

provides the coolant. Descriptions of the laboratory are included in Montgomery's book.

This is indeed a handbook for the designer. It tells the reader how to design for the most field per watt, for the highest possible field and for the most uniform field. Problems of design, of mechanical construction and of cooling are treated in some detail. There is a chapter on superconducting solenoids and a little discussion of "noncircular" coils. The mathematical sections are presented simply and clearly and need not frighten a beginning graduate student. The author follows admirably his stated philosophy that "it is unwise to complicate (unnecessarily) the analysis of a given problem."

The early chapters treat, in sequence, solenoids of uniform and nonuniform current density. Many elegant little theorems are derived. For example, it is shown that the solenoid that gives the highest field per watt of power consumption has an outer diameter three times its inner diameter and a length twice its inner diameter. The discussion of nonuniform current distributions leads into presentation of the disk solenoids evolved by Francis Bitter and now in routine use at the National Magnet Laboratory. Montgomery devotes appropriate attention to materials of construction and to methods for restraining the magnetic forces from destroying the magnet coil.

The chapter on superconducting solenoids was written just before an impor-

tant development took place and so is not up to date. It includes a clear discussion of the conventional methods for stabilization of type II superconductors. But, as the book went to press, work was beginning on inherently stable superconductors that consist of many fine transposed strands of superconductor imbedded in a copper matrix. The success of this approach can be expected to revolutionize the superconducting-magnet art. Nevertheless the author's treatment of superconducting-coil design will be useful for some time.

The book concludes with a chapter on "field analysis," treating the distribution of field in and around solenoids and describing methods for producing fields of any desired homogeneity over any required volume. The chapter includes 25 pages of computer printout, for a variety of solenoid geometries, of several parameters that characterize field patterns.

I was slightly disappointed to find no discussion of the effects of iron shields. An intriguing theorem, attributed to someone at the National Magnet Laboratory, says that iron is best used for increasing solenoid fields when it is all completely saturated, and one might have hoped that Montgomery would enlarge upon this. But, in general, this is a satisfying and definitive work. If the reader has occasion to build solenoid magnets, this book should be on his shelves.

JOHN P. BLEWETT

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Electronic and Ionic Impact Phenomena, Vols. 1 and 2: Collision of Electrons with Atoms

By H. S. W. Massey, E. H. S. Burhop
1335 pp. Oxford U. P., Oxford, 1969.
\$32.00

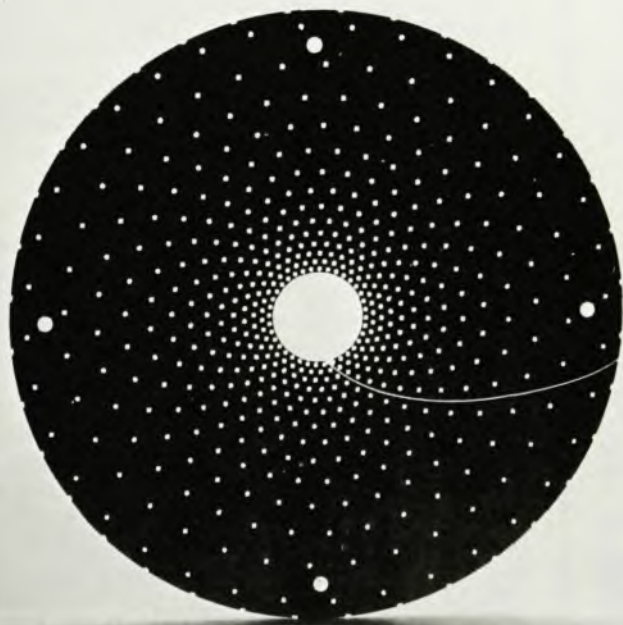
These two volumes by Sir Harrie Massey and E. H. S. Burhop will undoubtedly become an asset for a wide range of scientists. Theoreticians and experimentalists engaged in continuously refining our knowledge of electron impact cross sections, plasma physicists, atmospheric scientists and astrophysicists who urgently need these cross sections will all find this book a treasure house in which to look for very authoritative information.

This reliability comes from the authors' many pioneering works in electron collisions. Under Massey's leadership, University College London has remained one of the finest centers of research in atomic and molecular physics. In fact, no one else is better qualified to write this book.

Volume 1 is devoted to the collisions of electrons with atoms. The first part (chapters 1-5, covering 372 pages) contains descriptions of the various experimental methods used for determining the electron-impact cross sections. A chapter for each of the collision processes (namely, momentum transfer or ionization), starts with a very lucid and up-to-date discussion of the various laboratory techniques available for their measurement. Naturally, such recent developments as techniques for measuring the cross sections for the excited or ionized atoms have received their fair share of discussion.

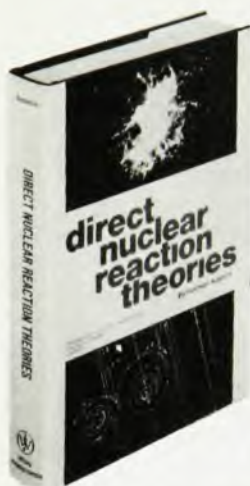
Nowhere is the description of the experimental methods made boring by the excessive enumeration of details. The emphasis is on clearly explaining the principles of measurements. To this end, detailed and explanatory block diagrams of the experimental setup are used frequently. The observational method is followed by detailed review of the results obtained, with a stress on the interpretation of the data rather than on their cataloging.

The latter half of the first volume (chapters 6-9, covering 291 pages) deals with theoretical models for describing cross sections. The authors have prefaced their discussion by a very illuminating description of the systematics of the theoretical problem, which will considerably help the readers to digest easily the succeeding material. The semi-empirical "optical-model" approach to elastic scattering is treated at full length as is the scattering problem in terms of the detailed atomic structure, which includes the existence of the atomic states. This latter



"Bitter plate," that is, a single-turn coil, for a 1.88 MW magnet, which generates 123 kOe; plate has a 2.54 cm internal diameter. The slit is curved to avoid intersecting any cooling holes. (From *Solenoid Magnet Design*.)

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The section on photoionization also includes negative ions and radiative attachment and photo detachment. These processes play an important role in the lower D region of the ionosphere and, therefore, their inclusion greatly adds to the book's utility.

The level of the theoretical treatment is very practical minded. Thus it places this tends to be nonrigorous and may not completely satisfy a serious modern theorist. But, because of this approach, the two volumes will be very welcome to a large cross section of readers.

SHEO S. PRASAD
University of Florida

Introduction to University Physics, Vol. 2

By J. Magan

972 pp. Allyn and Bacon, Boston, Mass., 1969.

Introductory books to university physics are now almost legions in number. Almost each university has its own textbook, written by one or more members of the physics faculty. Slowly the time is coming, when an International Association of Physics Introductory Text Writers (IAPITW) will be formed.

Joseph Magan's textbook is intended for an introductory course for college and university students majoring in science and engineering. The contents follow the classical pattern. Part one presents mechanics, heat, wave motion and sound. In the first paragraph the philosophy of physical methods is very well introduced, and the notions of vector additions and subtractions are helpful for the students. It is a pity that a college physics course can not generally use the simple calculus. I hope the present generation will still be alive when basic calculus is among the stan-