the factorization of the rational primes in an algebraic number field and its relation to the decomposition of $f(x)$ with respect to the modulus p, where $f(x) = 0$ is an equation one of whose roots generates the field. The last part of the chapter considers the prime factors of the field discriminant and also the factorization of the rational primes in cyclotomic fields.

The first part of chapter nine contains the theory of orders (Dedekind, Ordnung; Hilbert, Ring) in a field, and the ideals of any order. The second part of the chapter is devoted to Galois domains and their sub-domains.

Chapter ten deals with the analytic theory of algebraic numbers and develops the transcendental expression for the number of classes of ideals in a field.

Chapter eleven contains the development of the expression for the number of classes of the quadratic and cyclotomic fields and the proof of Dirichlet's theorem regarding arithmetic progressions.

G. E. WAHLIN

Report on Radiation and the Quantum-Theory. By J. H. Jeans. London, Fleetway Press, Ltd., 1924. 86 pp.

The first edition of this report was written in 1914 and was published by the Physical Society of London. In preparing the new edition the writer has omitted some of the parts in which he says there is an *apologia* for the defects and inconsistencies of the theory and has made numerous additions which add to the charm and lucidity of the presentation. The author's remark "that the quantum theory need no longer be considered on the defensive" aptly describes the present situation; in fact some writers have a feeling that the apologia must now be made for the classical electrodynamics.

In the first chapter Jeans points out that the smallness of the total density of radiant energy in temperature-equilibrium with matter compared with that of the heat-energy in the matter cannot be explained on the basis of Newtonian mechanics or by a supposed analogy with a vibrating elastic system immersed in a fluid such as air or water, for it is known by experience that the energy of the elastic system is finally transformed into heat energy of the fluid. The relative smallness of the density of the radiation at $0°$ C is quite startling in the case cited, being 4×10^{-5} ergs per cubic centimeter as compared with 8×10^9 ergs per cubic centimeter in the matter.

In the next chapter it is shown how the classical electrodynamics in combination with the kinetic theory of gases leads to the radiation formula which is associated with the names of Rayleigh and Jeans.

This formula is correct in the region of long wave-lengths or at very high temperatures when the density of radiation is very large

and one of the guiding principles of quantum theory in its later developments is that a formula of quantum theory should reduce to that given by the classical theory under the conditions just mentioned.

Jeans then gives an account of the development of the quantum-theory, describing, in particular, the derivation of Planck's formula which was given by Einstein and the investigations of Poincaré and Fowler regarding the nature of the laws of motion that can lead to Planck's formula.

Chapters IV and V are devoted to Bohr's theory of spectra and to Einstein's theory of the photoelectric effect while Chapter VI contains an account of Debye's theory of the specific heat of solids. Much additional matter is contained in Chapter VII which deals with the dynamics of the quantum theory. The articles on conditionally periodic systems and Bohr's principle of correspondence will be found useful as an introduction to the more complete works mentioned in the text.

The report ends with a short discussion of the physical basis for the quantum theory in which the views expressed are practically the same as in the first edition. The idea of light-quanta is regarded with disfavor but it is perhaps unfortunate that the new report should have been completed just when a big development of the theory of light-quanta was taking place. The beautiful discoveries of Compton and Duane have shown that the phenomena of the scattering and diffraction of X-rays are not incompatible with the idea of light-quanta and the development of the idea of light-molecules by Wolfke, Bothe and de Broglie has shown that Planck's law of radiation is indeed obtained by slight modifications of arguments which previously led to Wien's law. Thus Pauli's remarkable application of the Compton-Debye theory of scattering to the equilibrium between free electrons and cavity radiation has been completed in this way by Bothe and Schrödinger and it now appears that the distribution of energy among the different wave-lengths may be unaltered by collisions of various types, including even the collisions between waves of light and sound which were considered first by Brillouin.

H. BATEMAN

Bibliographie des Déterminants à plus de Deux Dimensions. By Maurice Lecat. Louvain, 1924. 16 pp.

Those interested in determinants will welcome this short bibliography by an author who has made the subject peculiarly his own. It consists of three parts; a bibliography with 121 entries arranged alphabetically, an interesting chronological table, and a list of minor contributions to the subject. It is worthy of note that 50 out of the titles listed are by M. Lecat himself.

J. H. M. WEDDERBURN