model would have made things much clearer.

The last section of this chapter brings the greatest surprise. Here we are told that elastic (ν,e) scattering is "almost pure s-wave" while elastic ($\bar{\nu}$,e) scattering is "almost pure p-wave." Since orbital angular momentum is, for relativistic particles, a meaningless concept, one is puzzled.

Since Lindenbaum was "present at the creation" of modern particle physics, his book—in particular the early chapters—is written with an effort to give history its fair due. The historically interested reader is, however, often puzzled by the text; thus Fröhlich, Heitler and Kemmer are supposed to have introduced (1938) a $T = 1$ triplet of pions *once* the existence of charged pions was discovered (1947). One might be lead to believe that Fermi died (1954) without realizing that he and his co-workers had discovered the (3,3) resonance. The historical emphasis appears often distorted: Early Japanese workers on SU(3) are properly mentioned, but Feynman and Gell-Mann (not to speak of Theis) are not quoted at all where V–A is discussed.

All in all, this book contains many facts and is a good guide to the reference literature. Proofs are however so rarely given in it, that the reader will indeed need such a guide. In fact a possible title for it might have been "Everything you always wanted to know about particle physics, and now won't be afraid to ask."

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Spectral Line Broadening by Plasmas

H. R. Griem
408 pp. Academic, New York, 1974. $31.50

The problems that arise in the analysis of spectral-line shapes have been intriguing physicists and astronomers since the late nineteenth century. Whilst the effect of the motion of the emitting atoms on the observed lines is easily understood, the broadening and shift of spectral lines produced by the presence of many particles in the plasma that interact with the emitting atoms, gives rise to a number of problems that remain unsolved. Information on this pressure-broadening effect is extremely useful in plasma diagnostics, whether it is a relatively high-density laboratory plasma that is being studied, or a low-density astrophysical plasma such as the interstellar medium.

In this book, Hans R. Griem reviews the recent work on spectral lines emitted by atoms and atomic ions in plasmas. A considerable amount of progress has been made in this field since the author's earlier book, *Plasma Spectroscopy* (McGraw-Hill, 1964). He discusses both the theoretical and experimental advances in the subject, and there is a final chapter on applications to density and temperature measurements, to stellar atmospheres and the radiofrequency lines. Data on lines in hydrogen, helium and various atomic ions, many of astrophysical interest, are included in tabular form in seven appendices.

The author has been a very active research worker in plasma spectroscopy for the last 20 years, and has made many contributions to our understanding of spectral line broadening. Other workers in this field who are already familiar with Griem's many papers will recognize immediately the author's inimitable style. The book should be a useful reference work for all people interested in line broadening, including graduate students who are starting to do research in this area. For those who are predominantly interested in the theory, it will probably be necessary to look up the original references in

order to find a more detailed treatment, because, as the author himself states in the preface, he has devoted a major section of the book to a discussion of critical experiments and their interpretation. Although one may disagree with some of the author's statements, such as the one stating that the plasma polarization shift is usually an additive effect, I for one can certainly agree with his basic conclusion that, as yet, no truly unified theory of line broadening exists, in the sense that it can be used in practice, without introducing major approximations.

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Aqueous Dielectrics

J. B. Hasted
302 pp. Halsted, New York
1973. $18.50

As the title suggests, this book is concerned principally with dielectric and electromagnetic properties of water in its various forms and of the variety of systems in which water is an important constituent. In his introduction John B. Hasted remarks that "some ten years ago it almost seemed that physics had passed [water] by." Since then, interest of physicists has revived and any remaining lack of concern with our most important substance is compensated by major efforts in the fields of chemistry, biology and medicine, earth sciences, and various technologies. In his accounts of the various interests, the author progresses from molecular theory and basic experimental evidence to increasingly macroscopic descriptions and applications for more complex systems. He is well qualified to carry out his broad survey by virtue of continuing interests since the early days of microwave measurements and substantial contributions in several areas.

The book begins with a brief, quite conventional summary of relevant aspects of dielectric theory and properties of the water molecule, followed by discussions of the electromagnetic spectrum of water and ice from infrared to subaudio frequencies and interpretations in terms of "structure" and molecular interactions. After an account of dielectric properties of heterogeneous substances and dielectric-mixture theories, three chapters are devoted to aqueous solutions of electrolytes and non-electrolytes, including proteins, amino acids and nucleic acids. Hasted discusses heterogeneous biological-cell suspensions and dielectric properties of numerous systems that are strongly affected by absorbed water. The book ends with a review of wave propagation and geophysical aspects of moist soil, snow and ice.

The book can clearly be useful to people with widely diverse interests. In 286 pages the author could hardly be expected to present all the ramifications of this wide range of topics, but he has succeeded very well in giving the essentials and a fair picture of both the extent and deficiencies of our knowledge and understanding. I repeatedly found discussions of models that are the best available but fail in important respects, and of data that are incomplete, inconclusive or non-existent.

Hasted provides incentives galore for further theoretical and experimental work. Some references to the literature will help the reader interested in exploring further; these are well chosen on the whole, but I found several significant omissions, particularly recent reviews and proceedings of conferences. The book is well produced, with a good subject index and about the normal density of misprints. Most of the ones I found are unlikely to cause serious difficulty.

In summary, this book provides an excellent introduction to the diverse dielectric properties of aqueous systems.