to obscure the argument." On points like these, and others, it would have been good to hear from the subject himself.

There is an excellent collection of essays, *Albert Einstein: Philosopher-Scientist* (P. A. Schilpp, Ed.), the value of which is much enhanced by the final article, which is Einstein's reply. It is true that Dirac is a less controversial figure than Einstein; his work has not had the same impact on the world at large, and he is himself legendary for his silences rather than his interventions. Yet he is said to have some interesting views (for example, on the futility of mathematical rigor in physical theory, that the fundamental importance of group theory has been exaggerated, that Bohr's complementarity principle added little to quantum theory, that indeterminism is a defect of contemporary physical theory that one day may be eliminated). Perhaps an invitation to conclude this volume by a review of it would have tempted him out of his habitual reticence. By the way, a theory is given here of this reticence, in one of the several biographical and anecdotal contributions. Mehra tells how Dirac's father, who had been Swiss, ruled that at home French was to be spoken. It seems that Dirac was not very good at French, and so became early a man of few words.

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Tunneling

Superconductive Tunnelling and Applications. L. SOLYMAR. Wiley-Interscience, New York, 1972. xii, 460 pp., illus. $22.95.

The Josephson Effect in Superconductive Tunneling Structures. I. O. KULIK and I. K. YANSON. Translated from the Russian edition (Moscow, 1970) by P. Gluck. Israel Program for Scientific Translations, Jerusalem, 1972 (U.S. distributor, Halsted [Wiley], New York). x, 182 pp., illus. $20.

The introduction of newcomers to the subject of superconductive tunneling will be relatively painless now that these two authoritative books have appeared. Before identifying the appropriate audiences for these books, it is perhaps worthwhile at least to define the words in their titles. "Superconductive tunneling" denotes either the tunneling of condensed pairs of electrons between weakly coupled superconductors (Josephson tunneling) or the tunneling of normal electrons between a superconductor and a normal metal (normal electron tunneling). Josephson tunneling occupies all of Kulik and Yanson's book and half of Solymar's and normal electron tunneling the remainder of Solymar's. In normal electron tunneling the tunneling current depends in detail upon the phononic and electronic properties of the metals used in the tunneling pair; hence such tunneling can be used as a diagnostic probe of various physical properties of a metal. On the other hand, Josephson tunneling is, roughly speaking, independent of the physical parameters of the pair of superconductors and depends only upon the existence of a well-defined superconducting order parameter. The physics of the Josephson effect is elegantly simple and well understood. The utility, present and promised, of the Josephson effect lies in device applications, such as microwave generators, mixers, and detectors and incredibly sensitive voltmeters and magnetometers. Solymar has responded by pitching his book at a mathematical level appropriate for a developmental engineer or applied physicist rather than a many-body theorist.

Solymar's book is richly pedagogical, uniform in depth of mathematical treatment, and extremely well organized. It is self-contained in the sense of supplying the basic and background material required of, for example, a device engineer who knows nothing about superconductivity but plans to work on applications of the Josephson effect. The reader who has a definite commitment to the investigation or use of superconductive tunneling will greatly appreciate Solymar's thorough referencing of the existing literature (964 references). Solymar's high level of scholarship is breached at only one point, where he refers to the quantum interference effect discovered by Jaklevic, Lambe, Mercereau, and Silver as the "Mercereau effect" and, indeed, gives that title to one chapter. This is hardly judicious; nor can it be excused, as Solymar implicitly requests, merely because P. W. Anderson made a similar judgment earlier.

Kulik and Yanson's book, like Solymar's, is authoritative, comprehensive, and well organized. It differs considerably from Solymar's in the level of presentation. For example, chapter 1 contains a full-blown treatment of the many-body theory of the Josephson effect, and thus would be incomprehensible to a large fraction of the readership mainly interested in the second half of the book, which deals, as does Solymar's, with the various observed effects, sample preparation, and device applications.

The device engineer or solid state physicist working with Josephson tunneling cannot afford not to have both these books on his shelf. Solymar's will find additional markets as a reference book for solid state physicists involved with normal electron tunneling and as a textbook for specialized engineering courses on Josephson-effect devices. Both books should be available for reference to students taking graduate-level solid state or superconductivity courses. Solymar's, because of its level, is appropriate as well for final-year undergraduates.

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Effects of the Sun

Solar-Terrestrial Physics. An Account of the Wave and Particle Radiations from the Quiet and the Active Sun, and of the Consequent Terrestrial Phenomena. SYUN-ICHI AKASOFU and SYDNEY CHAPMAN. Oxford University Press, New York, 1972. xxiv, 902 pp., illus., $80. International Series of Monographs on Physics.

Geomagnetism, the two-volume work by Sydney Chapman and Julius Bartels, served as the basic reference and source book on solar-terrestrial relations up to the International Geophysical Year (1958), which initiated the era of artificial satellites and space probes. *Solar-Terrestrial Physics* is intended as its sequel, carrying the subject through 1971 and thus through the first decade of space research. Because of the volume of new material and the breadth of the field, it is an ambitious undertaking for two authors. The authors have made prolific and significant contributions to nearly every aspect of the field, and in my opinion they have succeeded in this latest undertaking. The magnitude of the effort this book represents is illustrated by the time required for preparation. It was begun in 1964, final compilation started in the summer of 1969, and it was completed in February 1971.

The work is effectively a handbook on all topics associated with the relations between the sun and the earth. In addition to the usual or expected topics included under this heading, the