necessity of including damped waves in two and three dimensions. Many good physicists have run aground trying to do this in a way that would, simultaneously, preserve the various conservation laws, keep the perturbed distribution functions continuous as the growth rates pass through zero, avoid ill-posed diffusion equations, lead to estimates for the accuracy of the solutions, and, lastly, predict final states. In my opinion, no one has yet succeeded in doing this, though T. Burns and G. Knorr have come closer than anyone (*Phys. Fluids* **15**, 610 (1972)). Yet if I read page 164 correctly, the whole issue is being dismissed as trivial—without, however, indicating any details!

To the extent that one can overcome such occasional misgivings, the presentation of the applications is then clear and energetic. Applications to electromagnetic instabilities and to plasmas in an external dc magnetic field are given an impressive treatment.

The book is of a genre which is all too rare in plasma physics. If attended to by the rest of the physics community, such monographs could do much to improve the still slightly sleazy reputation plasma physics suffers among the older branches of the physical sciences. No other book now on the market does the job this one sets out to do so well.

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Statistical Physics

F. Mandl
379 pp. Wiley, New York, 1971. $10.00

Statistical physics is a subtle subject. Its foundations yield a rich harvest of delicate questions. Yet a great many of the essential techniques require no elaborate mathematical preparation, and the material can be introduced into the curriculum at a fairly early stage. The problem of presentation is largely one of achieving a balance between methods and understanding. This is made especially challenging when both thermodynamics and statistical techniques are brought together under the rubric "Statistical Physics"; for then it becomes necessary to insure that the student grasps the scope of traditional thermodynamic reasoning so as not to short-change its power and validity for the apparent insight offered by those examples simple enough to be dealt with in detail by statistical methods.

My impression of this volume by F. Mandl is that it meets very well the objectives suggested above, and in a straightforward manner makes the material accessible for all students at some point in their undergraduate careers while maintaining a level that insures suitability for good students as early as the second year. By contrast, the recent splendid book of J. Kestin and J. R. Dorfman, *A Course in Statistical Thermodynamics* (Academic, 1971), is more detailed, more sophisticated, more demanding and is ideally suited for a course given in the senior year. An earlier work by Mandl on quantum mechanics is well known to physicists and is distinguished by its rigor, formality and elegance. I was anxious, therefore, to find how the author would treat a different subject for a different audience.

The flavor of this book is evident in the very first chapter where the First Law is introduced by macroscopic and microscopic arguments developed together. There is an easy exchange between them, and the result is pedagogically sound. Clarity characterizes the presentation and becomes especially helpful for such unfamiliar topics as, for example, adiabatic cooling, negative temperatures or the Bose–Einstein condensation.

All the essential material is here as well as a significant number of marked sections that could be omitted if a simpler or somewhat reduced course were desirable. The author also offers a "flow chart" on the inside cover, which is intended to assist in selecting alternative, simplified paths through the material. It is never obvious what ought to be omitted, however, and some might reasonably argue that black-body radiation or the Debye theory of specific heats, for instance, are essential to any presentation, however elementary. The point is, that Mandl's book is usable in reduced form and gains considerably from this flexibility.

The volume (which although written for an English university course and a part of the Manchester Physics Series, is entirely suitable for American students) is divided into 12 chapters ranging from the First and Second Laws to fluctuations in the grand ensemble, and includes a good discussion of problems dealt with only by quantum statistics. The examples chosen are current whenever possible and generally informative. In addition there are Appendices covering some useful mathematical formulas, a discussion of the density of states and "hints" to the solution of the problems that close each chapter. There is a decent bibliography and a useful index.

Students should find the reading direct and unambiguous and the problems of help in understanding the text. The numerous figures, graphs and illustrations are all well chosen and reproduced with clarity. They ought to be of particular help to anyone whose first exposure to the subject comes from this book, and it is for just such an audience that "Statistical Physics" can be recommended with confidence.

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Principles of Surface Chemistry

G. A. Somorjai
283 pp. Prentice-Hall, Englewood Cliffs, N.J., 1972. $10.95

Surface phenomena have been around for a very long time. Willard Gibbs laid the foundations of the thermodynamics of interfaces in the 19th century and Irving Langmuir discovered chemisorption in the 1920's. It is only quite recently, however, that surface studies have become fashionable in physics. The reasons are at least partly connected with the development of a number of new techniques, the ready availability of ultrahigh vacuum, and undoubtedly also with the fact that surfaces and the processes occurring on them represent one of the few frontiers left in the electron-volt domain. Whatever the reasons, the current interest in surfaces makes welcome any book that may serve as a general introduction to the field, summarizes the current state of knowledge, discusses the principal methods of attack and points out the major unsolved problems.

Principles of Surface Chemistry by Gabor A. Somorjai tries to fulfill the first three of these objectives, but does not address itself particularly to the fourth. The book was written as part of an undergraduate physical-chemistry series, and its level is elementary throughout. It covers a fairly wide range of topics from surface structure and diffraction to physi- and chemisorption with chapters on thermodynamics, electronic properties, and the dynamics of surface atoms in between. Perhaps the range has made superficiality inevitable, but one wishes for considerably more depth in almost every chapter, as well as for better balance. Somorjai is an expert in low-energy electron diffraction, and it is understandable that this subject receives considerable emphasis, that is, more than one chapter, while field emission, for instance, receives only two pages including a figure that is not a field-emission pattern, but an ion micrograph. Despite the emphasis on diffraction, the determination of structures is not really explained, and the inadequacies of kinematic theory are not sufficiently emphasized.

I was also disappointed by the treatment of chemisorption, which should take a central place in a book like this. Unfortunately the discussion and the data are badly out of date, there is barely any mention of work on single-crystal planes, let alone of results, and there is no mention at all of modern theory. The names of Dennis Newns or Robert Schrieffer do not occur in the text or the references.

There are some other curious omissions and errors. The chapter on surface dynamics contains a long section on surface diffusion that mentions only rather dubious macroscopic methods and omits all references to the elegant field-ion-microscopic work of Gert Ehrlich on atomically perfect single-crystal planes. Field-emission work on adsorbate diffusion is also left out. There is an error of sign for all the work-function changes induced by CO on metals in Table 5.9, and there are several other errors as well.

Despite these by no means minor defects, the book does contain a great deal of useful information and, except as noted, a large number of useful references.

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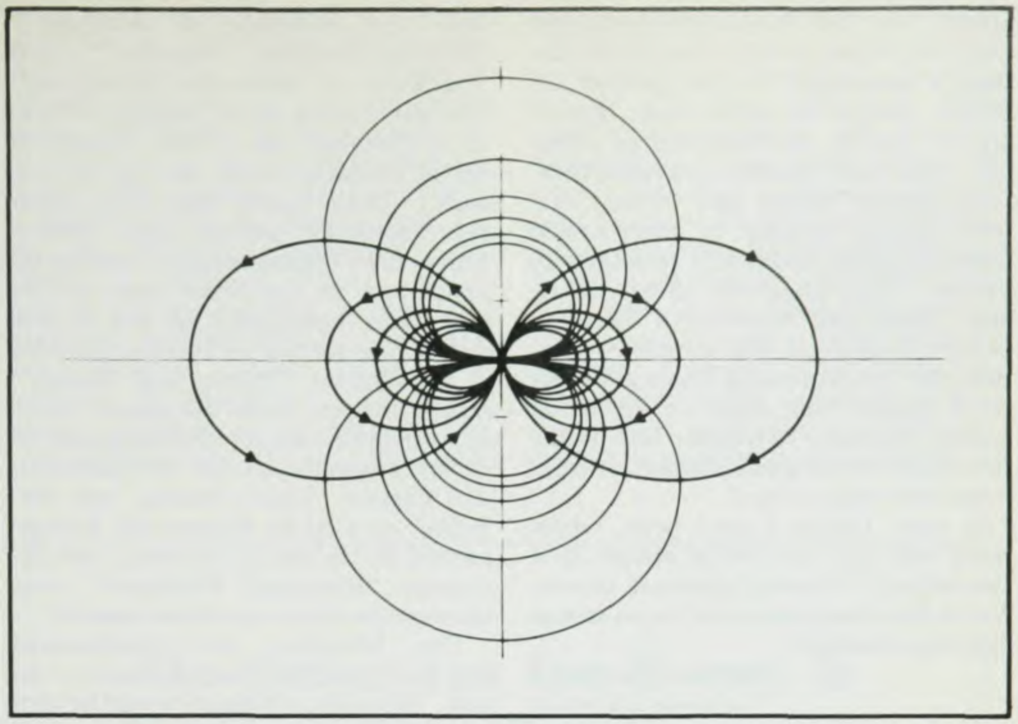

The Classical Electromagnetic Field

Leonard Eyges
433 pp. Addison-Wesley, Reading, Mass., 1972

Classical electromagnetic theory being one of the pillars of physics, it is customarily taught three times to serious students of the subject. *The Classical Electromagnetic Field,* by Leonard Eyges, is a text designed for the third or graduate level. The author has taught physics for many years and is presently a senior physicist with the Air Force Cambridge Research Laboratories.

The mathematical level of this book is similar to that of *Classical Electrodynamics* by John D. Jackson. Vector analysis, Bessel functions, and partial differential equations are freely used without prior exposition. There is a useful series of mathematical appendices in which important formulas and techniques are reviewed.

Multipole expansions, Green's functions, boundary-value problems, image solutions, radiation fields, aperture diffraction, waveguides and scattering are treated, all in about the same detail as by Jackson and in a somewhat more leisurely and lucid explanatory style. Technical complexities, while not glossed over, are firmly subordinated to conceptual organization. However, the book hews strictly to the theory of fields and excludes particle dynamics. Thus the theory of passage of charged particles through matter, treated extensively by Jackson, is absent here; Cerenkov radiation receives only a passing mention, and radiation reaction is treated very briefly. Problems, like those in Jackson, are excellent and sometimes very difficult.

Eyges's approach is distinctly theoretical, and he stresses conceptual analogies between electricity and magnetism and between static and dynamic problems. Relativity is *not* emphasized; one chapter is devoted to a mathematico-physical exposition, but outside this chapter there is no use of 4-notation and hardly any reference to the Lorentz transformation.

There is no treatment of laboratory devices, circuit problems, or the detailed distribution of fields in practical situations such as one finds in *Static and Dynamic Electricity* by William R. Smythe, which is oriented toward engineering students. Historical material is concise but clear and useful. Unrationalized c.g.s. units are used.

Eyges takes particular pains with the theory of the microscopic and macroscopic fields in matter. He emphasizes that the microscopic field, which has unknown fluctuations, is the "true" one, and defines the macroscopic field **E** very carefully, in static problems, by means of a fictitious smeared source. He defines **D**, but downgrades it as a physical concept.

Although I find this treatment of electrostatics good, I think it would be more valuable at the intermediate level. Graduate students are too occupied with the confrontation of classical with quantum ideas to undertake a fundamental revision of their concepts with respect to classical microscopic and macroscopic fields. To make a difference to them, one would have to go even further than Eyges does, not merely rederiving the Maxwell fields but identifying and computing, to leading order, the corrections that arise when the logarithmic field gradient becomes comparable to the inverse atomic separation.

Static magnetic fields in matter are treated similarly. The macroscopic **B** is defined through a fictitious smeared current source, and **H** is downgraded. The author fails, though, to point out that one could just as validly define the macroscopic **H** through a fictitious pole distribution. Thus he loses an opportunity to elucidate the relative physical significance of **H** and **B**. His bias toward current sources here, as against poles, also seems philosophically at odds with his preference for the scalar rather than the vector potential in free-space magnetostatic problems. (I mention this only because such stress is laid on conceptual unity.)

Time-varying fields are treated mainly by the fixed-frequency method—that is, by Fourier analysis in time. Here the author takes the extreme point of view that there is no such thing as a frequency-dependent dielectric constant, because the macroscopic fields cannot be defined except in a static or quasistatic situation. I think he is being too careful. At a fixed fre-