Waves, particles, new atom pictures; (16) Limitations imposed by nature—the uncertainty principle; (17) Modern applications of physics.

E. U. CONDON

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The Physics of Electron Tubes. By L. R. KOLLER. Second edition. McGraw-Hill Book Company.

THE author has presented a simple, clear survey of the principles of electronics, together with a wealth of practical information. This book will be welcomed by the engineer or student who wishes an accurate non-mathematical account of the physics involved in the electronic devices which have become so important in present-day industry. Those working in the field covered by the book will find a great deal of valuable detailed description of the technique used in the preparation of electron tubes.

A very complete account of thermionic emission is given in the first few chapters. This treatment includes not only thoriated tungsten and oxide coated emitters but also the less well-known caesium treated cathodes. The problem of electrical discharge in gases is very adequately and clearly covered. Sections dealing with photoelectric and photoconductive phenomena provide a clear practical outline of the field and include numerous tables and curves describing the properties of photoactive materials.

The book also contains a large amount of useful information on such subjects as the use of getters for producing high vacua, the measurement of temperatures inside of vacuum tubes and the general methods used in electron tube work.

In addition to the material contained in the first edition, the second edition includes a discussion of secondary emission multipliers, the ignitron, and various new devices employing electron optics. The book is well printed and illustrated with many diagrams and charts which clarify the text.

V. K. ZWORYKIN

R.C.A. MANUFACTURING COMPANY,
CAMDEN, N. J.

L'Unité de la Force et L'Unité de la Matière dans la Conception Physique Uniforme du Monde. By JAN BAŠTA. Pp. 103. Masarykova Akademie Práce, Prague, 1936.

IN this monograph the author maintains, largely by qualitative arguments, the unity of all force and the unity of all matter. The latter hypothesis leads him to the concept of a cosmic ether composed of protoatoms, which, under certain conditions, may manifest themselves as the chemical elements of ordinary matter. Rejecting the concept of action at a distance, he assumes that forces are transmitted from one protoatom to another by immediate contact. To maintain the unity of force, he supposes that elementary forces possess both a longitudinal and a transverse aspect, the first accounting for gravitational attraction and the second for electromagnetic interaction. By developing a theory of elasticity of the ether he computes a velocity of gravitational waves between 1.73 and 2.00 times the velocity of light.

The author dislikes both the special and the general theories of relativity. He prefers to explain the negative result of the Michelson-Morley experiment on the ground of ether entrainment, without, however, offering any escape from the difficulties to which that hypothesis leads.

LEIGH PAGE

YALE UNIVERSITY

Atomic Physics. By MAX BORN. New York: G. E. Stechert and Co. pp. vii + 352. 1936.

THE book is characterized by a reasonably comprehensive introduction of about three chapters dealing with phenomena from the experimental side. A brief review of the Bohr theory follows, mention is made of the matrix mechanics, and the remainder of the book deals with the wave mechanical theory. At the end there is an appendix, in which some of the mathematical expressions are developed in greater detail.

The author's prominence in the field of atomic structure, of course, insures an authoritative statement of the situation. The book deals with the relative elementary aspects of the subject; but it does not always form very easy reading. Although it is presumably written for one who has not made a study of the subject before, the nature of the language in the discussions is such that a previous knowledge of wave mechanics and of the problems which confront the theory of atomic structure would be almost essential for a proper comprehension of the contents of the book.

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SPECIAL ARTICLES

APHIS RESISTANCE IN BREEDING MOSAIC-ESCAPING RED RASPBERRIES

PREVIOUS investigation[1] has indicated that certain red raspberry varieties are either immune to red raspberry mosaic or non-infectible by its common vectors. These varieties are now either unobtainable for breeding stock or they are objectionable because of unde-

[1] W. Howard Rankin, *N. Y. (Geneva) Agr. Exp. Sta. Bul.*, 543, 1927.

sirable fruit or plant characters. In experiments to be reported in detail elsewhere we have found that the Lloyd George variety, an outstanding parent from the standpoint of fruit quality,[2] completely escapes mosaic infection in the Puyallup Valley of western Washington by virtue of its resistance to the aphid vector, *Amphorophora rubi* Kalt., and that it transmits this characteristic when hybridized with a susceptible variety.

During the three-year period of our investigations no effective vector other than *A. rubi* was found upon the red raspberry. That varieties grown in the field differ greatly in their susceptibility to this aphid is shown in the following table.

TABLE I

FIELD COUNTS OF *Amphorophora rubi* KALT., MADE UPON TEN RED RASPBERRY VARIETIES IN 1936

Variety	June 25		July 23	
	Range of aphid counts per cane	Ave. no. aphids per cane	Range of aphid counts per cane	Ave. no. aphids per cane
Antwerp	0–2	0.2	0–5	1.8
Chief	8–104	42.7	3–108	41.1
Cuthbert	0–16	5.0	0–30	10.8
Herbert	0–3	0.3	0–6	1.8
Latham	2–27	14.7	4–49	23.1
Lloyd George	0–0	0.0	0–0	0.0
Marlboro	1–9	4.6	4–42	16.8
Newburgh	0–6	2.0	0–9	4.6
Newman	4–17	10.1	1–26	12.5
Viking	0–39	16.0	3–83	32.8

Although populations of *A. rubi* on susceptible varieties varied throughout the summers of 1935 and 1936, repeated field counts were sufficiently consistent to permit a general classification of varieties relative to aphid susceptibility. Antwerp, Herbert and Newburgh show marked resistance to the vector, while the other varieties, except Lloyd George, show greater susceptibility. Observations indicate also that the rate of spread of mosaic in the 10 varieties appears to be directly proportional to their relative aphid populations. Many field counts were made upon Lloyd George, in addition to those shown in the table and all gave negative results. The only specimens of *A. rubi* found upon Lloyd George were a few winged individuals that probably landed there accidentally while in flight. That such chance visitors do not infect the Lloyd George is shown by the fact that red raspberry mosaic was not observed on this variety in the field, although artificial infection by graftage resulted in the development of distinct mottling, indicating that Lloyd George is susceptible to the virus. In another experiment, a Lloyd George plant that remained in constant contact with a mosaic-infected, aphid-infested Newman plant throughout one summer did not develop symptoms of mosaic during two years thereafter.

In greenhouse experiments, stem mothers were placed upon individual plants under cheesecloth cages. Large populations developed upon highly susceptible varieties; little reproduction occurred upon more resistant varieties; and the aphids could not maintain themselves on Lloyd George. They gradually died without reproducing after wandering about over the cage and the plant, apparently without feeding. Greenhouse testing of varieties by means of cages proved to be a convenient, rapid and accurate method of determining relative susceptibility to *A. rubi* and is a valuable aid in the breeding of resistant varieties.

Both field counts and greenhouse tests were conducted with hybrids resulting from crossing several red raspberry varieties. Of 31 hybrids of Lloyd George × Cuthbert and the reciprocal cross, six proved to be completely resistant and several others were highly resistant. Of six hybrids of Lloyd George × Latham and the reciprocal, three were resistant and three susceptible. Of nineteen hybrids of susceptible parents, all were definitely susceptible.

The numbers of plants whose relative susceptibility was definitely determined were too small to permit genetic analysis. The behavior of *A. rubi* when confined to Lloyd George plants under cages indicates that resistance probably results from a lack of suitable food for the insect rather than the presence of an actively repellent substance. Such a negative character may be expected to be a recessive. The data thus far obtained support this theory.

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[2] C. D. Schwartze, *Proc. Amer. Soc. Hort. Sci.*, 30: 113–116, 1933; 32: 411–415, 1934.

THE SIMILARITY OF ACTION OF PURIFIED CORTICAL ADRENAL EXTRACTS TO CRYSTALLINE ANDROSTERONE AND TESTOSTERONE

HAVING shown that crystalline androsterone and testosterone can initiate the lengthening of the ovipositor of the female bitterling,[1] we were interested in the observation of Barnes, Kanter and Klawans.[2]

[1] I. S. Kleiner, A. I. Weisman and D. I. Mishkind, *Proc. Soc. Exp. Biol. and Med.*, 35: 344, 1936; I. S. Kleiner, A. I. Weisman, D. I. Mishkind and C. W. Coates, *Zoologica*, 21, part 4: 241, 1936.

[2] B. O. Barnes, A. E. Kanter and A. H. Klawans, SCIENCE, 84: 310, 1936.