Book Reviews

Tropical Meteorology. Herbert Riehl. McGraw-Hill, New York–London, 1954. x + 392 pp. Illus. $8.50.

About half the earth's atmosphere is contained in the tropics. Yet the literature dealing with tropical weather, while fairly extensive, has consisted of random papers or chapters in widely scattered publications and several books concerned with specialized subjects, such as hurricanes. The author has performed a great service for the meteorologic profession by gathering together and presenting in one volume a wealth of information on tropical meteorology. In doing this, he has permitted the influence of his own original and prolific papers to be quite evident. In a less able author this could be a severe drawback. In the present case, the result is a well-integrated account in which the theoretical and speculative aspects are remarkably free from attack. At the same time, Riehl has only rarely failed to consider the findings of other workers in the field.

The style of writing is clear and free flowing, and the presentation is well organized. The author begins with a synoptic-climatologic treatment of wind, pressure, temperature, rainfall, and cloudiness. He proceeds by discussing convection, mainly as it is concerned with low-latitude cloudiness, and then presents a chapter on the physics of tropical rain (prepared by his colleague, Raymond Wexler). Riehl touches on the subjects of weather observing and analysis, and then he moves briefly into the realm of theory with a short discussion of divergence and vorticity. He concludes with and places greatest emphasis on chapters dealing with low-latitude disturbances, for example, hurricanes and waves in the easterlies and how they fit into the general-circulation scheme. This is probably the most valuable portion of the book, and it is done convincingly. While studying it, the reader should nevertheless always be aware of the profound lack of low-latitude data from which one can generalize on the structure and behavior of tropical phenomena, and he should constantly make the effort to differentiate between fact and theory. The over-all treatment is empirical or synoptic rather than dynamic; the mathematics is simple and unobtrusive. The author has elected to explain a number of important and quite involved atmospheric phenomena and processes of the tropics, although it is true that he does not devote much space to the methods of forecasting them. Proper understanding of the explanations requires basic meteorologic training. Thus, the layman will derive benefit mainly from the climatologic and purely descriptive material. However, as a text or as reference material for the trained meteorologist concerned with the synoptic meteorology of low latitudes, this book admirably fills a long-felt need.

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Geometrical Mechanics and De Broglie Waves. J. L. Synge. Part of Cambridge Monographs on Mechanics and Applied Mathematics. G. K. Batchelor and H. Bondi, Eds. Cambridge Univ. Press, New York, 1954. vi + 167 pp. Illus. $4.75.

This small and well-made book has an unusual place among monographs on physics. It does not summarize a rapidly growing field, nor is it an exposition of a well-established branch of theory. Instead it is an original setting forth of a theoretical topic that seems to fill a logical gap in the structure of physical theory rather than to form the basis for new developments.

The Hamiltonian theory of the characteristic function (and the closely related eikonal) is both an elegant and a practical tool for studying the motion of rays or of particles. Its greatest usefulness has been in geometric optics, but the intimate relationship between the ray paths of optics and the trajectories of particles and between the wave fronts of optics and the surfaces of constant action in mechanics is familiar to students of dynamics and optics alike, especially since De Broglie. Synge has pressed the analogy a step ahead; he has introduced the analogue of Hamilton's characteristic function, and of the extremal principle that lies behind it, into the pseudo-Euclidean four-space of Minkowski. Proper time and not ordinary time now labels the motions.

From such a theory, developed quite generally and elegantly, but not without many examples of the heuristic arguments always so helpful to physicists, Synge has drawn a collection of interesting and somewhat recondite consequences. Typical is his result, quite familiar, which shows that the particle velocity is the group velocity of a packet of wave fronts. This comes without any introduction of wavelengths, frequency, or phases. Only surfaces of constant action, arbitrarily spaced, are used. Finally he is able, at least approximately, to introduce phase and wavelengths by marking off action intervals the size of Planck's constant. He can then make a subtly pleasing geometry appear out of familiar Schrödinger wave functions in a number of special examples.

The monograph presents the geometric optics of wave fronts for which the Schrödinger theory gives the true wave equation. Its wider applications are not evident, unless perhaps to such problems as the theory of solids where complicated one-body potentials are encountered, and any new approximation method may be worthwhile. But the work mainly has the appeal of all unifying and completing theories, and it is intrinsically of beauty and interest. Anyone who is quite familiar with Hamiltonian theory, and a little bit at home in Minkowski space, can find insight in the work if it strikes his fancy; but reading it without such a background cannot be recommended.

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