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ANNUAL TECHNICAL REPORT

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(Program Manager: Dr. James Stobie, Lt. Col, USAF)

CENTER FOR
THEORETICAL GEOPLASMA PHYSICS

Center for Space Research
Massachusetts Institute of Technology
(an AFOSR-URI program)

Reported by Tom Chang, Director

Cambridge, Massachusetts
February 15, 1992

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<p>This annual report contains a detailed description of the activities, accomplishments, and research progress of the MIT Center for Theoretical Geoplasma Physics established under the University Research Initiative Program by AFOSR. During this second phase of the program, the Center has made definite strides toward the goals prescribed in the renewal proposal. The Center has now a staff of twenty-five (25) faculty, research scientists, postdoctoral, graduate and undergraduate students and visiting scientists. Members of the Center published forty-eight (48) scientific papers and five (5) books and proceedings, delivered forty (40) invited lectures and fifty-one (51) contributed papers. We have initiated a number of new research activities to complement our other ongoing research programs. Some of our research efforts have already been utilized by Dr. J.R. Jasperse's group at the Geophysics Directorate of the Phillips Laboratory in practical space technology applications relevant to the</p> <p style="text-align: right;">(continued on reverse side)</p>			
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missions of the Air Force. In addition to the Phillips Laboratory, the Center has interacted with numerous research organizations and universities. The research publications are generally the direct product of such interactions.

The Center organized three (3) annual symposia on the "Physics of Space Plasmas" and two (2) workshops in Theoretical Geoplasma Physics. Alfvén Lectureships (established in honor of Professor Hannes Alfvén, Nobel Laureate and a member of our group) were awarded to three outstanding space plasma physicists, Professor James van Allen of the University of Iowa (discoverer of the van Allen radiation belt), Professor Eugene N. Parker of the University of Chicago (father of the solar wind), and Professor Oscar Buneman of the Stanford University (of the Buneman and Farley-Buneman instabilities).

During the summers of 1990 and 1991, our Center collaborated with the School of Science, the Graduate School, and Whittaker College of Health, Science, and Technology at MIT in a "Minority Summer Science Program (MSSRP)". Ms. Dannielle Sharp, a minority mathematics major participated and did innovative research in plasma particle heating and chaos in two-dimensions.

In addition, Dr. Tom Chang is serving as a member of the NASA Space Physics Theory Working Group, an Associate Editor of Reviews of Geophysics, and a Co-Convener of the AGU Chapman Conference on Micro/Meso Scale Phenomena in Space Plasmas. He was a member of the Visiting Committee of the NSF magnetospheric program, a member of the Program Committee of the Division of Plasma Physics of the American Physical Society, and a member of the Steering Committee of the International Topical Conference on Nonlinear Space Plasma Physics.

ANNUAL TECHNICAL REPORT No. 2

February 15, 1992

Grant Number: AFOSR-90-0085

Program Manager: Dr. James Stobie, Lt. Col. USAF

Center for Theoretical Geoplasma Research

Reported by: Dr. Tom Chang, Director

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ANNUAL TECHNICAL REPORT

I. TABLE OF CONTENTS

I. TABLE OF CONTENTS.....	2
II. PROLOGUE.....	3
III. PROFESSIONAL PERSONNEL ASSOCIATED WITH THE PROGRAM.....	6
IV. BIOGRAPHICAL SKETCHES OF KEY PERSONNEL.....	7
V. CHRONOLOGICAL LISTING OF SCIENTIFIC PUBLICATIONS	
- 8 PAPERS AND 5 BOOKS.....	12
VI. INVITED LECTURES-TOTAL 40.....	16
VII. PROGRAMS OF THE 1990, 1991, AND 1992 MIT SYMPOSIA	
OF THE PHYSICS OF SPACE PLASMAS.....	19
VIII. PRELIMINARY PAGES INCLUDING THE TABLES OF CONTENTS	
OF THE 1990, 1989, AND 1988 CONFERENCE PROCEEDING	
ON THE 'PHYSICS OF SPACE PLASMAS'.....	23
IX. PRELIMINARY PROGRAM OF THE AMERICAN GEOPHYSICAL	
UNION CHAPMAN CONFERENCE ON MICRO/MESO SCALE	
PLASMA PHENOMENA IN SPACE PLASMAS, HAWAII 1992....	42

II. PROLOGUE

During the past two years (the first two years of the second phase of the Center for Theoretical Geoplasma Physics program at MIT), we have made definite strides toward the goals prescribed in our AFOSR-URI renewal proposal.

Members of the Center published a total of forty-eight (48) scientific papers and five (5) books, delivered a total of forty (40) invited lectures, and presented fifty-one (51) additional contributed papers at various national and international conferences.

We have initiated a number of new research activities to complement our other active ongoing research programs. Some of our research efforts have already been utilized by Dr. Jasperse's group at the Geophysics Directorate of the Phillips Laboratory in practical space technology applications relevant to the missions of the Air Force. Examples of such applications are: prediction of charged-particle precipitation patterns and deposition profiles in the diffuse-auroral zone of the ionosphere; prediction of solar EUV and X-ray fluxes based on ionospheric photoelectron measurements and transport calculations; and calculation of ionospheric electron density profiles in the mid-latitude and high-latitude portions of the globe.

Other relevant research programs germane to the basic theme of the Center include:

1. Propagation characteristics of ULF waves along auroral field lines connected to the central plasma sheet.
2. Effect of preexisting turbulence on current sheet configurations and instabilities in the auroral zone and the magnetotail.
3. The application of magnetohydrodynamic turbulence to the phenomenon of ionosphere-magnetosphere coupling.
4. Self-consistent studies of the nonclassical polar wind and their relevance to plasma transport.
5. Magnetic reconnection processes and flux transfer events in the terrestrial magnetosphere and ionosphere.
6. An analytical description of three-dimensional double layers along auroral field lines using nonlinear plasma stability theories and the related energization process of the auroral electrons and ions.
7. The origin of high-latitude ionospheric turbulence due to velocity shear and its relevance to charged particle acceleration processes.
8. The investigation of the inter-relations of the particle precipitation, plasma waves, field-aligned currents, convection patterns, the direction of the inter-planetary magnetic field, and the mysterious sub-visual polar cap arcs.
9. Effect of cold ion beam diffusion on the generation of double layers in the auroral zone.

10. A combined computer simulation/theoretical study of the various beam-plasma interaction phenomena in the ionosphere, magnetosphere and the solar wind.
11. Heavy ion-light ion interaction along auroral field lines.
12. Many other topics as indicated in the enclosed publication list.

The Center has interacted actively with a number of research organizations including the Geophysics Directorate of the Phillips Laboratory, the Southwest Research Institute, the Lockheed Palo Alto Scientific Research Laboratory, The Swedish Space Institute, the Finish Meteorological Institute, the Max-Planck Institute for Extraterrestrial Physics, Cornell University, the University of California at Berkeley, the University of California at Irvine, the Imperial College, the University of Maryland, the Utah State University, the Naval Research Laboratory, Boston College, the Applied Physics Laboratory of the Johns Hopkins University, the University of Alaska, and the University of California at Los Angeles. Visits by scientists from these institutions and our visits to some of these institutions helped to keep our research program vibrant and up-to-date. *In particular, Drs. J.R. Jasperse and J.M. Retterer of the Geophysics Directorate have provided the guidance and inspiration of our entire technical program.*

Our computer capability has been further enhanced. Through our network of Sun Sparcstations, we are tied to the MIT ethernet, the internet, and all the networks worldwide. We continue to have access to the Computer Center at the Geophysics Directorate and have a fast speed access to the National Center for Supercomputer Applications (NCSA) at the University of Illinois in Urbana-Champaign. Dr. G.B. Crew is Chairman of the Computer Committee in charge of these computing activities at the Center.

Twenty-five (25) scientists and one (1) senior secretary were affiliated with the Center program. These include members of the faculty, staff, postdoctoral and graduate students from MIT and several visiting scientists, consultants, and research affiliates from other interacting institutions.

The Center organized three annual symposia on the "Physics of Space Plasma" which included leadoff lectures on "Space Plasma Physics via Particle Simulations" by Professor Oscar Buneman of the Stanford University, a world renowned space plasma physicist, "The Magnetospheres of the Planets and the Moon" by Professor James van Allen of the University of Iowa, the discoverer of the "van Allen radiation belts", and "Spontaneous Discontinuity and the Stellar X-Ray Emission" by Professor Eugene N. Parker, father of the Solar Wind. Over one hundred and twenty scientists (120) participated during each of these symposia including many from the Geophysics Directorate of the Phillips Laboratory. The Center also sponsored two Cambridge Workshops in Theoretical Geoplasma Physics on the subjects, "Magnetic Fluctuations, Diffusion, and Transport in Geoplasmas", and "Nonlinear Phenomena and Active Experiments in Geoplasmas". The workshops, organized with the assistance of *Drs. J.R. Jasperse and Herbert Carlson* of the Geophysics Directorate, attracted over one hundred and thirty (130) international scientists including thirty

graduate students. Four proceedings volumes based on these and prior conferences were published by the Scientific Publishers, Inc.

In addition, Dr. Tom Chang is serving or have served as a member of the NASA Space Physics Theory Working Group, the Program Committee of the Division of Plasma Physics of the American Physical Society, the NSF Committee of Visitors, the Steering Committee of the International Topical Conference on Nonlinear Space Plasma Physics, and the Organizing Committee of the Chapman Conference on Micro/Meso Scale Phenomena in Space Plasmas: Theory and Observations.

During the summers of 1990 and 1991, our Center collaborated with the School of Science, the Graduate School and the Whittaker College of Health, Science and Technology at MIT in a "Minority Summer Science Research Program (MSSRP)". This is an institutional effort to address the issue of under-representation of African American, American Indian, Mexican American, and Puerto Rican students in mathematical, physical, and biological sciences in the United States. Miss Dannielle Sharp, a gifted minority mathematics undergraduate student from Tougaloo College of Jackson, Mississippi spent a total of ten (10) weeks each summer with our group and did innovative research in "Plasma Particle Heating in the Magnetosphere" and "Chaos in 2D". Miss Sharp graduated from Shaw High School as valedictorian and is a honor student in mathematics/computer science at Tougaloo. Her research at MIT culminated in thesis type presentations at the conclusion of the programs. This program is so successful that we plan to continue our participation in the project again in 1992.

Enclosed are: an organization chart with biographical sketches of key personnel of the Center, detailed lists of publications and invited presentations by members of the Center during the past two years, symposium programs and tables of contents of published conference proceedings on the "Physics of Space Plasmas", and a preliminary program of the Chapman Conference on Micro/Meso Scale Phenomena in Space Plasmas.

III . PROFESSIONAL PERSONNEL ASSOCIATED WITH THE PROGRAM

Tom T. S. Chang, Director
Geoffrey B. Crew, Assistant to the Director and Research Scientist
John Belcher, Professor
Stanislaw Olbert, Professor (emeritus)
Daniel Hastings, Associate Professor
Hannes Alfven (Nobel Laureate), Sponsor of Alfven Lectureship
D. Swift, Visiting Professor
C. Chan, Visiting Professor
D. Tetreault, Research Scientist
J. R. Jasperse, Visiting Scientist
J. M. Retterer, Visiting Scientist
Fareed Yaseen, Visiting Scientist
C.T. Dum, Research Affiliate and Consultant
Rachelle Bergmann, Consultant
Sunanda Basu, Consultant
M. Andre, Visiting Scientist
J. D. Winningham, Visiting Scientist
Jay Johnson, Graduate Student and Research Assistant
W.T. Tam, Graduate Student and Research Assistant
N. Gatsonis, Graduate Student and Research Assistant
Dannielle Sharp, UROP Student (Summer minority student awardee)
Professor Oscar Buneman, 1990 Alfven Lecturer
Professor James A. van Allen, 1991 Alfven Lecturer
Professor Eugene N. Parker, 1992 Alfven Lecturer
Kanton Phillips, Computer Manager
Mary Terhune, Senior Secretary

IV. BIOGRAPHICAL SKETCHES OF KEY PERSONNEL

Dr. Tom Chang is internationally known for his contributions in charged particle acceleration processes in the Earth's ionosphere and magnetosphere. He is currently directing a Center of Excellence effort in Theoretical Geoplasma Research within MIT's Center for Space Research. In addition to his two Ph.D.'s in theoretical physics and engineering, he has done postdoctoral work at the University of Cambridge and was an Honorary Research Fellow at Harvard's Lyman Laboratory of Physics. He is a Fellow of the American Physical Society and has served for many years as Editor of the international journal, Plasma Physics. He is currently a member of the NASA Space Physics Theory Working Group (SPTWG) and served as a member of the program committee of the Plasma Physics Division of the American Physical Society and the Committee of Visitors for the NSF Magnetospheric Physics Program. He is the Editor-in-Chief of the popularly referenced AGU monograph, "Ion Acceleration Processes in the Magnetosphere and Ionosphere", the series Editor of the SPI Conference Proceedings series, "Physics of Space Plasmas", an Associate Editor of the AGU journal, "Reviews of Geophysics", and served as a member of the Steering Committee of the International Conference on Plasma Science held in La Jolla in 1991. He is the organizer of over a dozen National and International Conferences including the well-established Cambridge Workshop series in Theoretical Geoplasma Physics, which is held at MIT annually each summer. Tom Chang is an author editor of over 120 scientific publications including 12 books and proceedings volumes. He was the recipient of the prestigious National Thompson Award.

Dr. Geoffrey B. Crew received his A.B Summa Cum Laude in physics and mathematics from Dartmouth. He was a National Science Foundation Fellow at MIT where he received his Ph.D. in theoretical plasma physics. His research has been directed toward tractable, analytic formulations of space plasma phenomena including those related to the conical distribution of ionospheric ions in the magnetosphere and the stability of current sheets in the magnetotail in the presence of pre-existing turbulence. Dr. Crew is currently serving as Chairman of the Computer Committee of the Center for Space Research. He has co-organized a number of scientific conferences and has been a co-editor of the corresponding proceedings. He is an author of 32 scientific papers.

Dr. Dave Tetreault is a renowned space plasma theorist with eighteen (18) years of research experience. A Summa Cum Laude Physics Graduate from the University of New Hampshire, Dr. Tetreault received his Ph.D. in nonlinear plasma theory from the Massachusetts Institute of Technology under the direction of the renowned physicist, Professor Thomas Dupree. Dr. Tetreault is a member of Phi Beta Kappa and Sigma Xi, and held a National Science Foundation Fellowship during the years 1969-72. He has given numerous invited talks on nonlinear plasma theory involving auroral double layers, ion holes, turbulent reconnection and clump theory. He is an author of over twenty five research articles in refereed journals.

Dr. John Belcher graduated Summa Cum Laude in physics and mathematics from Rice University and obtained his Ph.D. in Physics from Cal Tech. He is internationally known for his innovative theory of Alfvén wave heating of the solar wind and is the principal investigator of the plasma experiment of the Voyager program. He is an authority in the physics of the

ionospheres and magnetospheres of all planets and the heliosphere. As Professor of Physics at MIT, Dr. Belcher provides the broad perspective and insight which the Center relies upon in geoplasma research and studies.

Dr. Stanislaw Olbert has a Ph.D. from MIT and was a student of the world-renowned space physicist, Professor Bruno Rossi. He has been interested in the Physics of Space since the very beginning. He is the author of the well-known text, "Introduction to the Physics of Space". He is known for his innovative research in cosmic rays, anomalous heat flux in the solar wind, and induced radiative losses of conducting objects in magnetized plasmas. Several of his students are now leading authorities in the field of physics of space plasmas.

Mr. Jay Johnson is undoubtedly the top graduate student in Theoretical Space Plasma Physics at MIT. He came from the University of Colorado with a straight A+ average, where he worked with the famous plasma physicist, Professor Martin Goldman, as an undergraduate honor student. His grades at MIT are outstanding and ranked number one in the physics general examination in 1989. He interacts at the level of an accomplished postdoctoral student with a lot of insight and knowledge of space plasma research. As a graduate student, he has already published papers in the Geophysical Research Letters, the Journal of Geophysical Research and Annales Geophysicae. He has given a number of presentations including invited talks at various international and US conferences. His presentation on "Auroral Turbulence" at the 1990 Fall Meeting of AGU qualified him as a recipient of the Outstanding Student Paper Award of the Solar-Planetary Relationship Section of the American Geophysical Union.

Mr. Sunny Wing Yee Tam obtained his B.S. degree in physics from the University of California, Berkeley with highest honors. He has an outstanding record at MIT including a top grade in the physics general examination in 1991. During a short period of less than two years, Mr. Tam has already accomplished a great deal. One of his outstanding achievements is the discovery of a number of inaccuracies and errors in one of the most popular plasma dispersion codes which have been used world wide for important space plasma instability calculations. He has since developed a much more efficient and versatile plasma dispersion code capable of treating nearly all conceivable geometries and plasma environments.

Dr. Christian T. Dum is world-renowned for his work on plasma diffusion theory and large scale numerical simulations. Since obtaining his doctoral degree in Physics from MIT, Dr. Dum taught for a few years at the Cornell University before assuming his position as head of the theory group of the Max-Planck Institute for Extraterrestrial Physics in Garching bei Munchen, Germany. Dr. Dum is a member of the European Space Agency on future space missions, a Fulbright Scholar, and a Member of the American Physical Society, the American Geophysical Union and Sigma Xi. He has written over forty (40) definitive research articles in refereed journals and given over fifty invited and review lectures at many international conferences and workshops.

Professor Rachelle Bergmann obtained all her degrees from the University of California, Berkeley. She graduated in Physics and Applied Mathematics with distinction and wrote her doctoral thesis under the renowned space

physicist, Professor Mary Hudson (now at Dartmouth College). Dr. Bergmann's work on ion beam interactions in the auroral zone is recognized by her peers as the standard in the field. She is very popular as an invited lecturer at various national and international conferences. She is member of Phi Beta Kappa and recently received a Faculty Excellence Award in Research at her University. She has contributed over thirty technical and scientific papers. Dr. Bergmann's current research interest is in ion-ion beam interactions and generation of double layers in the auroral region.

Dr. Mats Andre is at present the coordinator for the Swedish Satellite, Freja, which is scheduled to be launched next year. Trained as a theoretical space plasma physicist, Dr. Andre is also deeply involved with hardware and data analyses. He has obtained the degrees of Ph.D. and Doctor and is now an Associate Professor at the University of Umea and a senior scientist at the Swedish Space Institute. Dr. Andre has been collaborating with the MIT Center since its inception and has contributed in the areas of ion heating, low frequency turbulence, and double layers.

Dr. Daniel Hastings obtained his A.B. with highest honors from the Oxford University. A Ph.D. graduate from MIT, Dr. Hastings has been active in space research for many years. He is an authority in the phenomena of plasma radiation due to the motion of conducting bodies in magnetized plasmas and critical ionization, and is currently Professor and Director of the Space Grant program at MIT.

Dr. John R. Jasperse is head of theoretical space plasmas physics at the Geophysics Directorate of the Phillips Laboratory. A Harvard graduate, he obtained his Ph. D. from Northeastern. He has received many awards and is internationally renowned his work in ionospheric plasmas instabilities and collisional processes. He has interacted with the MIT group for a number of years and has given the guidance of the research activities at the Center since the inception of the MIT program. His joint research activities at MIT included the understanding of particle acceleration in space plasmas, theory of turbulence and other topics as described earlier in the prologue. He has jointly sponsored with Dr. Tom Chang at MIT a number of international conferences and workshops.

Dr. John M. Retterer received his Ph.D. in astronomy with high honors from the University of California at Berkeley. He has enjoyed an appointment as visiting scientist at MIT for a number of years. He is known for his innovative research in Monte Carlo and particle-in-cell simulations in space plasma physics, particularly in the field of VLF waves and electron beam excited plasma instabilities. He has been invited to deliver review lectures on his specialty all over the world at many prestigious international conferences.

Dr. Dan Swift obtained his degree from MIT and is now Professor of Geophysics and Physics at the renowned Geophysical Institute of the University of Alaska. He is world-renowned for his innovative numerical simulations of the geoplasma environment. Professor Swift spent the sabbatical year (1989-90) at MIT and the Geophysical Directorate of the Phillips Laboratory and did joint research with the MIT group on shear induced plasma instability and ion acceleration processes.

Dr. Chen Chan obtained his Ph.D. from the University of Wisconsin and received an Outstanding Graduate Student Award from IEEE's Nuclear and Plasma Science Society for his doctoral thesis. Professor Chan is world renowned for his work in laboratory weak double layers simulating the auroral potential structures in the magnetosphere. He is currently professor of Electromagnetic at Northeastern University. Professor Chan founded the Plasma Science and Microelectronics Laboratory which currently occupies over 7,000 sq.ft. of space and contains state of the art equipment in plasma physics, micro-fabrications, and material science. Professor Chan collaborates with the MIT group on laboratory simulations of space plasma phenomena and is spending a year at MIT and the Geophysics Directorate to work with Dr. Tom Chang at MIT and J.R. Jasperse at GL.

Dr. Fareed Yasseen obtained his Ph.D. from the Polytechnic Institute in Lausanne, Switzerland and was the student of the world-renowned plasma physicist, Professor E. Weibel. Dr. Yasseen has done outstanding research in theoretical space plasma studies. His ground-breaking work of the global analysis of collisional effects on photoelectron distributions in the polar wind has generated a new direction in polar wind research and investigators all over the world are following in his footsteps.

Dr. Peter Yoon obtained his Ph.D. from MIT doing relativistic plasma physics research with the famous Professor Ron Davidson (now Director of the Princeton Plasma Physics Laboratory). He spent two postdoctoral years at the MIT Center and has done innovative research in the application of cyclotron maser theory to a number of space plasma environments. He is now a recognized authority on the pitch-angle diffusion processes of pickup ions near comets, the IO torus, and other space plasma situations where electromagnetic turbulence are prevalent.

Dr. Nick Gatsonis obtained his M.S. in Space Physics from the University of Michigan and completed his Ph.D. in space physics a couple of months ago at MIT under the direction of Professor D. Hastings. He has done such outstanding research in studying the plasma surroundings and instabilities near moving spacecraft that he was immediately offered a position in charge of these types of research at the Applied Physics Laboratory of the Johns Hopkins University upon graduation.

Dr. Sunanda Basu is one of the foremost women space scientists in the world. She is virtually on every scientific committee of IAGA, URSI, NSF, NASA, and other scientific societies. She is an expert in ionospheric plasma physics. Since 1990, Dr. Basu has been collaborating with the MIT Center as a consultant in studying the plasma wave spectra induced by velocity shear and gradient drift instabilities. She is also interested in ion acceleration processes in the ionosphere.

Dr. Hannes Alfvén is the sponsor of the Alfvén Lecture series at MIT. Professor Alfvén is a Nobel Laureate and is known for the Alfvén waves that bear his name. He is generally considered as the father of theoretical space plasma physics. Every year, a world-renowned space physicist is invited to MIT to deliver a plenary lecture (the Alfvén Lecture) and to interact with members of the MIT Center on research topics of mutual interest. The awardees of the lectureship include such luminaries as Professor James van Allen of the University of Iowa (discoverer of the van Allen Belt), Professor Jim Dungey of the Imperial College (discoverer of the reconnection model of the open magnetosphere),

Professor Oscar Buneman of the Stanford University (co-discoverer of the Farley-Buneman instability in ionospheric plasma physics), Professor Eugene N. Parker of the University of Chicago (developer of the solar wind theory) and others. Professor Alfvén visits MIT periodically and offers precious encouragement to the theorists at MIT that only a Nobel Laureate can provide.

V. CHRONOLOGICAL LISTING OF SCIENTIFIC PUBLICATIONS - 48 PAPERS AND 5 BOOKS

1. "Low-Dimensional Behavior and Symmetry Breaking of Stochastic Systems Near Criticality: Can These Effects be Observed in Space and in the Laboratory?", Tom Chang, to be published in IEEE, Trans. of Plasma Science, Special Issue on Space and Cosmic Plasmas, October 1992.
2. "Turbulent Relaxation of Magnetic Fields-I: Coarse-Grained Dissipation and Reconnection", D. Tetreault, J. Geophys. Res., to be published.
3. "Turbulent Relaxation of Magnetic Fields-II: Self-Organization and Intermittency", D. Tetreault, J. Geophys. Res., to be published.
4. "Path Integral Approach to Nonlinear Particle Acceleration and Diffusion in Space Plasmas," Tom Chang, Recent Trends in Physics, A.I.P. Publication, New York, to be published.
5. "Ion Acceleration along Auroral Field Lines-A Mesoscale Phenomenon", Tom Chang, Proceedings of the 1991 Brazilian Congress on Plasma Physics, to be published.
6. "Path Integrals, Differential Renormalization-Group, and Stochastic Systems Near Criticality," Tom Chang, Int. Jr. Engr. Science, to be published.
7. "Nonlocal Analysis of Finite Beam-Driven Instabilities", C.T. Dum and Y. Serizawa, Phys. Fluids, to be published.
8. "Convection of Ion Cyclotron Waves to Ion Heating Regions", K. Ronnmark and M. Andre, J. Geophys. Res., 96, 17373, 1991.
9. "Decay of Ion Beam Driven Acoustic Waves into Ion Holes", P.C. Gray, M.K. Hudson, W. Lotko and R. Bergmann, Geophys. Res. Lett., 9, 1675, 1991.
10. "What Parts of Broadband Spectra are Responsible for Ion Conic Production?", L. Ball and M. Andre, Geophys. Res. Lett., 18, 1683, 1991.
11. "Critical Points in the 16-Moment Approximation", F. Yasseen and J.M. Retterer, J. Geophys. Res., 96, 1827, 1991.
12. "Theory of Electric Fields in the Auroral Acceleration Region", D. Tetreault, J. Geophys. Res., 96, 3549, 1991.
13. "A Stochastic MHD Model of Reconnection in the Dayside Magnetopause", D. Tetreault, Physics of Space Plasmas, 10, 109, 1991.
14. "Heating of O^+ Ions in the Cusp/Cleft: Double-Cyclotron Absorption vs. Cyclotron Resonance", L. Ball and M. Andre, J. Geophys. Res., 96, 1429, 1991.

15. "Differential Renormalization-Group Generators, Multicritical Phenomena, and Critical Dynamics", Tom Chang, D. Vvedensky and J.F. Nicoll, Physics Reports, North Holland, Netherlands, 1991.
16. "Wave Observations and Their Relation to "Nonresonant" Ion Heating in a "Weakly Turbulent" Plasma Model", L. Ball, M. Andre and J.R. Johnson, Ann. Geophys., 9, 37, 1991.
17. "Heating of O^+ Ions in the Cusp/Cleft: Double-Cyclotron Absorption versus Cyclotron Resonance", L. Ball and M. Andre, J. Geophys. Res., 96, 1429, 1991.
18. "Nonlinear Wave Scattering and Electron Beam Relaxation", L. Muschietti and C.T. Dum, Physics of Fluids B, 3, 1968, 1991.
19. "Wave-Particle Interactions via Merging of Eigenmodes: Magnetospheric Applications", I. Roth, M.K. Hudson, R. Bergmann and B. Cohen, Physics of Space Plasmas, 10, 333, 1991.
20. "Current Driven Ion Cyclotron Turbulence-Evolution of the Electron Distribution Function and Wave Spectrum", L. Muschietti and C.T. Dum, J. Geophys. Res., 95, 173, 1990.
21. "Simulation Study of Ion Two Stream Instability in the Auroral Acceleration Region", P. Gray, M. Hudson, R. Bergmann and I. Roth, Geophys. Rev. Lett., 17, 1609, 1990.
22. "Ion Cyclotron Resonance Heated Conics: Theory and Observations," G.B. Crew, T. Chang, J.M. Retterer, W.K. Peterson, D.A. Gurnett and R.L. Huff, J. Geophys. Res., 94, 3959, 1990.
23. "Particle Acceleration by Electromagnetic Ion Cyclotron Turbulence", G.B. Crew and T. Chang, Physics of Space Plasmas, 6, 31, 1990.
24. "Turbulent Relaxation in MHD Plasmas", Physics of Fluids B, 2(1), 511, 1990.
25. "Characteristics of ULF Waves Along Auroral Field Lines in the Central Plasma Sheet", J.R. Johnson, T. Chang, and G.B. Crew, Physics of Space Plasmas, 9, 277, 1990.
26. "Energy Source and Generation Mechanism for Auroral Kilometric Radiation", E. Ungstrup, A. Bahnsen, H.K. Wong, M. Andre and L. Matson, J. Geophys. Res., 95, 5973, 1990.
27. "Trapped Electrons as a Free Energy Source for the AKR", P. Louarn, A. Roux, H. de Feraudy, D. LeQueau, M. Andre and L. Matson, J. Geophys. Res., 95, 5983, 1990.
28. "On Waves below the Local Proton Gyrofrequency in Auroral Acceleration", G. Gustafsson, M. Andre, L. Matson, and H. Koskinen, J. Geophys. Res., 95, 5889, 1990.
29. "Ion Heating by Broadband Low-Frequency Waves in the Cusp/Cleft", M. Andre, G.B. Crew, W.K. Peterson, A.M. Persoon, C.J. Pollock, and M.J. Engebretson, J. Geophys. Res., 20809, 1990.
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33. "Turbulent Relaxation in Magnetohydrodynamic Plasma", D. Tetreault, Phys. Fluids B, 2, 53, 1990.
34. "Simulation Studies of Plasma Waves in the Electron Foreshock: The Generation of Langmuir Waves by a Gentle Dump-on-Tail Electron Distribution", C.T. Dum, "J. Geophys. Res.", 95, 8095, 1990.
35. "Simulation Studies of Plasma Waves in the Electron Foreshock: The Transition from Reactive to Kinetic Instability", C.T. Dum, J. Geophys. Research, 95, 8111, 1990.
36. "Simulation Studies of Plasma Waves in the Electron Foreshock: The Generation of Downshifted Oscillations", C.T. Dum, J. Geophys. Res., 95, 8123, 1990.
37. "Equatorially Generated ULF Waves as a Source for the Turbulence Associated with Ion Conics", J. Johnson, T. Chang, G.B. Crew, M. Andre, Geophys. Res. Lett., 16, 1469, 1989.
38. "Transition in the Dispersive Properties of Beam-Plasma Interactions and Two-Stream Instabilities", C.T. Dum, J. Geophys. Res., 94, 2429, 1989.
39. " H^+O^+ Two Stream Interaction on Auroral Field Lines", R. Bergmann, Physics of Space Plasmas, 9, 361, 1990.
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41. "Monte-Carlo Modeling of Polar Wind Electron Distributions with Anomalous Heat Flux", F. Yasseen, J.M. Retterer, T. Chang and J.D. Winningham, Geophys. Res. Lett., 16, 1023, 1989.
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44. "Electromagnetic Tornadoes in Earth's Ionosphere and Magnetosphere", T. Chang, G.B. Crew and J.M. Retterer, Eringen Symposium Volume, Recent Advances in Engineering Science, Springer-Verlag, 39, 12, 1989.
45. "Heating of Thermal Ions Near the Equatorward Boundary of the Mid-Altitude Polar Cleft", W.K. Peterson, M. Andre, G.B. Crew, A.M. Persoon, M.J. Engebretson, C.J. Pollock and M. Temerin, Electromagnetic Coupling in the Polar Clefts and Caps, NATO ASI

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46. "Lower Hybrid Wave Generation in an Electron Beam of Finite Transverse Dimension", G.B. Crew, *J. Plasma Phys.*, 41, 119, 1989.
47. "A Numerical Simulation of Inhomogeneous Ion Cyclotron Turbulence", *Nonlinear Phenomena in Vlasov Plasmas*, L. Muschietti and C.T. Dum, ed. F. Doveil, Editions de Physique, Orsay, 193, 1989.
48. "Exact Dielectric Tensor for Relativistic Magnetized Anisotropic Plasma", P. Yoon and T. Chang, *J. Plasma Phys.*, 42, 193, 1989.

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1. "Physics of Space Plasmas (1991): Nonlinear Phenomena and Active Experiments", SPI Conference Proceedings and Reprint Series, Vol. 10, T. Chang, G.B. Crew and J.R. Jasperse, eds., Scientific Publishers, Inc., Cambridge, MA, to be published, 1992.
2. "Differential Renormalization-Group Generators for Static and Dynamic Critical Phenomena," Tom Chang, D. Vvedensky and J.F. Nicoll, *Physics Reports*, to be published, 1992
3. "Physics of Space Plasmas (1990): Magnetic Fluctuations, Diffusion and Transport", SPI Conference Proceedings and Reprint Series, Vol. 10, T. Chang, G.B. Crew and J.R. Jasperse, eds., Scientific Publishers, Inc., Cambridge, MA 1991.
4. "Physics of Space Plasmas (1989): Wave-Particle Interaction Phenomena in Geoplasmas", SPI Conference Proceedings and Reprint Series, Vol. 9, T. Chang, G.B. Crew and J.R. Jasperse, eds., Scientific Publishers, Inc., Cambridge, MA 1990.
5. "Physics of Space Plasmas (1988): Polar Cap Dynamics and High-Latitude Ionospheric Turbulence", SPI Conference Proceedings and Reprint Series, Vol. 8, T. Chang, G.B. Crew and J.R. Jasperse, eds., Scientific Publishers, Inc., Cambridge, MA 1989.

VI. INVITED LECTURES - TOTAL 40

1. "Recent Advances in Auroral Ion Heating: Theory/Data Closure", Tom Chang, Western Pacific Geophysics Meeting, Hong Kong, August 1992.
2. "Ion Cyclotron Resonance Heated Conics", G. Crew and Tom Chang, Chapman Conference on Micro/Meso Scale Phenomena in Space Plasmas, Hawaii, February 1992.
3. "The Ion Conic Observed by Marie", J.M. Retterer, Tom Chang, and J.R. Jasperse, Chapman Conference on Micro/Meso Scale Phenomena in Space Plasmas, Hawaii, February 1992.
4. "High Frequency Electrostatic Plasma Instabilities and Turbulence in the Lower Ionosphere", J.R. Jasperse, B. Basu, J.M. Retterer, D.T. Decker, and Tom Chang, Chapman Conference on Micro/Meso Scale Phenomena in Space Plasmas, Hawaii, February 1992.
5. "Ion Conics in the Magnetosphere - A Mesoscale Phenomenon", Tom Chang, First Brazilian Congress on Plasma Physics, Santos, Brazil, December 1991.
6. "Path Integrals, Differential Renormalization Group and Systems far from Equilibrium", Tom Chang, Eringen Symposium, 28th Annual Meeting of the Society of Engineering Science, Gainesville, Florida, November, 1991.
7. "Ion Heating by Low Frequency Waves", Tom Chang, AGU Chapman Conference on Auroral Plasma Dynamics, Minneapolis, Minnesota, October 1991.
8. "Evolution of an Ion Two-Stream Instability", R. Bergmann, AGU Chapman Conference on Auroral Plasma Dynamics, Minneapolis, Minnesota, October 1991.
9. "Low Dimensional Behavior and Symmetry Breaking of Nonlinear Stochastic Systems - Can these Effects be Observed in the Laboratory and in Space?", Tom Chang, International Workshop on Plasma Experiments in the Laboratory and in Space, Alpbach, Austria, 1991.
10. "Ion Heating in the Cusp/Cleft-An Experiment in Space Using the VIKING and DE1 Satellites as Laboratory Equipments", M. Andre, General Assembly of IAGA, Vienna, 1991.
11. "Interaction of Upflowing Ions in the Auroral Acceleration Region", R. Bergmann, STAR Laboratory, Stanford University, May 1991.
12. "Turbulent Relaxation in Space and Laboratory Plasmas", D. Tetreault, International Workshop on Plasma Experiments in the Laboratory and in Space, Alpbach, Austria, 1991.
13. "Beam Driven Instabilities in the Auroral Acceleration Region", R. Bergmann, International Workshop on Plasma Experiments in the Laboratory and in Space, Alpbach, Austria, 1991.

14. "Ion Heating: What We Have Learned from VIKING", M. Andre, VIKING Workshop, Kiruna, Sweden, April 1991.
15. "Formation of Ion Conics by Lower Hybrid Turbulence", Tom Chang, Space Sciences Laboratory, University of Michigan, April 1991.
16. "Path Integral Approach to Ion Heating", Tom Chang, Space Plasma Physics, Cornell University, April 1991.
17. "Path Integral and Renormalization Group Approach to Nonlinear Stochastic Systems Far from Equilibrium", Tom Chang, Research Trends in Nonlinear Space Plasma Physics, La Jolla, CA, February 1991.
18. "Turbulent Relaxation in Space Plasma", D. Tetreault, Research Trends in Nonlinear Space Plasma Physics, La Jolla, CA, February 1991.
19. "Simulation and Theoretical Study of Wave Particle Interaction and Mode Coupling Processes in the Supraauroral Region", J.M. Retterer, Tom Chang and J.R. Jasperse, Research Trends in Nonlinear Space Plasma Physics, La Jolla, CA, February 1991.
20. "The Electron Foreshock", C.T. Dum, Workshop on Collisionless Shocks, Paris, April 1991.
21. "Classical and Anomalous Transport in Chromosphere and Corona", C.T. Dum, European Geophysical Society, Wiesbaden, Germany, April 1991.
22. "Electromagnetic Tornadoes in Space", Tom Chang, Space Plasma Physics, University of Maryland, April 1991.
23. "The Monte Carlo Technique for Mesoscale Space Plasma Phenomena", J.M. Retterer, Tom Chang, and J.R. Jasperse, International School for Space Simulations, Nara, Japan, April 1991.
24. "Mechanisms for Ion Conic Generation", Tom Chang, Yosemite Conference on Transition Regions in Solar System Plasmas, Yosemite, CA, February 1990.
25. "Electromagnetic Tornadoes in Space", Tom Chang, University of Maryland, September 1990.
26. "Intermittency Structures in Plasma Turbulence", D. Tetreault, Space Plasma Sciences, University of New Hampshire, April 1990.
27. "Propagation Characteristics of ULF Waves Associated with Ion Conics", Jay Johnson, Cambridge Workshop in Theoretical Geoplasma Physics, Magnetic Fluctuations, Diffusion and Transport in Geoplasmas, Cambridge, MA, June 1990.
28. "Theory and Simulation of the Electron Beam-Plasma Instability-Are the Textbook Approximations Valid?", C.T. Dum, University of Iowa, October 1990.
29. "Heating of Ion Conics in the Cusp/Cleft", M. Andre, Cambridge Workshop in Theoretical Geoplasma Physics, Wave-Particle Interaction Phenomena in Geoplasmas, Cambridge, MA July 1989.

30. "H⁺-O⁺ Two Stream Interaction on Auroral Field Lines", R. Bergmann, Cambridge Workshop in Theoretical Geoplasma Physics, Wave-Particle Interaction Phenomena in Geoplasmas, Cambridge, MA July 1989.
31. "3D Model of Double Layer Formation on Auroral Field Lines", D. Tetreault, Cambridge Workshop in Theoretical Geoplasma Physics, Wave-Particle Interaction Phenomena in Geoplasmas, Cambridge, MA July 1989.
32. "The Electron Beam Instability and Turbulence Theories" Cambridge Workshop in Theoretical Geoplasma Physics, Wave-Particle Interaction Phenomena in Geoplasmas, Cambridge, MA July 1989.
33. "Interaction of Upflowing Ions in the Auroral Acceleration region", Second Huntsville Workshop on Magnetosphere/Ionosphere Plasma Models", R. Bergmann, Huntsville, AL, October 1989.
34. "Classical Transport Properties of Plasmas", C.T. Dum, NATO Workshop on Physical Processes in Hot Cosmic Plasmas, Vulcano, Italy, July 1989.
35. "Particle Acceleration by Electromagnetic Ion Cyclotron Turbulence", G. Crew, Cambridge Workshop in Theoretical Geoplasma Physics, Wave-Particle Interaction Phenomena in Geoplasmas, Cambridge, MA July 1989.
36. "Particle Acceleration by Intense Auroral VLF Turbulence", J.M. Retterer, Cambridge Workshop in Theoretical Geoplasma Physics, Wave-Particle Interaction Phenomena in Geoplasmas, Cambridge, MA July 1989.
37. "EIC Waves, Double Layers and Solitary Waves in the Auroral Acceleration Region", D. Tetreault, Second Huntsville Workshop on Magnetosphere/Ionosphere Plasma Models, Huntsville, AL, October 1989.
38. "Classical Transport Properties of Plasmas", C.T. Dum, NATO Workshop on Physical Processes in Hot Cosmic Plasmas, Vulcano, Italy, 1989.
39. "Double Layers in the Auroral Acceleration Region", D. Tetreault, Physics Department, Dartmouth College, October 1989.
40. "Modeling Ion Conics in Space", T. Chang, Nineteenth IEEE International Conference on Plasma Science, Tampa Florida, June 1992.

**VII. Programs of the 1990, 1991 and
1992 MIT Symposia of the Physics of
Space Plasmas**

PHYSICS OF SPACE PLASMAS

- DATE AND TIME:** January 25, 1990, 8:30-17:30 (Thursday)
(snow day: January 26)
- LOCATION:** Rm. 37-252, Marlar Lounge
- ORGANIZED BY:** T.Chang, J.Belcher, J.Jasperse, G.Crew
- MASTER OF CEREMONY:** J. Binsack (MIT)
- COFFEE, TEA AND MUFFINS:** 8:30 - 9:00
- SESSION I:** 9:00-10:15 Chairperson: M.Hudson (Dartmouth
Berkeley/Stanford)
1. Introduction & Presentation of Certificate
 2. Alfvén Lecture: "Space Plasma Experimentation
by Computer Simulation" O.Buneman (Stanford)
- COFFEE AND TEA:** 10:15-10:45
- SESSION II:** 10:45-12:30 Chairperson: J. Belcher (MIT)
1. "Voyager II at Neptune" J.Belcher (MIT)
 2. "News from the Outer Heliosphere" A.Lazarus (MIT)
 3. "The Continuing Mystery of the Interstellar
Pickup Protons" P.Isenberg (UNH)
- LUNCH (\$4) & MOVIE 12:30 - 13:30**
Marlar Lounge - Rm. 37-252 - Coordinator: G. Crew
- SESSION III:** 13:30-14:45 Chairperson: H.Carlson (AFGL)
1. "A Review of the Theory of Energetic
Particle Transport in the Terrestrial Ionosphere" J.Jasperse
(AFGL/MIT)
 2. "Mapping the Cusp from the Magnetosphere
to the Ionosphere" N.Crooker
(UCLA/AFGL)
- COFFEE AND TEA:** 14:45-15:15
- SESSION IV:** 15:15-16:30 Chairperson: R.Sagalyn (AFGL)
1. "Multisatellite Observations of Substorm Onsets" J.Hughes (BU)
 2. "Prospects of Forecasting Weather in
the Earth's Magnetosphere" D.Swift
(U.Alaska/AFGL/MIT)
- WINE AND CHEESE PARTY:** 16:30-17:30 (Rm. 37-232)
- For Further Information Contact:*** Dr. Tom Chang, Mary Terhune (617) 253-7527
Dr. J.Jasperse (AFGL) (617) 377-5090

IAP 1991

FINAL PROGRAM
"1991 Eleventh Annual MIT Symposium"

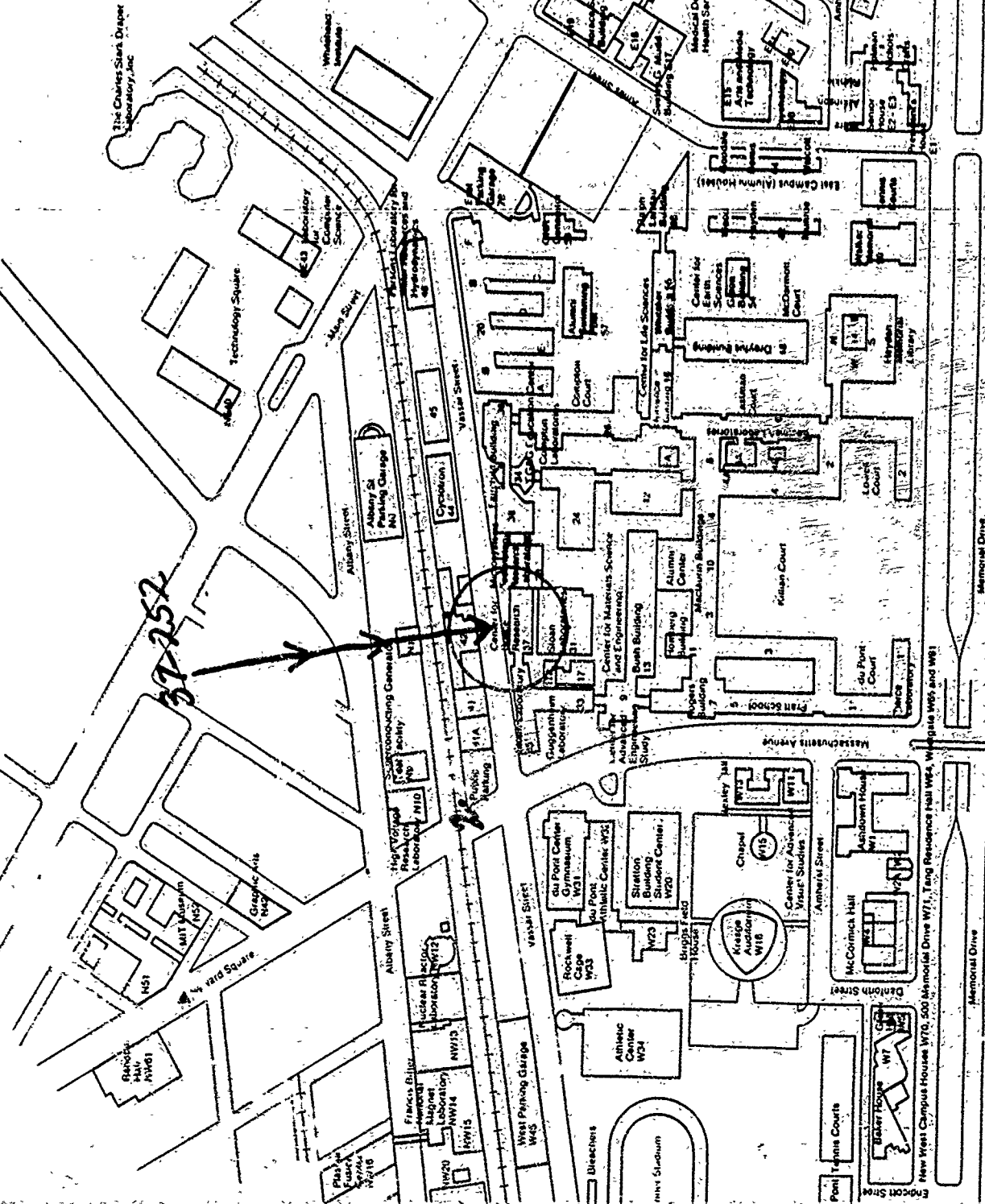
1991 IAP

PHYSICS OF SPACE PLASMAS

- DATE AND TIME:** January 24, 1991, 8:30-17:00 (Thursday)
(snow day: January 25)
- LOCATION:** Bldg. 37, Rm. 252, Marlar Lounge, MIT Center for Space Research
- ORGANIZED BY:** T. Chang, J. Jasperse, G. Crew
- COFFEE, TEA AND MUFFINS:** 8:30 - 9:00
- MASTER OF CEREMONY:** J. Binsack (MIT)
- WELCOME:** 9:00-9:10 C. Canizares (MIT)
- SESSION I:** 9:10-10:10 Chairperson: R. Carovillano (Boston College)
1. Introduction & Presentation of Certificate
 2. Alfvén Lecture: "The Magnetospheres of Eight Planets and the Moon" J. van Allen (U. of Iowa)
- COFFEE AND TEA:** 10:10-10:40
- SESSION II:** 10:40-12:10 Chairperson: J. Jasperse (GL)
1. "Transverse Ion Acceleration at Rocket Altitudes" R. Arnoldy (UNH)
 2. "High Frequency Excitation in Outer Planetary Magnetospheres" I. Roth (UC/Berkeley)
M. Hudson (Dartmouth)
 3. "Cusp Topology: A New Interpretation" J.D. Winningham (SWRI)
- LUNCH (\$5) & MOVIE 12:10 - 13:10**
Marlar Lounge - Rm. 37-252 - Coordinator: G. Crew
- SESSION III:** 13:10-13:40 Chairperson: M. Hudson (Dartmouth)
1. "NASA Space Physics Theory Program" T. Birmingham (NASA/GSFC)
- SESSION IV:** 13:40-14:40 Chairperson: R. Sagalyn (GL)
1. "Plasma Irregularity Studies with CRRES/Chemical Releases" H. Carlson (GL)
 2. "The van Allen Radiation Belts: New Measurements with CRRES" G. Mullen (GL)
- COFFEE AND TEA:** 14:40-15:20
- SESSION V:** 15:20-16:20 Chairperson: A. Lazarus (MIT)
1. "Problems of the Confinement of the Heliosphere" S. Grzedzielski (Polish Space Res. Ctr./ Polish Academy of Sci.)
 2. "Birkeland Currents in an Anisotropic Plasma" T. Birmingham (NASA/GSFC)
- WINE AND CHEESE PARTY:** 16:20-17:00 (Rm. 37-232)
- For Further Information Contact:* Dr. Tom Chang, Mary Terhune (617) 253-7527
Dr. J. Jasperse (GL) (617) 377-5090

See Reverse For Map, Room Locations and Parking Sites

West Campus



East Campus

Public Parking:

1. Behind Legal Seafoods
2. Corner of Mass. Ave and Vassar Street

Street Parking:

- Memorial Drive
- Vassar Street

Metered Parking:

- Mass. Ave.
- Main Street

Public Parking
Legal Seafoods

IAP 1992

FINAL PROGRAM
 "1992 Twelfth Annual MIT Symposium"

1992 IAP

PHYSICS OF SPACE PLASMAS

- DATE AND TIME: January 24, 1992, 8:30-17:30 (Friday)
- LOCATION: Bldg. 37, Rm.252, Marlar Lounge, MIT Center for Space Research
- ORGANIZED BY: T.Chang, J.Belcher, J.Jasperse, G.Crew
- COFFEE, TEA AND MUFFINS: 8:30 - 9:00
- WELCOME: 9:00-9:10 Master of Ceremony: J.Binsack(MIT)
C.Canizares(MIT)
- SESSION I: 9:10-10:30 Chairperson: J.Jasperse(GD/PL)
1. Opening Remarks: E.Good(GD/PL)
 2. Introduction & Presentation of Certificate: S.Olbert(MIT)
 3. Alfvén Lecture: "Spontaneous Discontinuity and the Stellar X-ray Emission" E.N.Parker (U.of Chicago)
- COFFEE AND TEA: 10:30-11:00
- SESSION II: 11:00-12:00 Chairperson: R.Carovillano(BC)
1. "Current Sheets" A.Bhattacharjee (Columbia U.)
 2. "Country Club Model of the Corona" J.Scudder(GSFC/NASA)
- LUNCH (\$5) 12:00 - 13:00**
Marlar Lounge - Rm. 37-252 - Coordinator: G. Crew
- SESSION III: 13:00-13:30 Chairperson: T.Chang(MIT)
1. "NASA Space Plasma Physics" G.Withbroe(NASA HQ)
- SESSION IV: 13:30-14:30 Chairperson: J.Belcher(MIT)
1. "The Termination Shock of the Solar Wind" M.Lee(UNH)
 2. "Solar Wind Triggering of the VLF Heliospheric Radio Emissions" R.McNutt(Visidyne)
- COFFEE AND TEA: 14:30-15:00
- SESSION V: 15:00-16:30 Chairperson: R.Sagalyn(GD/PL)
1. "Mesoscale Plasma Structuring in the High Latitude Ionosphere" Su.Basu
Sa.Basu (BC & GD/PL)
 2. "Dynamics, Structure & Energization in the Near Earth Space Plasma Environment" M.Keskinen(NRL)
 3. "New Low Energy Particle Measurements in the Inner Magnetosphere From the CRESS Satellite" D.Hardy(GD/PL)
- REFRESHMENTS: 16:30-17:30 (Rm. 37-232)
- For Further Information Contact:* Dr. Tom Chang, Mary Terhune (617) 253-7527
Dr. J.Jasperse (GL) (617) 377-5090

See Reverse For Map, Room Locations and Parking Sites

VIII. Preliminary Pages including the
Tables of Contents of the 1990, 1989,
and 1988 Conference Proceedings on the
"Physics of Space Plasmas"

SPI CONFERENCE PROCEEDINGS AND REPRINT SERIES

Series Editor: T. S. Chang

Number 10

Physics of Space Plasmas (1990)

*Proceedings of the
1990 Cambridge Workshop in Geoplasma Physics on
Magnetic Fluctuations, Diffusion and
Transport in Geoplasmas and the
1990 MIT Winter Symposium on the
Physics of Space Plasmas*

EDITORS

T. Chang, G. B. Crew and J. R. Jasperse



Scientific Publishers, Inc.

PREFACE

This volume of the Physics of Space Plasmas is devoted to the proceedings of the 1990 Cambridge Workshop in Theoretical Geoplasma Physics and the 1990 MIT Winter Symposium on the Physics of Space Plasmas.

During the past twenty years, substantial progress has been made in the understanding of the nature of the dynamics and plasma domains of the terrestrial ionosphere and magnetosphere. However, only limited tutorial accounts of the subject are available in the published literature. Consequently, it becomes extremely difficult for beginning graduate students or researchers of related fields to become acquainted with the exciting research topics that are being investigated by the active researchers in geoplasma physics. The Cambridge Workshops were conceived to address such a need. In addition to the workshops themselves, it is hoped that these proceedings of the tutorial and specialty lectures given at the workshops can serve as informal textbooks dealing with the particular research topics discussed at these gatherings. Since the themes of the workshops are devoted to current research topics in geoplasma physics, the contents of the proceedings are expected to contain both tutorial materials and current research findings. It is hoped that each set of these proceedings can serve the dual purpose of acquainting the novice to the research topic considered as well as the difficulties that are being encountered at the frontier of research.

The theme of the 1990 Cambridge Workshop was devoted to magnetic fluctuations, diffusion and transport in geoplasmas. Our discussion of this topic was guided in part by the following tutorial presentations: "Theory of Ultra-Low-Frequency Magnetic Pulsations in the Earth's Magnetosphere" by Dr. Liu Chen of the Princeton Plasma Physics Laboratory, "The Magnetopause: A Tutorial Review" by Prof. L. C. Lee of the University of Alaska, "A Stochastic MHD Model of Reconnection in the Dayside Magnetopause" by Dr. David Tetreault of the Massachusetts Institute of Technology, and "Wave Particle Interactions in the Magnetopause Boundary Layer" by Richard M. Thorne of the University of California. In addition to these outstanding tutorials, this volume of proceedings also include the accounts of a number of the invited specialty lectures and contributed poster presentations.

The MIT Winter Symposia on the Physics of Space Plasmas were conceived on the premise that the Greater Boston-New England area had one of the world's greatest concentration of scientists and research groups active in this field, and that a forum such as this would be of value for: cross-fertilization, consolidation of their intellectual resources and periodic focusing of its potential on topical problems. Each January a new symposium is held featuring presentations covering a wide range of space plasmas, extending from the Earth's ionosphere to the solar wind and the extended heliosphere,

including comets and the magnetospheres of other planets. We are pleased to include in the present proceedings the interesting paper, "The Continuing Mystery of the Interstellar Pickup Protons" by Dr. Philip A. Isenberg of the University of New Hampshire.

Both the Cambridge Workshops in Theoretical Geoplasma Physics and the MIT Symposia on the Physics of Space Plasmas are sponsored by the MIT Center for Theoretical Geo/Cosmo Plasma Physics, which was established under the AFOSR-URI program at the Massachusetts Institute of Technology, and the Marlar Fund. Strong support from the Geophysics Laboratory is also gratefully acknowledged. G. Fitzgerald, M. Seamon and members of their Conferences Services staff handled the organizational details. The organizers of the 1990 MIT Symposium included Drs. T. Chang, G. B. Crew, and J. R. Jasperse. Dr. J. Binsack served as the Master of Ceremony. Both of these 1990 activities were micro-managed by M. Terhune who also handled all the necessary editorial communications and manuscript preparation for these proceedings.

Tom Chang
G. B. Crew
J. R. Jasperse

March 1991,
Cambridge, Massachusetts.

CONTENTS

Preface	v
SYMPOSIUM PAPERS	
The Continuing Mystery of the Interstellar Pickup Protons <i>by Philip A. Isenberg</i>	3
TUTORIAL PAPERS	
Theory of Ultra-Low-Frequency Magnetic Pulsations in the Earth's Magnetosphere <i>by Liu Chen</i>	17
The Magnetopause: A Tutorial Review <i>by L. C. Lee</i>	33
A Stochastic MHD Model of Reconnection in the Dayside Magnetopause <i>by David Tetreault</i>	109
Wave-Particle Interactions in the Magnetopause Boundary Layer <i>by Richard M. Thorne and Bruce T. Tsurutani</i>	119
INVITED PAPERS	
Electric and Magnetic Field Fluctuations in the Cusp/Cleft Regions <i>by Ewa M. Basinska, William J. Burke, and Nelson C. Maynard</i>	153
Theory of Current Disruption and Diversion in Magnetotail Plasmas: Recent Developments <i>by Xiaogang Wang, A. Bhattacharjee, A. T. Y. Lui</i>	169
An Integro-Differential Treatment of the Collisionless Non-Maxwellian Tearing Mode in a Neutral Sheet <i>by James Chen</i>	183
Simultaneous Radial and Pitch-Angle Diffusion and Dynamic Outer Radiation Belt Modeling <i>by Y. T. Chiu, M. A. Rinaldi, and W. E. Francis</i>	195

Recent Ion Composition Results in the Magnetopause Region <i>by Tim Eastman</i>	209
Multisatellite Studies of the Propagation and Spatial Extent of Dayside Pc 3-4 Pulsations <i>by M. J. Engebretson, N. Lin, W. Baumjohann, H. Lühr, and B. J. Anderson</i>	219
High Latitude Observations of Electromagnetic Ion Cyclotron Waves <i>by R. E. Erlandson, B. J. Anderson, and L. J. Zanetti</i>	235
Heating by Alfvén Waves in Two-ion-species Laboratory Mirror Plasmas <i>by N. Hershkowitz and D. R. Roberts</i>	243
Ring Current Ion Interaction with Pc 5 Micropulsations <i>by M. K. Hudson, A. A. Chan, X. Li, and I. Roth</i>	263
Propagation Characteristics of ULF Waves Present along Closed Field Lines in the Central Plasma Sheet <i>by Jay R. Johnson, Tom Chang, and G. B. Crew</i>	277
Ion Heating in Quasi-Parallel Collisionless Shocks <i>by J. R. Kan and L. H. Lyu</i>	291
A Series of Flux Transfer Events in the Dayside Magnetopause <i>by D. M. Klumpp and S. A. Fuselier</i>	301
A Possible Mechanism for Current Disruption and Turbulence in the Earth's Neutral Sheet <i>by A. T. Y. Lui</i>	315
Satellite Observations of Waves and Birkeland Currents <i>by T. A. Potemra</i>	339
Absolute Versus Convective Analysis of Instabilities in Space Plasmas <i>by Abhay K. Ram and Abraham Bers</i>	351
The Substorm Onset and Magnetosphere-Ionosphere Coupling <i>by P. L. Rothwell, M. B. Silevitch, L. P. Block, and C.-G. Fälthammar</i>	367
Quantifying the Magnetospheric Response to Solar Wind Dynamic Pressure Variations <i>by D. G. Sibeck</i>	379

Diffusive Transport at the Magnetopause <i>by D. Winske, S. P. Gary, and D. S. Lemons</i>	397
CONTRIBUTED PAPERS	
Statistical Correlations between Pc 3–5 Pulsations and Solar Wind/IMF Parameters and Geomagnetic Indices <i>by B. J. Anderson, T. A. Potemra, L. J. Zanetti, and M. J. Engebretson</i>	419
Monte Carlo Study of the Transition from Collision-Dominated to Collisionless Polar Wind Flow <i>by A. R. Barakat, R. W. Schunk, I. A. Barghouthi, and J. Lemaire</i>	431
Collisionless Drift-Tearing Modes and the Magnetic Percolation Model of Flux Transfer Formation <i>by N. T. Gladd</i>	439
Impulsive Penetration at the Dayside Magnetopause <i>by Joseph G. Hawkins, Zhiwei Ma, and Lou-Chuang Lee</i>	447
Transport of a High Energy Neutral Beam in the Atmosphere <i>by Shu T. Lai</i>	455
Measurement of Non-Adiabatic and Chaotic Charged-Particle Motion in a Collisionless Laboratory Terrella <i>by M. E. Mauel and A. Hasegawa</i>	461
Unstable Electron Beams in the Low Latitude Boundary Layer <i>by V. Peromian, M. Ashour-Abdalla, S. A. Fuselier, W. K. Peterson, D. Schriver, and R. J. Strangeway</i>	467
Diffusive Transport of Solar Origin Energetic Carbon Ions through the Earth's Magnetosphere: Predicted Phase Space Distributions <i>by Walther N. Spjeldvik</i>	473
Kelvin-Helmholtz Instability in the Magnetosphere and Post-Noon Auroral Bright Spots in the Ionosphere <i>by C. Q. Wei and L. C. Lee</i>	485
The Daytime F Layer Trough: An Ionospheric Signature of Magnetospheric Convection <i>by J. A. Whalen</i>	495

SPI CONFERENCE PROCEEDINGS AND REPRINT SERIES

Series Editor: T. S. Chang

Number 9

Physics of Space Plasmas (1989)

*Proceedings of the
1989 Cambridge Workshop in Geoplasma Physics on
Wave-Particle Interaction Phenomena
in Geoplasmas and the
1989 MIT Winter Symposium on the
Physics of Space Plasmas*

EDITORS

T. Chang, G. B. Crew and J. R. Jasperse



Scientific Publishers, Inc.

PREFACE

This volume of the Physics of Space Plasmas is devoted to the proceedings of the 1989 Cambridge Workshop in Theoretical Geoplasma Physics and the 1989 MIT Winter Symposium on the Physics of Space Plasmas.

During the past twenty years, substantial progress has been made in the understanding of the nature of the dynamics and plasma domains of the terrestrial ionosphere and magnetosphere. However, only limited tutorial accounts of the subject are available in the published literature. Consequently, it becomes extremely difficult for beginning graduate students or researchers of related fields to become acquainted with the exciting research topics that are being investigated by the active researchers in geoplasma physics. The Cambridge Workshops were conceived to address such a need. In addition to the workshops themselves, it is hoped that these proceedings of the tutorial and specialty lectures given at the workshops can serve as informal textbooks dealing with the particular research topics discussed at these gatherings. Since the themes of the workshops are devoted to current research topics in geoplasma physics, the contents of the proceedings are expected to contain both tutorial materials and current research findings. It is hoped that each set of these proceedings can serve the dual purpose of acquainting the novice to the research topic considered as well as the difficulties that are being encountered at the frontier of research.

The theme of the 1989 Cambridge Workshop was devoted to wave-particle interaction phenomena in geoplasmas. Our discussion of this topic was guided by the following tutorial presentations: "Particle Acceleration by Electromagnetic Ion Cyclotron Turbulence" by Dr. G. B. Crew of the Massachusetts Institute of Technology, "The Electron Beam Instability and Turbulence Theories" by Dr. C. T. Dum of the Max-Planck Institute für Extraterrestrische Physik, "Ion Loss from the Ring Current and Plasmaspheric Heating" by Prof. M. K. Hudson of Dartmouth College, "Particle Acceleration by Intense Auroral VLF Turbulence" by Dr. John M. Retterer of the Air Force Geophysics Laboratory, "Chaos in Wave-Particle Interactions" by Dr. F. Skiff of the University of Maryland, and "Some Phenomena in Space Plasmas Attributed to Wave-Particle Interactions" by Prof. Ching-Sheng Wu of the University of Maryland. In addition to these outstanding tutorials, this volume of proceedings also include the accounts of a number of the invited specialty lectures and contributed poster presentations.

The MIT Winter Symposia on the Physics of Space Plasmas were conceived on the premise that the Greater Boston-New England area had one of the world's greatest concentration of scientists and research groups active in this field, and that a forum such as this would be of value for: cross-fertilization, consolidation of their intellectual resources and periodic focusing

of its potential on topical problems. Each January a new symposium is held featuring presentations covering a wide range of space plasmas, extending from the Earth's ionosphere to the solar wind and the extended heliosphere, including comets and the magnetospheres of other planets.

The opening lecture for each symposium is reserved for the awardee of the prestigious Alfvén Lectureship which was established in honor of the Noble Laureate, Professor Hannes Alfvén of the Swedish Royal Institute of Technology. The present set of proceedings includes the contents of the 1989 Alfvén Lecture, "Anomalous Resistivity in the Geotail Neutral Sheet", delivered by Prof. J. W. Dungey of Imperial College as well as "Energetic Photoelectrons and the Polar Rain" by Dr. Dwight T. Decker of Boston College.

Both the Cambridge Workshops in Theoretical Geoplasma Physics and the MIT Symposia on the Physics of Space Plasmas are sponsored by the MIT Center for Theoretical Geo/Cosmo Plasma Physics, which was established under the AFOSR-URI program at the Massachusetts Institute of Technology, and the Marlar Fund. Strong support from the Air Force Geophysics Laboratory is also gratefully acknowledged. G. Fitzgerald, M. Seamon and members of their Conferences Services staff handled the organizational details. The organizers of the 1989 MIT Symposium included Drs. T. Chang, G. B. Crew, J. Belcher, and J. R. Jasperse. Dr. J. Binsack served as the Master of Ceremony. Both of these 1989 activities were micro-managed by M. Terhune who also handled all the necessary editorial communications and manuscript preparation for these proceedings.

Tom Chang
G. B. Crew
J. R. Jasperse

April 1990,
Cambridge, Massachusetts.

CONTENTS

Preface	v
SYMPOSIUM PAPERS	
Anomalous Resistivity in the Geotail Neutral Sheet <i>by J. W. Dungey</i>	3
Energetic Photoelectrons and the Polar Rain <i>by Dwight T. Decker, J. R. Jasperse, and J. D. Winningham</i>	15
TUTORIAL PAPERS	
Particle Acceleration by Electromagnetic Ion Cyclotron Turbulence <i>by G. B. Crew and Tom Chang</i>	31
The Electron Beam Instability and Turbulence Theories <i>by C. T. Dum</i>	67
Ion Loss from the Ring Current and Plasmaspheric Heating <i>by M. K. Hudson, S. Qian, and I. Roth</i>	97
Particle Acceleration by Intense Auroral VLF Turbulence <i>by John M. Retterer, Tom Chang, and J. R. Jasperse</i>	119
Chaos in Wave-Particle Interactions <i>by F. Skiff</i>	161
Some Phenomena in Space Plasmas Attributed to Wave-Particle Interactions <i>by Ching-Sheng Wu</i>	179
INVITED PAPERS	
Heating of Ion Conics in the Cusp/Cleft <i>by Mats André, G. B. Crew, W. K. Peterson, A. M. Persoon, C. J. Pollock, M. J. Engebretson</i>	203
Wave-Particle Interactions for Relativistic Electrons in a Recirculation Acceleration Model <i>by D. N. Baker</i>	215

H^+-O^+ Two-Stream Interaction on Auroral Field Lines <i>by Rachelle Bergmann</i>	229
The Distribution of Continuously Created Newborn and Pickup Cometary Ions <i>by J. D. Gaffey, Jr.</i>	245
Computer Simulations of Electromagnetic Ion Instabilities in the Plasma Sheet Boundary Layer <i>by S. Peter Gary and Dan Winske</i>	259
Near Equatorial Signatures of Dynamic Auroral Processes <i>by D. M. Klumpar</i>	265
Collisionless Coupling Processes in AMPTE Releases <i>by A. T. Y. Lui</i>	277
Laboratory Simulation of Magnetospheric Ion Transport <i>by R. McWilliams</i>	301
Auroral Kilometric Radiation: An Example of Relativistic Wave-Particle Interaction in Geoplasma <i>by P. L. Pritchett</i>	319
Wave-Particle Interaction Via Merging of Eigenmodes: Magnetospheric Applications <i>by I. Roth, M. K. Hudson, R. Bergmann, and B. Cohen</i>	333
Wave-Particle Interactions on the FAST Satellite <i>by M. A. Temerin, C. W. Carlson, C. A. Cattell, R. E. Ergun, J. P. McFadden, F. S. Mozer, D. M. Klumpar, W. K. Peterson, E. G. Shelley, R. C. Elphic</i>	343
3D Model of Double Layer Formation on Auroral Field Lines <i>by David Tetreault</i>	361
Gyroresonant Interaction of Energetic Trapped Electrons and Protons <i>by Elena Villalón, Michael B. Silevitch, William J. Burke, and Paul L. Rothwell</i>	365
Artificial Electron Beams in the Magnetosphere and Ionosphere <i>by John R. Winckler</i>	385

- Short Wavelength Striations on Expanding Plasma Clouds 399
by *D. Winske and S. P. Gary*

CONTRIBUTED PAPERS

- Ray Tracing of Auroral Z Mode Radiation, AKR and Auroral Hiss 415
by *R. B. Horne, D. Jones, I. Kimura, and A. Sawada*
- Refraction and Growth of Electrostatic Electron Cyclotron Harmonic
Waves and Z Mode Radiation 421
by *R. B. Horne*
- Effects of Density Gradients on the Growth and Damping of 427
Electrostatic Electron Cyclotron Harmonic Waves
by *R. B. Horne*
- Equatorially Generated ULF Waves as a Source for the Turbulence 433
Associated with Ion Conics
by *Jay R. Johnson, Tom Chang, G. B. Crew, and Mats André*
- Collisional and Wave-Particle Interactions in Critical Velocity 447
Ionization
by *William J. McNeil, Shu T. Lai, and Edmond Murad*
- The Correlation of Ring Distributions with Electron Conics: 455
Simulations of the Production of Upper Hybrid Waves
by *J. D. Menietti, C. S. Lin, and H. K. Wong*
- Wave and Particle Properties of the Subsolar Magnetopause 463
by *P. Song, C. T. Russell, N. Lin, R. J. Strangeway, J. T. Gosling,
M. Thomson, T. A. Fritz, D. G. Mitchell, and R. R.
Anderson*
- Lightning, Whistlers, and Hiss: A Possible Relationship 477
by *Vikas S. Sonwalker*

SPI CONFERENCE PROCEEDINGS AND REPRINT SERIES

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Number 8

Physics of Space Plasmas (1988)

*Proceedings of the
1988 Cambridge Workshop in Geoplasma Physics on
Polar Cap Dynamics and High Latitude
Ionospheric Turbulence and the
1988 MIT Winter Symposium on the
Physics of Space Plasmas*

EDITORS

T. Chang, G. B. Crew and J. R. Jasperse



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The theme of the 1988 Cambridge Workshop was devoted to the phenomena associated with polar cap dynamics and high latitude ionospheric turbulence. Professor M. C. Kelley of Cornell University delivered the opening lecture "On the Origins of Weather in the High Latitude Ionosphere". Other tutorial lectures were given by Professor B. G. Fejer of Utah State University on "Ionospheric Plasma Turbulence in the High Latitude E Region", Dr. J. D. Huba of the Naval Research Laboratory on "Theoretical and Simulation Methods Applied to High Latitude Ionospheric Turbulence", and Professor R.W. Schunk of the Utah State University on the polar wind. In addition to these outstanding tutorials, this volume of proceedings also include the accounts of a number of the invited specialty lectures and contributed poster presentations.

The MIT Winter Symposia on the Physics of Space Plasmas were conceived on the premise that the Greater Boston-New England area had one of the world's greatest concentration of scientists and research groups active in this field, and that a forum such as this would be of value for: cross-fertilization, consolidation of their intellectual resources and periodic focusing of its potential on topical problems. Each January a new symposium is held featuring presentations covering a wide range of space plasmas, extending from the Earth's ionosphere to the solar wind and the extended heliosphere,

including comets and the magnetospheres of other planets.

The opening lecture for each symposium is reserved for the awardee of the prestigious Alfvén Lectureship which was established in honor of the Noble Laureate, Professor Hannes Alfvén of the Swedish Royal Institute of Technology. The present set of proceedings includes the contents of the 1988 Alfvén Lecture, "How Does Magnetospheric Plasma Escape Thermalization?", delivered by Dr. R. Gendrin of the Centre de Recherches en Physiques de l'Environnement (France), the lecture on "Magnetosconvection on the Solar Surface" by Dr. G. Simon of the Air Force Geophysics Laboratory (Sunspot) and the paper on "A Filamentary Current Structure at Ionospheric Altitudes" by Drs. M. F. Smith and J. D. Winningham of the Southwest Research Institute (San Antonio), and J. D. Slavin of the Goddard Space Flight Center (Greenbelt).

Both the Cambridge Workshops in Theoretical Geoplasma Physics and the MIT Symposia on the Physics of Space Plasmas are sponsored by the MIT Center for Theoretical Geo/Cosmo Plasma Physics, which was established under the AFOSR-URI program at the Massachusetts Institute of Technology, and the Marlar Fund. Strong support from the Air Force Geophysics Laboratory is also gratefully acknowledged. Drs. H. Carlson, R. Schunk, and S. Ossakow were instrumental in organizing the scientific sessions of the 1988 Workshop. G. Fitzgerald and members of her Conferences Services staff handled the organizational details and S. Gelzins was responsible for the audio-visual aspects of the Workshop. The organizers of the 1988 MIT Symposium included Drs. T. Chang, G. B. Crew, J. Belcher, and J. R. Jasperse. Dr. J. Binsack served as the Master of Ceremony. Both of these 1988 activities were micro-managed by M. F. Jeanig who also handled all the necessary editorial communications and manuscript preparation for these proceedings.

Tom Chang
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August 1989,
Cambridge, Massachusetts.

CONTENTS

Preface	v
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TUTORIAL PAPERS

On the Origins of Weather in the High Latitude Ionosphere <i>by M. C. Kelley</i>	3
Ionospheric Plasma Turbulence in the High Latitude E Region <i>by Bela G. Fejer</i>	15
Theoretical and Simulation Methods Applied to High Latitude Ionospheric Turbulence <i>by J. D. Huba</i>	49
Polar Wind Tutorial <i>by R. W. Schunk</i>	81

INVITED PAPERS

Coordinated Observations of High Latitude Ionospheric Turbulence <i>by Santimay Basu, Sunanda Basu, C. E. Valladares, E. J. Weber, J. Buchau, G. J. Bishop, and B. W. Reinisch</i>	137
The Polar Cap with Northward IMF: What I Think I know <i>by William J. Burke</i>	153
Formation of Polar Cap Arcs <i>by Y. T. Chiu</i>	173
Fluctuations Associated with Sheared Velocity Regions Near Auroral Arcs <i>by Bruno Coppi and Bamandas Basu</i>	185
Energetic Atmospheric Photoelectrons Due to Solar Soft X-Rays and Auger Production <i>by Dwight T. Decker and J. D. Winningham</i>	199
Plasma Turbulence and Enhanced UHF Radar Backscatter from the Topside Ionosphere <i>by J. C. Foster</i>	213

Oscillations in a Plasma with Parallel Currents and Transverse Velocity Shears <i>by G. Ganguli, Y. C. Lee, P. J. Palmadesso and S. L. Ossakow</i>	231
“Kinetic” Modelling of the Transport of Ionospheric Ions into the Magnetosphere <i>by J. L. Horwitz, K. Swinney, G. Wilson, T. Reyes, D. C. Delcourt and T. E. Moore</i>	243
High Latitude Electric Fields <i>by Nelson C. Maynard</i>	261
Time Dependent Response of the Topside Ionosphere to Field Aligned Currents <i>by Peter J. Palmadesso, Supriya B. Ganguli and H. G. Mitchell, Jr.</i>	275
Auroral Electric and Magnetic Fields <i>by Patricia H. Reiff, Gang Lu, Daniel R. Weimer, James A. Slavin, and M. Sugiura</i>	287
Plasma Simulation of Intense VLF Turbulence and Particle Acceleration in the Supraauroral Region <i>by John M. Retterer and Tom Chang</i>	309
Wave-Induced Diffusion in the Turbulent E-Region <i>by J-P St-Maurice</i>	323
Suprathermal Ion Outflows in the Polar Ionosphere <i>by Andrew W. Yau</i>	349
CONTRIBUTED PAPERS	
Polar Cap Total Electron Content Variations: Linkages to 250 MHz Amplitude Scintillation <i>by Gregory J. Bishop, John A. Klobuchar, and David W. Blood</i>	365
A Real-Time High Latitude Ionospheric Specification Model <i>by R. E. Daniell, Jr., L. D. Brown, D. N. Anderson, J. J. Sojka, and R. W. Schunk</i>	373
Enhanced Ion Heating and Density Fluctuations of the Field Line Plasma Due to CDICI and Anomalous Resistivity in the High Latitude Topside Ionosphere <i>by Supriya B. Ganguli and Peter J. Palmadesso</i>	379

A Study of the Spatial Scales of Discrete Polar Auroral Arcs <i>by D. J. Gorney</i>	385
Determination of the Ionospheric Convection Pattern from DMSP Data <i>by Marc R. Hairston and Roderick A. Heelis</i>	391
The Use of Combined Satellite and Ground-Based Observations for Determining High-Latitude Electric Fields and Currents <i>by Delores J. Knipp, Arthur D. Richmond, Frederick J. Rich, and David S. Evans</i>	397
Simulation of Electrostatic Ion Cyclotron Instabilities in the Presence of Parallel Currents and Transverse Electric Fields <i>by K.-I. Nishikawa, G. Ganguli, Y. C. Lee, and P. J. Palmadesso</i>	405
Gradient-Drift Instability Irregularities in the High-Latitude Ionosphere: Scintillation and EISCAT Observations <i>by S. E. Pryse, L. Kersley and C. D. Russell</i>	415
Nonlocal Gradient-Drift Modes in the Equatorial Electrojet <i>by C. Ronchi, P. L. Similon, and R. N. Sudan</i>	421
Multiple Bright Spots on the Dayside Auroral Distribution <i>by H. B. Vo, D. Venkatesan, and J. S. Murphree</i>	431
The Daytime F Layer Trough <i>by J. A. Whalen</i>	441
SYMPOSIUM PAPERS	
How Does Magnetospheric Plasma Escape Thermalization? <i>by Roger Gendrin</i>	457
Magnetoconvection on the Solar Surface <i>by George W. Simon</i>	481
A Filamentary Current Structure at Ionospheric Altitudes <i>by M. F. Smith, J. D. Winningham and J. D. Slavin</i>	505

**IX. Preliminary Program American
Geophysical Union Chapman Conference
on Micro/Meso Scale Phenomena in
Space Plasmas, Hawaii 1992"**

PRELIMINARY SCIENTIFIC PROGRAM

Conveners: Maha Ashour-Abdalla, University of California, Los Angeles; Tom Chang, Massachusetts Institute of Technology; Paul Dusenbery, University of Colorado

Monday, February 17, 1992

Morning Session:

8:15 a.m.	M. Ashour-Abdalla, Tom Chang, and P. Dusenbery	Introduction
8:30 a.m.	S.-I. Akasofu, G. S. Choe, and L. C. Lee	Formation of Solar Prominences by Photospheric Searing and Converging Motions
8:55 a.m.	C. S. Wu	Synchrotron Maser Processes Associated With Solar Flare-Generated Energetic Electrons
9:20 a.m.	M. L. Goldstein	Magnetohydrodynamic Turbulence and Its Relationship to Interplanetary Magnetic Fluctuations
9:45 a.m.	R. Schmidt	Cluster - A Novel Mission Concept to Study Space Plasmas
10:10 a.m.	K. B. Quest	Simulations of Ion Acceleration at Quasi-Parallel Shocks: Details of the Ion Velocity Space Distribution Function
10:35 a.m.	BREAK	
11:00 a.m.	O. L. Vaisberg	Particle Distribution in the Shock Region: Quasi-Perpendicular Case
11:25 a.m.	B. Lembege	Interaction of Electron and Ion Dynamics in Collisionless Magnetosonic Shocks
11:50 a.m.	J. R. Kan and L. H. Lyu	Simulations of Quasi-Parallel Shocks and Double Layers
12:15 a.m.	G. K. Parks	Small-Scale Particle Structures Observed in the Neighborhood of the Terrestrial Magnetosphere
12:40 a.m.	G. Ganguli, H. Romero, and P. B. Dusenbery	Origin and Stability of Small-Scale Structures at PSBL-Lobe Interface
Evening Session:		
7:00 p.m.	G. Paschmann	The Dayside Magnetopause for Small and Large Magnetic Shear: AMPTE/IRM Observations
7:50 p.m.	H. Okuda	Particle Simulations of the Low Latitude Magnetopause Boundary Layer

- 8:15 p.m. R. C. Elphic, M. F. Thomsen, and C. T. Russell Small-Scale Magnetic Structure in the Magnetopause: ISEE Magnetic Field and Plasma Observations
- 8:40 p.m. R. L. Lysak Mesoscale Magnetosphere-Ionosphere Coupling
- 9:05 p.m. BREAK
- Poster Session:
9:25 p.m. - 11:00 p.m.
- E. S. Belenkaya and I. I. Alexeev Nonlinear Alfvén Structures Caused by the Scattering of Plasma Particles in the Field of a Magnetic Dipole
- J. Sun and W. Lotko Simulation of the Low-Latitude Magnetopause Response to an Upstream Density Fluctuation
- C. K. Goertz, K.-I. Nishikawa, T. Whelan, and J. Lyon Simulations of Current Driven Double Layers and Solitary Potential Structures on Auroral Field Lines
- D. Xu and M. G. Kivelson Polar Cap Field-Aligned Currents for Southward IMF: SBZ FACs
- K. R. Moore and V. A. Thomas Flux Ropes, Plasma Clouds, and the Kelvin-Helmholtz Instability at Venus
- R. D. Belian, T. E. Cayton, and G. D. Reeves Quasi-Periodic Substorm Generated Flux Variations Observed at Geosynchronous Orbit
- Z. Zhu and G. K. Parks Particle Orbits in Magnetotail-Like Current Sheets With a Nonzero B_y Component
- E. Siregar, D. A. Roberts, and M. L. Goldstein The Evolution of Magnetized Vortex Streets: Magnetohydrodynamics of Vortex Sheet Interactions
- S. Ghosh, T. Stribling, M. L. Goldstein, and W. H. Matthaeus The Evolution of Magnetic Helicity in Compressible Magnetohydrodynamics With a Mean Magnetic Field
- M. L. Goldstein, D. A. Roberts, and C. A. Fitch Observed Properties of Helical Interplanetary Magnetic Fields
- T. Stribling and W. H. Matthaeus Decay of Magnetic Helicity in Ideal Three Dimensional Magnetohydrodynamics With a Mean Magnetic Field
- J. C. Samson, R. Rankin, and B. J. Harrold The Nonlinear Evolution of Field Line Resonances in the Earth's Magnetosphere
- R. L. Richard, M. Ashour-Abdalla, and R. J. Walker Onset of the Coalescence Instability in Compressible Magnetohydrodynamics
- S. Y. Fu, Z. Y. Pu, and S. C. Guo Kinetic Alfvén Wave Instability and Wave-Particle Interaction at the Magnetopause

J. Grieger, R. L. Lysak, and Y. Song	Numerical Studies of the Ionospheric Alfvén Resonator Cavity
M. Prakash	Nonlinear Wave-Particle Interaction in the Magnetosphere
B. Bavassano and R. Bruno	On the Interplanetary Generation of Alfvénic Turbulence
S. Xue and R. M. Thorne	Ion-Cyclotron Instability in a High Energy Tail Magnetospheric Plasma: The Effect of Heavy Ions
P. L. Rothwell, L. P. Block, M. B. Silevitch, and C.-G. Falthammar	Single Ion Motion in an Auroral Arc

Tuesday, February 18, 1992

Morning Session:

8:30 a.m.	D. A. Gurnett, W. S. Kurth, G. B. Hospodarsky, L. A. Frank, A. Roux, P. Louarn, M. G. Kivelson, R. J. Strangeway, and D. J. Williams	Beam-Driven Electron Plasma Oscillations: Recent Results From Galileo
9:20 a.m.	J. Chen	Nonlinear Dynamics of Charged Particles in the Magnetotail
9:45 a.m.	D. Schriver and M. Ashour-Abdalla	Local Dynamics in the Auroral Zone and the Magnetotail That Result From Large Scale Plasma Acceleration
10:10 a.m.	C. A. Cattell, C. W. Carlson, W. Baumjohann, G. Paschmann, and H. Luhr	An AMPTE/IRM Study of the MHD Structure of the Plasmasheet Boundary
10:35 a.m.	BREAK	
11:00 a.m.	L. M. Zelenyi	Shaping of Magnetotail Distributions From the Solar Wind Plasma
11:50 a.m.	C. Y. Huang	Plasma Velocity Distributions in the Earth's Magnetotail
12:15 p.m.	W. Horton and T. Tajima	Characteristics of the Dielectric Tensor in the Geomagnetic Tail
12:40 p.m.	R. F. Martin, Jr.	Single Particle Magnetospheric Plasma Theory: Current Results and Comparison to Observation

Evening Session:

7:00 p.m.	K. Schindler, U. Arendt, and A. Otto	On Theoretical Concepts and Numerical Results Regarding Magnetospheric Activity
7:50 p.m.	A. T. Y. Lui	Observed Features in Current Disruption and Their Implications to Existing Theories

- 8:15 p.m. M. Yamada and F. W. Perkins Laboratory Plasma Studies of Magnetic Reconnection Physics: Local Parameter and Global Configuration Issues
- 8:40 p.m. BREAK
- 9:05 p.m. T. W. Speiser Neutral Line Energetic Ion Signatures in the Geomagnetic Tail: Comparisons With Observations
- 9:30 p.m. L. R. Lyons and D. C. Pridmore-Brown Collisionless Plasma Forces and Energization Near an X-Line
- 9:55 p.m. J. Büchner and A. Otto The Influence of Chaotic Particle Motion on Current Sheet Stability

Wednesday, February 19, 1992

Morning Session:

- 8:30 a.m. G. Haerendel The Auroral Evacuation Process
- 9:20 a.m. C. T. Dum Simulation of Meso Scale Phenomena Using Quasi-linear Theory
- 9:45 a.m. J. R. Jasperse, B. Basu, J. M. Retterer, D. T. Decker, and T. Chang High Frequency Electrostatic Plasma Instabilities and Turbulence in the Lower Ionosphere
- 10:10 a.m. B. G. Fejer, C. J. Heiselman, J. F. Vickrey, and E. J. Weber Anomalous Electron Heating Near Auroral Arcs
- 10:35 a.m. BREAK
- 11:00 a.m. S. A. Curtis Micro- and Mesoscale Phenomena in Space Plasmas: The Roles of ISTP/GGS and Grand Tour Cluster
- 11:25 a.m. S. B. Ganguli, H. G. Mitchell, Jr., and P. J. Palmadesso Auroral Plasma Dynamics in the Presence of Finite Width Current Filament and V-Shaped Potential Drops
- 11:50 a.m. J. L. Roeder, H. C. Koons, M. Schultz, H. E. Spence, and M. C. McNab Where is the Source of the Diffuse Auroral Electron Precipitation?
- 12:15 p.m. J. M. Bosqued, M. El Alaoui, M. Ashour-Abdalla, and L. M. Zelenyi Auroral Zone Signatures of Acceleration Processes Acting in the Magnetotail
- 12:40 p.m. T. I. Gombosi, G. V. Khazanov, J. U. Kozyra, A. Körösmezey, R. H. Miller, A. F. Nagy, and C. E. Rasmussen Generalized Transport Equations in Mesoscale Modeling of Ionosphere-Magnetosphere Coupling
- 1:05 p.m. R. W. Schunk and J. J. Sojka Ionosphere-Magnetosphere Coupling Processes at High Latitudes
- Evening Session:
- 7:00 p.m. R. M. Thorne and R. B. Horne Energy Transfer Between Differential Particle Population due to Ion Cyclotron Waves

7:25 p.m.	M. W. Chen, M. Schulz, L. R. Lyons, and D. J. Gorney	Particle Access to Stormtime Ring Current: Simulations and Interpretations
7:50 p.m.	K. Takahashi	Particles and ULF Waves Near the Dayside Magnetopause
8:15 p.m.	C. Z. Cheng	Theories and Observations of Micropulsations
8:40 p.m.	J. E. Borovsky	Auroral-Arc Fine Scales: A Comparison of Theory With Observations
9:05 p.m.	BREAK	
Poster Session: 9:25 p.m. - 11:00 p.m.		
	J. A. Koehler and G. J. Sofko	Meter Scale Plasma Irregularities in the Polar Cap
	J. M. Grebowsky, S. A. Curtis, L. H. Brace, and J. D. Huba	Generation of Small Scale Plasma Density Irregularities in a High β Plasma - Venus' Ionosphere
	G. J. Sofko, J. A. Koehler, M. McKibben, and M. Uspensky	Over-the-Horizon Radar Observations of E-Region Auroral Plasma Irregularities
	D. Shklyar, D. Nunn, A. Smith, and S. Sazhin	A Theoretical and Numerical Investigation of Frequency Shifts of VLF Signals in the Inner Magnetosphere due to Nonlinear Wave Particle Interaction
	D. Nunn	The Numerical Modelling of VLF Trimpis Using a Full Modal Scattering Matrix
	O. Buneman	Self-consistent Models for Analytical and Computational Studies of Beam- Plasma Interactions
	O. Buneman, T. Neubert, and K.-I. Nishikawa	Solar Wind-Magnetosphere Interaction as Simulated by a 3D, EM Particle Code
	P. A. Bernhardt and W. A. Scales	The Role of Initial Stage Distributions to Develop Irregularities in Artificial Plasma Clouds
	A. B. Draganov, U. S. Inan, V. S. Sonwalker, and T. F. Bell	Magnetospherically Reflected Whistlers as a Source of Plasmaspheric Hiss
	D. Jasna, U. S. Inan, and T. F. Bell	Precipitation of Suprathermal Electrons by Oblique Whistler-Mode Waves
	D. S. Lauben, T. F. Bell, and U. S. Inan	VLF Saucers in the Southern Auroral Zone
	T. K. Nakamura and C. F. Kennel	Parametric Cyclotron Resonance in Space Plasmas

S. S. Sazhin, N. M. Temme, and A. E. Sumner	Are Relativistic Effects Significant for the Analysis of Whistler-Mode Waves in the Earth's Magnetosphere?
G. M. Chen and R. E. Horita	Proton Cyclotron Echoes at X-Wave and Z-Wave Cutoff Frequencies
P. H. Yoon	Spatial and Temporal Scales for Quasi-linear Relaxation of Velocity Shell Cometary Ions and Generation of Oblique Alfvén Turbulence
R. Bruno and B. Bavassano	Cross-Helicity Depletion due to Magnetic Field and Velocity Fluctuations Decoupling
R. Lundin	Mass-Loaded Pick-Up as a Process for Ionospheric Plasma Escape From the Innermost Planets
H. Okuda	Generation of Field-Aligned Current in the Auroral Zone
V. Perroomian, M. Ashour-Abdalla, and R. J. Walker	Accessibility of Ionospheric Particles to Various Regions of the Magnetotail

Thursday, February 20, 1992

Morning Session:

8:30 a.m.	J. L. Burch, J. D. Menietti, C. S. Lin, and R. M. Winglee	Mesoscale-Microscale Coupling Observed in Auroral and Cusp-Region Plasmas
9:20 a.m.	M. André	Generation of Ion and Electron Conics
9:45 a.m.	W. K. Peterson	Bi-Modal Ion Energization at High Altitudes
10:10 a.m.	G. B. Crew and T. Chang	Ion Cyclotron Resonance Heated Conics
10:35 a.m.	BREAK	
11:00 a.m.	P. M. Kintner, J. Vago, R. Arnoldy, C. Pollock, and T. Moore	Localized Regions of Transverse Ion Acceleration by Lower Hybrid Waves
11:25 a.m.	J. M. Retterer, T. Chang, and J. R. Jasperse	The Ion Conic Observed by MARIE
11:50 a.m.	R. E. Ergun, C. W. Carlson, J. P. McFadden, and M. H. Boehm	Observation of Strong Wave-Particle Interactions During Langmuir Emissions
12:15 p.m.	V. D. Shapiro	Lower Hybrid Turbulence and Acceleration of Ions

Afternoon Session:

2:00 p.m.	M. Temerin, J. McFadden, and C. W. Carlson	Auroral Particle Acceleration
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2:40 p.m.	D. Le Quéau and A. Roux	Theory of the Resonant Absorption of Alfvén Waves in a Multi-component Plasma. A Mechanism for Ion Heating and the Formation of Conics
3:05 p.m.	L. Chen, G. Vetoulis, and A. A. Chan	Linear and Nonlinear Physics of Kinetically Excited Geomagnetic Pulsations
3:30 p.m.	D. Nunn	The Numerical Simulation of VLF Wave Particle Interactions Using a Vlasov Hybrid Simulation Code
3:55 p.m.	BREAK	
4:20 p.m.	D. M. Klumpar	Discrete Plasma Structures in the Outer Dayside Magnetosphere
4:45 p.m.	H. K. Wong and N. T. Shatin	Electromagnetic Components of Auroral Hiss and Lower Hybrid Waves in the Polar Cusp
5:10 p.m.	C. Paranicas, W. J. Hughes, H. J. Singer, R. R. Anderson, and D. Hardy	Intensities of Electron Cyclotron Harmonic Emissions and Energetic Electrons as Observed by CRRES
5:35 p.m.	K. Stasiewicz and G. Gustafsson	Plasma Wave Environment Inside Auroral Acceleration Regions as Measured by Viking
8:00 p.m.	EVENING LUAU	

Friday, February 21, 1992

Morning Session:

8:30 a.m.	R. Lundin	Micro and Meso Scale Measurements by the Freja Satellite
8:55 a.m.	L. C. Lee and C. Q. Wei	Coupling of the Low-Latitude Boundary Layer to the Polar Ionosphere and Generation of Cusp Pulsations
9:20 a.m.	Z. Y. Pu, S. Y. Fu, and Z. X. Liu	Vortex Induced Fast and Turbulent Reconnection in the Dayside Magnetospheric Boundary Region
9:45 a.m.	S. Basu, W. R. Coley, E. M. Basinska, J. R. Sharber, and J. A. Slavin	Plasma Density and Electric Field Structures in the Dayside Cusp
10:10 a.m.	H. Oya	Studies on the Generation Mechanism of AKR Based on the Evidences of the Plasma Conditions Observed by EXOS-D (AKEBONO) Satellite in the Source Regions
10:35 a.m.	BREAK	
11:00 a.m.	C. G. Falthammar and N. Brenning	Magnetic-Field Aligned Electric Fields due to Dynamic Trapping of Electrons
11:25 a.m.	D. T. Young	Plasma Composition and Mesoscale Structures in Saturn's Magnetosphere

- 11:50 a.m. J. D. Winningham and C. G. Gurgiolo A Reinterpretation of the Dayside Cusp and the Physical Processes Associated With It
- 12:15 p.m. N. F. Otani and M. Silberstein The Transfer of Alfvén Wave Energy to Electron Acceleration Processes Along Auroral Field Lines
- 12:40 p.m. Y. Omura Nonlinear Whistler Mode Wave-Particle Interaction in the Magnetosphere
- Evening Session:
- 7:00 p.m. M. C. Kelley, D. Hysell, and C. E. Seyler On the Linkage of Macroscale and Microscale Structures in Equatorial Spread F
- 7:25 p.m. O. Buneman Internal Dynamics of a Plasma Propelled Across a Magnetic Field
- 7:50 p.m. J. D. Huba Hall Magnetohydrodynamics in Space Plasmas
- 8:15 p.m. I. Roth, M. K. Hudson, X. Li, and A. Chan Analytical Description of Ion Interaction With Pc 5 Waves and Stationary Electric Fields
- 8:40 p.m. D. W. Swift Effects of Ion Demagnetization in the Plasma Sheet
- 9:05 p.m. BREAK
- Poster Session:
9:25 p.m. - 11:00 p.m.
- B. J. Vasquez Nonlinear Wave Packet Evolution: Application to Rotational Discontinuities of the Solar Wind
- G. Le and C. T. Russell Spatial Variation of Upstream ULF Waves and Discrete Wave Packets in the Earth's Foreshock Region
- L. H. Lyu and J. R. Kan Hybrid Simulation of Rotational Structures and Quasi-Parallel Shocks Observed in Space Plasmas
- U. Motschmann Simulation of Shell Like Heavy Ion Distributions Downstream of the Bow Shock
- S. Livi, B. Wilken, T. Roatsch, J. Geiss, and G. Gloeckler Interplanetary Shocks as Observed by the Ulysses SWICS Experiment
- Y. Xu and M. G. Kivelson On Discontinuities and Intermediate Shocks in the Solar Wind
- B. Shizgal Effect of Coulomb Collisions on Anisotropic Features of Solar Wind Distributions
- S.-H. Chen, M. G. Kivelson, J. T. Gosling, and A. J. Lazarus Observations of High Speed Flows ($V > V_{\alpha}$) in the Magnetosheath and Anomalous Perturbations in the Low-Latitude Boundary Layer During a Strongly Northward IMF

- X. Li, M. K. Hudson, A. A. Chan, and I. Roth
 Loss of Ring Current O^+ Ions due to Interaction With Pc 5 Waves
- C. Z. Cheng, Q. Qian, K. Takahashi, and A. T. Y. Lui
 Theory of Ballooning and Mirror Modes and ULF Wave Instability Conditions Obtained From AMPTE/CCE Particle Data
- J. D. Menietti, R. M. Winglee, and C. S. Lin
 A Mesoscale Model for the Injection of Magnetosheath Plasma Into the Cusp
- P. Song, C. T. Russell, R. J. Strangeway, R. R. Anderson, and R. J. Fitzenreiter
 Properties of VLF Waves Near the Subsolar Magnetopause
- J. Hamila and C. Chan
 Laboratory Experiments on Particle Acceleration Processes Associated With Parallel Electric Fields
- Z. Wang and M. Ashour-Abdalla
 Particle Diffusion in a Stochastic Field
- J. Bonnell, C. Cattell, C. Carlson, and G. Paschmann
 Are There "Hidden" Cold Populations in the Magnetotail?
- B. Savenkov, L. M. Zelenyi, and D. Zogin
 Quasiadiabatic Charged Particle Motion in Sharp Field Reversal
- L. Ofman, P. J. Morrison, and R. S. Steinolfson
 Nonlinear Evolution of Resistive Tearing Mode Instability With Shear Flow and Viscosity
- D. L. Holland and J. Chen
 Nonlinear Dynamics and Current Sheet Acceleration of Ions in the Magnetotail
- R. S. Steinolfson, L. Ofman, and P. J. Morrison
 Nonlinear Reconnection at an X-Type Neutral Point

Saturday, February 22, 1992

Morning Session:

- 8:30 a.m. K. Papadopoulos
 Transport Processes in Space Plasmas
- 9:20 a.m. K.-I. Nishikawa, O. Buneman, and T. Neubert
 Simulation Studies of Electron Beam-Driven Instabilities by a 3-D Electromagnetic Particle Code
- 9:45 a.m. P. L. Pritchett and F. V. Coroniti
 Formation of the Macroscopic Tail Current Sheet in a Microscopic Distributed-Source Model
- 10:10 a.m. R. R. Anderson
 Wave-Particle Interactions in the Magnetosphere and Solar Wind Detected by the ISEE, AMPTE-IRM, and CRRES Plasma Wave Instruments
- 10:35 a.m. BREAK
- 11:00 a.m. Panel Discussion
 R. Carovillano, Chairman, M. Ashour-Abdalla, J. Burch, T. Chang, P. Dusenbery, J. Jasperse, G. Paschmann, K. Schindler