BOOK REVIEWS

Selection of books for review is based on the editors' opinions regarding possible reader interest and on the availability of the book to the editors. Occasional selections may include books on topics somewhat peripheral to the subject matter ordinarily considered acceptable.

Annual Review of Nuclear Science, Volume 22, 1972

Editor	Emilio Segre, University of California, Berkeley
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Reviewer	Varada P. T. (Hary) Charyulu

Volume 22 of the *Annual Review of Nuclear Science* consists of twelve chapters, with topics ranging from accelerators to applications in art and archaeology. Two chapters deal with high-energy physics and seven chapters are concerned with topics in nuclear structure and particle physics. In the present volume, only three articles are of an applied nature. Thus, no single reader will be equally interested in all of the articles, nor by the same token, will a single reviewer be able to make a competent evaluation of all of them.

Two chapters, "Colliding-Beam Accelerators" and "Evidence for Regge Poles and Hadron Collision Phenomena at High Energies," are directly related to high-energy physics. The one on accelerators presents a very critical analysis of problems and some solutions in achieving beams of particles of very high energies in the range of several hundred GeVs. The author, Pellegrini, not only does a good job of discussing the practical aspects involved in constructing such accelerators, but also stimulates the curiosity of laymen in the field, like myself, about the possibility of someday being able to know more about the nuclear forces via colliding beams of particles. The article about Regge poles is above the reach of an ordinary nuclear engineer. Unless one has an interest in meson physics, it would be difficult to plod through this material. But, in all fairness the author, Chiu, I must say that he has done a commendable job in explaining what Regge poles are. This article presents a critical evaluation of the various absorption models and suggests a strong central absorption prescription for high-energy two-body scattering. It also summarizes the high-energy two-body collision phenomena and correlates the successes and failures of the Regge pole model to the low impact behavior of the pole terms. It discusses rather well the evidence and properties of Regge trajectories from hadron spectra and from the data gathered from relevant scattering experiments. A nice review of the various models for high-energy scattering based on Regge poles, cuts, and absorptions is also of interest. In reading through the summary, which brings forth what is known quite clearly and what is yet to be known, one cannot but wonder if the words like "DAM" and "SCAP" are physicist's frustrations over not having clearly understood the phenomena of mesons. By far, this is the longest article in the entire volume.

Now leaving the field of cosmic physics and coming to more mundane nuclear physics, with which most nuclear engineers are expected to be familiar, we encounter seven articles. The article "Isospin Impurities in Nuclei" discusses rather lucidly and quite thoroughly the lack of symmetry in the wave functions associated with p-n, n-n, p-p interactions and the coulomb effects involved therein. Although the authors point out that the theory of isospin mixing has turned out to be somewhat elusive, reading through this article one can gain further understanding of nuclear structure and the charge dependence of nucleon interactions. The effect of extranuclear electrons on the decay process of radioactive isotopes has been examined in the article by Emery, "Perturbation of Nuclear Decay Rates." Referring to specific cases as well as to a variety of physical conditions, the author brings out very interesting speculations and possibilities. In particular, the speculation as to whether nuclear processes can be stimulated by the electronic structure of macromolecules, based on the observation of emission of electrons, protons, and deutrons by biological materials, is of significance. The article "Electromagnetic Transitions and Moments in Nuclei" deals with precisely those in the areas of the intermediate region, namely the cases of nuclei having low-lying states, some spherical, some deformed, and some mixtures of both. It is rather heavy on quantum mechanics and, as the authors say, "it appears that we are now at least approaching an understanding!"

There are three other articles

that attempt to probe into the nuclear structure and nuclear forces: "Deep Inelastic Electron Scattering," "Nuclear Level Densities," and "The Nucleon-Nucleon Effective Range Expansion Parameters." All three articles try to bring out the balance between theories and experiments and hope that some of the unanswered questions may eventually be cleared up. These articles are only of academic interest to nuclear engineers. However, the topic discussed by Nix is probably of more direct interest to nuclear engineers, at least to reactor physicists, since it discusses the fission barriers in heavy and super heavy nuclei. If one has to give credit for the number of references cited, this would carry the first prize since it has by far the largest number of references cited (410). I would very strongly recommend to everyone that they read this article to see the progress that has been made in the past six years in our understanding of fission and other phenomena associated with nuclear shape changes. In these days of neglected support for scientific research, it is amusing to observe that there are still optimists in the field! Nix's reference to the speculation that in the coming years we will witness a shift in emphasis to studies involving nuclear fusion rather than fission and that "we are likely to make far more important discoveries than an island beyond the tip of a peninsula" is extremely optimistic. I hope somebody in Washington, D.C. takes note of this and channels appropriate efforts toward this rather enthusiastic as well as worthwhile suggestion.

Three articles are related to applications of nuclear science. The importance of ESR spectroscopy has been decidedly brought forth in Box's review of the subject, "Radiation Damage Mechanisms as Revealed Through Electron Spin Resonance Spectroscopy." I am sure that all of the nuclear community will be eagerly looking forward to the optimism expressed by this author in the hope that ESR spectroscopy may contribute significantly to the foundations of radiation biology. Let us hope that the mysteries of radiation biology will be solved one way or the other before too long. The article "Nuclear Applications in Art and Archaeology" is not only interesting but rather impressive. It is rather gratifying to note that nuclear science not only holds promise for the future but also unravels the secrets of the past as well. The subject of "Thermal Breeder Reactors" is of direct interest to nuclear engineers. The authors have made a convincing case for the thermal breeders. Although the thermal breeder reactor program, as suggested in this article, may be looked upon primarily as an insurance policy by the United States, it may be of significance to other nations that have not wholly committed themselves to the LMFBR program. In particular, I am thinking of nations such as India, Brazil, etc., where they have an abundance of thorium supplies; from their point of view it may be advantageous to get into the thermal breeder reactor program.

This volume, like all of its predecessors, measures up to the high standards. An additional feature of this series, which I like very much, is the cumulative index of both authors as well as chapter titles that have appeared in the previous volumes of this series. I am hoping that this feature will not be discontinued in the future. The editorial board, as well as the Annual Reviews, Inc., deserves very high praise in bringing a fund of knowledge, compiled by experts in the field, every year in a compact and easily accessible form. It has been a pleasure reviewing this book.

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The Chemistry of Fusion Technology

Editor	Dieter M. Gruen, Argonne National Laboratory
Publisher	Plenum Press
Pages	394
Price	$19.50
Reviewer	J. S. Watson

The Chemistry of Fusion Technology is a compilation of papers presented at the Symposium on the Role of Chemistry in the Development of Controlled Fusion during the American Chemical Society meeting held at Boston in April 1972. The appearance of the book at this time is opportune. Currently, there is much optimism in the fusion development community; and, at the same time, our society is becoming increasingly aware of the shortage of cheap, environmentally acceptable fuel and the concomitant need for new energy sources. Recent success in the magnetic confinement of plasma indicates that devices which produce, or are capable of producing, more electrical energy than they consume (i.e., they meet the Lawson criteria) may be available in less than a decade. Meanwhile, others are just as actively pursuing the development of inertially confined plasmas heated by powerful lasers. The likelihood of success in these programs appears to be high. However, demonstrations that plasmas can be heated to desired temperatures, with sufficient densities and residence times to release useful quantities of fusion energy, still do not mean that practical reactors will be available immediately. All reactor concepts currently under study will require the solution of major technological problems; many of these problems will remain to be solved after the Lawson criteria are met. Technological problems could be the deciding factor in determining which confinement method is eventually developed for use in commercial systems, assuming that more than one method can successfully meet the feasibility criteria. In the years that follow, many books and articles on the technological aspects of fusion are likely to be published.

This book contains articles cover-