

AUTHORS — MARCH 1991

ALPHA PARTICLES IN FUSION RESEARCH

POSSIBILITIES OF ALPHA-PARTICLE DIAGNOSTICS IN FUTURE TOKAMAKS USING HELIUM AND LITHIUM BEAM INJECTION

N. N. Gorelenkov
A. V. Krasilnikov

Photographs and biographies for **N. N. Gorelenkov** and **A. V. Krasilnikov** were not available at publication time.

PLASMA ENGINEERING

EQUILIBRIUM, STABILITY, AND DEEPLY TRAPPED ENER- GETIC PARTICLE CONFINEMENT CALCULATIONS FOR $I = 2$ TORSATRON/HELIOTRON CONFIGURATIONS

Yuji Nakamura (top right) (D. Eng., nuclear engineering, Kyoto University, Japan, 1987) has been a member of the Kyoto University Plasma Physics Laboratory research staff since 1987. He has done theoretical work on pellet ablation and transport. His current interests are magnetohydrodynamic (MHD) problems in nonaxisymmetric configurations. **Masahiro Wakatani** (top left) has worked in MHD theory, diamagnetic drift effects, and applications to stellarators and heliotrons. **Jean-Noel Leboeuf** (second from top right) (PhD, Institut National de la Recherche Scientifique du Quebec, Canada, 1976) is a member of the research staff of the Fusion Energy Division at Oak Ridge National Laboratory (ORNL). His research interests include computational plasma physics and plasma turbulence. **B. A. Carreras** (center left) is a Martin-Marietta corporate fellow at ORNL. He has worked in MHD theory and applications to tokamaks, stellarators, and reversed-field pinches. **N. Dominguez** (third from top right) (PhD, University of Texas–Austin, 1986) is a member of the research staff of the theory section of ORNL's Fusion Energy Division. He has worked on equilibrium and MHD stability of plasmas in mirrors, tokamaks, and stellarators. **Jeff A. Holmes** (bottom left) (PhD, physics, California Institute of Technology, 1976) is a computational physicist in the Computer Sciences Division of ORNL. He is a member of the MHD group, with experience in equilibrium, stability, and resistive MHD calculations applied to tokamaks, stellarators, and reversed-field pinch devices. **V. E. Lynch** (bottom right) (MS, University of Tennessee, 1979) is a member of the Computing and Telecommunications Division of ORNL. She has contributed in the fields of stellarator design and MHD calculations for stellarators and

Yuji Nakamura
Masahiro Wakatani
Jean-Noel Leboeuf
B. A. Carreras
N. Dominguez
Jeff A. Holmes
V. E. Lynch
S. L. Painter
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tokamaks. **S. L. Painter** (top) (MS, nuclear engineering, University of Tennessee) is on the staff of ORNL's Fusion Energy Division and a doctoral candidate in nuclear engineering at the University of Tennessee. His research interests include computational plasma engineering and stellarator reactor system studies. **Luis Garcia** (bottom) (PhD, physics, Universidad Complutense, Spain, 1979) is a former member of the Fusion Energy Division at ORNL. In 1986, he became an associate professor at Universidad Complutense in Spain. He has worked on physics optimization of magnetic confinement devices and nonlinear properties of MHD instabilities.



SADDLE POINT CONDITION FOR D-³He TOKAMAK FUSION REACTOR

Osamu Mitarai (top) (MS, mechanical engineering, 1977, and PhD, nuclear engineering, 1979, Kyushu University, Japan) is an associate professor of electrical engineering at Kumamoto University of Technology. He worked in the Department of Physics at the University of Saskatchewan from 1981 to 1984, where he built the STOR-1M tokamak. His current interests are in the areas of ac tokamaks, current drive, ignition studies for deuterium-tritium and D-³He tokamak reactors, spin-polarized fusion, transport studies, and cosmology based on plasma physics. **Akira Hirose** (center) (BE, 1956, and ME, 1967, Yokohama National University, Japan; PhD, University of Tennessee, 1969) is currently engaged in tokamak (STOR-M) experiments and theoretical work on anomalous transport. He is interested in waves and instabilities in plasmas, anomalous transport, and plasma turbulence. **Harvey M. Skarsgard** (bottom) (BE, engineering physics, 1949, and MSc, physics, 1950, University of Saskatchewan, Canada; PhD, nuclear physics, McGill University, Canada, 1955) is a member of the faculty of the physics department at the University of Saskatchewan, where he started a plasma physics research laboratory. He has worked mainly on plasma heating experiments with the Plasma Betatron and STOR tokamaks.

*Osamu Mitarai
Akira Hirose
Harvey M. Skarsgard*



FUSION REACTORS

PROJECTIONS FOR A STEADY-STATE TOKAMAK REACTOR BASED ON THE INTERNATIONAL THERMONUCLEAR EXPERIMENTAL REACTOR

R. Stephen Devoto (no photograph available) [SB and SM, Massachusetts Institute of Technology (MIT); PhD, Stanford University] has worked in plasma physics at Lawrence Livermore National Laboratory (LLNL) since 1974, mainly in studies of fusion reactors and other advanced devices. He recently cut back to part-time employment to devote more time to raising wine grapes. **William L. Barr** (right) (PhD, physics, University of California-Berkeley, 1957) is a member of the advanced mirror systems (fusion) group at LLNL, where he is currently analyzing end plasma and direct energy recovery for the Mirror Advanced

*R. Stephen Devoto
William L. Barr
Richard H. Bulmer
Robert B. Campbell
Max E. Fenstermacher
Joseph D. Lee
B. Grant Logan
John R. Miller
Louis L. Reginato
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Ronald L. Miller
Oscar A. Anderson
W. S. Cooper
Joel H. Schultz*



Reactor Study. He has developed and tested plasma direct energy converters for mirror end-loss plasma and beam direct converters for the ions from neutral beam injectors. **Richard H. Bulmer** (top right) (BS, 1967, and MS, 1968, engineering, University of Missouri-Rolla) is an engineer in the Magnetic Fusion Energy (MFE) Program at LLNL. He has worked on several fusion energy experimental facilities, including Astron, 2XII-B, and the Mirror Fusion Test Facility, in the areas of magnetic field analysis and magnet design. He is currently in the reactor studies group investigating toroidal magnetic configurations for future tokamak experiments. **Robert B. Campbell** (top left) (PhD, nuclear engineering, University of Michigan, 1980) is on location at LLNL and is currently involved in the International Thermonuclear Experimental Reactor (ITER) tokamak design study effort. He is working in the areas of current drive and steady-state operation of ITER. His primary area of expertise is the numerical simulation of plasmas. **Max E. Fenstermacher** (second from top right) (BA, mathematics/physics, Kalamazoo College, 1978; MS, 1980, and PhD, 1983, nuclear engineering, University of Michigan) is currently a physicist in the MFE Division at LLNL supporting the microwave tokamak experiment. From 1983 to 1988, he was a plasma physicist in the energy development group of TRW, Inc., working at LLNL in tandem mirror reactor analysis. His research interests include plasma power balance, noninductive current drive for tokamaks, propagation and absorption of electromagnetic waves in hot plasmas, and tokamak plasma transport. **Joseph D. (J. D.) Lee** (second from top left) (BSEE, Duke University, 1961; MS, nuclear engineering, University of New Mexico) is a member of the mirror (fusion) reactor studies staff at LLNL. He started investigating the potential of fusion/fission in 1969 and is one of its principal spokesmen. He joined LLNL full time in 1966 and has been involved in LLNL's fusion program since 1968. **B. Grant Logan** (third from top right) (BS, physics, New Mexico State University; MS, nuclear engineering, University of California-Berkeley; PhD, engineering science, University of California-Berkeley) is a deputy associate director and the program leader for the fusion reactor technology and conceptual design program in the MFE Division at LLNL. His main interests are the design of magnetic fusion systems, including experiments, engineering test reactors, and advanced commercial power reactors. **John R. Miller** (third from top left) (BS, 1966, and MS, 1978, physics, East Tennessee State University; PhD, physics, University of Virginia, 1973) is a leader of the superconducting magnet development group in the Beam and Fusion Engineering Division at LLNL, where he participates in the development of extremely high field magnets for the Mirror Fusion Program. He is also a leader of the magnet design unit for ITER. His major interests are in the fields of superconductivity and cryogenics. **Louis L. Reginato** (fourth from top right) (BSEE, Santa Clara University, 1960; MSEE, University of California-Berkeley, 1962) is a special projects engineer at LLNL working on negative ion source development with the MFE group at Lawrence Berkeley Laboratory (LBL), on kicker magnet development with the power conversion group at Stanford Linear Accelerator, and on kickers and all pulsed magnets for the Superconducting Super Collider. **R. A. Krakowski** (bottom left) (BS, chemical engineering, Ohio State University; PhD, nuclear engineering, University of California, 1967), after working on nuclear material problems at the Euratom Center of Research in Ispra, Italy, and teaching nuclear engineering at Ohio State University, joined Los Alamos National Laboratory (LANL) in 1972 to work on materials problems associated with space nuclear power. He currently heads a magnetic fusion systems study group at LANL responsible for alternative fusion concepts. **Ronald L. Miller** (bottom right) (BS, physics, University of

*James J. Yugo
Joel H. Fink
Yousry Gohar*



Illinois-Urbana, 1971; MS, 1973, and PhD, 1979, nuclear engineering, University of Illinois-Urbana) is a staff member in the plasma theory, computing, and systems studies group of the Controlled Thermonuclear Research Division at LANL. His research interests include magnetic fusion reactor design, integration, and economics, and he recently participated in the multi-institutional TITAN reversed-field pinch and ARIES tokamak reactor studies. **Oscar A. Anderson** (top right) (BS, Stanford University, 1949; PhD, University of California-Berkeley, 1969) is a staff physicist in the Accelerator and Fusion Energy Division at LBL. His main professional interest is plasma physics. He is also involved with a number of problems in the MFE neutral beam program. His main professional interest is plasma physics. A biography and photograph for **W. S. Cooper** were not available at publication time. **Joel H. Schultz** (top left) (EE, MIT) is an associate leader of the advanced reactor concepts group at the MIT Plasma Fusion Center. His technical interests are the design and analysis of superconducting magnets and tokamak scenarios, including stresses, pulsed losses, magnet safety and protection, power supply and cryogenic refrigerator design, and interface with tokamak plasma physics design. **James J. Yugo** (center right) (BS, 1978, and MS, 1980, electrical engineering, University of Wisconsin-Madison) has worked at the Fusion Engineering Design Center at Oak Ridge National Laboratory (ORNL) since 1984. He primarily works on the design of the ion cyclotron resonance heating (ICRH) system for the Compact Ignition Tokamak at Princeton Plasma Physics Laboratory. Prior to joining ORNL, he worked at LLNL on the ICRH system for the Tandem Mirror Experiment and the electron cyclotron resonance heating system for the Mirror Fusion Test Facility. **Joel H. Fink** (bottom left) (BSEE, Polytechnic Institute of Brooklyn, 1943; MEE, Cornell University, 1963; PhD, plasma physics, Carnegie-Mellon University, 1969) is currently a consultant on negative ion/neutral beam technology at LBL. He has been involved with neutral beam system development for more than 10 years. **Yousry Gohar** (bottom right) (BS, 1967; MS, 1970; and PhD, 1974, nuclear engineering, Alexandria University, Egypt) is a member of the Fusion Power Program and Applied Physics Division at Argonne National Laboratory (ANL). He worked on many aspects of light water reactors, including core design, thermal hydraulics, operation, and maintenance, at the Atomic Energy Establishment of Egypt for 6 years. Before joining ANL, he spent 2 years at the University of Wisconsin working on fusion reactor designs. His research interests include fusion reactor technology, blanket, shield, design studies, nuclear data, and computational method development.



SOME PHYSICS CONSIDERATIONS OF MAGNETIC INERTIAL-ELECTROSTATIC CONFINEMENT: A NEW CONCEPT FOR SPHERICAL CONVERGING-FLOW FUSION

Robert W. Bussard

Robert W. Bussard (BS, 1950, and MS, 1952, engineering, University of California-Los Angeles; AM, 1959, and PhD, 1961, physics, Princeton University) has conducted research and development in chemical rockets and nuclear rocket propulsion, as well as high-altitude plasma physics and electro-optics research. He created and directed research studies of high-density compact tokamaks, which subsequently formed the basis of the Compact Ignition Tokamak program at Princeton University. He is currently a technical director at Energy/Matter Conversion Corporation and directs research on a novel inertial-electrostatic confinement concept for nuclear fusion.

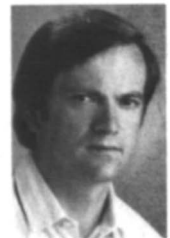


**IMPURITY CONCENTRATION LIMITS AND ACTIVATION IN
FUSION REACTOR STRUCTURAL MATERIALS***Massimo Zucchetti*

Massimo Zucchetti (degree, nuclear engineering, 1986, and PhD, energetics, 1990, Politecnico di Torino, Italy) is a researcher at Politecnico di Torino, where he works in the field of fusion reactor neutronics (breeding blankets) and neutron-induced radioactivity in fusion reactor materials

**²³³U PRODUCTION RATE MEASUREMENT IN A THORIUM
OXIDE ASSEMBLY AT THE LOTUS FACILITY***Pierre-Andre Haldy
Tejen Kumar Basu
Michel Schaer*

Pierre-Andre Haldy (top) [Diploma, nuclear physics, Technische Hochschule, Geneva, Switzerland, 1966; Diploma, physics, 1971, and PhD, physics, 1980, École Polytechnique Fédérale de Lausanne (EPFL), Switzerland] has been working mainly in the fields of neutron noise analysis and inertial confinement fusion. His current research interests are centered on theoretical and experimental studies on fusion-fission hybrids. **Tejen Kumar Basu** (center) (BS, physics, Kurukshetra University, India, 1969; Bhabha Atomic Research Centre 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 Institute for Reactor Development in Jülich, Federal Republic of Germany, from 1977 to 1978 in fusion blanket neutronics. His current interests include neutron transport calculations in micropellets and the experimental investigation of neutron multipliers. **Michel Schaer** (bottom) (electrical engineering ETS, École d'Ingénieur Lausanne, Switzerland, 1977) is participating in the LOTUS experimental research program. His current areas of interest include neutron spectrometry and activation analysis methods. He is responsible for the LOTUS experimental facility at the Institute de Génie Atomique-EPFL.

**COLD FUSION****COLD "FUSION": THE TRANSMISSION RESONANCE
MODEL FITS DATA ON EXCESS HEAT, PREDICTS OPTIMAL
TRIGGER POINTS, AND SUGGESTS NUCLEAR REACTION
SCENARIOS***Robert T. Bush*

Robert T. Bush (BS, physics, Michigan State University, 1959; MS, physics, University of California-Berkeley, 1961; PhD, physics, Northwestern University, 1971) is currently a professor



of physics at the California State Polytechnic University-Pomona, where he has taught and conducted research since 1971. His current interests include cold fusion theory and experimentation, plasma physics (relativistic beam-plasma source theory), philosophy of quantum mechanics, history of science, geophysics (seismology), and physics pedagogy.

DETECTION OF NEUTRONS IN ELECTROLYSIS OF HEAVY WATER

Tsutomu Sato (top right) (M. Eng., Tokyo Institute of Technology, Japan, 1990) studied the cold fusion phenomena while he was a graduate student at Tokyo Institute of Technology. He is currently employed by the Tokyo Electric Power Company. **Makoto Okamoto** (top left) (Dr. Eng., nuclear engineering, Tokyo Institute of Technology, Japan, 1966) has been a professor at the Research Laboratory for Nuclear Reactors at Tokyo Institute of Technology since 1974. His research work has been based on isotope effects on the chemical and physical behavior of matter. His recent interest is the behavior of hydrogen isotopes in their plasma states. **Poong Kim** (center right) (ME, metallurgical engineering, Kyoto University, Japan, 1982) is a graduate student in nuclear engineering at Tokyo Institute of Technology. He is studying metal/hydrogen plasma interactions in thermonuclear fusion. **Yasuhiko Fujii** (bottom left) (Dr. Eng., nuclear engineering, Tokyo Institute of Technology, Japan, 1973) is an associate professor at Tokyo Institute of Technology. His recent interest is the area of fusion chemistry. **Otohiko Aizawa** (bottom right) (PhD, nuclear engineering, Tokyo Institute of Technology, Japan, 1968) is a professor of nuclear reactor engineering at the Atomic Energy Research Laboratory at Musashi Institute of Technology. His interests are in neutron cross sections and neutron spectra measurements and in computer data analysis related to reactor physics.

*Tsutomu Sato
Makoto Okamoto
Poong Kim
Yasuhiko Fujii
Otohiko Aizawa*



DETERMINATION OF THE EXCESS ENERGY OBTAINED DURING THE ELECTROLYSIS OF HEAVY WATER

V. C. Noninski (top) (PhD, electrochemistry, Bulgarian Academy of Sciences, Bulgaria) is head of the Laboratory for Electrochemistry of Renewed Electrode-Solution Interface (LEP-GER). **C. I. Noninski** was a professor at the former State Sofia Polytechnic and later at the Higher Institute of Chemical Technology in Bulgaria until 1989. His interests include quantum theory, chemical kinetics, theory of solids and liquids, colloid chemistry, and electrochemistry.

*V. C. Noninski
C. I. Noninski*



DEUTERIUM FUSION THROUGH NONEQUILIBRIUM INDUCTION

P. H. Fang (PhD, Catholic University of America) has been affiliated with Boston College for 20 years. He previously worked with the National Bureau of Standards (now the National Institute of Standards and Technology) and with the National Aeronautics and Space Administration. His main contributions have been in the areas of applied mathematics and applied solid-state physics.

P. H. Fang



NEUTRON AND GAMMA-RAY EMISSION FROM PALLADIUM DEUTERIDE UNDER SUPERCRITICAL CONDITIONS

Jacob Jorne (BS, 1963, and MS, 1967, Technion-Israel Institute of Technology; PhD, chemical engineering, University of California-Berkeley, 1972) is a professor of chemical engineering at the University of Rochester. His research interests include electrochemical engineering, semiconductor processing, energy conversion and storage, and the theoretical biology of ecosystems.

Jacob Jorne



THERMAL, THERMOELECTRIC, AND CATHODE POISONING EFFECTS IN COLD FUSION EXPERIMENTS

R. G. Keesing (top right) (BSc, physics, University of London, England, 1961; PhD, atomic physics, University of London, England, 1965) is a lecturer in the Department of Physics at the University of York. His research interests include electron atom scattering, photoemission from metals and semiconductors, and resonance tunneling in metals and semiconductors. **R. C. Greenhow** (top left) (BA, 1959; MA and D. Phil., 1963, Oxford University, England) is a lecturer in the Physics Department at the University of York. His current research interests are in applications of lasers, using single-mode dye lasers in high-resolution spectroscopy in optical pumping. **M. D. Cohler** (bottom right) (BSc, physics, University of London, England, 1973; PhD, nuclear physics, University of London, England, 1977) is a lecturer at the University of York. His research interests include spin dependences in light-ion-induced nuclear reactions, heavy-ion-induced nuclear reactions, ultrarelativistic ion collisions, and the search for quark-gluon plasma. **A. J. McQuillan** (bottom left) (PhD, University of Otago, New Zealand) is a senior lecturer in the chemistry department at the University of Otago. He has used ultraviolet-visible absorption and electron paramagnetic resonance and Fourier transform infrared spectroscopies to study electrochemical reactions in aqueous and nonaqueous systems.

*R. G. Keesing
R. C. Greenhow
M. D. Cohler
A. J. McQuillan*



WINDOWS OF COLD NUCLEAR FUSION AND PULSED ELECTROLYSIS EXPERIMENTS

Akito Takahashi (top right) (BE, electrical engineering, 1963; MS, 1965, and PhD, 1974, nuclear engineering, Osaka University, Japan) is an associate professor at Osaka University, where he is the associate director of the Oktavian intense 14-MeV neutron source facility. He is currently working on fusion neutronics and cold fusion research. **Toshiyuki Iida** (top left) (PhD, nuclear engineering, Osaka University, Japan, 1978) is a senior scientist in the Department of Nuclear Engineering at Osaka University. He is currently working on fusion diagnostics. **Fujio Maekawa** (no photograph available) (ME, nuclear engineering, Osaka University, Japan, 1990) is currently working on fusion neutronics at the Fast Neutron Source facility at the Japan Atomic Energy Research Institute. **Hisashi Sugimoto** (bottom right) (BS, physics, Kyoto Industrial University, Japan, 1977) is a member of the Oktavian technical staff. **Shigeo Yoshida** (bottom left) (BE, nuclear engineering, Tokai University, Japan, 1984) is a member of the Oktavian technical staff.

*Akito Takahashi
Toshiyuki Iida
Fujio Maekawa
Hisashi Sugimoto
Shigeo Yoshida*



DETECTION OF HIGH TRITIUM ACTIVITY ON THE CENTRAL TITANIUM ELECTRODE OF A PLASMA FOCUS DEVICE

R. K. Rout (top right) [MSc, physics, Uktal University, India, 1984; Bhabha Atomic Research Centre Training School (BARCTS), India, 1985] has worked on plasma focus experiments, specializing in X-ray diagnostics. He is currently working on cold fusion studies, particularly tritium assay using X-ray measurements and autoradiography. **M. Srinivasan** (top left) (BSc, University of Madras, India, 1957; BARCTS, India, 1958; MSc, 1966, and DSc, 1984, University of Bombay, India) is head of the Neutron Physics Division of Bhabha Atomic Research Centre (BARC). His interests include zero-power reactor noise analysis, reactor kinetics and safety, nuclear criticality physics, the neutronics of fusion reactor blankets, and cold fusion. **A. Shyam** (bottom right) (MSc, physics, University of Delhi, India, 1975; BARCTS, India, 1976; PhD, University of Bombay, India, 1980) is involved in the study of various configurations of Z pinches and is currently responsible for the design and construction of a 500-kJ capacitor bank facility for plasma experiments. **V. Chitra** (bottom left) (BARCTS, India, 1976; MSc, physics, American College, India, 1987) is a member of the fusion research group at BARC, where she has been working on Z pinches and plasma focus.

*R. K. Rout
M. Srinivasan
A. Shyam
V. Chitra*

