The lectures covered the important applications of symmetry in nuclear structure and ranged from the somewhat abstractly theoretical discussion of the statistical aspects of nuclear levels to a lucid review of nuclear probing by electron scattering experiments. There is an account of the basic topics in nuclear structure: infinite nuclear matter, independent particle model, optical model, Hartree-Fock potential, effective interactions, symmetry properties of the shell model, isolation of spurious center of mass excitations, and rotational levels. The isospin symmetry in nuclei is broken by electromagnetic forces and the neutron-proton mass difference arising out of the *d* quark being heavier than the *u* quark. Weak interactions violate parity or left-right symmetry. It is pointed out that among the experimental consequences of these symmetry-breaking interactions are the isospin-mixed doublets and parity-mixed doublets in light nuclei. The lectures on the microscopic basis of collective symmetries deal with the conservation of seniority as an SU(2) symmetry and its application to the study of the level structure of closed shell lead isotopes under the assumption of pairing interaction. Spectrum functions, ensembles of many dimensional random matrices, and the central limit theorem form the subject matter of another lecture that deals with the statistical analysis of the energy levels of complex nuclei, the foundations of which were laid by Bethe, Wigner, Dyson, and Mehta. The predominantly experimental presentation reviews the measurement of the ground state charge density of a lead nucleus by means of high-energy electron scattering, which is theoretically analyzed using direct Fourier transform techniques and density-dependent Hartree-Fock wave functions.

Readers concerned with elementary particle studies will find it interesting to go through the discussion of electroweak interactions, parity nonconservation in nuclei, neutrino oscillations, and delta dynamics. These talks, which cover theoretical as well as experimental research, include the development of semileptonic "charge-changing" weak interactions as well as neutral current interactions, electro-weak unification, neutrino mass oscillations conjectured by cosmological missing mass problems, solar neutrinos and double beta decay, and the GUT theory. The book ends on a rather facetious note with a proposed parity nonconservation experiment in muonic helium atoms, "a difficult experiment which may succeed if several unknown factors are favorable."

The lectures were presented by experts in the respective fields who very often updated their discussions by referring to recent work. As remarked in the Foreword, the talks aimed at reaching graduate students as well as advanced researchers, although there are some discussions that may be somewhat strange to the uninitiated. In spite of one of its proponents being a lecturing participant in the summer school, the interacting boson models are barely touched and supersymmetries based on U(6/4) etc., and quark degrees of freedom are left out. This notwithstanding, the book is not only useful but also enjoyable with occasional relaxing expressions like "Goldstone Cannibalism" and "idiot-model"! Finally, because of its being such a dynamic and rapidly changing field, a few may be tempted to view opinions like the top quark not yet discovered or the existence of neutrino oscillations as rather old-fashioned.

Dr. N. V. V. J. Swamy is a professor of physics at Oklahoma State University in Stillwater, Oklahoma. He is the author of a book and several publications relating to nuclear structure, nuclear fission, relativistic quantum mechanics, symmetry and group theory, astrophysics, and plasma wave dispersion relations. In 1975, he spent his sabbatical at the Plasma Physics Institute of Kernforschungsanlage in the Federal Republic of Germany, where the dominant theoretical activity was the study of radio-frequency heating of tokamak plasmas, and later at Cambridge University in England. Because of the levitation experiments that seem to establish the existence of fractionally charged particles (quarks) and the contention of particle physicists that the existence of quantized charges implies the existence of magnetic charges, his current research interests include the investigation of consequences in plasma physics of the existence of such charges, besides nuclear fusion.

Advances in Two-Phase Flow and Heat Transfer, Vols. 1 and 2

Editors	S. Kakac and M. Ishii
Publisher	Martinus Nijhoff Publishers, Boston, Massachusetts (1983)
Pages	920
Price	$125.00
Reviewers	R. K. Chohan and Belle R. Upadhyaya

The importance of two-phase flow to nuclear technology does not require emphasizing. Most of the early monographs on the subject, such as those by Tong,[1] Hewitt and Hall-Taylor,[2] and Collier,[3] were written by authors connected with the nuclear industry. The same remark seems to apply to the papers presented in this two-volume work. Certainly most of the papers deal with problems, either directly or indirectly, related to nuclear reactor systems.

A great deal of two-phase flow and heat transfer research has been motivated by safety analysis of nuclear reactors and, recently, severe accident analysis. Factors that have contributed to the increased complexity are (a) difficulties in describing two-phase flow (due to, for example, different flow patterns), (b) complex geometries, (c) heat transfer, and (d) the coupling of heat, mass, and momentum transfer. Two-phase modeling has seen considerable development in recent years and Ishii and Kocamustafaogullari discuss these and their limitations in the first chapter. As they point out, interfaces between the phases characterize such flows, and the quantification of transport phenomena across them present a great (and unsolved) problem.

The first article is followed by four papers on modeling: a system mean void fraction model, a two-fluid model, critical flow modeling, and shock wave analysis. The first accounts for evaporating and condensing flows under transient conditions. The second deals with linearized and coordinate frame invariant constitutive equations for two-phase mixtures. Critical flow, which finds relevance in pipe breakage, is dealt with in the third. It is pointed out that, unlike single-phase critical flows, the rate of vapor formation is an important parameter. The fourth paper involves two-component, two-phase flow. Though conditions considered

in this paper may not be obtained in reactor situations (i.e., no heat transfer and phase change), it may assist in understanding more complex situations.

The next four papers deal with transport phenomena in two-phase flow with a continuous interface: annular and stratified flows. Interfacial transfer of mass, momentum, and energy appears as largely unknown parameters in a two-fluid model. Ishii and Kataoka deal with annular dispersed flow. In such flow, entrained droplets considerably transform the transport phenomena involved from the corresponding droplet-free annular flows. This, of course, introduces additional variables: entrainment and deposition rates, droplet volumetric concentration, droplet size and size distribution, and drag coefficient for dispersed flow. Correlations and comparisons with experimental data are presented. Yuen, in the subsequent paper, discusses interfacial shear stresses. Its continuity in the presence of surface waves is of interest. Measurements of Reynolds stress were carried out using laser-Doppler anemometry (LDA). The following paper also discusses interfacial shear stress and results of LDA measurements are presented. The authors point out the importance of secondary flow in liquid and gas flow. Moalem-Maron, Brauner, and Sideman discuss waves on thin film on inclined surfaces.

Rohsenow's contribution focuses on forced convection film boiling. The author considers empirical correlations and phenomenological models for predicting wall temperatures and heat flux. Prediction of heat flux is important in the safety analysis of reactors. Groeneveld and Rousseau present an assessment and recommendations for critical heat flux (CHF) and post-CHF heat transfer. Since most correlations tend to be based on the simplest geometry, namely, a heated tube, it is wise to look at extrapolation of such correlations to other geometries. The authors suggest geometric factors to account for tube bundles, rod-spacing devices, and flow orientation. An aspect of forced convective boiling, postcritical flux heat transfer is encountered in reactors and steam generators. Chen discusses pertinent questions in such situations, namely, existence of thermodynamic nonequilibrium, vapor temperature prediction using vapor-heat transfer correlations, transient liquid (droplet) contact with a superheated wall. Chen rightly points out the lack of experimental data.

Two of the rest of the papers in Vol. 1 are review articles. These deal with boiling heat transfer in binary liquid mixtures and two-phase mass flow rate instrumentation. Among other aspects, the first looks at bubble growth rates in various binary mixtures. The second addresses the developments in two-phase mass flow rate measurement. A number of instruments described are under development, such as reconstruction tomography for void fraction measurements. Flow measurement in single-phase flows is not easy but the problems are amplified in two-phase flows.

Reactor safety had motivated many efforts to investigate flooding, various kinds of instabilities and oscillations in two-phase flows, and critical flows. Most of the contributions in Vol. 2 deal with these topics together with chapters on boiling heat transfer and condenser reboiler design. Two of these are on critical flow. The first deals with the prediction of critical two-phase flow based on a separated two-fluid model. The criterion for critical flow uses the maximization of entropy as the base for its prediction. The second paper deals with forces exerted by fluids flowing out of a pipe break.

Flooding can constrain flows in the emergency core cooling system of pressurized water reactors and also affect the behavior of molten fuel pin cladding. The richness of two-phase flow processes allows for a number of definitions of flooding. These are presented by Ragland and Ganic, who also examine published results. As in many other engineering disciplines, modeling aids prediction. Bankoff and Lee provide a comparison of flooding models for both air/water and steam/water flows.

Of the papers on unsteady flows, one is a review article by Kakac and Veziroglu on two-phase flow instabilities. This covers both experimental and theoretical efforts. The models are based on the homogeneous model and the drift-flux model.

An interesting article by Duffey and Merilo discusses aids to reactor accident management. The importance of operator aids is emphasized since the accident at Three Mile Island Unit 2. They discuss the various cooling mechanisms so that adequate core cooling is achieved. Various possible actions by the operators are also presented.

Overall, the quality of papers in these two volumes is high and they are very well written. The reader is expected to have some background in two-phase flow and heat transfer. These two volumes on two-phase flow and heat transfer should be valuable to researchers involved in thermal-hydraulic analysis of nuclear reactors and are highly recommended to all research libraries.

R. K. Chohan received his PhD degree in systems engineering from the City University, London, England, in 1983. He attended the Institute of Mathematics and Its Applications, United Kingdom, in 1972 and 1973. He was a research assistant in fluids engineering at the City University, London, from 1974 to 1978. During September 1978 and September/October 1982, Dr. Chohan was a visiting research scientist at the Institute of Physics, University of Trieste, Italy. He was a visiting research associate in the Department of Nuclear Engineering, University of Tennessee, Knoxville, from August 1983 to November 1984. He is currently with the Wolfson Department of Chemical Engineering, Technion, Israel Institute of Technology, Haifa. Dr. Chohan's research interests include modeling, simulation, fluids engineering and dynamics, control and instrumentation, biomedical engineering, and interdisciplinary approaches to design/analysis.

Belle R. Upadhyaya received his PhD degree in systems engineering from the University of California, San Diego, in 1975.

In 1972 he worked as a summer engineer at General Atomic Company, San Diego. Since 1975 he has been with the Department of Nuclear Engineering, University of Tennessee, Knoxville, where he is currently an associate professor. His work includes research and development in data processing and systems analysis applied to nuclear power reactors and sensor fault monitoring. He is a consultant to Oak Ridge National Laboratory.

Dr. Upadhyaya is a senior member of the Institute of Electrical and Electronics Engineers (IEEE) and a member of the American Nuclear Society (ANS). He is currently a member of the Books, Monographs and Handbooks Committee of the ANS and a liaison representative of the IEEE control systems society technical activities board on energy. Dr. Upadhyaya has published more than 50 articles in the areas of systems analysis, data processing, and applications to nuclear power systems.

REFERENCES

1. L. S. TONG, *Boiling Heat Transfer and Two-Phase Flow*, Robert E. Krieger Publishing Company (1975).

2. G. F. HEWITT and N. S. HALL-TAYLOR, *Annular Two-Phase Flow*, Pergamon Press (1970).

3. J. G. COLLIER, *Convective Boiling and Condensation*, McGraw-Hill Book Company, New York (1972).

The Search for Charm, Beauty, and Truth at High Energies

Editors G. Bellini and S. C. C. Ting

Publisher Plenum Press (1984)

Pages 585

Price $85.00

Reviewer Hugh F. Henry

These are the proceedings of a Europhysics Study Conference on High Energy Physics held November 15–22, 1981, in Erice, Sicily, Italy, with the purpose of having both a conference and a workshop for the several groups and individuals searching for "flavored" particles. The 73 individuals attending from 11 nations provided 43 separate presentations in the following general areas:

1. e^+e^-, photo- and hadroproduction
2. lifetime measurements, branching ratios, and cross sections
3. the use of bubble chambers and visual detectors
4. high-resolution vertex detectors
5. special triggers.

Included under these various topics are discussions of experimental methods, results, and equipment. In addition, some of the bases for theoretical investigations and predictions thereby made are noted. The papers are rather informally presented, in many cases appearing to be transcripts of a participant's talk; however, others are typical of an author's summary of his discussion, but none has the formality of a paper designed for journal publication. Unfortunately, none of the group discussion that would necessarily have followed each presentation at such a conference is provided.

Although this is most definitely a book for the specialist actively working in the field, someone in related efforts might find the information of interest and possibly of use. However, the novice could even have difficulty with the specialized lingo necessarily used. The tentative nature of much of the data available is clearly indicated in many of the articles; someday, such information may be "nailed down," but that is in the future. Probably the book's greatest weakness is its lack of a state-of-the-art summary for each of the major topics treated; a chairman's introductory statement does provide this type of information in a couple of cases. Although there is no index, and this might not be feasible, each presentation is accompanied by appropriate references. Overall, this appears to be one of those books so important to a field of investigation as it summarizes results and information to a given date, and its editors, along with those arranging the conference, are to be congratulated on a job well done. It should certainly find a place in a university library and in the personal collections of those interested in the developing field of high energy and its associated "particles."

Hugh F. Henry is emeritus professor of physics at DePauw University where he served as chairman of the department from 1961 until his retirement in 1981. From 1949 until 1961, he supervised the health physics and criticality control staff functions along with other safety-type activities for the Oak Ridge Gaseous Diffusion Plant. He has published a large number of articles in these fields and is the author of Fundamentals of Radiation Protection *published by John Wiley & Sons in 1969. Most recently, he has been a member of the Public Information Committee of the Health Physics Society and has been active in its Hoosier chapter.*

Before It's Too Late

Author B. L. Cohen

Publisher Plenum Press (1983)

Pages 292

Price $16.95

Reviewer Hugh F. Henry

This is one of three "must read" books for anyone who is interested in accurate information on actual radiation problems and why members of the general public seem unable to understand them. In his concern for the effect of this situation on nuclear plant construction and our overall energy picture, the author's stated purpose is " . . . for once, to get the viewpoint of the main-line scientific community across to the public" on this topic. Technically, he succeeds admirably, but his overall success will depend on the attention his efforts receive among the nation's opinion molders. His book's special value is in providing specific data of help in refuting the usually undocumented, generally false, and frequently wildly exaggerated "information" emanating from the various antinuke camps. He correctly identifies the strongly biased opinions and consequent activities of members of the news media, especially the "big media" (television networks, leading news magazines, and dominant newspapers of the New York–Washington axis), as being a major factor in this "disinformation" process. As is the case with most of us, he is puzzled by the reason for such media hostility, although he does observe it seems to reflect a politically liberal viewpoint which, as a self-identified liberal, he finds particularly difficult to understand. He does not note, however, that the antinuke position appears to be part of a more general anti-science syndrome, particularly "hard science," and that it frequently seems to manifest a Luddite mentality.

The author treats those specific items about which he has been most often asked in his frequent public appearances.