nuclear technology/fusion

AUTHORS — JANUARY 1982

OVERVIEW

PHYSICS OF FUSION FUEL CYCLES

J. Rand McNally, Jr.

J. Rand McNally, Jr. (PhD, physics, Massachusetts Institute of Technology, 1943) is a senior research staff member in the Fusion Energy Division of Oak Ridge National Laboratory. His research interests include atomic physics, plasma physics, and nuclear fusion in which fields he has published well over 100 technical articles.

THE IMPACT OF ENGINEERING CONSTRAINTS ON THE FEASIBILITY OF ADVANCED FUEL FUSION REACTORS

J. Reece Roth

J. Reece Roth (SB, physics, Massachusetts Institute of Technology, 1959; PhD, engineering physics, Cornell University, 1963) joined the National Aeronautics and Space Administration (NASA) Lewis Research Center in Cleveland, Ohio, in 1963, where he was principal investigator of the Lewis Electric Field Bumpy Torus Project until 1978. He is presently on the faculty of the Electrical Engineering Department of the University of Tennessee, Knoxville. While at NASA, Roth pioneered in the application of superconducting magnet facilities to high temperature plasma research. This work included a superconducting magnetic mirror machine, which was put in service in 1964, and the superconducting Bumpy Torus magnet facility, which was put in service in 1972. Roth initiated research on the electric field Bumpy Torus concept, an approach to creating a plasma of fusion interest in which strong radial electric fields are imposed on a Bumpy Torus plasma in such a way that they contribute to the heating, stability, and confinement of the plasma. Among his contributions to the understanding of basic processes in plasmas are his experimental discovery of the continuity-equation oscillation, and of the geometric mean plasma frequency, a new mode of electromagnetic emission from plasmas.

FUSION FUEL CYCLES

DEUTERIUM-BASED PLASMAS AS A SOURCE FOR HELIUM-3

E. Greenspan
G. H. Miley

Ehud Greenspan (right) (BSc, mechanical engineering, Technion; PhD, nuclear science and engineering, Cornell University) was a visiting professor in the Nuclear Engineering Program of the University of Illinois from 1979 to 1981, on leave from the

Nuclear Research Center and the Ben-Gurion University of the Negev, Israel. He held visiting appointments at the Princeton Plasma Physics Laboratory and Oak Ridge National Laboratory. His professional interests include the conception and analysis of novel fusion and fission energy systems, transport processes in fission and fusion reactors, reactor physics, and methods development. **George H. Miley** (PhD, University of Michigan, 1958) is professor and chairman of the Nuclear Engineering Program at the University of Illinois in Urbana-Champaign. In addition to research on fusion, he is well known for his research on energy conversion and nuclear-pumped lasers.

BLANKET ENGINEERING

CATALYZED DEUTERIUM-DEUTERIUM AND DEUTERIUM-TRITIUM FUSION BLANKETS FOR HIGH TEMPERATURE PROCESS HEAT PRODUCTION

Magdi M. H. Ragheb
Behzad Salimi

Magdi M. H. Ragheb (top) [MS and PhD, nuclear engineering, University of Wisconsin (UW), 1978] is an assistant professor of nuclear engineering at the University of Illinois (UI), Urbana-Champaign. He has collaborated with the UW Department of Nuclear Engineering Fusion Engineering Program, Brookhaven National Laboratory, and the Division of Engineering Physics at Oak Ridge National Laboratory. His theoretical interests are in the areas of statistical simulation, reactor theory, advanced energy systems analysis, and variational and weighted residual methods. His current technical interests are in the blanket neutronics and photonics, shielding analysis, and the thermal hydraulics of fusion and fusion-fission energy systems. **Behzad Salimi** (MS, nuclear engineering, UI, 1981) is a PhD candidate in nuclear engineering at the UI. He is associated with the Energy Systems Division of the Construction Engineering Research Laboratory (U.S. Army Corps of Engineers). He is currently working in the areas of variational methods in reactor physics and fast reactor criticality.

NEUTRONIC CALCULATIONS FOR THE CONCEPTUAL DESIGN OF AN IN-REACTOR SOLID BREEDER EXPERIMENT, TRIO-01

R. L. Childs
T. A. Gabriel
R. A. Lillie

R. L. Childs (center) (PhD, University of Tennessee, 1979) is a member of the Nuclear Engineering Applications Department of the Computer Sciences Division of the Union Carbide Nuclear Division at Oak Ridge, Tennessee. His main area of work has involved radiation transport and shielding analyses using the discrete-ordinates method. **T. A. Gabriel** (left) (PhD, physics, University of Tennessee, 1969) is a member of the Engineering Physics Division at the Oak Ridge National Laboratory (ORNL). His interests are in neutron transport and neutron interactions with matter, related to electronuclear fuel production, nuclear instrument design, and fusion reactor engineering. A large part of his recent effort has been devoted to neutronic analysis of magnetically confined fusion reactors, in support of blanket design for a reactor conceptual design team, and to the ORNL Fusion Reactor Irradiation Effects Program. **R. A. Lillie** (right) (PhD, University of Tennessee, 1975) is a

research staff member in the Engineering Physics Division at ORNL. His work has been in the areas of fission reactor core physics and shielding analysis. His current interests focus on the application of radiation transport methods to fusion reactor neutronics problems.

PLASMA ENGINEERING

THE EFFECT OF QUADRUPOLE FIELDS ON PARTICLE CONFINEMENT IN A FIELD-REVERSED MIRROR

D. B. McColl
E. C. Morse
J. Hammer
H. L. Berk



D. B. McColl (photo not available) (BS, Queens College, 1978; MEng, nuclear engineering, University of California at Berkeley, 1980) is presently with General Atomic Corporation. **E. C. Morse** (top) (BS and PhD, University of Illinois) is presently an assistant professor of nuclear engineering at the University of California at Berkeley. **J. H. Hammer** (center) (BS, physics, Arizona State University, 1973; PhD, physics, University of California at Berkeley, 1979) is presently a physicist at Lawrence Livermore National Laboratory (LLNL). **H. L. Berk** (bottom) (PhD, Princeton University) has worked as a physicist at Lawrence Berkeley Laboratory and LLNL. He is currently a professor of physics at the University of Texas at Austin.

IDEAL AND RESISTIVE MAGNETOHYDRODYNAMIC STABLE STARTUP AND BURN FOR THE REVERSED-FIELD PINCH REACTOR

Richard A. Nebel
Ron W. Moses
Dennis W. Hewett
George H. Miley




Richard A. Nebel (top right) (BS, 1975, general engineering, and MS, 1976, and PhD, 1980, nuclear engineering, University of Illinois) is a post-doctoral staff member in the Plasma Theory Group (CTR-6) at the Los Alamos National Laboratory (LANL). His research interests are in plasma engineering, plasma transport, and magnetohydrodynamic stability theory. **Ronald W. Moses, Jr.** (top left) (BS, physics, Iowa State University, 1963; PhD, physics, University of Wisconsin, Madison, 1968), after working on theoretical electron optics at Cambridge University, the Institute for Theoretical Physics in Darmstadt, Germany, and the University of Chicago, returned to Wisconsin to work on magnetic energy storage and fusion magnetics. He joined the Magnetic Fusion Systems Study Group at LANL in 1976 and is currently a staff member in the Magnetic Fusion Theory Group there. **Dennis W. Hewett** (bottom right) (PhD, University of Kansas, 1973) is assistant group leader of the Theory Group in the Controlled Thermonuclear Reactor Division at LANL. He has worked primarily on the development of multidimensional hybrid (kinetic ions-fluid electrons) simulation models. He has served on the advisory committee to the U.S. Department of Energy/NMFECC computer network. **George H. Miley** (bottom left) (PhD, University of Michigan, 1958) is professor and chairman of the Nuclear Engineering Program at the University of Illinois in Urbana-Champaign. In addition to research on fusion, he is well known for his research on energy conversion and nuclear-pumped lasers.

DIVERTOR SYSTEMS

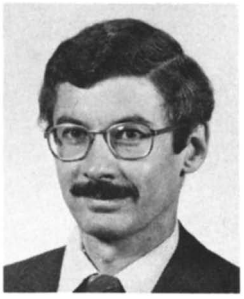
OSCILLATING LIMITER CONCEPTS

Ming Lun Xue
Tien-Fang Yang

Ming L. Xue (top) (Chiao-Tung University, Shanghai, 1956; Institute of Mechanics, Chinese Academy of Sciences, Beijing, China, 1961) is a visiting scientist at the Plasma Fusion Center (PFC), Massachusetts Institute of Technology (MIT), from the People's Republic of China. He is an associate research professor at the Institute. His research has been involved in internal aerodynamics, engineering thermophysics, magnetohydrodynamic energy converters, etc. He became interested in space plasma physics and fusion energy and began to devote his time to the research of fusion energy in 1977. **Tien-Fang Yang** (PhD, experimental nuclear physics, University of Michigan, 1969) is a member of the research staff and a group leader in the Divertor Developmental Program at the MIT PFC. He did post-doctoral work at Purdue University and subsequently taught in the Physics Department there. He started fusion energy research at the University of Wisconsin in 1971. He left Wisconsin in 1978 and spent three years at Westinghouse Electric Company. He joined the MIT PFC in 1979.

HYBRID BUNDLE DIVERTOR DESIGN

Glenn Bateman
P. Theriault



Glenn Bateman (PhD, Princeton University, 1970) is an associate professor of nuclear engineering at the Georgia Institute of Technology. As a physicist at Oak Ridge National Laboratory from 1974 to 1979, he wrote a number of research papers and a book on magnetohydrodynamic instabilities in tokamaks. His more recent interests concern the effect of coil configurations on the magnetic field in tokamaks. **Paul Theriault** (photo not available) is a graduate student in the School of Nuclear Engineering and Health Physics at Georgia Institute of Technology.

NEUTRAL BEAM INJECTION

POSSIBLE NONHYDROGEN NEUTRALIZERS FOR HIGH ENERGY D^+ AND H^+ BEAMS

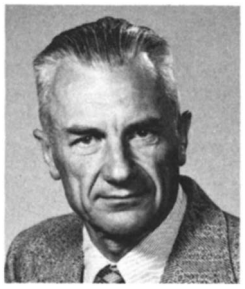
L. R. Grisham
D. E. Post

Larry R. Grisham (top) (PhD, physics, Oxford University) has been a physicist at the Princeton University Plasma Physics Laboratory (PPPL) since 1974. He has mainly worked in the application and development of neutral beam heating for magnetically confined plasmas. **Douglass E. Post** (PhD, physics, Stanford University) has been a physicist at PPPL since 1975. He has worked primarily in the computational modeling of tokamaks and the application of atomic processes to fusion research.

ICF CHAMBER ENGINEERING

RESPONSE OF LIQUID LITHIUM LAYERS TO NEUTRON AND X-RAY PULSES

Ihor O. Bohachevsky



I. O. Bohachevsky (BAE magna cum laude, New York University, 1956; PhD, applied mathematics, New York University, 1961) is a staff member in the Analysis and Assessment Division of the Los Alamos National Laboratory. His current work is in the area of inertial confinement fusion systems and applications studies with particular emphasis on the identification and solution of technical problems associated with the utilization of fusion energy. His previous work in the areas of fluid mechanics, numerical analysis, magnetohydrodynamics, and mathematical modeling was carried out at Cornell Aeronautical Lab, Buffalo, New York; Arco-Everett Research Lab, Everett, Massachusetts; and Bell Telephone Lab, Murray Hill, New Jersey.

FIRST WALL TECHNOLOGY

SIMULATION OF FUSION FIRST-WALL ENVIRONMENT IN A FISSION REACTOR

A. M. Hassanein
G. L. Kulcinski
G. R. Longhurst

Ahmed M. Hassanein (top) [BS, 1974, and MS course requirements, 1976, nuclear engineering, Alexandria University; MS, nuclear engineering, 1978, and MS, physics, 1981, University of Wisconsin (UW)] is currently working on his PhD in nuclear engineering at UW-Madison. His research interests include pulsed radiation damage, energy deposition, and thermal response of first walls, both in inertial and magnetic fusion reactors. **Gerald L. Kulcinski** (center) (BS, chemical engineering, and PhD, nuclear engineering, 1965, UW) is currently a professor in the Nuclear Engineering Department and Director of the Fusion Engineering Program at UW-Madison. He has also conducted and directed research on the effects of radiation on metals while serving as a senior research scientist at the Battelle-Pacific Northwest Laboratories from 1965 to 1971, when he was also a lecturer at the Center for Graduate Study in Richland, Washington. In 1963, he worked on the Nuclear Rocket Program at Los Alamos National Laboratory. His current research interests lie with the assessment of the technological problems associated with the production of power from both controlled thermonuclear and fission reactors and with specific problems of metals exposed to the intense radiation environment associated with fission and fusion reactors. **Glen R. Longhurst** (bottom) (BS, 1968, and MS, 1970, Utah State University; PhD, mechanical engineering, Colorado State University, 1978) is a senior engineering specialist with EG&G Idaho, Inc. and an affiliate professor of mechanical engineering at the University of Idaho. He is presently working in EG&G's Fusion Technology Program, where he is responsible for test planning and project development. Before coming to EG&G, he was employed by the U.S. Army Armament Command where he was inter-agency coordinator for development testing of guided artillery weapons.