

Books

The Classical Theory of Fields. By L. Landau and E. Lifshitz. 354 pp. Addison-Wesley Press, Inc., Cambridge, Mass., 1951. \$7.50.

This book by two prominent Russian physicists fills an important gap existing in the English scientific literature. Its purpose is to give a systematic presentation of the classical theory of the electromagnetic and gravitational fields.

The treatment is deductive in method and is based on the variational principle of least action. Starting with the principle of special relativity, the authors derive the fundamental relations of the electrodynamics of the vacuum and of point charges. There is no discussion of continuous media in this book, and for the gravitational field the principle of general relativity is introduced. No previous knowledge of the tensor calculus is assumed. By this procedure maximum generality and simplicity are attained.

The major portion of the book is devoted to the electromagnetic field. The first chapter introduces the theory of special relativity in which a neat derivation of the Lorentz transformation is given. The second chapter starts with the relativistic mechanics of a free particle, and continues with the problem of the elastic collision of two particles and with the concept of center of mass in the relativistic limit. The third chapter takes up the motion of a charge in an electromagnetic field. The Hamiltonian is given, gauge invariance discussed, and the invariants of the field found. In the fourth chapter the electromagnetic field equations (Maxwell's equations) are put in tensor form. The energy-momentum tensor and its connection with the law of conservation of energy and momentum are formulated. In chapter five, which deals with special problems of constant fields, Coulomb's law is first derived and then the motion of a charged particle in a Coulomb field is obtained. The potential of a charge distribution is given in terms of multipole moments. In chapter six we have a treatment of electromagnetic waves. From plane waves by a Lorentz transformation is derived the Doppler effect which the Fourier resolution of the electrostatic field leads to longitudinal waves. The characteristic vibrations of the field as developed here remind us of the procedure used in quantum electrodynamics. Chapter seven studies the propagation of light. The limits of geometrical optics are first discussed and then put in the form of uncertainty relations. Diffraction, both Fresnel and Fraunhofer is extensively treated. Chapter eight deals with the field of moving charges.

We are introduced to the retarded potentials of a continuous distribution and then to the Lienard-Wiechert potentials. The chapter ends with the Hamiltonian of a system of charges, accurate to terms of the second order of velocity. The ninth chapter concerns the radiation of electromagnetic waves. The radiating dipole, radiation during collisions, radiation in the case of Coulomb interaction, electric quadrupole and magnetic dipole radiation, radiation damping, scattering by free charges, and scattering by low-frequency and high-frequency waves are some of the topics in this long and important chapter. Chapter ten, the first on the gravitational field, is an excellent introduction to tensor calculus. The chapter entitled "Particle in a Gravitational Field" includes the relativistic equations of motion for such a case. The last chapter, number eleven, is on the gravitational field equations. After obtaining the Riemann-Christoffel curvature tensor, the energy-momentum tensor and the field equations of the combined electromagnetic and gravitational field are deduced. The motion for a centrally symmetric gravitational field is worked out in detail.

The present volume is quite suitable for advanced graduate students and in its limited space the range of topics discussed is impressive. However, little historical material and few references to original work are included. A valuable feature of the book is the large selection of illustrative problems. Some of these will help the student in further clarifying his ideas and others are important for their experimental or practical implications. In this translated edition no steps could be taken to bring the book up to date as neither the authors nor the publisher could be reached for advice in translating the book, but numerous misprints, errors in sign and wrong references have been corrected by the translator.

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Phase Transformations in Solids. Edited by R. Smoluchowski, J. E. Mayer, and W. A. Weyl. 660 pp. John Wiley and Sons, Inc., New York, 1951. \$9.50.

Phase Transformations in Solids consists of a series of seventeen papers presented at a conference held under the auspices of the National Research Council at Cornell University in August, 1948. The principal objective of the conference, as stated in the preface, was to "bring together scientists who, although working in their own specialized and diverse fields—physics, chemistry, crystallography, metallurgy, ceramics, glass—have a common interest in the fundamental phenomenon of phase change". The material was arranged for publication by an editorial committee consisting of R. Smoluchowski, J. E. Mayer, and W. A. Weyl.

The diverse fields of interest of the authors are evident from the wide variety of topics which can be divided into three main groups: theoretical, nonmetals, and metals. In the first group, L. Tisza gives a general thermodynamical treatment of phase transitions and