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The Theory Of Heat Radiation (Dover Books On Physics)



Synopsis

The profoundly original ideas introduced by Nobel laureate Max Planck in this endeavor to reconcile the electromagnetic theory of radiation with experimental facts have proved to be of the greatest importance. Few modern introductions to the theory of heat radiation can match this work for precision, care, and attention to details of proof. Although Planck originally intended the book to be simply the connected account of ten years of study, he soon expanded it to a treatise which could serve as an introduction to the study of the entire theory of radiant heat in terms of the recently discovered principle of quantum action. He states his point of view in the introduction: "The hypothesis of quanta \hat{h} may be reduced to the simple proposition that the thermodynamic probability of a physical state is a definite integral number, or, what amounts to the same thing, that the entropy of a state has quite a definite positive value, which, as a minimum, becomes zero, while in contrast therewith, the energy may, according to the classical thermodynamics, decrease without limit to minus infinity." Although several other points of fundamental value in thermodynamics are included, the book is basically a rigorous elaboration of this fundamental idea. The treatment starts from the simple known experimental laws of optics and advances, by gradual extension and the addition of the results of electrodynamics and thermodynamics, to the problems of spectral distribution of energy and of reversibility.

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Customer Reviews

In 1900 Max Planck introduced a quantum constant into his mathematical expression for the energy

distribution of blackbody radiation. This act is now considered to mark the beginning of the twentieth century revolution in physics. Planck's contemporaries had difficulty understanding his earliest papers on the quantum concept. In 1906 and 1914 Planck published more comprehensive accounts of his theory of blackbody heat radiation and his quantum hypothesis. This American Institute of Physics publication, *The Theory of Heat Radiation*, reprints these two later works - *Vorlesungen Über die Theorie der Wärmestrahlung* (1906) and his revised and expanded second edition (1914). The 1906 work is in German while the revised 1914 edition is in English. This publication is volume 11 in the outstanding AIP series titled *The History of Modern Physics 1800-1950*. I found the lengthy introduction by Allan Needell to be very helpful in placing Planck's work in the proper historical context and in identifying points at which Planck made key changes in his personal views. Much of Needell's introduction is devoted to Planck's gradual acceptance of Boltzmann's probabilistic approach to entropy. The first fifty pages examine heat radiation from the perspective of classical optics, including topics like radiation at thermodynamic equilibrium, Kirchhoff's law, and blackbody radiation. The next fifty pages, deductions from electrodynamics and thermodynamics, were substantially more mathematical. Planck discussed the Stefan-Boltzmann law of radiation and the Wien displacement law in detail as well as spectral distribution of energy radiation. Section III presents a general procedure for calculating entropy and introduces his quantum hypothesis.

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