trade of a physicist, that is, to participate actively in the program of describing, creating and understanding human experience, it is unnecessary to hold any particular professional philosophical view. Thus to be successful the physicist need not believe in the existence of a "real" world as the basis of experience, nor is he forced on the other hand to subscribe to the notion that, because many abstract theories have worked remarkably well, our experience is really only a figment of our imagination. So one might be tempted to conclude that philosophy has nothing to do with physics. Actually this ignores the persistent desire to provide an interpretation of modern physical theories which is not content with their role as mere tools for predicting experience but insists that the concepts of these theories shall be related somehow to the great ideas of space, time, number, probability, causality and the like which have long served the human mind in its search for meaning in human experience. The greatest physicists of our time have felt this desire, and the writings of men like Planck, Einstein, Bohr, De Broglie, Schrödinger and Heisenberg reflect their attempts to satisfy it.

The author of the book under review, the well-known professor of theoretical physics at the University of Paris, has felt himself impelled to study once more the meaning to be attributed to the concepts of the quantum theory. The result is a volume which, though perhaps unduly verbose, is worthy of considerable attention.

After an introduction justifying his concern over the whole problem and a very brief resumé of the fundamental principles of quantum mechanics, the author proceeds to divide his book into two main parts, devoted respectively to what he calls the realistic interpretation on the one hand and the positivistic or empiricist on the other. By the realistic point of view he means the assumption that on the microscopic level, systems can exist and have well-defined properties wholly independent of any observer or measuring instrument. On this view the "knowledge" of the observer has nothing to do with the existence of the system and its behavior. The author then endeavors to show how quantum mechanics can be interpreted in terms of the realistic hypothesis. There is a fair amount of detailed analysis presented in the Dirac notation. This includes an analysis of the Einstein, Podolsky and Rosen paradox and the problem of measurement. The difficulties are found to be great and the conclusions are negative. The next step is to investigate macroscopic systems under what the author calls the unirealistic hypothesis, which he expresses in the form that everything that exists in the world is purely physical in nature and obeys the principles of quantum mechanics. This view also is found to be untenable.

The second part of the book is devoted to an exposition of what the author calls the positivistic or empiricist point of view. To him the positivist or empiricist in physics (and he treats the terms as essentially synonymous) is one who believes that the only legitimate aims of the science are to provide an accurate and economical description of actual observations and to construct a formalism which permits the prediction of new observations on the basis of those already made. Probably few physicists would quarrel with this. Indeed, if by "constructing a formalism" means to invent a theory with full play allowed to the human imagination, this statement just made would fit practically all theoretical physicists and indeed a great many who do not think of themselves as at all positivists or empiricists in what they believe to be the professional philosophical meaning. Terminology can be deceptive. The interested person should read Professor d'Espagnat's book to see how ingeniously he develops his critique. In this part of the volume there is an interesting discussion of the views of Niels Bohr and other adherents of the Copenhagen school as well as the objections raised by Einstein, Wigner and others.

The book concludes with a mélange of observations on the relevance of ancient Greek philosophy for modern physics, including numerous references to Plato and Pythagoras. The author sums up by expressing his belief that the great contribution of modern physics to science is its defiance of dogmatism and its insistence on the freedom to invent new ideas to meet new experience.

* * *

R. Bruce Lindsay, who is dean of the graduate school at Brown University, has been interested in relations between physics and philosophy for many years.

Compositions of diamond-like substances

THE CHEMISTRY OF DIAMOND-LIKE SEMICONDUCTORS. By N. A. Goryunova. J. C. Anderson, ed. 244 pp. MIT Press, Cambridge, Mass., 1965. $10.00.

by Lars C. Luther

The author of this monograph is a member of the Leningrad Physico-Technical Institute. She and her coworkers have published numerous articles since 1950 reporting on experimental work in the semiconductor field with special emphasis on multicomponent solid solutions. The present text, whose original Russian version appeared in Leningrad in 1963, is based in part on lectures given in the Chemistry Department of Leningrad University in 1958-1961.

The book is divided into three chapters. An introduction dealing with theoretical aspects is followed by a small encyclopedia with a large bias. In the encyclopedic articles on each of the Group IV elements and the III-V compounds, a considerable amount of detail is summarized (physical appearance and constants, methods of preparation, etches, etc.) However, arriving at the II-VI and I-VII compounds, the discussion becomes very cursory. Throughout these articles the author's interest is reflected in a prominence of phase diagrams. A review article on solid solutions between III-V, II-VI and I-VII compounds completes the middle section. The final chapter contains an interesting qualitative discussion of the variation of properties within groups and periods.

In the theoretical introduction some of the author's original work is presented. Most important is her discus-

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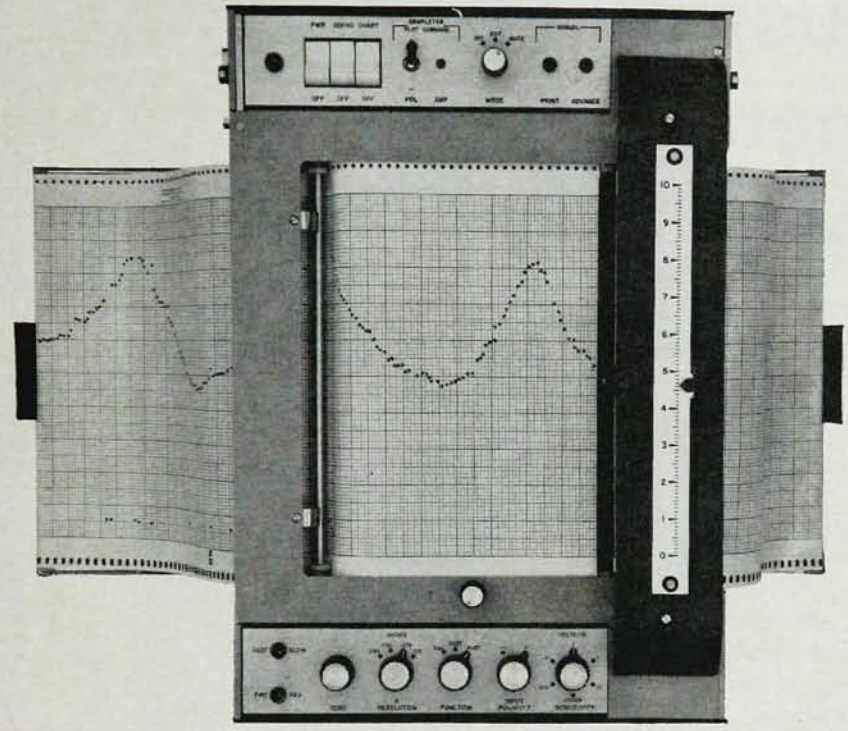

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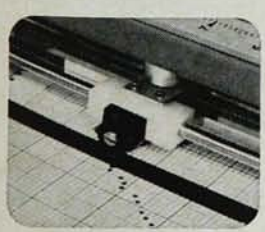

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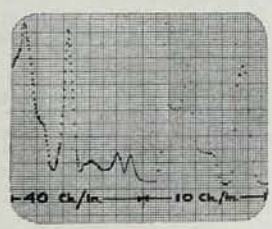

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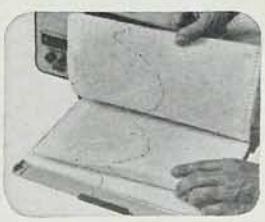

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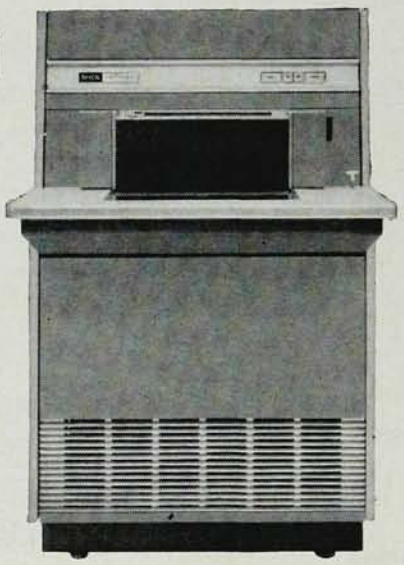

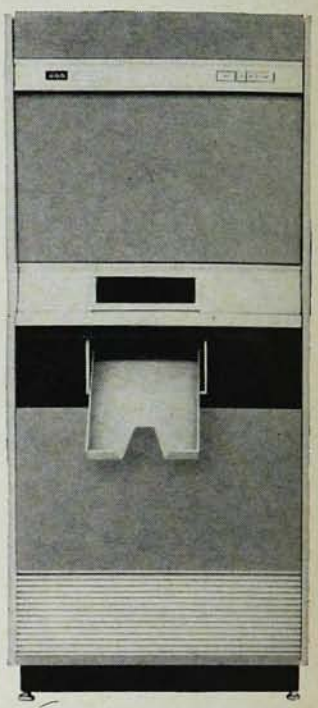

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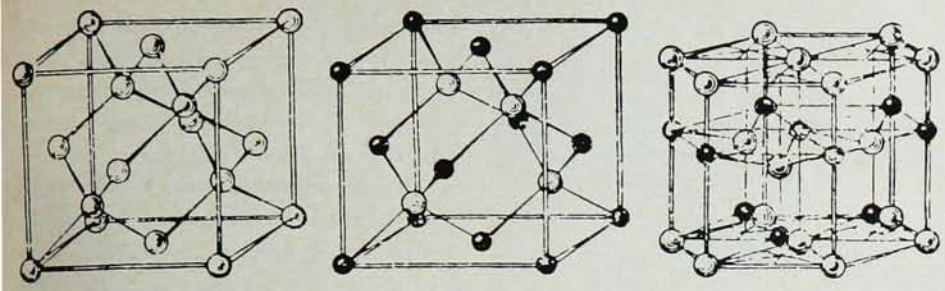

a b c

CRYSTAL STRUCTURES of (a) diamond, (b) sphalerite and (c) wurtzite. From the book ***The Chemistry of Diamond-Like Semiconductors*** by N. A. Goryunova.

sion of complex tetrahedral phases. In a systematic program the compositions of diamond-like substances are predicted on the basis of the following two criteria: (1) the average number of valence electrons must be four, and (2) normal valence must be achieved (this means that the anion must have a completed octet). Goryunova finds, for instance, that of 35 possible ternary phases formed from the seven elements of a row in the periodic table, only five can be considered analogs of elements of Group IV. There are four seven-component analogs.

It is characteristic of the author's approach that she remains aloof from theory-lets nucleating on observable trends. Thus she is also modest in assessing the value of her own proposed scheme which separates binary compounds into two groups with tetrahedral and octahedral coordination on the basis of electron affinities of the constituent elements rather than quantum numbers and electronegativities as suggested by Mooser and Pearson.

The translation is excellent as a whole, yet there are spots where Chinese-box sentences contain very little meaning. One of the tables is useless because bold and ordinary type cannot be distinguished. However, these are minor flaws compared with the more serious one of organization. The book is too slanted to appeal as an introduction to the subject as named by the title yet there is too much peripheral encyclopedic information to make it a good monograph on a special aspect of the subject.

* * *

Lars C. Luther is a member of the staff of the Bell Telephone Laboratories at Murray Hill, N. J.

Surface phenomena for everybody

RECENT PROGRESS IN SURFACE SCIENCE, VOLUME 2. J. F. Danielli, K. G. A. Pankhurst, and A. C. Riddiford, eds. 541 pp. Academic Press, New York, 1964. $18.00.

by M. E. Straumanis

The cover of this book reveals that this serial publication brings together reviews of different disciplines within the general field of surface studies. The articles collected provide newest information (the years 1956 to 1961 are covered) on surface studies to all those who are interested in them: physicists, physical and colloidal chemists, electrochemists, plant and animal physiologists, botanists, zoologists, industrial chemists and even graduate students. Accordingly, the book covers topics from physics of adsorption to cell membranes and the articles are well written and understandable.

The three editors collected 10 articles for the book. The first article is written by M. M. Dubinin, B. P. Bering, and V. V. Serpinskii, all three from the Institute of Physical Chemistry of the Academy of Sciences of the U.S.S.R. in Moscow, and deals with physical adsorption at the gas-solid interface. Especially valuable are the references because they include the work done by Russian scientists, not so easily available in the West. Only physical adsorption is discussed, as the authors tried to avoid chemisorption. Some of the sections of the article are as follows: theoretical calculation of adsorption energies, adsorption heats and entropies, capillary condensation, properties of substances in the adsorbed state, adsorption of gas and vapor mixtures and sorption on major adsorbents. Some equations are given in the article but not their derivations.

The second article is on heterogeneous catalysis and is written by D. Brennan (The Donnan Laboratories of the University of Liverpool, England). It covers the topics: heterogeneous atomization of hydrogen and oxygen, the hydrogen-deuterium exchange reaction and the ortho-para hydrogen conversion, the hydrogenation of ethylene and the decomposition of formic acid.

"Contact angles" is the third article, written by G. E. P. Elliott and A. C. Riddiford (Dept. of Chemistry of the University of Southampton, England). It covers Young's equation, critical surface tension, polymers, and contact-angles studies.

J. T. Davies of the Department of Chemical Engineering of the University of Birmingham (England) wrote the next article which is on emulsions. It contains, among others, sections on formation and stability of emulsions, electrical and solvation barriers, coalescence and stability, breaking, creaming and viscosity of emulsions.

The last article still of interest for metallurgists or physical chemists is on flotation by A. S. Jay and A. J. Robinson (Warren Spring Laboratory, Stevenage, England). This article covers the topics: fundamental principles, kinetics of flotation, flotation performance, cell design, plant practice and other applications of the flotation process.

The last five articles of the book are of lesser interest for a physicist