



## AUTHORS — OCTOBER 1985

### A TRIBUTE TO KARL WIRTZ

#### FISSION REACTORS

#### A HELIUM-COOLED, POLOIDAL BLANKET WITH CERAMIC BREEDER AND BERYLLIUM MULTIPLIER FOR THE NEXT EUROPEAN TORUS

**Mario Dalle Donne** (top) (PhD, engineering science, Bologna University, Italy, 1956) worked from 1956 to 1959 at Agip Nucleare, Italy, and from 1959 to 1963 at the Dragon Project, England. Since 1963 he has worked in the Federal Republic of Germany (FRG) at the Kernforschungszentrum Karlsruhe (KfK) Institut für Neutronenphysik und Reaktortechnik (INR). Since 1976 he has been adjoint professor at Karlsruhe University. He has worked in the fields of gas-cooled, water, and liquid-metal-cooled fission reactors and of blankets for fusion reactors. His main technical interests are thermohydraulics, safety, and reactor assessment. **Ulrich Fischer** (center) (Dipl.-Physiker, Universität Karlsruhe, FRG, 1979) has worked at KfK INR since 1979. He is engaged in neutron physics and nuclear data, mainly in the field of the nuclear fuel cycle. At present his interests are focused on the neutronics of fusion reactor blankets. **Marko Küchle** (bottom) began working in Karl Wirtz' group at the Max-Planck Institut für Physik in Göttingen in 1954; he moved in 1958 to the newly founded Institut für Neutronenphysik und Reaktortechnik, KfK, directed by Professor Wirtz. Here he was active as group leader in thermal and fast reactor physics, nondestructive safeguard techniques, research reactors, and fast reactor safety experiments. His present engagement is primarily in fusion reactor blanket development.

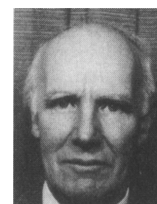
*Mario Dalle Donne  
Ulrich Fischer  
Marko Küchle*



#### ON THE DEVELOPMENT AND APPLICATION OF QUANTITATIVE METHODS IN NUCLEAR REACTOR REGULATION

**Leslie Cave** (top) (MSc, engineering, Oxford University, 1954) is an adjunct professor in the mechanical, aerospace and nuclear engineering department at the University of California, Los Angeles (UCLA). His research activities are probabilistic risk assessment (PRA) and fast and thermal reactor safety. **William E. Kastenber** (PhD, engineering, University of California,

*Leslie Cave  
William E. Kastenber*

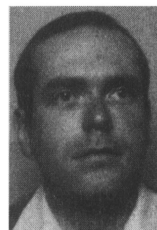


Berkeley, 1966) is professor of engineering and applied science in the mechanical, aerospace and nuclear engineering department at UCLA. His research activities include fast and thermal reactor safety, severe accident analysis, and PRA.

**BACCHUS-3D/SP, A COMPUTER PROGRAM TO DESCRIBE TRANSIENT THREE-DIMENSIONAL SINGLE PHASE FLOW IN LMFBR ROD BUNDLES**

**Maurizio Bottoni** (top right) (Dr. Eng., Bologna University, Italy, 1965) has been working at Kernforschungszentrum Karlsruhe (KfK) since 1974. He is currently responsible for the development and verification of computer programs applied for safety analysis of liquid-metal fast breeder reactors (LMFBRs). **Burkhardt Dorr** (top left) [Dipl.-Phys.-Eng., Physical-Technological Institute, Wedel, Federal Republic of Germany (FRG), 1966] has been mainly involved with the design and interpretation of sodium boiling experiments in partially blocked bundles of LMFBRs. **Christoph Homann** (bottom right) (Dr. rer. nat., Hannover University, FRG, 1977) has previously worked in the field of plasma physics. Since 1978 he has been involved in the numerical simulation of the thermohydraulic behavior of partially blocked LMFBR subassemblies at KfK. **Dankward Struwe** (bottom left) (Dr.-Ing., Karlsruhe University, FRG, 1977) joined KfK in 1967. He is head of the Reactor Dynamics Section of the Institut of Reactor Development.

*Maurizio Bottoni  
Burkhardt Dorr  
Christoph Homann  
Dankward Struwe*



**MEASUREMENTS AND CALCULATIONS OF REACTIVITY EFFECTS OF MATERIAL REARRANGEMENTS IN A PLUTONIUM-FUELED FAST REACTOR ROD LATTICE**

**Friedrich Helm** (top) [Dipl. Phys., University of Erlangen, Federal Republic of Germany (FRG), 1955; Dr. rer. nat., University of Würzburg, FRG, 1959] worked on experimental neutron physics at the Institut für Neutronenphysik und Reaktortechnik (INR) at Kernforschungszentrum Karlsruhe (KfK) in 1959-1960. From 1960 to 1967 he was a reactor physicist at Argonne National Laboratory. In 1967 he returned to Karlsruhe where he started to work at the fast critical facility SNEAK. Since 1970 he has been head of an experimental reactor physics group that became part of INR in 1975. **Georg Henneges** (Dipl. Phys., University of Mainz, FRG, 1974) joined KfK in 1975. He worked at INR in the field of fast breeder neutronics. His current interest is in simulation of liquid-metal fast breeder reactor core-disruptive accidents and their analysis.

*Friedrich Helm  
Georg Henneges*



**CONCEPTUAL DESIGN OF A (Pu,U)O<sub>2</sub> CORE WITH A TIGHT FUEL ROD LATTICE FOR AN ADVANCED PRESSURIZED LIGHT WATER REACTOR**

**Cornelis H. M. Broeders** (top) (Higher Technical School, Breda, 1962, and Technical University, Eindhoven, The Netherlands, 1968) is an electrical engineer with a special emphasis on nuclear engineering. He joined the Kernforschungszentrum Karlsruhe (KfK) Institut für Neutronenphysik und Reaktortechnik (INR) in 1969. He has been involved with the nuclear physics and design studies for the advanced pressurized water reactor since 1968. **Mario Dalle Donne** (PhD, engineering science, Bologna University, Italy, 1956) worked from 1956 to 1959 at Agip

*Cornelis H. M. Broeders  
Mario Dalle Donne*

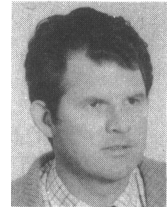


Nucleare, Italy, and from 1959 to 1963 at the Dragon Project, England. Since 1963 he has worked in the Federal Republic of Germany at the KfK INR. Since 1976 he has been adjoint professor at Karlsruhe University. He has worked in the fields of gas-cooled, water, and liquid-metal-cooled fission reactors and of blankets for fusion reactors. His main technical interests are thermohydraulics, safety, and reactor assessment.

### NEUTRON PHYSICS INVESTIGATIONS FOR ADVANCED PRESSURIZED WATER REACTORS

**Cornelis H. M. Broeders** (Higher Technical School, Breda, 1962, and Technical University, Eindhoven, The Netherlands, 1968) is an electrical engineer with a special emphasis on nuclear engineering. He joined the Kernforschungszentrum Karlsruhe Institut für Neutronenphysik und Reaktortechnik in 1969. He has been involved with the nuclear physics and design studies for the advanced pressurized water reactor since 1968.

*Cornelis H. M. Broeders*

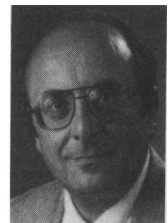


### CRITICAL HEAT FLUX CORRELATION FOR TRIANGULAR ARRAYS OF ROD BUNDLES WITH TIGHT LATTICES, INCLUDING THE SPIRAL SPACER EFFECT

**Mario Dalle Donne** (top) (PhD, engineering science, Bologna University, Italy, 1956) worked from 1956 to 1959 at Agip Nucleare, Italy, and from 1959 to 1963 at the Dragon Project, England. Since 1963 he has worked in the Federal Republic of Germany at the Kernforschungszentrum Karlsruhe (KfK) Institut für Neutronenphysik und Reaktortechnik. Since 1976 he has been adjoint professor at Karlsruhe University. He has worked in the fields of gas-cooled, water, and liquid-metal-cooled fission reactors and of blankets for fusion reactors. His main technical interests are thermohydraulics, safety, and reactor assessment.

**Walter Hame** studied mechanical engineering (thermo- and fluid dynamics) at the University of Karlsruhe, Federal Republic of Germany. He was an employee of KfK from 1974 through 1977. From 1978 through 1979 he was involved in the development of storage facilities in the nuclear industry and since 1980, in development of programs for thermo- and fluid dynamics applications.

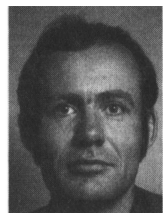
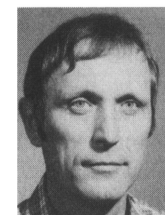
*Mario Dalle Donne  
Walter Hame*



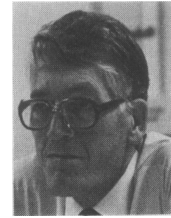
### A NEW IN-DEPTH TRAINING CONCEPT FOR NUCLEAR POWER PLANT OPERATORS

**Klaus Leinemann** (top) [Dipl., electrical engineering, Universität Hannover, Federal Republic of Germany (FRG), 1967; Dr.-Ing., mechanical engineering, Universität Karlsruhe, FRG, 1981] has developed digital electronics systems for nuclear instrumentation with Siemens AG and, since 1971, has been developing software systems for computer graphics, computer-aided drafting, remote handling, and man/machine cooperation at the Institute for Reactor Development (IRD) at Kernforschungszentrum Karlsruhe (KfK). **Rainer Meyder** (center) (Dipl., mechanical engineering, Universität Stuttgart, FRG, 1969; Dr., mechanical engineering, Universität Karlsruhe, FRG, 1974) has developed computer codes for fuel rod analysis under loss-of-coolant accident conditions at the IRD at KfK. **Horst Schnauder** (bottom) (Dipl., mechanical engineering, Fachhochschule Giessen-Friedberg, FRG; studied

*Klaus Leinemann  
Rainer Meyder  
Horst Schnauder  
Dieter Smidt*



nuclear engineering, 1964-1965) is working on reliability analyses at the IRD at KfK. **Dieter Smidt** (right) is director of the IRD at KfK and professor of nuclear engineering at Karlsruhe University. He served on the German Reactor Safety Commission for 16 years until 1983.



FUSION

**ANALYTICAL CORRELATIONS FOR RAYLEIGH-TAYLOR INSTABILITY GROWTH**

*Helmut Jacobs*

**Helmut Jacobs** [Dipl.-Phys., physics, University of Tübingen, Federal Republic of Germany (FRG), 1969; Dr.-Ing., University of Karlsruhe, FRG, 1975] works in the field of fast breeder reactor safety, especially on the analysis of thermal fuel/coolant interactions.

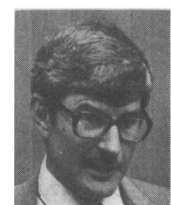
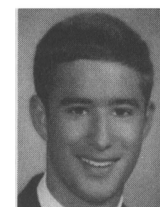
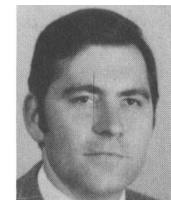


NUCLEAR SAFETY

**A STUDY OF FUEL REMOVAL VIA INNER BLANKET INTER-SUBASSEMBLY GAPS DURING THE DISRUPTION PHASE OF HYPOTHETICAL LOSS OF FLOW ACCIDENTS IN HETEROGENEOUS LMFBR CORES**

*Peter Royl  
Barry D. Ganapol  
Charles R. Bell*

**Peter Royl** (top) [masters degree, nuclear engineering, Technische Universität Berlin, Federal Republic of Germany (FRG), 1968; PhD, Universität Stuttgart, FRG, 1971] was a postdoctoral fellow at Argonne National Laboratory (ANL) from 1971 to 1973, participating in the development and application of the SAS3A code system. He has been at the Institut für Reaktorentwicklung, Kernforschungszentrum Karlsruhe, since 1973, responsible for code development and applications of analyses of hypothetical accidents in liquid-metal fast breeder reactors (LMFBRs). He was a consultant to Los Alamos National Laboratory's (LANL's) Energy Division in the summer of 1982 and is currently engaged in analysis of hypothetical core disruptive accidents in large LMFBRs with emphasis on thermal propagation after local faults. **Barry D. Ganapol** (center) (BS, mechanical engineering, University of California, Berkeley; MS, Columbia University; PhD, nuclear engineering science, University of California, Berkeley, 1971) has interests both in the theoretical and numerical aspects of particle transport theory as well as the engineering aspects of fast reactor safety. He has worked with reactor safety analysis groups at both ANL and LANL, and held visiting positions at the University of Bologna and Rome Air Development Center at Hanscom Field. Currently, he is an associate professor at the University of Arizona. **Charles R. Bell** (bottom) (BS, mechanical engineering, University of Cincinnati, 1965; PhD, nuclear engineering, Massachusetts Institute of Technology, 1970) worked at Atomics International from 1970 to 1975 assessing severe core-disruptive accidents in breeder reactors. He also led the effort to design, develop, test, and apply a systems analysis capability to investigate tube breaks in large sodium-water

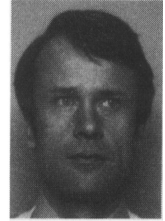


steam generators. At LANL, where he has been a staff member since 1975, he has been working to develop and apply advanced techniques for detailed assessment of severe breeder reactor accidents and has played a major role in establishing new perspectives on accident characteristics and in integrating these new perspectives into national and international research and development programs.

#### **AN EXPERIMENTAL INVESTIGATION OF FUEL EXPANSION DURING CORE DISRUPTIVE ACCIDENTS IN LIQUID-METAL FAST BREEDER REACTORS USING SIMULANT MATERIALS**

**Dirk Wilhelm** (top) [Dipl.-Ing., mechanical engineering, Technical University of Munich, Federal Republic of Germany (FRG), 1969] has been a research scientist since 1969 at the Institut für Neutronenphysik und Reaktortechnik (INR) at Kernforschungszentrum Karlsruhe where he completed his PhD under K. Wirtz in 1976. He has worked on safety studies for the gas- and sodium-cooled fast breeder reactors. He is presently interested in experiments to verify core disruption accident codes. **Leonhard Meyer** (Dipl.-Ing., mechanical engineering, Technical University Hannover, FRG, 1972; Dr.-Ing., mechanical engineering, Technical University of Karlsruhe, FRG, 1978) has worked at the INR since 1973 and completed his PhD thesis under K. Wirtz. He has been engaged in thermohydraulic experimental research for the gas-cooled and liquid-metal fast breeder reactors and is currently involved in work for the advanced pressurized water reactor.

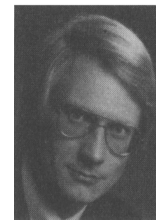
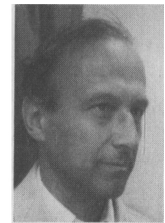
*Dirk Wilhelm  
Leonhard Meyer*



#### **THE ROLE OF VAPOR BUBBLE DYNAMICS DURING ENERGETIC POWER EXCURSIONS IN FAST REACTOR CORE DISRUPTIVE ACCIDENTS**

**Erhard A. Fischer** (top) [Diploma, physics, University of Munich, Federal Republic of Germany (FRG), 1956; PhD, nuclear engineering, University of Karlsruhe, 1969] has been a scientist at the Karlsruhe Nuclear Research Center (KfK) since 1964. His current professional interest is in the analysis of liquid-metal-cooled fast breeder reactor core disruptive accidents, including the safety-relevant neutronics. **Werner Maschek** (Diploma, physics, 1972; PhD, technical physics, Technical University Graz, Austria, 1974) has been a scientist at the Institute of Neutron Physics and Reactor Technology at KfK since 1974. He is currently a guest scientist at Los Alamos National Laboratory. His main interests are fast breeder reactor safety and neutron physics.

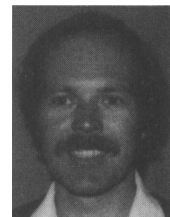
*Erhard A. Fischer  
Werner Maschek*



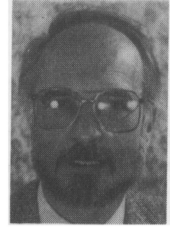
#### **IN-PILE OBSERVATIONS OF FUEL AND CLAD RELOCATION DURING LMFBR CORE DISRUPTIVE ACCIDENTS IN THE STAR EXPERIMENTS**

**Steven A. Wright** (right) (BS, electrical engineering, 1971; PhD, nuclear engineering, University of Washington, 1976) is a staff member at Sandia National Laboratories (SNL), Albuquerque, New Mexico. His technical interests are the fuel behavior and relocation aspects of hypothetical core disruptive accidents in fast breeder reactors. He has been at SNL since 1976. In 1974 he worked at the Kernforschungszentrum Karlsruhe (KfK) on his

*Steven A. Wright  
Gustav Schumacher  
Peter R. Henkel*



PhD thesis under the supervision of Karl Wirtz. **Gustav Schumacher** (top) [physics diplom, Martin Luther University, Halle, Federal Republic of Germany (FRG), 1957; Dr. Ing., University of Karlsruhe, 1970] is a staff member of the Institute for Neutron Physics and Reactor Technique of KfK, now delegated to SNL. He has been engaged in the investigation of thermal diffusion in nuclear fuels, a work that was initiated by Karl Wirtz. His current work is in high-temperature behavior of nuclear fuel during normal and accident conditions. **Peter R. Henkel** (bottom) (Dipl. phys., University of Heidelberg, FRG, 1981) has been employed at KfK since 1981. His current interests include clad motion dynamics during undetected loss-of-flow accidents in liquid-metal fast breeder reactors.



**ASSESSMENT OF THE RISK RESULTING FROM POSTULATED ACCIDENTS IN NUCLEAR POWER PLANTS: AN INTERIM REPORT ON ADVANCED STUDIES**

*Anton Bayer*

**Anton Bayer** (Dipl.-Phys., 1966; Dr.-Ing., 1971; and Dr. Ing. habil., University of Karlsruhe, Federal Republic of Germany, 1978) worked in the field of reactor physics until 1971 and then on the radiological impact of nuclear facilities and on risk analysis. He is a scientist at the Kernforschungszentrum Karlsruhe and a professor at the University of Karlsruhe.

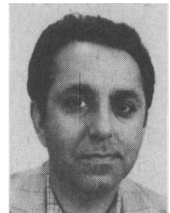


FUEL CYCLES

**THE POSSIBLE ROLE OF <sup>235</sup>U-Pu FUELED ADVANCED PRESSURIZED WATER REACTORS**

*Rakesh Chawla  
Walter Seifritz*

**Rakesh Chawla** (top) (PhD, nuclear power, Imperial College, University of London, 1970) worked at the U.K. Atomic Energy Establishment, Winfrith, and the Indian Institute of Technology, Kanpur, before joining the Swiss Federal Institute for Reactor Research (EIR) in 1978. He is currently responsible for the Institute's light-water high-converter reactor project, in the framework of which experiments are under way on reactor physics and thermal-hydraulics aspects. **Walter Seifritz** (Dr. Ing., nuclear technology, University of Hannover, Federal Republic of Germany, 1969) is head of the Physics Division at EIR and, since 1979, professor at the Technical University in Hannover. His varied research interests include general energy problems, and he is currently involved in the development of space heating reactors for small communities.



**NUCLEAR ENERGY FOR COAL AND STEEL**

*Rudolf Schulten*

**Rudolf Schulten** [Dipl.-Ing., physics and mathematics, University of Bonn, Federal Republic of Germany (FRG), 1950; Dr. rer. nat., Max-Planck Institute, FRG, 1953] is a professor of mechanical engineering and reactor technology at the Technical University of Aachen. Since 1964 he has also been director of the Institute for Reactor Development at the Nuclear Research Center, Jülich, where he was the manager of the high-temperature reactor (HTR) project from 1965 to 1970. He previously directed



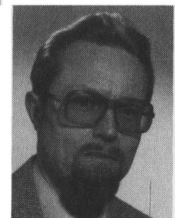
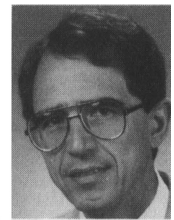
the planning work on the HTR at Brown Boveri and Company, where he was head of the Department of Reactor Development from 1956 to 1964. From 1969 to 1972, 1974 to 1976, and 1983 to the present, he has been chairman of the Scientific-Technical Council of the Nuclear Research Center, Jülich, and from 1983 to the present he has been vice-rector of the Technical University of Aachen.

## CHEMICAL PROCESSING

### ON THE DISSOLUTION OF (U,Pu)O<sub>2</sub> SOLID SOLUTIONS WITH DIFFERENT PLUTONIUM CONTENTS IN BOILING NITRIC ACID

**Dieter Vollath** (top right) (PhD, physics and materials science, Technical University of Vienna, 1965) has been on the staff at the Institute of Materials and Solid-State Research (IMSR) of the Karlsruhe Nuclear Research Center, Federal Republic of Germany (FRG) since 1968. He is presently head of the Department of Ceramics. Since 1975, he has also taught ceramic sciences at the Technical University of Vienna. His main areas of interest are production and characterization of ceramics, especially nuclear fuel and fusion breeder ceramics. **Horst Wedemeyer** (top left) (Dr. rer. nat., Technical University at Clausthal-Zellerfeld, FRG, 1965) has worked as a research staff member at the IMSR since 1965. His work involves the fabrication of nuclear fuels within the liquid-metal fast breeder reactor (LMFBR) development program. More recently, his main area of interest is fabrication of ceramic materials, especially fusion breeder ceramics. **Helmut Elbel** (bottom right) (Diplomphysiker, Philipps University, Marburg, FRG, 1966) has worked as a research staff member at the IMSR since 1970. He is involved in the program for LMFBR fuel pin development. His current interest is in the area of fuel materials development, with emphasis on characterization and quality control. **Elmar Günther** (bottom left) (Diplom-Ing., Fachhochschule of Isny, FRG, 1967) has worked as a research staff member at the IMSR since 1968. He is involved in the program for LMFBR fuel pin development. His current interests are in the areas of production and characterization of nuclear fuel ceramics and fusion breeder ceramics.

*Dieter Vollath  
Horst Wedemeyer  
Helmut Elbel  
Elmar Günther*

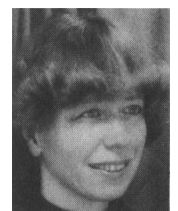


## NUCLEAR FUELS

### MODELING CHANGES IN THE FISSION GAS BEHAVIOR CODE LAKU BASED ON RECENT ANALYSIS OF EXPERIMENTS

**L. Väth** (right) [Dipl.-Phys., Universität Hamburg, Federal Republic of Germany (FRG), 1963; Dr. Ing., mechanical engineering, Technische Universität Karlsruhe, FRG, 1968] joined the Karlsruhe Nuclear Research Center (KfK) in 1963 to work under Professor Wirtz, who was her tutor during her thesis research.

*L. Väth  
Erhard A. Fischer*



She has been working on burnup modeling, collision probability techniques, and reactor kinetics; her present field of interest is the modeling of gaseous and volatile fission product behavior. **Erhard A. Fischer** (right) (Diploma, physics, University of Munich, FRG, 1956; PhD, nuclear engineering, University of Karlsruhe, FRG, 1969) has been a scientist at the KfK since 1964. His current professional interest is in the analysis of liquid-metal fast breeder reactor core disruptive accidents, including the safety-relevant neutronics.

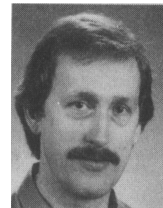


## ECONOMICS

### ANALYSIS OF THE MACRO- AND MICROECONOMIC ASPECTS OF ADVANCED PRESSURIZED WATER REACTORS

*Peter Klumpp*

**Peter Klumpp** (diploma in economics, Technical University of Karlsruhe, Federal Republic of Germany, 1979) worked for two years at the Technical University of Karlsruhe. Since 1981 he has worked at Kernforschungszentrum Karlsruhe in the field of systems analysis of energy problems. His main interests are modeling and the use of models to support decision makers.

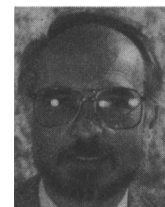


## MATERIALS

### DELAY OF THE ATTACK OF LIQUID STEEL ON NIOBIUM BY A MULTILAYER COATING

*Volker Heinzl  
Rolf Huber  
I. Schub  
Gustav Schumacher*

**Volker Heinzl** (top right) [Dipl.-Ing., mechanical engineer, 1969; Dr.-Ing., University of Karlsruhe, Federal Republic of Germany (FRG), 1974] was a researcher and teacher on nuclear reactor technique at the Institute of Physical Basics at Karlsruhe University from 1969 to 1979. In 1979 he moved to the Institute for Reactor Technique at the university and the Institute for Reactor Development at the Nuclear Research Center in Karlsruhe. He worked on the layout and design of research reactors and related problems, from which arose his inquiry into the development of refractories as containers for molten core materials. The experience with boiling heat transfer led recently to the development of solar collectors for process steam production with internal evaporation. **Rolf Huber** (top left), a technician at the Institute for Neutron Physics and Reactor Technology, has been active since 1966 in the area of high-temperature technology related to reactor safety and material property research. **I. Schub** (bottom right), chemotechnician, joined the Karlsruhe Nuclear Research Center (KfK) in 1979 and has worked since 1980 at the Institute of Neutron Physics and Reactor Engineering on metallurgical research for reactor safety studies. **Gustav Schumacher** (bottom left) (physics diplom, Martin Luther University, Halle, FRG, 1957; Dr. Ing., University of Karlsruhe, FRG, 1970) is a staff member of the Institut for Neutron Physics and Reactor Technique of KfK, now delegated to Sandia National Laboratories. He has been engaged in the investigation





of thermal diffusion in nuclear fuels, a work that was initiated by Karl Wirtz. His current work is in high-temperature behavior of nuclear fuel during normal and accident conditions.

### THE $(n,2n)$ AND $(n,3n)$ REACTIONS OF LEAD, A POTENTIAL NEUTRON AMPLIFIER FOR FUSION BLANKETS

**Samuel Carmona** (top) (MS, nuclear engineering; doctoral candidate in the nuclear engineering department, Ben-Gurion University, Beer-Sheva, Israel) is currently a member of the scientific staff at Soreq Nuclear Research Centre. His current research interest and thesis topic are new concepts for nuclear power stations. **Shimon Yiftah** is a research professor at Soreq Nuclear Research Centre and in the Department of Nuclear Engineering of Technion, Israel Institute of Technology. He is a member of the editorial advisory board of *Nuclear Technology*. His current interests are in nuclear science and engineering, nuclear power stations, science and technology policy, and include technological innovation and technology transfer.

*Samuel Carmona*  
*Shimon Yiftah*

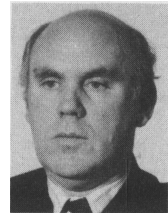


RADIOISOTOPES  
AND ISOTOPES

### A REVIEW ON IMPROVEMENTS OF EVALUATED MINOR TRANSACTINIUM ISOTOPE NEUTRON DATA, THEIR QUALIFICATION BY INTEGRAL EXPERIMENTS, AND REMAINING DATA REQUIREMENTS

**H. Küsters** is head of the Department of Reactor Physics at the Institut für Neutronenphysik und Reaktortechnik, Karlsruhe, Federal Republic of Germany (FRG), where he also serves as deputy chairman of the Advisory Board. He has represented FRG on the Nuclear Energy Agency Committee on Reactor Physics and the Committee on Data Bank Management. His current research interests are nuclear science and engineering in advanced fission reactors and in fusion reactor development.

*H. Küsters*



HEAT TRANSFER  
AND FLUID FLOW

### AN EFFICIENT METHOD TO IMPROVE FLOW REPRESENTATION ACROSS ABRUPT CHANGES OF CROSS-SECTIONAL AREAS

**Philipp Schmuck** (top) (Dipl.-Ing., 1965, and Dr. techn., 1969, engineering physics, Technical University of Vienna, Austria) has worked as a senior scientist in the safety analysis of fast breeder reactors since 1972 when he joined Kernforschungszentrum Karlsruhe. His earlier work at the Austrian Research Center for Atomic Energy and at the University of Tübingen, Federal Republic of Germany, concentrated on computational solid-state physics. Currently, his technical interests are in the theoretical descriptions of safety-related aspects of multiphase flows and in the application, verification, and further development of the SIMMER accident analysis code.

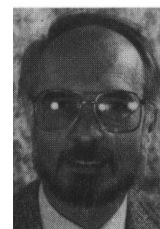
*Philipp Schmuck*



## IN-PILE DETERMINATION OF FUEL DISRUPTION MECHANISMS UNDER LMFBR LOSS-OF-FLOW ACCIDENT CONDITIONS

**Steven A. Wright** (top right) (BS, electrical engineering, 1971; PhD, nuclear engineering, University of Washington, 1976) is a staff member at Sandia National Laboratories (SNL), Albuquerque, New Mexico. His technical interests are the fuel behavior and relocation aspects of hypothetical core disruptive accidents in fast breeder reactors. He has been at SNL since 1976. In 1974 he worked at the Kernforschungszentrum Karlsruhe (KfK) on his PhD thesis under the supervision of Karl Wirtz. **Erhard A. Fischer** (top left) [Diploma, physics, University of Munich, Federal Republic of Germany (FRG), 1956; PhD, nuclear engineering, University of Karlsruhe, FRG, 1969] has been a scientist at KfK since 1964. His current professional interest is in the analysis of liquid-metal-cooled fast breeder reactor core disruptive accidents, including the safety-relevant neutronics. **Peter K. Mast** (bottom right) (PhD, nuclear engineering, University of Illinois, Urbana, 1979) is manager of the Engineering Sciences Division at Science Applications International Corporation in Albuquerque, New Mexico. His work has included the computational modeling and analysis of nuclear reactor accident phenomenology, especially in the areas of coolant thermal hydraulics, fuel pin thermomechanical response, fission product behavior, and molten corium relocation and freezing. His current efforts are in the modeling of light water reactor fuel rod response during severe accidents. **Gustav Schumacher** (bottom left) (physics diplom, Martin Luther University, Halle, FRG, 1957; Dr. Ing., University of Karlsruhe, FRG, 1970) is a staff member of the Institute for Neutron Physics and Reactor Technique of KfK, now delegated to SNL. He has been engaged in the investigation of thermal diffusion in nuclear fuels, a work that was initiated by Karl Wirtz. His current work is in high-temperature behavior of nuclear fuel during normal and accident conditions.

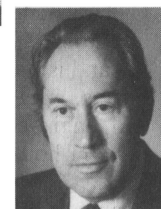
*Steven A. Wright  
Erhard A. Fischer  
Peter K. Mast  
Gustav Schumacher*



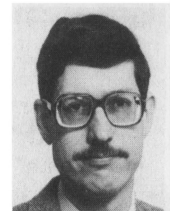
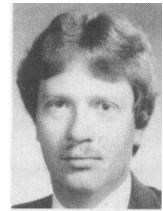
## NEUTRON REACTION RATE MEASUREMENTS AS TESTS OF DIFFUSION CALCULATIONS IN A FAST BREEDER BLANKET FACILITY

**Franklyn M. Clikeman** (top) (BS, engineering physics, Montana State University, 1955; PhD, nuclear physics, Iowa State University, 1962) has been professor of nuclear engineering at Purdue University since 1970; he is also director of Nuclear Engineering Radiation Laboratories, including the Fast Breeder Blanket Facility (FBBF). From 1963 to 1970, he was at the Massachusetts Institute of Technology, where he was associated with the Heavy Water Lattice Project and the Rockefeller Van de Graaff Generator Project working in the areas of reactor physics and inelastic cross-section measurements. He helped design the FBBF at Purdue and has directed the experimental research using the facility. Present research interests include experimental reactor physics, fast reactors, and nuclear instrumentation. **Sai-Chi Mo** (center) (BS, nuclear engineering, London University, 1981) is currently a PhD candidate in the School of Nuclear Engineering at Purdue University, where he is engaged in the theoretical analysis of FBBF experiments. **Karl O. Ott** (bottom) [BS, physics,

*Franklyn M. Clikeman  
Sai-Chi Mo  
Karl O. Ott  
Gary Alan Harms  
H. P. Chou  
R. H. Johnson*



J. W. von Goethe Universität, Frankfurt, Federal Republic of Germany (FRG), 1949; MS, 1953, and PhD, 1958, theoretical physics, Georg August Universität, Göttingen, FRG] has been a professor of nuclear engineering at Purdue University since 1967. From 1958 to 1967, he was staff scientist and later head of the Theoretical Section in the Institute for Neutron Physics and Reactor Technology at the Kernforschungszentrum Karlsruhe working in areas of method development for neutronics and dynamics calculations and the planning of experiments (e.g., SEFOR transients). At Purdue University he originated the FBBF and is responsible primarily for the areas of calculations and analysis of experiments within the FBBF project. Present research interests include fast reactor physics safety, fuel cycle, and design. **Gary Alan Harms** (top) [BS, mineral engineering (physics), Colorado School of Mines, 1976; MS, 1981, and PhD, 1983, nuclear engineering, Purdue University] joined the staff of Sandia National Laboratories (SNL) in 1983 in the Department of Reactor Development and Applications. Since joining SNL, he has worked on fast burst reactor design, nuclear criticality safety, and radiation effects experiments. **H. P. Chou** (center) (PhD, nuclear engineering, Purdue University, 1981) has been an associate professor in the Department of Nuclear Engineering, National Tsing Hua University, Taiwan, since 1982. Prior to this he worked as an instrumentation engineer at Argonne National Laboratory. His current activities are in the areas of light water reactor transient analysis with an emphasis on reactivity faults as well as nuclear instruments. **R. H. Johnson** (bottom) (BS, engineering physics, University of Illinois, 1971; MS, 1972, and PhD, 1975, nuclear engineering, University of Illinois at Urbana-Champaign) is a group training supervisor in the production training department of Commonwealth Edison Company. He was an assistant professor in the School of Nuclear Engineering at Purdue University from 1975 to 1981. His activities have included neutron spectroscopy, fission rate measurements, analysis of integral experiments, and the training of operations, engineering, quality control, and quality assurance personnel.



## TECHNIQUES

### THE CABRI FAST NEUTRON HODOSCOPE

**K. Baumung** (top) [MS, physics, and Dr.-Ing., mechanical engineering, Technical University of Karlsruhe (TUK), Federal Republic of Germany (FRG)] has been head of the CABRI fast neutron hodoscope project since 1981. He previously worked at the Institut für Neutronenphysik und Reaktortechnik (INR) at Kernforschungszentrum Karlsruhe when K. Wirtz was its director. He has worked in the areas of fast reactor physics, nuclear materials properties, and nuclear safeguards. **K. Böhnel** (center) (MS, physics, Technical University of Munich, FRG; Dr.-Ing., mechanical engineering, TUK, FRG) worked on the design of the CABRI hodoscope. He was head of the hodoscope team at Cadarache for four years during its installation, testing, and first operation. He began his career at INR when K. Wirtz was director and is presently working on experiments with high-energy ion beams. **H. Bluhm** (bottom) (MS, physics, and Dr.-Ing., mechanical engineering, TUK, FRG) worked on the design of the CABRI hodoscope. He worked at INR when K. Wirtz was director and is presently working on experiments with high-energy ion beams.

*K. Baumung  
K. Böhnel  
H. Bluhm*

