

Plasmas and Fluids

PHYSICS THROUGH THE 1990s



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Panel on the Physics of
Plasmas and Fluids

Physics Survey Committee

Board on Physics and Astronomy

Commission on Physical Sciences,
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National Research Council

NATIONAL ACADEMY PRESS
Washington, D.C. 1986

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Preface

This survey of plasma physics and fluid physics briefly describes present activities and recent major accomplishments. It also identifies research areas that are likely to lead to advances during the next decade.

Plasma physics is divided into three major areas: general plasma physics, fusion plasma confinement and heating, and space and astrophysical plasmas. Fluid physics is treated as one topic, although it is an extremely diverse research field ranging from biological fluid dynamics to ship and aircraft performance to geological fluid dynamics. Subpanels, chosen for their technical expertise and scientific breadth, reviewed each of the four areas. The entire survey was coordinated and supervised by an Executive Committee, which is also responsible for the Executive Summary of this volume. Wherever possible, input from recent Advisory Committees was used, e.g., from the Magnetic Fusion Advisory Committee, the Space Science Board, and the Astronomy Survey Committee.

This volume is organized as follows: Chapter 1 is an Introduction and Executive Summary that outlines (a) major findings and recommendations; (b) significant research accomplishments during the past decade and likely areas of future research emphasis; and (c) a brief summary of present funding levels, manpower resources, and institutional involvement. The subpanel reports constitute Chapters 2-5 of this volume, including Fluid Physics (Chapter 2), General Plasma Physics

(Chapter 3), Fusion Plasma Confinement and Heating (Chapter 4), and Space and Astrophysical Plasmas (Chapter 5).

An important conclusion of this survey is that both plasma physics and fluid physics are scientifically and intellectually well developed, and both areas are broad subdisciplines of physics. We therefore recommend that future physics surveys have separate volumes on the physics of plasmas and the physics of fluids.

Finally, we are grateful for the technical contributions and conscientious efforts of the individual subpanel members. In addition, we wish to thank the many expert readers who have reviewed this report and provided useful suggestions that improved the document. The readers include Stirling Colgate, John Deutch, Herman Feshbach, George Field, William Fowler, Edward Frieman, Harold Furth, Hans Griem, Robert Gross, Donald Kerst, Hans Liepmann, Jeremiah Ostriker, Eugene Parker, David Pines, Marshall Rosenbluth, Ascher Shapiro, Joseph Smagorinsky, and Edward Stone. We appreciate their valuable contributions.

Contents

1 INTRODUCTION AND EXECUTIVE SUMMARY	1
General Findings and Recommendations, 1	
Findings, 1	
Recommendations, 2	
Introduction, 3	
The Emergence of Plasma Physics, 3	
Classification of Plasmas, 6	
Fluid Physics, 8	
Principal Findings and Recommendations, 10	
General Plasma Physics, 10	
Fusion Plasma Confinement and Heating, 11	
Magnetic Confinement, 11	
Inertial Confinement, 13	
Space and Astrophysical Plasmas, 14	
Fluid Physics, 16	
Recent Accomplishments and Future Research	
Opportunities, 18	
General Plasma Physics, 18	
Significant Recent Accomplishments, 18	
Future Research Opportunities, 19	
Fusion Plasma Confinement and Heating, 20	
Significant Recent Accomplishments, 20	
Future Research Opportunities, 20	
Magnetic Confinement, 20	
Inertial Confinement, 20	

Confinement, 20; Future Research Opportunities—	
Magnetic Confinement, 22; Significant Recent	
Accomplishments—Inertial Confinement, 24; Future	
Research Opportunities—Inertial Confinement, 25	
Space and Astrophysical Plasmas, 26;	
Significant Recent Accomplishments, 26; Future	
Research Opportunities, 27	
Fluid Physics, 28	
Significant Recent Accomplishments, 28; Future	
Research Opportunities, 30	
Funding and Manpower Resources, 32	
Institutional Involvement, 32	
General Plasma Physics, 32	
Plasma Confinement and Heating, 33	
Space and Astrophysical Plasmas, 34	
Fluid Physics, 35	

2 FLUID PHYSICS. 36

Introduction and Overview, 36	
Significant Accomplishments and Opportunities in	
Fluid Physics, 38	
Significant Recent Accomplishments, 38	
Significant Research Opportunities, 40	
Findings and Recommendations, 42	
Principal Findings, 42	
Support Structure, 42; Computational Techniques, 43;	
Instrumentation Techniques, 43; Education, 43	
Principal Recommendations, 44	
Research Support, 44; Education, 45	
Government Support, Manpower, and University	
Research, 45	
Detailed Review of the Branches, Selected Topical	
Subject Areas and Technical Disciplines of	
Fluid-Physics Research, 48	
Branches of Fluid Physics, 48	
Combustion and Reacting Flows, 48; Non-Newtonian	
Fluids and Rheology, 51; Vortex-Dominated Flows, 53;	
High-Speed Flows, 55; Molecular and Statistical	
Phenomena, 56; Viscosity-Dominated Flows, 57;	
Stability, 60; Turbulence, 62; Bouyancy-Driven	

Motion, 66; Interface Phenomena, 67; Sound
Generation and Propagation, 69; Radiation
Hydrodynamics, 70; Porous Media, 72; Rotating
Phenomena, 73; Phase Change, 74

Topical Subject Areas, 76

Aerodynamics, 76; Biofluid Dynamics, 81; Flows of
Electrically Conducting Fluids, 83; Geophysical Fluid
Dynamics, 84; Multiphase Flows, 86

Technical Disciplines, 88

Modeling and Analytical Methods, 88; Computational
Fluid Dynamics, 89; Experimental Methods, 91

Acknowledgments, 94

3 GENERAL PLASMA PHYSICS 95

Scope and Objectives of General Plasma Physics, 95

Intense Beams—Electrons, Ions, and Photons, 97

Development of Low-Impedance Multiterawatt
Machines, 98

Intense Ion Beams, 98

Development of High-Energy, High-Current
Machines, 99

Z-Pinch X-Ray Sources, 99

Propagation of Charged-Particle Beams in Gas
and Plasma, 99

Expectations and Recommendations for the Next
10 Years, 100

Collective Accelerators, 101

Space-Charge Accelerators, 102

Wave Accelerators, 102

Electron-Ring Accelerators, 102

Collective Focusing Accelerators, 103

Laser-Driven Accelerators, 103

Beat-Wave Accelerator, 104

Inverse Free-Electron-Laser Accelerator, 105

Grating Accelerator, 105

High-Gradient Structures, 105

Inverse Cerenkov Accelerator, 105

Cyclotron Resonant Accelerator, 105

Problem Areas,	106
Recommendations for the Next 10 Years,	106
Coherent, Free-Electron Radiation Sources,	107
Electromagnetic Wave-Plasma Interaction,	111
Scattering and Absorption of Electromagnetic Waves by Plasmas,	111
Isotope Separation,	114
Nonlinear Phenomena in Plasmas,	116
Chaos in Hamiltonian Systems,	116
Soliton and Related Phenomena,	117
Strong Langmuir Turbulence,	118
Parametric Instabilities,	118
Magnetic Reconnection,	118
Turbulent Relaxation to Force-Free States,	119
Other Major Achievements in the Past Decade,	120
Plasma Theory Developments Related to Magnetic Confinement,	120
Magnetic-Flux Geometries and Coordinate Systems,	121
Single-Particle Orbits,	121
Coulomb Collisional Processes,	122
Macroscopic Equilibria,	122
Macroscopic Instabilities—Ideal Magnetohydrodynamics,	122
Macroscopic Instabilities—Resistive Magnetohydrodynamics,	123
Microscopic (Kinetic) Instabilities and Turbulent Transport,	123
Summary,	124
Atomic Physics in (and for) Plasmas,	124
Recent Progress,	125
Outstanding Research Problems,	126
Recommendations,	126
Training,	127
Funding Levels,	128
Recommended Funding Levels,	128
Plasma Diagnostics,	128
Laser Scattering,	130

	Microwave Interferometry, 130	
	Spectroscopy, 130	
	Charge Exchange, 131	
	Neutrons and Alpha Particles, 131	
	Blackbody and Plasma-Well Interactions, 132	
	Heavy-Ion Diagnostics, 132	
	Time-Resolved Plasma Activity, 132	
	Scattering from Collective Fluctuations, 133	
	Data Acquisition and Instrumentation, 133	
	Desiderata, 134	
	Strongly Coupled Plasma Physics, 136	
	History, 136	
	Recent Progress, 138	
	Outlook for the Next 10 Years, 139	
	Nonneutral Plasmas, 140	
4	FUSION PLASMA CONFINEMENT AND HEATING	144
	Scope and Objectives of Fusion Plasma Research, 144	
	Introduction, 144	
	The Fusion Process, 146	
	Magnetic Confinement, 150	
	Inertial Confinement, 154	
	Tokamak and Stellarator Magnetic-Confinement Systems, 156	
	Introduction, 156	
	Major Advances, 161	
	Optimization of Experimental Performance, 161;	
	Confinement, 163; Stability and Beta Limits, 166	
	Current Frontiers of Research, 168	
	Prospects for Future Advances, 171	
	Magnetic Mirror Systems, 172	
	Introduction, 172	
	Major Advances—the Tandem Mirror, 174	
	Current Frontiers of Research, 176	
	Microstability, 177; Axial Confinement: Control of the	
	Potential Profile and Thermal Barriers, 178;	
	Macrostability: Equilibrium and Beta Limits, 181; Radial	
	Confinement: Particle Transport and Radial Potential	
	Control, 183	

Prospects for Future Advances in Mirror Confinement, 184	
Elmo Bumpy Torus, 185	
Introduction, 185	
Major Advances, 187	
Current Frontiers of Research, 188	
Prospects for Future Advances, 189	
Reversed-Field Pinch, 190	
Introduction, 190	
Major Advances, 192	
Current Frontiers of Research, 193	
Prospects for Future Advances, 194	
Compact Toroids, 195	
Introduction, 195	
Major Advances, 198	
Spheromaks, 199; Field-Reversed Configurations, 201	
Current Frontiers of Research, 201	
Prospects for Future Advances, 203	
Plasma Heating, 204	
Introduction, 204	
Radio-Frequency Heating, 204	
Major Advances: Theory, 206; Major Advances: Experiment, 207; Prospects for Future Advances, 210	
Radio-Frequency Current Drive, 212	
Major Advances: Theory, 213; Major Advances: Experiment, 213; Prospects for Future Advances, 216	
Neutral-Beam Heating, 216	
Major Advances, 217; Prospects for Future Advances, 219	
Inertial-Confinement Fusion Systems, 221	
Introduction, 221	
Major Advances, 224	
Drivers for Inertial-Confinement Fusion, 224; Laser-Target Physics, 226	
Current Frontiers of Research, 228	
Laser-Plasma Coupling, 228; Heat Transport and Ablation, 231; Shell Acceleration, Uniformity, and Hydrodynamic Instabilities, 233	
Prospects for Future Advances, 235	
Advanced Fusion Applications, 236	

Funding of Fusion Plasma Research in the United States, 238	
Principal Findings and Recommendations, 240	
Magnetic Confinement, 240	
Inertial Confinement, 241	
Acknowledgments, 242	
5 SPACE AND ASTROPHYSICAL PLASMAS	243
Principal Conclusions, 243	
Principal Recommendations, 244	
Introduction, 245	
Relationship Between Laboratory, Space, and Astrophysical Plasma Research, 246	
Definition of Space and Astrophysical Plasma Physics, 246	
Relationship Between Laboratory and Space Plasma Physics, 246	
Relationship Between Space and Astrophysical Plasma Research, 247	
Magnetohydrodynamic Atmospheres and Winds, 248;	
Planetary and Astrophysical Magnetospheres, 249; Magnetic-Field Reconnection, 252; Particle Acceleration and Cosmic Rays, 254	
The Unifying Physical Problems, 255	
Space and Astrophysical Plasma Physics in the Past 10 Years, 255	
Problem 3: The Behavior of Large-Scale Plasma Flows, 256	
Planetary Magnetospheres, 256; Dynamics of the Earth's Magnetosphere, 256; Magnetohydrodynamic Structures in the Sun's Atmosphere and in the Solar Wind, 256; Magnetospheres of Neutron Stars, 257; Magnetohydrodynamic Jets, 257; General Relativistic Electrodynamics, 259	
Problem 1: Reconnection, 259	
Problem 2: Interaction of Turbulence with Magnetic Fields, 259	
Problem 4: Acceleration of Energetic Particles, 260	
Problem 5: Particle Confinement and Transport, 261	
Problem 6: Collisionless Shocks, 261	
Problem 7: Beam-Plasma Interactions, and the Generation of Radio Emissions, 262	

Problem 8: Interactions Between Plasmas and Neutral Gases, 262	
Space and Astrophysical Plasma Physics in the Next 10 Years, 263	
Impact of Research on Space and Astrophysical Plasmas, 264	
The Role of Space and Ground-Based Measurements and Observations, 266	
Solar-System Plasma Physics, 266	
Astrophysical Plasma Physics, 267	
In Situ Measurements near the Sun, 268	
Concluding Remarks, 269	
The Roles of Laboratory and Active Space Experiments, 269	
Laboratory Experiments, 269	
Active Space Experiments, 270	
The Role of Theory, 271	
Space Plasma Theory, 271	
Theoretical Astrophysics, 272	
The Role of Numerical Models and Simulations, 273	
Why Quantitative Models are Essential, 273	
System Models and Process Simulations in the Next Decade, 275	
System Models, 275; Process Simulations, 276; Overall Conclusions, 277	
Proposal for a Dedicated, Advanced Computational Program, 278	
The Role of Plasma Physics in the University Curriculum, 279	
Space Plasma Physics, 279	
Astrophysical Plasma Physics, 280	
Plasma Physics in General, 281	
References, 282	
GLOSSARY	283
INDEX	307