and magnetic effects are essentially omitted. The influence of dislocations on physical properties or, in other words, the true *physics of dislocations* is admittedly a very difficult field in which progress is still dishearteningly slow and is obtained often by hindsight. A most welcome aspect of the book are excellent exercises and problems discussed in the text or appended at the end of chapters. The subject index is only fair although better than in the earlier books on dislocations. The printing and the general appearance of the book are excellent.

Nabarro's book shows clearly that it is written by a physicist for whom the dislocation theory and its analytical, topological and theoretical details are only a tool for understanding physical phenomena and not a goal in themselves. For this reason the mathematics is rather restrained and the symbolism not too cumbersome. Besides chapters that deal with the usual fundamentals of stationary and moving dislocations, the role of point defects, the structure of grain boundaries, etc., there are excellent chapters on interaction of dislocations with surfaces, electrical effects, magnetic effects and dislocation optics. There is also a useful chapter that discusses the geometry of generalized noneuclidean spaces and dislocated lattices in tensorial formalism, which play an important role in the present attempts to develop a continuum theory of dislocations. Sections of various chapters deal with such topics as the role of dislocations in oxidation processes, in catalysis and even in apparently remote fields such as zoology, botany and geophysics. Unfortunately the various aspects of work-hardening and of fracture are not considered in detail because "it is not at present clear which mechanism predominates in any given situation." The book has an unusually large number of references, mostly from before 1966. There are no problems attached, and the subject index, though good, could stand improvement.

Both these books, which are, in fact, complementary, will serve well the research man and the student, Hirth's and Lothe's as a rigorous and quite mathematical treatment of the subject and Nabarro's as a source of insight into the rich variety of associated physical phenomena.

An historical footnote: The very important Frank–Read source of dislocations that removed one of the major obstacles in the early stages of the dislocation theory was invented in Pittsburgh around 1951 in the wee hours of the morning in a beer establishment affectionately called "the Greeks." May the future progress in this very important field be made under equally pleasant circumstances.

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Broader spectrum

PHOTOIONIZATION PROCESSES IN GASES. By Geoffrey V. Marr. 282 pp. Academic Press, New York, 1967. $12.50

by Bruce W. Shore

Increased study of ultraviolet spectroscopy, motivated by research in plasma physics and by the possibility of rocket and satellite observations of solar and stellar spectra, has provided much new information during the dozen years since the subject of photoionization was summarized by Gerhard Weissler.[1] New observations of photoionization have been made, many by Geoffrey Marr and his students at the J. J. Thomson Physical Laboratory, University of Reading, England. New computations have been reported; many use the quantum defect theory. And a better understanding of resonance features, such as autoionizing lines, has developed. Thus a survey of observational and computational results would appear to be appropriate. One such survey, written by James Samson,[2] was published last year. The present monograph enlarges the subject matter of Samson's review, filling in background to provide a broader, self-contained introduction for the nonspecialist.

As with Samson's review, the approach here reflects the author's research activity as an experimentalist although the topics show a nice balance between theory, experimental methods, numerical results and applications. Although Samson provided numerous tables of absorption coefficients and detailed plots of autoionizing features, Marr has confined himself to graphs of absorption coefficients.

The author begins with a brief review of the conventional quantum theory of radiation absorption and emission and summarizes the several common approximate methods for computation. Although the discussion is too brief to give a real understanding, the references are adequate for that task. Next the author reviews common laboratory arrangements for measuring photoionization and mentions the broadening of spectral lines and the lowering of the ionization potential caused by neighboring ions, atoms and electrons in the absorption source. The author then presents, in graphical form, experimental and theoretical photoionization cross sections for numerous atoms and molecules. He summarizes some of the observations of autoionization and the theoretical approach of Ugo Fano.[3]

As one might hope of a monograph on photoionization, the topics of predissociation, preionization, and photodetachment are discussed. In addition, the author discusses the opacity of the terrestrial atmosphere for ultraviolet radiation. Perhaps surprising is a discussion of those electrical discharge phenomena in which photoionization is "a significant process in their

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maintenance" (such as Geiger tubes).

Although I would have liked a more thorough discussion on the theory of photoionization of molecules and complex atoms, research workers in plasma physics, astrophysics and aeronomy will find the present survey quite helpful. It should prove useful as a supplement in senior-graduate-level courses on spectroscopy, atomic physics and astronomy.

References

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2. J. A. R. Samson, in *Advances in Atomic and Molecular Physics*, Academic Press, New York (1966), Vol. 2, p. 178.
3. U. Fano, Phys. Rev. **124**, 1866 (1961). (1961).

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Progress reports on particles

HIGH ENERGY PHYSICS, Vol. 1. E. H. S. Burhop, ed. 499 pp. Academic Press, New York, 1967. $22.00

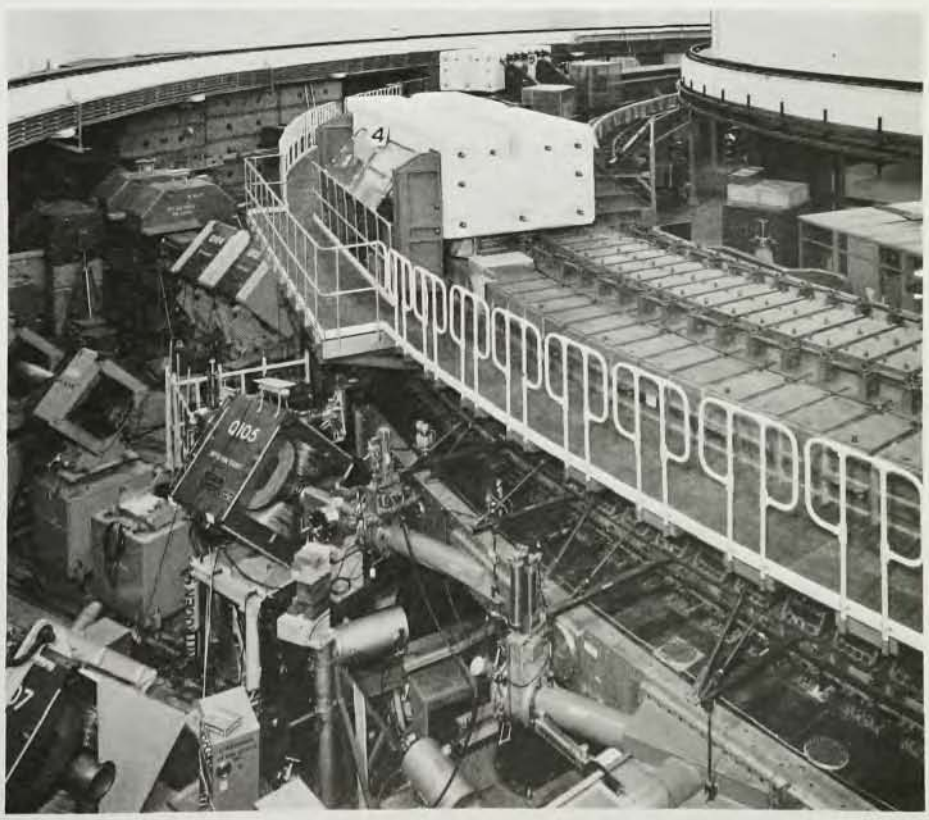
by Wendell G. Holladay

This is the first volume of a projected three-volume work in which over 20 authors will cover important aspects of the physics of particles and their interactions at high energy. The material in volume I and the listed contents of the other two volumes indicate that a systematic treatment of general theoretical schemes, such as quantum field theory, and properties of the analytic S matrix will not be given; rather, developments in high-energy physics (with emphasis on physics) will be reviewed in a series of topical monographs written by experts on the individual topics. This fact suggests that the reader of these volumes will benefit by first learning the general language of theoretical particle physics and the properties of the quantum numbers associated with the particles from some of the advanced textbooks devoted to such expositions. This is not to say that *all* the material in such textbooks will have to be mastered, for the articles in volume I are reasonably self contained in that they do not depend very much on one another and present new ideas and methods as required, albeit with brevity in most instances.

Now for the contents of volume I. There are five articles that may be read in any order. Victor F. Weisskopf presents a perceptive introduction to particle physics by considering the relation of the present status of knowledge in the field to a question raised by Isaac Newton: What are the reasons behind the parmanent features of the structure of matter? Gregory Breit and Richard D. Haracz then devote 160 pages to a discussion of certain features of nucleon–nucleon scattering. Here the intricacies of writing the scattering matrix in terms of phase parameters are exposed in detail. An unusually thorough discussion is given of the search procedures by which the parameters are obtained from the data. Results of the latest searches by the Yale group as of September 1965, are compared with earlier searches and with the data. The authors give particular attention to the intermediate energy region from 10 to 340 MeV and to the determination of the pion–nucleon-coupling constant in the one-pion exchange term. References to the literature are extensive. The tables listing references to measurements of physical quantities at various energies and angles will be especially useful to workers in this field.

The approach to pion–nucleon interactions in the article by James Hamilton is quite different from that taken by Breit and Haracz on the nucleon–nucleon interaction. Hamilton's aim is to *calculate* the pion–nucleon-scattering amplitudes by using crossing symmetry, unitarity and causality as manifested in partial-wave-dispersion relations. The explicit dynamical assumption is that the principal interaction is produced by exchange processes involving known particles. This approach, which has been most thoroughly explored by Hamilton and his colleagues, is presented in detail in this review. Some impressive results have been obtained, but the ultimate viability and validity of the point of view exploited by Hamilton remain in doubt.

The electromagnetic form factors of the nucleon is the subject of the article by Thomas A. Griffy and Leonard I. Schiff. Two principal aspects of this problem are discussed. The first is a detailed exposition of the way in which the form factors are extracted from electron-scattering measurements. A review of the efforts to



NIMROD, the 7-GeV proton synchrotron at Rutherford Laboratory, England. The two beam lines emerging from the magnet have both focusing and bending magnets.