and neutrinos over hindered rotation and flash photolysis? There is a certain imbalance in presenting four methods of measuring the boiling-point elevation, each with its own picture, while polarography and electron diffraction go without. NMR is just mentioned and the manner of discussing the mass spectrometer leaves the impression that this is an historical instrument that merely figured in the discovery of isotopes.

The fundamental experiments are presented in a very readable account which often challenges too easily accepted ideas. Thoroughness and clarity characterize the description of measurements ordinarily made in the physical chemistry laboratory. These are the strongest points of the book and merit special emphasis.

Lectures on Strong and Electromagnetic Interactions. Brandeis Summer Institute, 1963, Volume 1. By P. T. Matthews, et al. 346 pp. Brandeis University, Waltham, Mass., 1964. Paper $3.00.
Reviewed by D. B. Lichtenberg, Indiana University.

This book consists of three sets of lectures: "The strong interactions of elementary particles" by P. T. Matthews, "Topics in quantum electrodynamics" by D. R. Yennie, and "Unitary symmetry of strong interactions" by M. E. Mayer. The printed versions of the lectures are based on notes taken by A. Phillips, S. Bradsky, and L. Heiko, respectively. Although the lecturers were undoubtedly given the opportunity to make corrections, I do not know whether they took advantage of this opportunity. Also, I do not know to what extent the notes were checked by the editor, K. W. Ford. In any event, although I came across a number of minor errors and a few misstatements of fact, I discovered no mistakes that I regard as serious.

Matthews' lectures give an admirable general introduction to the physics of the strongly interacting particles. With the exception of field theory, which is scarcely touched, most of the major topics necessary to an understanding of current work on the subject are presented with sufficient detail to be useful and yet with remarkable economy of language. The

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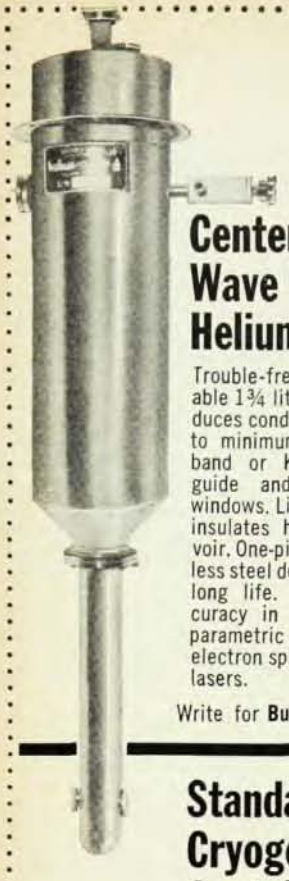

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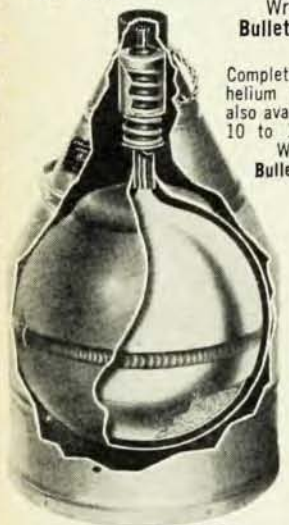

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material is divided almost equally between principles and selected applications.

Much of the treatment is based on the use of the S matrix and dispersion relations, although symmetry principles and conservation laws are also discussed. Matthews defines the S matrix, the T matrix, phase space, and the connection between these quantities and observable differential cross sections. I applaud his decision to deal with relativistically invariant quantities and to pay particular attention to questions of normalization of scattering amplitudes.

Among the topics discussed are the substitution law and crossing symmetry, the unitarity principle in single-channel and multichannel reactions, single and double dispersion relations, the connection between invariances of the S matrix and conservation laws, and the use of helicity amplitudes. Applications are given in meson-nucleon scattering and in the determination of the quantum numbers of resonances.

The contribution of Yennie is quite different. It is a presentation in detail of techniques used in the calculation of two problems in quantum electrodynamics: the Lamb shift and radiative corrections to scattering. The subject is introduced with a brief discussion of the Dirac equation and gamma matrices. This section is probably given more to reassure the reader with something he already knows than to inform him, for if he is not already familiar with this and related topics, he is likely to have difficulty in following the subsequent calculations.

The calculation of the Lamb shift is carried out to the lowest order, but higher order terms are discussed. The general procedure followed by Yennie is closest to that of Karplus, Klein, and Schwinger, but certain operator techniques developed by Yennie and Erickson are used. The calculation is beset with the usual divergence difficulties and seemingly arbitrary calculational recipes. Yennie does not try to hide any of these difficulties for the sake of beauty. This makes it all the more astonishing (except that in quantum electrodynamics we are used to such astonishments) that the procedure should lead to such accurate final results.

Perhaps of more immediate interest than the Lamb shift calculation is the detailed treatment of infrared divergences and radiative corrections to scattering. Since the radiative corrections in any scattering process depend on the particular arrangement and precision of the experiment, there is continual need for further calculations. Yennie's discussion of the subject is useful for those who want to understand the nature of some of the problems that arise in such calculations.

Mayer's treatment of unitary symmetry is different from some others that I have seen in that the emphasis throughout is on physics. Useful mathematical theorems are stated, but seldom proved. As a help, Mayer presents the analogy between SU_3 and the more familiar isospin group SU_2. A discussion is given of both the Sakata model based on the three-dimensional representation of SU_3 and the Gell-Mann–Ne'eman model based on the eight-dimensional representation. Although both models serve equally well for the mesons, the predictions of the Gell-Mann–Ne'eman model agree more closely with experiment for the baryons and meson-baryon resonances. Among the other topics discussed by Mayer, I found most interesting the treatment of the breaking of SU_3 by both strong and electromagnetic interactions and the methods for obtaining relations among different scattering cross sections.

There are more than the usual number of typographical errors in the book, but most of them are easily recognizable and therefore harmless. Another flaw is the duplication by Matthews and Mayer of information about the masses and quantum numbers of the strongly interacting particles. There is also a certain amount of duplication of material which has appeared in previous volumes of this series. However, if each set of lectures was to be reasonably self-contained it is hard to see how this duplication could have been avoided. Altogether, I recommend the book highly, especially to graduate students in view of its very reasonable price.