattering of electromagnetic waves by a collection of plasma drift turbulent vortices	
D. RESENDES	365
Relaxed states of an ideal MHD plasma with external magnetic field G. KNORR, M. MOND AND C. GRABBE	373
·	
AUTHOR INDEX TO VOLUME 53	387



