lustrate the usefulness of this standard climatological tool. Munn even discusses the application of economic analysis to biometeorological problems.

It is obvious that the book covers an extraordinarily wide range of topics. No one can read the book without obtaining ideas for new approaches to old problems. I think it would be useful as a textbook, but probably primarily in conjunction with a book such as W. P. Lowry's *Weather and Life: An Introduction to Biometeorology*.

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Cyclic Variations

Geomagnetic Micropulsations. J. A. JACOBS. Springer-Verlag, New York, 1970. viii, 180 pp., illus. $9.90. Physics and Chemistry in Space, vol. 1.

Natural sinusoidal phenomena have always been especially attractive to physical scientists. One of the last unexplained phenomena of this type is the smooth cyclic variation or pulsation of the geomagnetic field. Just over 100 years ago systematic records were begun for these small-amplitude, relatively rapid (periods from a fraction of a second to several hundred seconds) variations. Very few facts can be stated with certainty about them today. The body of observational knowledge of their behavior is now exceedingly large and has been summarized in a number of review articles. The origin and behavior of these pulsations are described by quasi-statistical rather than direct cause-and-effect theories. The elusive nature of the phenomenon has discouraged many investigators who were initially attracted by its basic simplicity.

J. A. Jacobs' contributions to micropulsation research have been consistent, fundamental, and significant. Here he writes on the subject in an easily readable treatise. Only one long chapter, a review occupying about a third of the book, is devoted exclusively to the observational knowledge. Other chapters cover relevant aspects of the earth's main magnetic field, characteristics of magnetohydrodynamic waves, theories of the origin of micropulsations, and the possible use of micropulsations to diagnose the state of the magnetosphere. In many cases there is no attempt at mathematical completeness, but enough theoretical background is included to make the theories fully understandable and creditable. The author treats the various theories of origin, attenuation, and propagation, but does not attempt to reconcile theories that are somewhat at variance with one another.

Jacobs divides the subject matter into continuous pulsations (Pc's) and irregular pulsations (Pi's) following the classification guidelines of the International Association of Geomagnetism and Aeronomy. Theories of the higher frequency and more persistent Pc 1 are discussed separately from those of Pc 2–5 and Pi. There is no treatment of very low frequency phenomena, nor is there any discussion, at the other end of the spectrum, of magnetic storm theory. There is no discussion of the instrumentation used in the recording or analysis of micropulsations, although references are given to such discussions.

A completely coherent book on micropulsations is impossible to write. This book is the clearest and most well-balanced account that has been written to date of this complex subject.

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Two Years' Discussions

Quantum Optics. Proceedings of the International School of Physics "Enrico Fermi," course 42, Varenna, Italy, 1967. R. J. GLAUBER, Ed. Academic Press, New York, 1969. xx, 762 pp., illus. $31.

Quantum Optics. Proceedings of the 10th session of the Scottish Universities Summer School in Physics, 1969. S. M. KAY and A. MAITLAND, Eds. Academic Press, New York, 1970. xiv, 568 pp., illus. $23.

Two books with the same title should present no difficulty for a simultaneous review. However, *Quantum Optics* edited by Glauber is a presentation of a summer school held in 1967, and *Quantum Optics* edited by Kay and Maitland presents seminars given two years later. The emphasis and selection of topics in the volumes are different and represent the development of the field over the span of two years.

Glauber's volume covers a wide range of topics with emphasis on the use of the laser as a new tool for laboratory studies. It lacks coherence in the selection of topics, and for the quantum physicist it is not up to date. For the laser physicist or experimentalist it is a much better review. The sections on scattering include discussions of resonance scattering and scattering by density fluctuations and a general overview by H. Z. Cummins of laser light scattering. Also included is a discussion of scattering by magnons, excitons, and density fluctuations. The two reviews of nonlinear optics are of more historical interest owing to the recent rapid advances in the field. However, taken as a group the chapters by J. Ducuing, Y. R. Shen, and J. A. Giordmaine present a very readable account of nonlinear interactions. The final sections of the book include a treatment of the quantum theory of the laser by M. Scully. The book is useful as a reference and belongs in the library for that purpose.

Kay and Maitland's volume is better edited and presents a more organized discussion. In some cases the same authors participate (Glauber, Haken, Louisell, Pike, and Toraldo di Francia) as in the earlier summer school. In general, the articles are better presented the second time, which may be a result of proper aging. Of particular interest is a seminar on "Quantum theory of coherence" by Glauber. This article is in the style of a lecture and gives needed relief from the mathematical detail of quantum theory. The use of transcribed taped lectures is a welcome, humanizing trend in the proceedings of the summer sessions.

The session was attended by A. Kastler and optical pumping was therefore a topic of discussion. G. W. Series reviews the field in a chapter entitled "Optical pumping and related techniques." The chapter is significant in a discussion of quantum theory now that the techniques can be extended by use of recently developed tunable laser sources. This book is well presented and is of value as a collection of reviews.

Together the two *Quantum Optics* volumes provide a graphic proof of the tremendous growth of the field. They give the reader an opportunity to study a field and gain some perspective of its development. The discussions for the most part are not available elsewhere, and the books serve as useful references of specialized fields of quantum electronics.

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