



## AUTHORS — MAY 1983



### NEW SCHEME FOR CURRENT DRIVE IN A TOKAMAK REACTOR

**Dilip K. Bhadra** (top) (BSc, University of Calcutta; PhD, physics, University of California, 1969) is a staff scientist at GA Technologies Inc. (formerly General Atomic Co.). His specialty is the design and implementation of studies in plasma physics, both theoretical and applied. He has had extensive experience in working with aspects of the design of different conceptual reactor-type fusion devices. **Cheng Chu** (center) (BS, nuclear engineering, Tsing Hua University, 1969; PhD, plasma physics, Princeton University, 1974) is a scientist with GA. His research interests are in both fundamental and applied plasma physics. He has worked in the fields of plasma equilibrium, stability, and transports, and also in plasma fluctuations, radio-frequency plasma heating, and current drive. **Unto A. Peuron** (bottom) (Dipl. Eng., electrical engineering, Polytechnic Institute of Finland, 1950) was engaged in design and development of power, distribution, specialty, and instrument transformers with Finnish, Swedish, and American transformer manufacturing companies from 1950 to 1952. In subsequent years, he worked in the emerging field of superconducting magnet design and developed design methods for magneformers. During 1970 to 1974, with Allis Chalmers Manufacturing Co., he developed new types of coils, surge voltage distribution methods, and automated the optimal design of several lines of power, distribution, and regulating transformers. Since joining GA in 1974, he has worked with the computer analysis of fusion research devices.

*Dilip K. Bhadra  
Cheng Chu  
Unto A. Peuron*



### SHELL STABILIZATION OF TILTING MODE INSTABILITY IN A MOVING RING REACTOR

**Masami Ohnishi** (top) (Dr. Eng., electrical engineering, Kyoto University, Japan, 1979) is a research associate at the Institute of Atomic Energy, Kyoto University. He was a visiting assistant professor in the Nuclear Engineering Program of the University of Illinois from April 1979 for six months and held a visiting appointment at Lawrence Livermore National Laboratory (LLNL) from October 1979 to April 1980. His current interests include alpha-particle transport in magnetic fusion, dynamics and control of fusion reactors, and reactor design studies of open-ended systems. **Hiroki Matsuoka** (center) (MS, electrical engineering, Kyoto University, Japan, 1982) has worked as a research engineer at the Corporate Engineering Division of Matsushita Electric Industrial Company, Ltd. **Kiyoshi Yoshikawa** (bottom) (Dr. Eng., Nuclear engineering, Kyoto University, Japan, 1974) is an associate professor at the Institute of

*Masami Ohnishi  
Hiroki Matsuoka  
Kiyoshi Yoshikawa*



Atomic Energy, Kyoto University. He held a visiting appointment at LLNL from October 1978 for one year and then stayed at Lawrence Berkeley Laboratory, University of California, until March 1980. His main interests are direct energy conversion, reactor relevant technology, and reactor design in nuclear fusion.

**STUDIES OF ACHIEVING BUILDUP AGAINST CHARGE-EXCHANGE LOSSES IN A MIRROR-CONFINED PLASMA**

**Mark M. Campbell** (top) [BS, physics, Rose Polytechnic Institute, 1972; MS, physics, 1973, and PhD, nuclear engineering, 1981, University of Illinois, Urbana-Champaign (UI)] joined Mission Research Corporation in Albuquerque, New Mexico, in 1981 and is currently involved in optimizing a three-dimensional particle in cell model for simulating relativistic particle beams for Los Alamos National Laboratory. **George H. Miley** (PhD, University of Michigan, 1958) is professor and chairman of the Nuclear Engineering Program at UI. In addition to research on fusion, he is well known for his research on energy conversion and nuclear-pumped lasers.

*Mark M. Campbell  
George H. Miley*



**BLANKET ENGINEERING**

**INDUCED RADIOACTIVITY AND INFLUENCE OF MATERIALS SELECTION IN DEUTERIUM-DEUTERIUM AND DEUTERIUM-TRITIUM FUSION REACTORS**

**M. Z. Youssef** (top) (PhD, University of Wisconsin, 1980) is an assistant research engineer in the Fusion Engineering and Physics Program at the University of California-Los Angeles (UCLA). **R. W. Conn** (PhD, California Institute of Technology, 1968) is currently a professor of engineering and applied science at UCLA.

*M. Z. Youssef  
R. W. Conn*



**NEUTRON LEAKAGE THROUGH FUSION CHAMBER PORTS: A COMPARISON OF LITHIUM AND LEAD-LITHIUM BLANKETS**

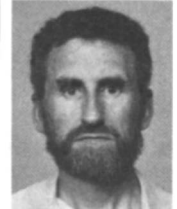
**Wayne R. Meier** (BS, physics, Western Illinois University, 1974; MS, nuclear engineering, University of Illinois, 1976) is a research engineer in the Energy and Military Applications Group of the Laser Fusion Program at Lawrence Livermore National Laboratory. He has been involved in the conceptual design of various reactor concepts for inertial confinement fusion (ICF) for the past six years. His current technical interests include neutronics, fusion-fission hybrids, and the economics of ICF electric power plants.

*Wayne R. Meier*



### RADIATION-INDUCED SWELLING IN AN AUSTENITIC ALLOY: OBSERVATIONS AND INTERPRETATION OF THE EFFECTS OF HELIUM

*Nicolas H. Packan  
Kenneth Farrell*



**Nicolas H. Packan** (top) (PhD, metallurgy, University of Missouri-Rolla, 1971) is a research staff member in the Metals and Ceramics Division of Oak Ridge National Laboratory (ORNL). He has been studying radiation effects in materials by the use of transmission electron microscopy, lately concentrating on the simulation of neutron damage (particularly void swelling) by heavy ion bombardment. **Kenneth Farrell** (PhD, metallurgy, University of Sheffield, England, 1962) is involved with studies of radiation damage and gases in metals in the Metals and Ceramics Division of ORNL.

### CONTROL OF PLASMA/WALL INTERACTIONS IN TANDEM MIRRORS

*R. Paul Drake*



**R. Paul Drake** (BA, philosophy and physics, Vanderbilt University, 1975; PhD, physics, John Hopkins University, 1979) is a physicist in the Laser Fusion Experiments Program at Lawrence Livermore National Laboratory. He is now involved in laser fusion experiments using the Novette laser, with emphasis on laser/plasma interactions. His past work includes research on tandem mirror (TM) confinement, design studies of advanced TMs and TM vacuum systems, and spectroscopic studies of extreme-ultraviolet emissions from magnetic mirror machines.

### ON THE PROPAGATION OF INTENSE NEUTRALIZED ION BEAMS FOR FUSION

*William B. Thompson  
Siebe Jorna*



**William B. Thompson** (top) (BS, physics and mathematics, 1944, and MA, physics, 1947, University of British Columbia; PhD, applied mathematics, University of Toronto, 1950) was a senior fellow to the U.K. Atomic Energy Authority, Harwell, Theoretical Physics Division for ten years before moving to Culham Laboratory where he was head of the Theoretical Physics Division from 1961 to 1963. He is a professor of physics at the University of California, San Diego. He was also a professor of plasma physics at Oxford University. **Siebe Jorna** (BSc, theoretical physics and applied mathematics, University of Western Australia, 1960; MSc, 1962, and PhD, 1965, theoretical physics, University of St. Andrews, Scotland) is a staff scientist at the La Jolla Institute and an associate research physicist at the University of California, San Diego.

His research interests include mathematical methods, nonlinear optics, nuclear physics, high-energy physics, plasma physics, laser/matter interaction, inertial fusion, particle beam propagation, hydrodynamics, and numerical analysis.

## DIVERTOR SYSTEMS

### PLASMA CHARACTERISTICS AND GAS TRANSPORT IN THE SINGLE-NULL POLOIDAL DIVERTOR OF THE INTERNATIONAL TOKAMAK REACTOR

**M. F. A. Harrison** (top) is a physicist at the U.K. Atomic Energy Authority (UKAEA) Laboratory in Culham. He has been active in the fields of atomic physics, ion source and electric propulsion physics and technology, and is currently involved in boundary problems. **P. J. Harbour** (center) (mathematics/physics, Cambridge University, 1960; PhD, physics, Cavendish Laboratory, Cambridge, 1963) worked on heat transfer and aerodynamic drag in rarefied gases at Cavendish Laboratory. After a year of postdoctoral research at Cambridge, he spent five years at the Gas Dynamics Laboratory, Department of Aerospace and Mechanical Science, Princeton University, where he was on the research staff and worked on hypersonic rarefied gas dynamics. He has been with the UKAEA since 1969 at Risley, where he worked on the condensation of gas and metal vapors in nozzle flows, and at Culham where he worked on the testing and development of mercury ion thrusters from 1971 to 1976 and since then on the physics and technology of plasma and gas exhaust for fusion reactors. **E. S. Hotston** (bottom) (BSc, PhD, London) has spent most of his professional life as a physicist in research and development within the energy and power producing area. He is currently at the UKAEA's Culham Laboratory.

*M. F. A. Harrison  
P. J. Harbour  
E. S. Hotston*



## PLASMA HEATING SYSTEMS

### A TECHNIQUE FOR MEASURING THE FAST $^3\text{He}^{++}$ DISTRIBUTION DURING $^3\text{He}^{++}$ MINORITY ICRF HEATING

**Douglass E. Post** (top) (PhD, physics, Stanford University) has been a physicist at the Princeton Plasma Physics Laboratory (PPPL) since 1975. He has worked primarily in the computational modeling of tokamaks and the application of atomic processes to fusion research. **Larry R. Grisham** (center) (PhD, physics, Oxford University) has been a physicist at PPPL since 1974. He has mainly worked in the application and development of neutral beam heating for magnetically confined plasmas. **Sidney S. Medley** (bottom) (PhD, physics, University of British Columbia, Canada, 1968) performed plasma diagnostics at the U.K. Atomic Energy Authority's Culham Laboratory from 1969 to 1970 and at the Fusion Research Center from 1971 to 1976 prior to becoming a PPPL research staff member in 1977. His plasma/tokamak experimental work includes application of laser interferometry, ion spectrometry, magnetic probe, fusion gamma, and charge-exchange diagnostics.

*Douglass E. Post  
Larry R. Grisham  
Sidney S. Medley*





## MEASUREMENT OF DEUTERIUM BEAM ENERGY DISTRIBUTION AND SPECIES USING AN ELECTROSTATIC ENERGY ANALYZER

**Alex Wekhof** (top) (PhD, plasma physics, Lebedev Physics Institute, USSR Academy of Science, 1975; MSD, experimental physics, Moscow Physics-Engineering Institute, 1969) specializes in the areas of plasma diagnostics of various discharges, beams and plasma interactions with walls, and their applications. After emigration to the United States in 1979, he joined the University of California at Berkeley, where he accomplished a number of plasma related projects during three years of work there. He is now working on plasma technology for the semiconductor industry at INTEL Corp. in Livermore, California, as a senior engineer. **Richard R. Smith** (center) (BS, physics, Massachusetts Institute of Technology; MS and PhD, engineering science, California Institute of Technology) has worked in the field of controlled thermonuclear fusion for ten years, specializing in neutral beam heating and in high-temperature plasma diagnostics. He has worked at the Lawrence Livermore Laboratory, the Princeton Plasma Physics Laboratory (PPPL), and the Lawrence Berkeley Laboratory. He currently works in the field of medical linear accelerators. **Sidney S. Medley** (bottom) (PhD, physics, University of British Columbia, Canada, 1968) performed plasma diagnostics at the U.K. Atomic Energy Authority's Culham Laboratory from 1969 to 1970 and at the Fusion Research Center from 1971 to 1976 prior to becoming a PPPL research staff member in 1977. His plasma/tokamak experimental work includes application of laser interferometry, ion spectrometry, magnetic probe, fusion gamma, and charge-exchange diagnostics.

*Alex Wekhof  
Richard R. Smith  
Sidney S. Medley*



## TRITIUM SYSTEMS

## PRELIMINARY DESIGN OF A FUSION REACTOR FUEL CLEANUP SYSTEM BY THE PALLADIUM-ALLOY MEMBRANE METHOD

**Hiroshi Yoshida** (top) (PhD, nuclear engineering, Tokyo Institute of Technology, 1971) is a research engineer at the Tritium Engineering Laboratory of the Japan Atomic Energy Research Institute (JAERI). He has been engaged in nuclear technology research relative to uranium enrichment by gaseous diffusion, spent fuel off-gas treatment, and the fusion fuel cycle since 1971 at JAERI. His present interests include developmental work on tritium processing technologies for fusion fuel cycles and blanket. **Satoshi Konishi** (center) (MS, nuclear engineering, University of Tokyo, 1981) is a research engineer at the Tritium Engineering Laboratory. He has been working on the development of tritium processing technology related to palladium diffusers and electrolyzers for the fusion fuel cycle. He is also interested in the property of breeding blanket materials. **Yuji Naruse** (bottom) (BS, chemical engineering, Kyoto University, 1959) is chief of the Tritium Engineering Laboratory. He has been engaged in engineering work relative to fuel reprocessing and uranium enrichment. He is now involved in the design and construction of tritium facilities.

*Hiroshi Yoshida  
Satoshi Konishi  
Yuji Naruse*



**POWER DENSITY FLATTENING IN FUSION-FISSION HYBRID REACTORS**

**Alexander Misulovin** (photograph not available) (BSc, electrical engineering, and MSc, nuclear engineering, Ben Gurion University of the Negev) is a research staff member at Nuclear Research Center-Negev (NRC-Negev). His interests are in lattice optimization and fuel management. **David Gilai** (right) (BSc, mechanical engineering, ETH, Zurich; MSc, nuclear engineering, Technion) is a research staff member at the NRC-Negev. In 1981 he was a visiting scientist at the Engineering Physics Division of Oak Ridge National Laboratory. His fields of interest are the analysis of nuclear reactor performance, nuclear reactor control, and the optimization of nuclear energy systems. Biography and photograph of **E. Greenspan** were not available at publication time.

*E. Greenspan  
Alexander Misulovin  
David Gilai*

**FLOWING  $Pb_{83}Li_{17}$  LIQUID-METAL COOLANT IN FUSION REACTORS WITH HIGH-POWER DENSITIES AND MAGNETIC FIELDS**

**Robert F. Bourque** (BS, mechanical engineering, Northeastern University, 1964; MS, 1965, and PhD, 1968, mechanical engineering, University of Connecticut) is responsible for reactor systems studies of the Ohmically Heated Toroidal Experiment and other compact fusion reactors at GA Technologies, which he joined in 1975. Previously, he contributed to Plowshare-related projects at Lawrence Livermore National Laboratory and, while at SRI International, was project leader for several underground nuclear effects tests.

*Robert F. Bourque*

**POWER BALANCE AND COST ESTIMATE OF A SEMI-CATALYZED-DEUTERIUM HYBRID WITH A  $D-^3He$  SATELLITE**

**G. Pantis** (Diplom Eng., electrical engineering, Technical University of Munich, 1967; BSc, physics, University of South Africa, 1970; MSc, 1974; PhD, physics, McMaster University, Hamilton, Canada, 1979) is assistant professor in the Physics Department at the University of Ioannina of Ioannina, Greece. He is a member of professional engineering associations in South Africa, Greece, and Ontario, Canada.

*G. Pantis*

