principal focus of this book is the physics that arises in the presence of a coulomb field strong enough to cause polarization of the vacuum. Although the roots of this physical problem go back to the earliest days of relativistic quantum mechanics, it has only been in the last 15 years or so that it has been recognized as containing fascinating experimental ramifications as well as posing fundamental philosophical questions.

It has been shown in relativistic atomic theory that when an atom possesses a nuclear charge greater than 173 proton charges, the binding energy of the innermost electrons exceeds $2mc^2$. This is so great that the bound energy levels overlap the positron states proceeding downward from $-mc^2$. If the innermost electron shell (the K shell) is initially unoccupied, the end result is that two sets of electron-positron pairs are created from the vacuum, with the two electrons occupying the two degenerate ground states in the K shell and the two positrons being ejected. At first glance, this process seems unphysical. After all, the heaviest naturally occurring element has $Z = 92$, the heaviest man-made nucleus has $Z = 105$, and the theoretical predictions of "islands of stability" for superheavy nuclei have yet to be demonstrated in practice. However, there now exist particle accelerators capable of accelerating very heavy atomic ions. If, for example, two uranium atoms are collided at very high energies, a quasi molecule is formed that behaves briefly as a single center of coulomb attraction with an effective nuclear charge of $2 \times 92 = 184$. Furthermore, the process of creation of the quasi molecule has the effect of ionizing the innermost electrons from the colliding ions. These emitted inner-shell electrons are called delta rays. They are often quite energetic. The end result is that the quasi molecule is formed with K-shell vacancies available to be filled by electrons from the electron-positron pairs created out of the vacuum.

The physics just described has been very fruitful for both theoreticians and experimentalists and promises to be much more so in the future. For instance, with respect to theory, the volume under review contains a general survey by Müller, a treatment of positron creation in supercritical quasi molecules by Reinhardt et al., a study of ground-state electron ionization probabilities in heavy-ion collisions by Soff et al., and a discussion of continuum x-ray emission in heavy-ion collisions by Vincent. Experimental papers presented include results by Backe et al. on positrons from heavy-ion collisions, a report by Armbruster on characteristic x-ray production, a review of inner-electron excitation by Bosch, a report by Bokemeyer et al. on spontaneous positron production in heavy-ion collisions, and a discussion by Kozhuharov on delta-ray spectroscopy of quasi molecules.

There is much more in this book, however. The subject has been interpreted fairly broadly, although there is only one paper on intense-plane-wave electrodynamics, given by Mitter. For example, there is a paper on precise measurements and calculations in quantum electrodynamics, a report on radiative corrections in strong fields, papers on general methods for treating the Dirac equation, several papers each on Yang-Mills theory and on quantum chromodynamics, papers on particle condensates in strongly coupled fields, and so on.

Strong field electrodynamics is a relatively new area of endeavor in physics. It is rich in new insights and new understanding as well as in new difficulties. *Quantum Electrodynamics of Strong Fields* presents a fascinating sampling of the activity in this area.

Howard R. Reiss has been visiting research professor of physics in the University of Arizona since 1975, and professor of physics at the American University in Washington, D.C., since 1968. Prior to that, he headed the Nuclear Physics Division at the Naval Ordnance Laboratory. A substantial fraction of his published papers over the years have been related to intense fields and nonperturbative methods in electrodynamics, starting with his PhD dissertation at the University of Maryland.

Low Reynolds Number Flow Heat Exchangers

Editors	S. Kakac, R. K. Shah, and A. E. Bergles
Publisher	Hemisphere Publishing Corp., Washington, D.C. (1983)
Pages	1016
Price	$125.00
Reviewer	Thomas R. Rehm

This reference work is a collection of papers presented by the invited lecturers at the fourth NATO Advanced Study Institute on heat transfer held in Ankara, Turkey, July 13-24, 1981. As such the topics covered in these lectures represent the latest theoretical and empirical thinking associated with the evaluation, design, and operation of heat exchangers where at least one of the fluids is in the laminar, <2300 Reynolds number flow region.

The arrangement of topics in the book begins with a general description of the field based on classification and design methodology. Next, the situations in which forced convection is predominant are presented. Included are papers on fully developed channel flow, axial conduction Graetz problems, developing and transient flows, flow across or along tube bundles, and experimental techniques.

Subsequent sections focus on non-Newtonian flows, numerical analysis, heat transfer augmentation, compact heat exchangers, plate heat exchangers, fouling, and finally problems and prospects for the future in the field of low Reynolds number flow heat exchangers.

From this list of topics, it can be seen that the material would be of primary interest to those nuclear scientists and engineers involved with heat transfer in reactor cores.

Although the book is made from photo-offsets of the original typed papers, it reads well and, in my estimation, contains a thorough and comprehensive presentation of the state of the art in its field. A rigorous attention to and understanding of the book's contents would put a reader well on the road to being an expert in the field.

Thomas R. Rehm, professor of chemical engineering at the University of Arizona, Tucson, Arizona, taught chemical engineering from 1960 to 1966 at the University of Denver and at the University of Arizona since 1966. His teaching areas are in the plant and equipment design, mass transfer, and material and energy balance fields. He has also spent 20 years in the supervision of research and teaching laboratory operations along with equipment specification, purchase, and *maintenance. His research fields are in computer-aided design and optimization, mass transfer, and process control.*

Dr. Rehm's industrial experience has been in process development and equipment design with Universal Oil Products, Chevron Research, and the Monsanto Company. He is a current or former member/chairman of three national committees of the American Institute of Chemical Engineers.

High Pressure Measurement Techniques

Editor	G. N. Peggs
Publisher	Applied Science Publishers, London (1983)
Pages	404
Price	$81.50
Reviewer	Thomas R. Rehm

This reference book on the principles and devices used in the measurement, generation, and application of high and ultra-high pressures consists of nine chapters, each written by an expert in the field of high-pressure measurement. The thoroughness and understandability of each of these chapters are excellent. Chapters 1 and 2 cover in a clear and precise way the fundamentals of measurement techniques at steady pressures and at ultra-high dynamic pressures. Historical and current methods are presented with advantages and disadvantages discussed for both situations.

Chapters 3 and 4 explain secondary methods for high-pressure measurement from the standpoint of fixed reference points and from the standpoint of detailed descriptions of the actual apparatus and principles utilized in metrology. In Chapters 5, 6, and 7, the specific details of a number of devices are described, including pressure transducers based on electrical resistance, piezo-electric resonance, time of transit, relative dielectric permittivity, optical effects, and elastic deformation principles. In particular, those gauges based on electrical resistance are thoroughly covered as to materials, behavior, and range of application. Methods of dynamic pressure measurement are also thoroughly discussed.

Chapters 8 and 9 are presented in a more practical vein in that they deal with high-pressure generation and containment and with the description of a number of industrial applications of high pressure from both a physical and chemical standpoint. Each of these chapters contains a very thorough and exhaustive list of references for further investigation by the reader.

Although the material presented is often of a highly technical nature and often based on complex mathematical development, the accompanying text is so clearly written that both the novice and the expert in the field cannot help but come away from a reading of the text with a greatly enhanced understanding of the fundamentals of high-pressure measurement.

Thomas R. Rehm, professor of chemical engineering at the University of Arizona, Tucson, Arizona, taught chemical engineering from 1960 to 1966 at the University of Denver and at the University of Arizona since 1966. His teaching areas are in the plant and equipment design, mass transfer, and material and energy balance fields. He has also spent 20 years in the supervision of research and teaching laboratory operations along with equipment specification, purchase, and *maintenance. His research fields are in computer-aided design and optimization, mass transfer, and process control.*

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Nuclear Engineering Data Bases, Standards and Numerical Analysis

Author	Jacek Jedruch
Publisher	Van Nostrand Reinhold Company, Inc., New York (1985)
Pages	295
Price	$58.50
Reviewer	Walter Loewenstein

This book is an attempt to fill a very practical need. Diverse sources of information, data, computing methods, regulations, and standards are described along with examples that make much of the material come alive. The references are comprehensive and provide a substantive basis for further and in-depth follow-up. The attempt is successful in providing a book that tells the reader where to go and what to do and provides practical insights on how to do it without exhaustively dwelling on why things are done. Emphasis on the latter in most text and reference books tends to detract from the practical need that this volume fills.

The chapter on experiments in nuclear reactor engineering is somewhat disappointing. It is very brief and, as such, portions seem dated. The major disappointment is a lack of reference to the large amount of experimental data being extracted from operating nuclear power plants. These results are very instrumental in sharpening methods and data for design and safety analyses. The extraordinary and convoluted scaling analyses needed to prudently use the data cited (e.g., LOFT and Semiscale) to the operating nuclear steam supply system are barely referred to.

With Chap. 2, the author provides a guide on who does what and identifies current organizations that may be contacted for information. The growing impact of legal, business, and security aspects of codes and data is also described here. This chapter is very useful and a promise for the remainder of the book.

The chapter on data centers describes several. It also provides insight into coolant properties (e.g., light water) used for computation beyond identification of the source. For example, Table 12 describes the specific computational formalism that is extremely valuable for a novice in large-scale computation.

The chapter on property and performance data bases is very qualitative but useful for reference and introduction.