Selected Highly Cited Papers from 50 Years of Plasma Physics

A Special Publication
Prepared for the 50th Anniversary Meeting
of the APS Division of Plasma Physics

Dallas, Texas, November 2008

Editor

Ronald C. Davidson

Princeton Plasma Physics Laboratory, Princeton, New Jersey

Selected Papers Published in:

Physics of Fluids, 1958–1988

Physics of Fluids B, 1989–1993

and

Physics of Plasmas, 1994–2008

By visiting *Physics of Plasmas* at **pop.aip.org**,
you will find a version of this special publication in Adobe PDF,
with embedded links pointing to each highly cited paper.

Published by the American Institute of Physics

AMERICAN INSTITUTE OF PHYSICS

www.aip.org

Submit your manuscript to *Physics of Plasmas* at **pop.peerx-press.org**.

Contact Information:

Physics of Plasmas Editorial Office
Princeton Plasma Physics Laboratory
James Forrestal Campus, MS 20
Princeton, New Jersey 08543
USA

E-mail: physplas@pppl.gov

International Standard Book Number: 978-0-7354-0583-7

AIP Publication Number: R-443

Published by
American Institute of Physics
Suite 1NO1
2 Huntington Quadrangle
Melville, New York 11747-4502
USA

Printed in the United States of America.

Selected Highly Cited Papers from 50 Years of Plasma Physics

Contents

Credits—Cover Photographs

Grateful acknowledgment is given to those who granted permission to reprint the photographs used on the front cover of this special publication. Beginning with the photo in the top left-hand corner and reading clockwise, below are listed the person pictured and the source for each photograph:

William P. Allis (standing) and Adolf Hurwitz (seated)
Photograph by Jacqueline; courtesy of AIP's Emilio Segrè Visual Archives, *Physics Today* Collection

Edward Teller
Courtesy of AIP's Emilio Segrè Visual Archives

Derek C. Robinson
Courtesy of EURATOM-UKAEA

Lyman S. Spitzer, Jr.
Courtesy of AIP's Emilio Segrè Visual Archives

Lev D. Landau
Courtesy of AIP's Emilio Segrè Visual Archives, *Physics Today* Collection

Harold P. Furth
Courtesy of Lawrence Livermore National Laboratory

Burton D. Fried
Courtesy of AIP's Emilio Segrè Visual Archives

Katherine E. Weimer
Courtesy of American Physical Society, Division of Plasma Physics

Inspecting the torus at John Jay Hopkins Laboratory's fusion research building are, from left to right: **Richard Courant, Hideki Yukawa, Marshall N. Rosenbluth, Marcus Oliphant, Niels Bohr, Edward C. Creutz, and Donald W. Kerst**, General Atomic, Division of General Dynamics Corporation
Courtesy of AIP's Emilio Segrè Visual Archives

Marshall N. Rosenbluth
Courtesy of AIP's Emilio Segrè Visual Archives, *Physics Today* Collection

John M. Dawson
Courtesy of AIP's Emilio Segrè Visual Archives, *Physics Today* Collection

Subrahmanyan Chandrasekhar
Photograph by Dorothy Davis Locanthi; courtesy of AIP's Emilio Segrè Visual Archives

James A. Van Allen
Courtesy of AIP's Emilio Segrè Visual Archives

Boris Kadomstev
Courtesy of AIP

Frontiers in Plasma Physics Research: A Fifty-Year Perspective from 1958 to 2008

This special anniversary publication has been assembled by the Editorial Office of *Physics of Plasmas* to feature many of the outstanding papers published by the journal and its predecessors that have significantly advanced the fundamental understanding of plasmas over the past fifty years. The abstracts of 221 highly cited papers are included in chronological order by subfield, reproduced as they appeared in the original issues.

The earliest papers included in this anniversary publication appeared in the first journal published by the American Institute of Physics (AIP) to include plasma physics, *Physics of Fluids*. The first issue of this journal appeared in January 1958, under the editorship of François N. Frenkiel. As noted by John T. Scott in his recent history of the *Physics of Fluids* [J. T. Scott, Phys. Fluids **20,** 011301 (2008)], the emphasis on plasma physics grew markedly from the first year of publication. In 1982, two editors replaced Frenkiel, with Fred L. Ribe taking on the role of Editor for the plasma physics papers. In 1989, the journal was divided into two separate publications, with the plasma physics papers appearing in *Physics of Fluids B—Plasma Physics*. Ronald C. Davidson became Editor of the journal in 1991, and in 1994, the journal was renamed again, as *Physics of Plasmas*. The covers of the first issues of each of these journals are reproduced on the front cover of this anniversary publication, along with a collage of photos in memory of some of the founding physicists of the field.

Selecting highly significant papers covering a fifty-year time period has been challenging, and an effort has been made to include papers that represent the diverse subfields of plasma physics. The selection of many papers will be obvious to the reader, while the selection of others may be somewhat surprising. Our apologies to those readers who have candidate papers that are not included. In any case, we believe you will agree that this anniversary publication indicates that plasma physics is a healthy and vibrant field of physics. We look forward to another fifty years of significant progress and landmark publications in *Physics of Plasmas*.

We wish to thank everyone in the production team at AIP, whose conscientious efforts made the concept for this anniversary publication a reality.

Ronald C. Davidson
Editor
Physics of Plasmas

