though short relative to the second, is extremely important, for here Kurtén summarizes his own ideas on Pleistocene faunal evolution, evolutionary trends in size, problems of the origin and extinction of species, faunal turnover, the rate of the change of a fauna as expressed by its half-life and the mean longevity of a species, the low endemicity of the European fauna at all periods in the Pleistocene, and human effects on the fauna (particularly at the close of the Pleistocene and after). The wonder is that so much information and so many worthy ideas could be compacted into 37 pages.

The detailed faunal data available for most periods of the European Pleistocene make possible such analytical studies, with the results often determined statistically and presented graphically. As would be expected, evolutionary change accelerated during the period of the glacials and the interglacials as compared with the Villafranchian. An unexpected conclusion is that the rate of human evolution, from the Holsteinian through the Würm, although rapid in comparison with that of most mammals, was exceeded by that of the European elephants for the same period.

This short third section has implications of importance to all evolutionary studies, particularly where the fossil fauna is rich, with multiple specimens of many species. The Pleistocene, with its many major climatic changes, mostly within the last half-million years, was a period of intense selection and rapid faunal evolution. Kurtén has done an admirable job in organizing and explaining this complexity in understandable terms.

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Plasma Waves

Ondes dans les Plasmas. DANIEL QUÉMADA. Hermann, Paris, 1968. 384 pp., illus. Paper, 48 F. Collection de Physique du Centre National d'Etudes Spatiales.

Of the wide range of phenomena and techniques encompassed by plasma physics, Quémada's cogent, carefully prepared monograph deals with a single, but remarkably rich, aspect: the bewildering variety of waves that can propagate in plasmas. Even this subject is further restricted to phenomena susceptible of description by a linearized theory, so that only scant allusion is made to instabilities and wave interactions. Nevertheless, the author has rendered an important service in systematically characterizing the properties of waves in plasmas, particularly as regards the diagnostic capabilities they provide.

The book is written in a lucid style and should be clear even to readers with only a modest knowledge of technical French. The author claims to have addressed his work primarily to students of plasma physics, but it should not be considered a textbook. A beginning student would be well advised to acquaint himself with the more basic aspects of plasmas before turning to this monograph. The first chapter does in fact provide a review of the general properties of plasmas, so succinct, however, as to comprise little more than a list of topics *not* covered in the main text, among them diffusion, particle orbits, sheaths, transport properties, kinetic theory, and nonlinearities.

The bulk of the work analyzes and catalogs the properties of waves in plasmas for a variety of regimes of the parameters. Numerous graphs of relations among the characteristic parameters are presented. Applications of wave properties to plasma diagnostics are discussed and illustrated, including the important practical cases of reflection from an inhomogeneous plasma column and of whistler mode propagation. Energy transfer and the group velocity of waves receive the emphasis they deserve. The author undertakes detailed wave analyses without losing sight of the underlying physics and injects frequent reminders of the limits of validity of the theories applied. The thorough presentation of the intricate Clemmow-Mullaly-Allis diagram and the elucidation of ray-tracing techniques merit particular commendation.

The work is marred by a faulty analysis of the radiating modes of a bounded plasma, wherein the radiation condition at infinity has unaccountably been ignored and is not satisfied. The unwary reader should also be warned of a number of typographic errors, primarily involving missing subscripts and superscripts. Consistent use of mks units and of radian frequency is a boon to students, but the text thereby loses touch with nearly universal practice in the technical literature on plasmas.

While the monograph may best serve the researcher as a compendium of plasma wave properties, it will certainly reward the student who turns to it for a survey of the theoretical analysis, practical applications, and useful characterizations of waves in plasmas.

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Single-Nucleon Behavior

The Nuclear Independent Particle Model. The Shell and Optical Models. A. E. S. GREEN, T. SAWADA, and D. S. SAXON. Academic Press, New York, 1968. xiv + 370 pp., illus. $16.

The "nuclear independent particle model" means different things to different people. To the theoretical spectroscopist it implies a space of many-particle wave functions, essentially uncorrelated except for exclusion principle effects, in which he can hope to simulate the effects of various physical operations. Such a space can have a great deal of structure, and with it one can attempt to handle a great quantity and a great variety of nuclear data. The understanding derived in this way has been somewhat superficial, not only in the literal sense that it mostly involves the "valence" nucleons but in the other sense as well. Those who have wanted a more fundamental understanding, without the usual model assumptions, have restricted themselves to gross features and have considered *nuclear matter* rather than finite nuclei.

The viewpoint of the present book is different from either of these. The book is concerned with gross features of *nuclei,* as revealed by their single-nucleon behavior, dealing then with such quantities as single-nucleon separation energies and optical potentials for nucleon scattering by nuclei. It is not then concerned with derivations of these quantities from the basic nucleon-nucleon interaction, though the last chapter does give a compact and readable account of the foundations of the shell and optical models. That chapter comes too late and doesn't really make contact with the six chapters that come before and that really form the essentials of the book.

These chapters are given over to a treatment of one-body potentials for bound states and scattering states. There is a fair amount of detail about the nuclear energy surface, and a great deal about optical model scattering

analysis, with lots of figures and numerical values and discussion as to how things depend on the optical model parameters; one chapter is given to a review of recent work on the subject. The theory, mostly elementary, is derived as needed, and as a result we have a self-contained account that will be found useful by the student and nonexpert as well as by the initiate. Beyond the most elementary things, there is a good account of velocity-dependent and nonlocal interactions and of echoes, the glory, the rainbow, and other things like that in the semiclassical theory of scattering. Much more could have been said, however, about McVoy's analysis of the role of giant resonances in the nucleon-nucleus scattering. And the nuclei dealt with are simply too often regarded as spherical. True, there is a sketchy account of nuclear deformations, but the authors don't make much either of the static or of the dynamic effects due to these deformations. An opportunity has been missed also to give some detail about the superheavy elements which are currently of such great interest and the present theory of which draws heavily on extrapolations of single-nucleon effects.

There is no use complaining that the single-nucleon viewpoint is a very narrow one. It is indeed narrow, but this book and earlier accounts with a similar basis make clear that it is adequate to handle a large number of significant ideas and quantities. The book itself would appear to give the best available account of the subject. It would have been a better one but for some of the omissions.

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Symmetry Violations

The CP Puzzle. Strange Decays of the Neutral Kaon. P. K. KABIR. Academic Press, New York, 1968. x + 138 pp., illus. $6.

In 1964 an experiment was performed which indicated that the symmetry *CP* was violated. By inference from the universally accepted *CPT* theorem, a violation of symmetry under reversal of time was also indicated. Since so much of the progress in elementary particle physics has centered around questions of symmetry, a tremendous surge of theoretical and experimental activity was generated. Since 1964 fully 20 percent of the activity of every major high energy physics laboratory in the world has been devoted to experimental investigations searching for *CP* violation or time-reversal violation. A violation of *CP* symmetry would be indicated if the laws of physics in a mirror-reflected antiworld were different from ours. A time-reversal violation would be indicated if the microscopic laws of physics changed when the sign of the time was reversed in all the equations.

The new discovery, in which long-lived neutral mesons were found to have decays to two π-mesons, reminded one of the discovery of parity violation in 1957. That discovery led rapidly to a deeper understanding of β-decay and the weak interactions. Sadly, the similar vigorous pursuit of the *CP* violation has not led to any deeper understanding at all, and the phenomenon nags one to the point where one wishes that it had never appeared. Nevertheless, the phenomenon does exist, and we must face up to it. An absolute distinction can be made between matter and antimatter.

Kabir's book deals with the first few years of research following the original discovery. The beginning chapter reviews the fundamentals of the strangeness concept and the bizarre nature of the two-component *K*-meson system. The second chapter gives a detailed discussion of the two-pion decays of the long-lived *K*-meson. The third chapter discusses the possible origins of *CP*-noninvariance. Subsequent chapters discuss regeneration and interference phenomena. A final chapter provides a summary of conclusions that can be drawn from the experiments. More technical discussions such as the basis for the Wigner-Weisskopf description of decaying states are placed in appendices. The book is carefully written and contains the best descriptions of the early experiments to be found outside the original papers.

The existence of a *CP* violation or a time-reversal violation has consequences that reach far beyond the neutral *K*-meson system, and it is unfortunate that the author did not spend more time on these topics. Experimentalists have met the challenge by performing many beautiful experiments searching for *CP* or *T* violations. Up to the present there have been a few hints but no hard evidence of any violations outside of the *K*-meson system. The lack of experimental progress outside the *K*-meson system may justify the author's faith that important understanding of the effect will come from the *K*-meson system itself.

It is usual to criticize a book in a rapidly moving field for being out of date before it is published. The reviewer cannot refrain from remarking on this point, for the entire thrust of the experimental results has changed since the book went to press. That the book is thus dated is no fault of the author but is rather due to the fact that some of the early experiments were either incorrect or incorrectly interpreted. Evidence is accumulating that the *CP* effect either is due to a very weak microscopic interaction which contains the violation or is related in some way to the total environment. It may be a problem for the cosmologists. In either case it is unlikely that fruitful experimentation in this field will continue many more years. We must await some other related discovery or brilliant insight before the significance of the *CP* effect will be fully appreciated.

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The Solid State

Excitons, Magnons and Phonons in Molecular Crystals. Proceedings of a symposium, Beirut, 1968. A. B. ZAHLAN, Ed. Cambridge University Press, New York, 1968. xii + 224 pp., illus. $11.50.

As the editor of these proceedings points out, the purpose of the meeting was to help break down barriers in related fields and provide a learning experience. Indeed, six introductory talks were given the group, but are not included in the book; thus, the participants in the symposium received a background to the detailed lectures that the reader will not.

The symposium spanned a wide range of topics from infrared absorption to spin lattice relaxation, from the simpler aspect of vibrating lattices to exciton propagators and second quantization formalism. The book is divided into three sections: Phonons: Spectra and Density of States; Phonons in Combination with Electronic Transitions; and Excitons: Coupling to Phonon and Radiation Fields.

There are several articles that bear special mention because of their clarity of presentation and their educational