

meates all space. We are here presented with a mini-monograph on the ever present particulate matter, a synopsis of the kind that, to the reviewer's knowledge, has not been published before. It deals with distribution of sizes, number densities, origin, reactions with surroundings, cosmic and human roles of diverse particle populations: natural and man-made aerosols in the terrestrial atmosphere; air pollution and rain formation; radioactive fallout, its formation in nuclear explosions and further transport; interplanetary and interstellar dust; dust on the surfaces of the moon, on the planets and in their atmospheres.

To squeeze this enormous subject into so small a volume, a noncommittal method of presentation has been followed by the author—something intermediate between a popular and a technical style. Searchlight pictures of the various directions of research are given, sometimes with very elementary text, sometimes with formulas and symbols only being mentioned, often without adequate explanation and definitions. It is more like a catalog of what has been going on in this sector of research, rather than a systematic presentation of the topics. For the initiated researcher it is a useful guide; he will mostly be able to complete or reconstruct whatever is unfinished. The beginner may find it more difficult and will have to check on the literature, which, though profusely cited, is deliberately incomplete, the references being "selected as examples." This is not much of a setback since each of the sources cited is able to provide, if needed, new references and fill in the gaps. More objectionable is the inclusion of some less reliable sources, apt only to mislead the reader, such as A. Dauvillier's *Cosmic Dust* (which I reviewed in *PHYSICS TODAY*, Jan. 1963, p. 70) in which astronomical facts and physical laws are badly misrepresented. As a rule, Cadle's monograph usually abstains from critical judgment and presents the often contradictory data and opinions as they are published by the various authors.

With the somewhat loose style and casual approach, shortcomings are inevitable, some examples of which are given in the following.

In the theoretical introduction,

monotonous distribution functions of sizes, without frequency maxima, and the concept of cumulative frequencies appropriate to such functions, are not mentioned; they are later introduced, without further explanation, in the astrophysical applications (meteors, etc.). The monograph by G. Herdan, *Small Particle Statistics*, (which I also reviewed, *PHYSICS TODAY*, Jan. 1962, p. 66), is specially dedicated to size distribution functions, but is not mentioned—an omission that cannot be justified even by the deliberately casual method of selecting the literature.

On page 19, submicron-size extra-terrestrial particles are said to be vaporized, while "larger objects may only partially melt, casting off droplets"; the actual situation is exactly the reverse, small particles dissipating kinetic energy through radiation without vaporization.

In the Langmuir-Stokes equation (number 2.37), ρ , the density of the droplet, is not defined. The terms "exosphere," "ozonosphere," "chemisphere" are mentioned only once on page 75 without any explanation of their meaning.

On pages 135 and 136, an outdated view of the zodiacal light as part of the solar corona, and of a considerable role of light scattering in it by free electrons is maintained; Mariner II data have dispelled this concept.

On page 140, the author omitted mentioning that N is the cumulative meteor flux, and reference 20 for Whipple's data is not from *Vistas in Astronomy*. On page 143 and equation 5.8, N is not the "cumulative mass flux" but the cumulative number flux down to limiting mass m . Equation 5.9 on page 144, exactly copied from Hawkins with the original error repeated, would require impact penetration to increase with the density of the target; a negative power of the density, $-2/3$ is the correct expression. *Ibidem*, "Brunell" for Brinell hardness is also copied from Hawkins.

On page 164, the much publicized yet widely misinterpreted Alphonsus "eruption" observed by Kozyrev is again ascribed to "gas emission" although actually it was fluorescence of a solid that did not move from the place.

On page 173, equation 6.6 pretends to represent the general illumination

law on the lunar surface, although actually it is only valid at the lunar equator.

On page 188, the nonmelting limit for the Martian polar caps is, of course, 32°F , not 32°C , as stated. Promiscuous use of British and metric units in the book may have led to other similar misstatements.

On page 198, the contention of synchronous rotation for Mercury no longer holds.

On page 208, the suggestion that the sun-grazing Comet 1882 II "vaporized and later recondensed" is physically absurd; there is no process that could lead to recondensation of the vapors.

Despite these and similar shortcomings, the book is of considerable value for the researcher; it illuminates the field of study in all directions. It is up to the student to watch his step and to check the data and opinions critically.

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Emphasis on use

QUANTUM MECHANICS. By A. S. Davydov. Trans. from Russian by I. V. Schensted. 671 pp. NEO Press, Ann Arbor, Mich., 1966. Paper \$6.00

by Henry S. Valk

With the appearance of the NEO Press edition of A. S. Davydov's *Quantum Mechanics*, we now have available two English translations of this work.

The book is the outgrowth of a course of lectures given for several years to students in the physics department of Moscow University. As such, it presents a reasonably complete and clear exposition of the standard material to be expected in any introductory graduate course in quantum mechanics. Such topics as wave functions and the Schrödinger wave equation, exact and approximate solutions, perturbation theory, representation and transformation theory, and scattering theory are fully covered. The

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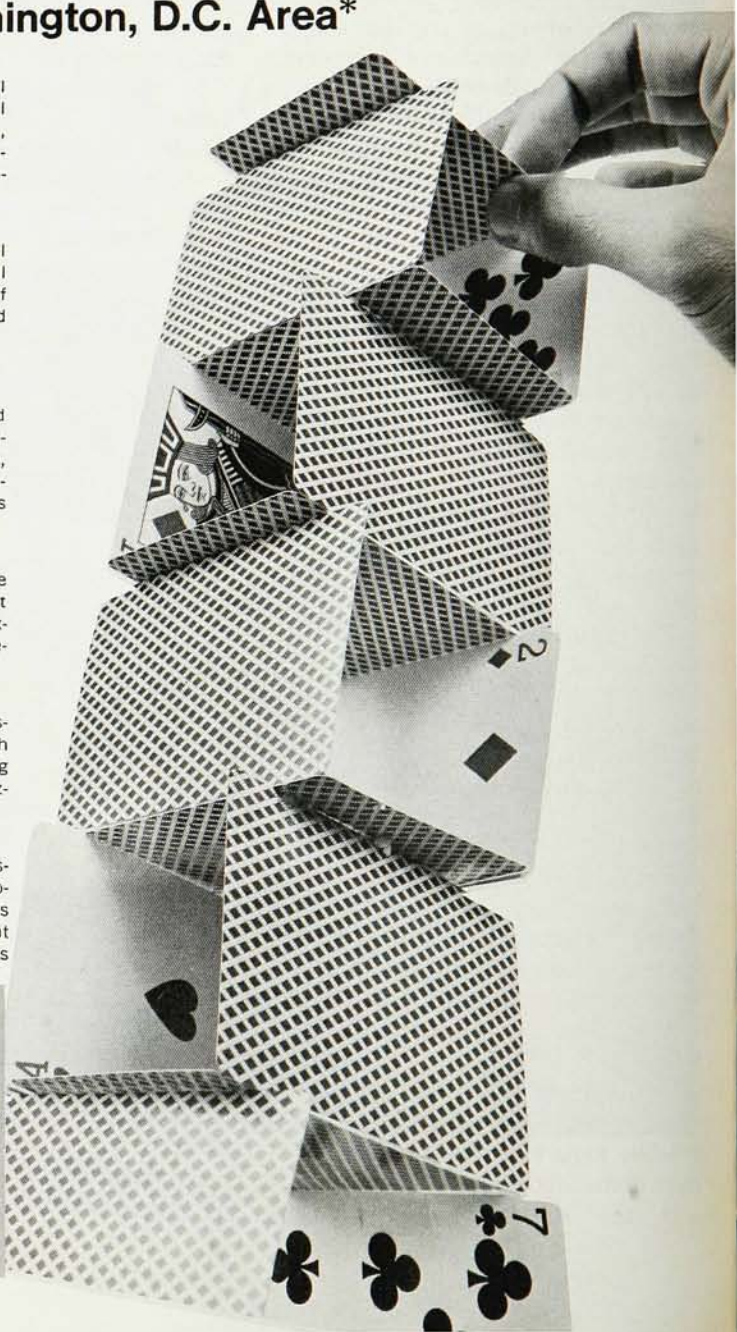
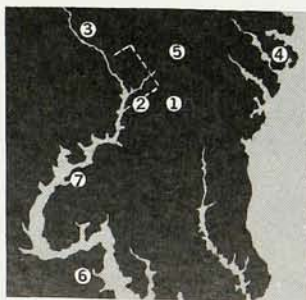
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book departs from the traditional pattern, however, by including a series of topics less often developed; for example, we find discussions of the density matrix, Racah coefficients, the Feshbach-Villars and Foldy-Wouthuysen representations, and the second quantization of boson and fermion systems. In addition, the reader will find applications to neutron scattering in crystals, molecular spectra, van der Waals forces, ferromagnetism, spin waves, superfluidity, and superconductivity. It is in these additional topics and applications that the book finds its *raison d'être*. All too many authors content themselves with presenting primarily the theory and its foundations, a situation that leaves the student often unaware of the manner in which quantum mechanics is actually used in physical problems. The variety of applications to be found partially reflects the range of the author's own research interests: He has made significant theoretical contributions in many branches of physics and is the author of books on solid-state and nuclear physics.

As might be expected in any work of such broad scope, there are places where the treatment is thin or insufficient. For example, in the chapter on central forces there are discussions of angular momentum and its couplings as well as transformation properties and *D*-functions, but, inexplicably, there is no mention of irreducible tensors or the Wigner-Eckart theorem and its applications. A superficiality of treatment is also apparent in certain parts of the text. To derive any real benefit from sections such as that on the nuclear shell model (section 94) it will be necessary for the reader to go elsewhere. Although these defects are an annoyance, they should not be considered to detract unduly from the overall usefulness of the book. Davydov's text may not replace its counterparts like Landau and Lifshitz in depth, but its emphasis on the uses of quantum mechanics makes it a valuable addition to the physicist's library.

The present version, translated from the Russian by Irene Schensted, differs from the earlier Dirk ter Haar edition (published in this country by Addison-Wesley) in several ways, not the least of which is cost: the NEO Press paperback is far less expensive and for

that reason may be much more attractive to students. The other differences, however, must be noted. The ter Haar edition is more idiomatic and professional in its language. Moreover, it includes an excellent set of problems at the end of each chapter. The present edition, on the other hand, is essentially correct physically and not so awkward in its literal translation as to be misleading. It furthermore has at the end of each chapter a set of translator's notes that enlarges upon the developments in the text and is intended to make the book more accessible to beginning graduate students and undergraduates. Both versions of the text thus have their difficulties and good points. "You pays your money and you takes your choice."

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Computer approximations

NUMERICAL INTEGRATION. By Philip J. Davis, Philip Rabinowitz. 230 pp. Blaisdell, Waltham, Mass., 1967. \$7.50

by Jacques E. Romain

"In writing this book," the authors state, "we have tried to keep our feet on the ground and our heads in the clouds. By ground we imply utility in day-to-day computation and know-how of the computer laboratory; by clouds, theoretical topics that underlie numerical integration." This statement gives a fairly exact overall description of the spirit of the book. The exposition is based on theoretical grounds (so that the reader can assess the validity of the various methods in the case of his own problem) and is carried to the point of practical application. Not all proofs are given, but when they are omitted, references are given. The authors take pains to indicate in which case each of several rival methods is advisable. Most methods are illustrated by examples, and the comparison between methods is displayed by means of examples selected in order to exhibit the convergence properties of the methods. The desirability of a careful analysis of the

problem before choosing a method is often stressed: "One good thought is worth a hundred hours on the computer."

The book is computer-oriented and the emphasis is on approximate rules of integration that involve functional values. The coverage is broad, and an abundant bibliography (referred to after each method and submethod) covers the literature as of 1965. These features make the book complete enough to provide a good basic text for both classroom and computing laboratory. The subject matter includes improper integrals, infinite intervals, and two- or more-dimensional integrals; a chapter is devoted to error analysis and one to automatic integration (that is, standard procedures to be applied blindly); the book is complemented with some FORTRAN programs, a bibliography of ALGOL procedures and a bibliography of tables for integration.

A prerequisite for this book is a course in advanced calculus. A basic knowledge of numerical analysis is also desirable, as the examples are not worked out in every detail. The book will be a real help to those who meet these prerequisites.

Both authors have published several papers on numerical integration. Philip J. Davis is probably best known to the occasional practitioner for his contribution to the chapter on numerical integration in the *NBS Handbook of Mathematical Functions*.

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The reviewer is an adviser in applied mathematics, engaged, in part, in numerical computation work.

NEW BOOKS

ELEMENTARY PARTICLES & FIELDS

Topics in Several Particle Dynamics. By Kenneth M. Watson, John Nuttall. 121 pp. Holden-Day, San Francisco, 1967. \$7.50

Progress in Elementary Particle and Cosmic Ray Physics, Vol. 9. J. G. Wilson, S. A. Wouthuysen, eds. 315 pp. North-Holland, Amsterdam (Interscience, New York), 1967. \$15.50

Symposia on Theoretical Physics, Vol. 3. (Summer School, Madras, India, 1964) Alladi Ramakrishnan, ed. 180 pp. Plenum Press, New York, 1967. \$9.50

Symposia on Theoretical Physics, Vol. 4. Conf. proc. (Madras, India, Jan. 1965)