Book Reviews

Noise and Fluctuations. D. K. C. MacDonald. Pp. 118, John Wiley & Sons, Inc., New York, 1962. Price $6.50.

Since Einstein's famous 1905 paper on the Brownian motion, fluctuation phenomena have been studied continuously and intensively by physicists and engineers. A large number of books have appeared on the subject, concerned either with the physical phenomena and their relation to irreversible processes, or their engineering aspects. On two shelves of my study, there are no fewer than 27 such books; and this is far from a complete library.

It was, therefore, with real astonishment that I read the first sentence on the dust cover of this book: "Relatively few books about 'spontaneous fluctuations,' Brownian movement, and 'Noise,' have been written by physicists." Likewise, the first sentence of the preface reads: "It is probably fair comment to say that to many physicists the subject of fluctuations (or 'noise,' to put it bluntly) appears rather esoteric and perhaps even pointless; spontaneous fluctuations seem nothing but an unwanted evil which only the unwise experimenter would encounter!"

On the contrary, I would find it difficult to name even one physicist, whether his interest lies in quantum field theory or cyclotron design, who is not concerned, in one way or another, with fluctuation phenomena. In particular, the "wise experimenter" in any field of physics is the one who knows how to improve his apparatus to the point where he is *continually* in the presence of fluctuation phenomena!

Although there is certainly nothing novel or esoteric about the field, any new exposition which fills a need not met by an existing book is, of course, very welcome. Of all the existing books on the subject, the one under review most nearly resembles *Elementary Statistical Physics*, by C. Kittel (John Wiley & Sons, Inc., New York, 1958), and it is inevitable that comparisons be drawn between them. The mathematical levels are the same, except that Kittel presupposes of the reader somewhat more knowledge of quantum mechanics.

A certain amount of basic material concerning Brownian motion, autocorrelation functions and power spectra, the Nyquist theorem and its generalizations, the Fokker–Planck equation and its applications, is given about equally well in either book. The beginner who wants only this much background will perhaps find MacDonald easier to read.

MacDonald's book is only half as long as Kittel's, but he takes up far fewer topics, and is thus able to give, in a few cases, more complete treatments than does Kittel. MacDonald also gives some interesting historical remarks, and some really good physical discussions of subtle points and speculations about unsolved problems, which Kittel passes over in silence. In addition, MacDonald exhibits at all times a lively sense of humor which, although it sometimes misses the mark, is never offensive and makes for more pleasant reading.

On the other hand, Kittel treats a far wider range of topics from physics, such as statistical mechanics, transport theory, blackbody radiation, low-temperature phenomena, and irreversible thermodynamics, all of which MacDonald scarcely mentions; while MacDonald gives a quite extensive discussion of several kinds of fluctuation effects in vacuum tubes and electric circuits, barely mentioned by Kittel.

In summary, both books are introductory treatments at the senior undergraduate or first-year graduate level. Neither book will make its reader an "expert" but either one will give him a good start. Engineers will definitely prefer MacDonald's book for its sparing use of quantum mechanics, and its choice of applications. Physicists will probably prefer Kittel's book for its considerably wider range of topics in physics; but they would be well advised to devote the few hours needed to peruse MacDonald's book also, for its more vivid physical discussion of many basic points.

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