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Flying Saucers

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tion and electrical oscillation systems with lumped and distributed elements. With much of this material many students will be relatively familiar though the method of presentation and some of the topics will probably be new to them. The next two chapters present a discussion of Lagrange's equations and vector analysis. Then follows a general treatment of the solutions of the wave equation, Laplace's equation, the heat-flow equation, the chemical-diffusion equation, and other linear partial differential equations. This treatment performs a very useful function as too often in his scientific education the student does not have the opportunity to see the methods and analysis applied in one field carried over into other related ones. Next follow chapters on heat flow, dynamics of fluids and electromagnetic theory. In the latter chapter is a useful summary of the units of the electric and magnetic quantities in the rationalized mks system as well as a brief discussion of wave guides, a subject in which Professor Bronwell has previously been co-author of a book. The last three chapters deal with the functions of a complex variable, complex roots of polynomials and dynamic stability and Laplace transformations. With the latter chapter is included a table of operations and a table of Laplace transformations.

At the end of every chapter, except a short one at the beginning on complex numbers and hyperbolic functions, there is included an extensive series of references both to books and journal articles. Also at the end of each chapter there are a large number of problems with the answers provided at the end of the book. There are many applications to physical problems scattered throughout the book. Comparing this book with one such as *The Mathematics of Physics and Chemistry* by Margenau and Murphy one sees much common ground and also much diversity. They represent somewhat different interests and both have their places in the educational scheme of things.

Any physicist whose major interest is experimental work will find this book very useful and if engineers are fully acquainted with this body of mathematics as well as their more professional subjects no one can justly hurl at them the accusation that their education is narrow and practical. Although many seniors in liberal arts colleges would find much of this material difficult, nevertheless they could profitably study certain sections. This book is a real contribution to scientific and engineering education and will be of help to scientists and engineers in the difficult problem of assimilating an almost exponentially growing body of knowledge.

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Flying Saucers. DONALD H. MENZEL. Pp. 319+96 photographs, illustrations, and diagrams. Harvard University Press, Cambridge, Massachusetts, 1953. Price $4.75.

Most of us think flying saucers have been with us for only six years. Yet Dr. Menzel, Associate Director of the Harvard College Observatory, who evidently has had an unusual degree of interest in flying saucers, tells us in his book *Flying Saucers* that the saucers have existed at least as far back as Biblical times. They have become more frequently observed in recent times, with some 1157 "unexplained" sightings recorded since 1947. This book is a popular, interesting, humorous, and entertaining mixture of history, science, yarns, and special investigations of the author. Flying saucers are real, according to Dr. Menzel, as real as a rainbow.

Many saucers involve nothing more mysterious than meteors, planets, stars, lenticular clouds, search lights, birds, high-flying aircraft, or their condensation trails, kites, the aurora, St. Elmo's fire, balloons, and hoaxes. Other apparitions are accounted for by somewhat more obscure phenomena such as halos, glories, coronas, sundogs, rings, mock suns or moons, various optical effects associated with ice crystals, etc. There are also other refraction and reflection effects, radar ducts, mirages, and "air lenses." These last two are treated mathematically in a plausible but somewhat unconvincing appendix, unconvincing because of the rather improbable choice of quantitative parameters. On the other hand, flying saucers are infrequent occurrences, and certainly no one can quarrel with the existence of mirages, or radar or television ducts which occasionally make possible transmission of signals over distances of many hundreds of miles. A dozen or more of the most well-known saucer stories are discussed in extensive detail.

For the scientist interested in atmospheric optics, Humphrey's classic *Physics of the Air* (McGraw-Hill), or Neuberger's article in the *Compendium of Meteorology* (American Meteorological Society) are recommended. Dr. Menzel's popularized scientific explanations are quite sound, and the reviewer noticed only two unimportant inaccuracies. Indeed one must be amazed that Dr. Menzel has unearthed so many interesting stories, from Ezekiel's wheels in the Bible, through *Strange Signes from Heaven* in 1646, to the *Strange Celestial Visitor* of 1882 (observed visually by such scientists as Nobel Prize Winner Zeeman, and observed spectroscopically by others···height 130 miles, length 70 miles, width 10 miles, speed 10 miles per second; which Dr. Menzel considers to have been "some unusual form of auroral activity"), and "the first complete and detailed picture of the story of the Little Men from Venus" (18 pages).

The book mentions a great many things: atom bombs, ball lightning, Cottrell precipitators, rain making, relativity, rocket ships, Russia, Shakespeare, Orson Welles, even some of Dr. Menzel's recent researches in the funneling action of the earth's magnetic field on macroscopically neutral ion beams ejected from the sun, reported to the January 1953 meetings of the American Meterological Society-Institute of the Aeronautical Sciences joint symposium on Solar-Weather Relationships.

There is, of course, nothing in Dr. Menzel's account to inflame the hysteria about uncommunicative visitors from space. Since there are 10^{11} stars in the Milky Way, our Earth must anticipate only about 10^{-11} part of the exploratory interstellar tourist trade.

You will enjoy some pleasant evenings reading this book, and you will still hope to see for yourself one of the more unexplainable saucers so that your friends too, can misinterpret the realities of the sky.

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Introduction to Theoretical Physics. Third edition. LEIGH PAGE. Pp. 701+xi, Figs. 210, 16×23.5 cm. D. Van Nostrand Company, Inc., 1952. Price $8.50.

Many teachers who use this well-known text will probably be happy to know that the third edition differs little from the second. A few explanatory sections have been added, a few new applications introduced, while mks units have been introduced into the problems. However, these are relatively small changes on the pre-formed background of the second edition. It would indeed be comforting to feel that a book published in 1935 required so little alteration to make it truly satisfactory in the world of 1953. In the opinion of the reviewer this is unfortunately not the case, and it is a matter of regret to him that Professor Page did not undertake a more thorough modernization of his text.

The revolution which has occurred in theoretical physics in the last quarter century, and which is proceeding today at an ever accelerating pace, is not one merely of finding wider fields of application for established theory. The outstanding trend towards mathematical generalization, coupled with a growing attitude of "experimentation in theory," is of much greater potential significance for the development of science than is the change in subject matter alone. A working grasp of vector analysis was apt to be a high point in the education of a graduate student in physics 25 years ago, while a feeble inoculation with the bare ideas of the special theory of relativity represented the outermost bounds of the known conceptual universe. Today mathematical physics is fast becoming the natural medium of thought of a considerable body of young physicists, and in the near future the Gibbsian dictum "mathematics is a language" is likely to be proved in an almost literal sense. Today even the most confirmed experimental nuclear physicist must have a nodding acquaintance with advanced quantum mechanics in order to cope with the intricacies of the Clebsch-Gordon coefficients and the concepts of parity and isotopic spin if he is to make sense out of the current literature. The student of electrical engineering who proposes to work with transistors must worry over fine points in the theory of semiconductors, while if he would use the methods of microwave spectroscopy to measure the energy levels of molecules he must wrestle with the quantum-mechanical theory of polyatomic molecules and the theory of radiation. And how is the graduate student in physical chemistry to understand the structures of crystals and of polyatomic molecules if he has not come to grips with the matrix representations of the space groups? This is not to argue that this legion of topics should be crammed into a course on theoretical physics! Heaven forbid, for they are too full now! But it does emphasize that the old way is no longer the right way, and new paths must be explored. How far the drive towards wider demands on the abilities of students to absorb new physical theories and their mathematical counterparts can go before it produces an unsurpassable mental saturation is not clear, but there is every evidence that the situation will become much worse before it becomes better.

Evidently the need here is for a better and more conscious selection of material, and this implies specialization and generalization. It is no longer truly possible to give a single course in theoretical physics which will be adequate to the needs of students in both the pure and applied branches of physics. We are still struggling with the attempt, but time is running out rapidly and we must soon recognize the necessity for a decisive change if we are to do justice to the next generation of students.

Some of these problems can be illustrated in practical terms by a consideration of the book under review. The writer has felt for some time that the chapters on advanced classical dynamics and hydrodynamics occupy an ambiguous position. The former is so condensed (27 pages) that it does not do justice to the subject itself, while its remaining contacts with the Bohr theory of the atom are no longer really important. Must students still endure the mental tortures which always arise from first studying the hydrogen atom from the point of view of Newtonian mechanics, and then unlearning it in the course on quantum mechanics? The work on hydrodynamics (63 pages for both perfect and viscous fluids) is so restricted and unrepresentative of the present state of the subject that it is hardly more than an extended exercise in the mathematical theory of vector fields. It is too little for the student of hydro- or aerodynamics, and too much for those without this interest. On the other hand, the material on thermodynamics, statistical mechanics, and kinetic theory is so condensed that it can hardly serve to produce real understanding in the student. In the reviewer's opinion Page's discussion of electromagnetic theory smacks too much of the time when theoretical physicists struggled in an intellectual vacuum to make the theory foolproof on purely mathematical grounds. Today even a modest use of the concepts of the molecular structure of matter, combined with a willingness to admit the incompleteness of the macroscopic theory of dielectrics and magnetic substances, will go far towards ostracizing such nuisances as the "*B–H* controversy."

It is very doubtful whether one can justify the devotion of 30 pages to the theory of geometrical optics in a book on theoretical physics. Its incorporation into a good course with laboratory work on the intermediate level, with some work in physical optics, would make the subject much more intelligible. A similar remark could well be made about many of the older topics in atomic structure and spectroscopy.

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Methods of Applied Mathematics. F. B. HILDEBRAND. Pp. 523+xi, Figs. 76. Prentice-Hall, Inc., New York, 1952. Price $7.75.

The most striking feature of the applied physics of this generation is its growing mathematization. Any issue of