

## AUTHORS — SEPTEMBER 1988

### OVERVIEW

#### LASER FUSION RESEARCH IN THE USSR

Photographs and biographies were not available at publication time.

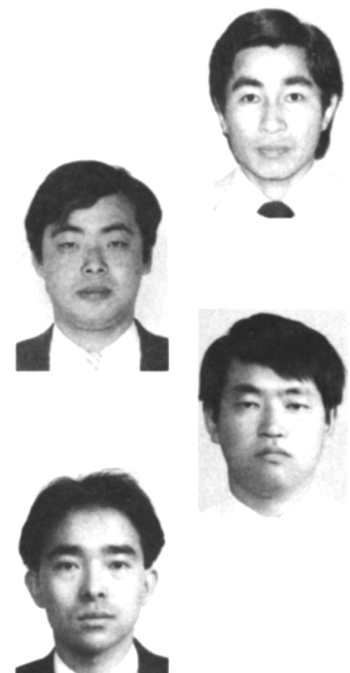
*N. G. Basov*  
*E. G. Gamaly*  
*V. B. Rozanov*  
*G. V. Sklizkov*

### ENERGY CONVERSION

#### DEVELOPMENT OF A TWO-DIMENSIONAL PARTICLE TRAJECTORY CODE AND APPLICATION TO A DESIGN OF A PLASMA DIRECT ENERGY CONVERTER IN THE FUSION ENGINEERING FACILITY BASED ON MIRROR PLASMA CONFINEMENT

**Kiyoshi Yoshikawa** (top right) [Dr. Eng., nuclear engineering, Kyoto University (KU), Japan, 1974] is an associate professor at the KU Institute of Atomic Energy. He held a visiting appointment at Lawrence Livermore National Laboratory in 1978 and then was at Lawrence Berkeley Laboratory until March 1980. His main interests are direct energy conversion, reactor-relevant technology, and reactor design in nuclear fusion. **Shinji Kouda** (top left) (MS, electrical engineering, KU, Japan, 1986) has worked on plasma direct energy conversion design and is currently on the staff of the central load dispatching station of the Kansai Electric Power Co., Inc. **Yasushi Yamamoto** (bottom right) (BS, electrical engineering, KU, Japan, 1981) is an instructor at the KU Institute of Atomic Energy. His current interests include beam and plasma direct energy conversion both in simulation and experiment. **Kouichi Maeda** (bottom left) (MS, electrical engineering, KU, Japan, 1985) is involved in the development of a simulation code for plasma direct energy conversion. He is currently on the staff at the Hiroshima power management office of the Chuugoku Power Electric Co., Inc.

*Kiyoshi Yoshikawa*  
*Shinji Kouda*  
*Yasushi Yamamoto*  
*Kouichi Maeda*



**NUMERICAL STUDY OF GYROPHASE AND TIME-DEPENDENT NONADIABATIC ELECTRON LOSSES IN AXIALLY SYMMETRIC MAGNETIC MIRROR FIELDS**

**Christopher B. Wallace** (top) (PhD, nuclear engineering, University of Missouri, 1985) is a member of the computational physics group at the BDM Corporation, Albuquerque, New Mexico. He joined BDM after completing his degree in computational plasma physics (nonlinear dynamics of charged particles in magnetic mirrors). His research interests are in the areas of computational plasma physics, high power electromagnetic radiation generation, and direct energy conversion. **Mark A. Prelas** (PhD, nuclear engineering, University of Illinois, 1979) is an associate professor of nuclear engineering at the University of Missouri-Columbia (UMC). He joined the UMC faculty after completing his PhD on a direct energy conversion technique (nuclear-pumped lasers). His research interests are in the areas of direct energy conversion, gaseous electronics, and plasma engineering.

*Christopher B. Wallace  
Mark A. Prelas*



**CONSIDERATION OF THE MAGNETIC FIELD RIPPLE IN THE DESIGN OF PLASMA EDGE COMPONENTS FOR TORE SUPRA**

**C. Christopher Klepper** (top right) (PhD, physics, University of Texas-Austin) did his dissertation on a study of particle transport on the Texas Experimental Tokamak. Since then he has been a member of the research staff of the Fusion Energy Division of Oak Ridge National Laboratory (ORNL). There, his primary role is in the design and diagnostic instrumentation of a pump limiter for Tore Supra. This limiter is the contribution of the U.S. partners [ORNL and Sandia National Laboratories (SNL)] to the international collaboration on Tore Supra. **Taner Uckan** (top left) (PhD, nuclear engineering, University of Michigan, 1975) is a staff member in the Fusion Energy Division at ORNL. His current research activities are in plasma/materials interactions, plasma edge diagnostics, pump limiters, and plasma confinement studies. He has worked in microwave development, Elmo Bumpy Torus experiments, and stellarator programs at ORNL, and has participated in tokamak experiments in the Federal Republic of Germany (FRG) (TEXTOR) and France (Tore Supra). **Peter K. Mioduszewski** (bottom right) (BS, physics, University of Bonn, FRG, 1965; MS, physics, University of Marburg, FRG, 1969; and PhD, physics, Technical University of Aachen, FRG, 1971) worked from 1972 to 1980 at Kernforschungsanlage Jülich on various problems of plasma/wall interactions. In 1980, he joined the Fusion Energy Division of ORNL, where he is presently group leader of the plasma edge physics group. He is currently involved in studies on the Advanced Toroidal Facility at ORNL, as well as in international collaborations on the Tore Supra and TEXTOR tokamak facilities. **Robert T. McGrath** (bottom left) [BS, engineering physics, 1972; MS, physics, 1974; MA, mathematics, 1975, The Pennsylvania State University (PSU); and PhD, nuclear engineering, University of Michigan, 1980], whose graduate research on fusion-fission hybrid concepts led to the award for outstanding thesis research from the American Nuclear Society, served as assistant professor of nuclear engineering at PSU from 1980 to 1984. He

*C. Christopher Klepper  
Taner Uckan  
Peter K. Mioduszewski  
Robert T. McGrath  
P. Hertout*



spent summers as visiting research staff at the Fusion Power Program at Argonne National Laboratory. In 1984, he joined the Fusion Technology Division at SNL, where his main research interests are in plasma/wall interactions. There he provides analytical modeling of impurity generation and transport in the tokamak boundary and edge plasma descriptions for power loading and particle exhaust for plasma-interactive components and for the analysis of data obtained during the operation of these components. **P. Hertout** (right) (Ecole Centrale des Arts et Manufactures, Paris, France, 1983) is an engineer with the Département de Recherche sur la Fusion Contrôlée of the Commissariat à l'Energie Atomique. His current work involves the study of magnetic field configurations and the calculation of eddy currents in edge components for the Tore Supra tokamak at Cadarache, France.



### RELATIVE MERITS OF SIZE, FIELD, AND CURRENT ON IGNITED TOKAMAK PERFORMANCE

*Nermin A. Uckan*

**Nermin A. Uckan** (PhD, nuclear engineering, University of Michigan, 1975) is a staff member in the Fusion Energy Division at Oak Ridge National Laboratory and a professor of nuclear engineering at the University of Tennessee, Knoxville. She has contributed to theory and modeling of bumpy tori and tokamaks in the areas of fusion plasma engineering and fusion reactor design studies.



### EXISTENCE AND ACCESSIBILITY OF IGNITING STATES IN A TOKAMAK INFERRED FROM ITS PERFORMANCE IN TRITIUMLESS DISCHARGES

*Ubaldo R. Carretta  
Ettore Minardi*

**Ubaldo R. Carretta** (top) (Laurea in Fisica, University of Milan, Italy, 1973) joined the National Research Council of Italy in 1975 and is now at the Institute for Propulsion and Energetics at Politecnico di Milano. His research interests are in the field of thermonuclear plasmas, with special emphasis on tokamak physics and related reactor problems. **Ettore Minardi** (Laurea in Fisica, University of Milan, Italy, 1951; Libera Docenza, University of Turin, Italy, 1959) is attached to the Institute for Plasma Physics of the National Research Council of Italy through Euratom. His research interests are in the area of theoretical problems on thermonuclear plasmas, particularly in the development of a thermodynamic theory for the non-Maxwellian equilibria and their global stability.



### STATUS AND DEVELOPMENT OF MAGNETIC MIRROR SYSTEMS FOR NUCLEAR TESTING APPLICATIONS

*Thomas C. Simonen  
Archer H. Futch  
Thomas B. Kaiser*

**Thomas C. Simonen** (top) (BS, electrical engineering and mathematics, Michigan Technological University, 1960; MS, 1964, and PhD, 1966, electrical engineering, Stanford University) is a physicist at the Lawrence Livermore National Laboratory (LLNL). He was previously employed by Hughes Aircraft Company, Stanford University, Max Planck Institute for Plasma Physics, and Princeton University Plasma Physics Laboratory. His research at LLNL has involved magnetic fusion mirror and tokamak experiments. **Archer H. Futch** (bottom) (BS, 1949, and MS, 1951, physics, University of North Carolina; PhD, physics, University of Maryland, 1955) is a research physicist at LLNL.



He was a staff physicist in the Reactor Physics Division at the Savannah River Laboratory for 3 years prior to joining the Magnetic Fusion Program at LLNL in 1959. His research at LLNL has been associated principally with experimental plasma physics and Fokker-Planck calculations of mirror-confined plasmas. **Thomas B. Kaiser** (right) (BS, physics, St. Edward's University; MS, 1971, and PhD, 1973, physics, University of Maryland) is a research physicist at LLNL. Prior to his present position with the theory and computations group in the Magnetic Fusion Energy Division at LLNL, he was a National Academy of Sciences/U.S. Nuclear Regulatory Commission resident research associate in the theory group at Goddard Space Flight Center, where he worked on the propagation of charged particles in stochastic magnetic fields. His current research interests include theoretical and computational study of the magnetohydrodynamic equilibrium and stability of space and laboratory plasmas and the transport of neutral particles.



**DIVERTOR/LIMITER SYSTEMS**

**A MODEL FOR DIFFUSION IN THE TOKAMAK EDGE AND APPLICATION TO THE MODULAR PUMP LIMITERS ON TORE SUPRA**

**Robert T. McGrath** (top right) [BS, engineering physics, 1972; MS, physics, 1974; and MA, mathematics, 1975, The Pennsylvania State University (PSU); PhD, nuclear engineering, University of Michigan (UM), 1980] served as assistant professor of nuclear engineering at PSU from 1980 to 1984 and spent summers as visiting research staff at the Fusion Power Program at Argonne National Laboratory. In 1984 he joined the Fusion Technology Division at Sandia National Laboratories (SNL), where his main research interests are in plasma/wall interactions. At SNL he provides analytical modeling of impurity generation and transport in the tokamak boundary, edge plasma descriptions of power loadings and particle exhaust for design of plasma interactive components (PICs), and analyses of experimental data obtained from PIC operation on various tokamaks. **C. Christopher Klepper** (top left) (PhD, physics, University of Texas-Austin, 1985) did his dissertation on a study of particle transport on the Texas Experimental Tokamak. Since then he has been a member of the research staff of the Fusion Energy Division of Oak Ridge National Laboratory (ORNL). His primary role is in the design and diagnostic instrumentation of a pump limiter for Tore Supra. This limiter is the contribution of the U.S. partners (ORNL and SNL) to the international collaboration on Tore Supra. **Taner Uckan** (bottom right) (PhD, nuclear engineering, UM, 1975) is a staff member in the Fusion Energy Division at ORNL. His current research activities are in plasma/materials interactions, plasma edge diagnostics, pump limiters, and plasma confinement studies. He has worked in microwave development, Elmo Bumpy Torus experiments, and stellarator programs at ORNL and has participated in tokamak experiments in the Federal Republic of Germany (FRG) (TEXTOR) and France (Tore Supra). **Peter K. Mioduszewski** (bottom left) (BS, physics, University of Bonn, FRG, 1965; MS, physics, University of Marburg, FRG, 1969; PhD, physics, Technical University of Aachen, FRG, 1971) worked at Kernforschungsanlage Jülich from 1972 to 1980 on various problems of plasma/wall interactions. In 1980 he joined the Fusion Energy

*Robert T. McGrath  
C. Christopher Klepper  
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Peter K. Mioduszewski*



Division at ORNL and is presently group leader of the plasma edge physics group. He is involved in studies on the Advanced Toroidal Facility at ORNL as well as in international collaborations on the Tore Supra and TEXTOR tokamak facilities.

#### MEASUREMENT OF 14-MeV NEUTRON MULTIPLICATION IN THORIUM OXIDE

**Vijay R. Nargundkar** (top) (MSc, physics, Karnataka University, India, 1956; PhD, pulsed neutron studies, University of Bombay, India, 1966) has been working at Bhabha Atomic Research Centre (BARC) since 1957. He has worked in the field of fission physics at Atomic Energy of Canada, Ltd., Chalk River, Canada (1961 and 1962); pulsed fast reactors at the Joint Institute for Nuclear Research, Dubna, Soviet Union (1972); and fusion blanket neutronics at the Institute for Reactor Development (IRD), Jülich, Federal Republic of Germany (FRG) (1977 and 1978). He has been the facility supervisor of the Purnima Critical Facility. His current interest is theoretical and experimental studies of fusion blanket neutronics. **Tejen Kumar Basu** (center) (BS, physics, Kurukshetra University, India, 1969; graduate, BARC Training School, India, 1970; PhD, physics, University of Bombay, India, 1980) has been associated with the experimental program of the Purnima fast reactor facility. He worked at the IRD, Jülich, FRG, from 1977 to 1978 in fusion blanket neutronics. His current interests include neutron transport calculations in micropellets and the experimental investigation of neutron multipliers. **Om Prakash Joneja** (bottom) (MSc, Punjabi University, India, 1966; graduate, BARC Training School, India, 1967; PhD, physics, University of Bombay, India, 1976) has been actively working on fast neutron spectrometry and development of Monte Carlo codes. His present interest includes development of new experimental techniques for on-line measurement of tritium breeding in fusion blankets. He has worked at the IRD, Jülich, FRG, from 1972 to 1974 in the field of fast neutron spectrometry and from 1979 to 1980 on the  $\text{LiAlO}_2$  blanket assembly for measuring tritium production.

*Vijay R. Nargundkar  
Tejen Kumar Basu  
Om Prakash Joneja*



#### MECHANICAL PROPERTIES OF $\text{LiAlO}_2$ CERAMIC BREEDER PELLETS

**M. Barra Caracciolo** (top) (PhD, mechanical engineering, Rome University, Italy, 1982) has worked at the C. R. E. Casaccia, Italian Commission for the Research and Development of Nuclear and Alternative Energies, European Nuclear Energy Agency (ENEA), Rome, Italy, since 1984. He has worked on fracture mechanics testing of structural steels. He is now involved in the mechanical characterization of nuclear ceramic materials for fusion reactors. **C. Alvani** (bottom) (PhD, chemistry, Parma University, Italy, 1976) has worked at the C. R. E. Casaccia, ENEA, Rome, Italy, since 1983. From 1976 to 1980 he worked on visible and ultraviolet spectroscopy at the European Institute for Transuranium Elements, in Karlsruhe, Federal Republic of Germany. Since 1981 he has worked on the preparation and characterization of nuclear ceramic materials for fission reactors at Kernforschungszentrum Karlsruhe. Currently, his interest is

*M. Barra Caracciolo  
C. Alvani  
S. Casadio*



focused on the chemical preparation and characterization of ceramic blanket materials for fusion reactors. **S. Casadio** (right) (PhD, physical chemistry, Rome University, Italy, 1965) has worked at the C. R. E. Cassaccia (ENEA), Rome, Italy, since 1968. He worked on molten salt and transuranic ion electrochemistry until 1974. Since 1975 he has worked on the liquid-metal chemistry for compatibility studies within the ENEA-Commissariat à l'Énergie Atomique cooperative program on fast reactors. Currently, he is involved in the chemical aspects of the fusion technology program for the Next European Torus and in the national advanced ceramic materials project.



## FUSION REACTORS

### CONCEPTUAL DESIGN OF A COMMERCIAL TOKAMAK REACTOR USING RESISTIVE MAGNETS

*Rene J. LeClaire, Jr.*

**Rene J. LeClaire, Jr.** (BS, 1980, and MS, 1981, nuclear engineering, University of Lowell; nuclear engineering, 1984, and ScD, 1986, nuclear engineering, Massachusetts Institute of Technology) has been a staff member at Los Alamos National Laboratory in the energy systems analysis group of the Analysis and Assessment Division since 1986. His current interests include fusion technology, accelerator breeding, space power, and electric propulsion.



## PLASMA ENGINEERING

### REACTION CYCLE CHARACTERIZATIONS OF MUON-CATALYZED FUSION

*A. A. Harms*

**A. A. Harms** (PhD, nuclear engineering, University of Washington, 1969) has been at McMaster University for the past 15 years. His research interests are in the areas of emerging nuclear energy systems (fusion-fission hybrids and symbionts, spallation breeders, muon-catalyzed fusion, fusion chains, etc.), neutron radiography, and the tritium fuel cycle.

