sections on subjects such as acoustic holography (including the liquid-surface variety) and image multiplexing, plus an entirely new chapter on holography by computer. The subject of optical filtering, to which the last chapter is devoted, is one of growing importance, and discussions there are limited to matched filters and pattern recognition, but with the basic treatment as presented, the reader should be able to pursue the subject further (into such areas as image de-blurring and x-ray or gamma-ray photos in astronomy). Two other fields that Françon does not discuss are hologram computer memories and the use of holographic (synthetic) apertures in radar, sonar and medical ultrasonic diagnosis.

The author, in the science faculty and optics laboratory at the University of Paris, has distinguished himself as an author of over a dozen papers on holography and as co-author in 1960 (with A. Marechal) of *Diffraction*. He apologizes for the book's bibliography, stating that it was impossible to cite all authors of articles on holography. Actually, the bibliography contains 481 references although only about 50 of those cited appeared after the 1969 publication of his first version.

All in all I recommend the book highly to those seeking a broad introduction to the field.

WINSTON E. KOCK
University of Cincinnati
Cincinnati, Ohio

Interstellar Communication: Scientific Perspectives

C. Ponnamperuma, A. G. W. Cameron
226 pp. Houghton Mifflin, Boston, 1974.
$5.95

A meeting of prominent scientists to discuss interstellar communication may seem to some as unlikely as a meeting on extra-sensory perception. However, during the past decade there has been such a meeting about every two years. This book is based on a series of lectures given at the NASA Ames Research Center during the summer of 1970 by the two editors and eight other scientists. Since most of the contributions in this book are review lectures rather than original works, the book provides a much better introduction to the subject than do the proceedings of most other conferences, which have stressed original contributions.

The recent rise to respectability of this subject is largely due to two factors: First, recent theoretical work indicates that the formation of planetary systems is relatively easy and may even be necessary for the formation of single stars. Second is Man's rapidly increasing technological prowess in communication. As Carl Sagan notes in the introductory lecture, it would be possible using a twin of the 1000-foot radio telescope at Arecibo to communicate between any two points in the Galaxy. Frank Drake notes in a later lecture that, using 1970 technology and prices, two 150-foot radio telescopes situated 10 lightyears apart could send a 60-word telegram using only one dollar's worth of power. The tacit assumption is that any other technological civilization would quickly develop a similar communication capability and would have the psychological desire to communicate.

The very fact that we have not yet detected evidence of another civilization in the Galaxy indicates that life in the Galaxy is not terribly successful when judged by the fraction of the total power of the Galaxy it commands. It seems unlikely that there is any civilization in the Galaxy using more than a small fraction of the power of its sun; otherwise we would have detected it long ago from its leakage radiation. Consideration of the state of life on Earth is sobering. At the present time, non-aquatic life on Earth is largely confined to a thin film less than 30 meters thick or less than 5×10^{-6} of the radius of the earth. The total power output of man is only 10^{-14} of the luminosity of the Sun, and only a fraction of this is going into communication. Even the management of this minute amount of power is producing sufficient negative feedback to limit its growth. If our pathetically small power expenditure is typical of other technological civilizations, the problem of detecting them is immensely difficult.

Recognizing the magnitude of the task, the book follows the usual custom of dividing itself into two parts: In the first part, the participants from a number of different disciplines review the evidence and assure each other that the probability of life existing beyond the earth is significant enough to be interesting. First, Sagan and more specifically Al Cameron review the astronomical evidence and conclude that the probability of a given star having a planet capable of sustaining life is of order unity. Next Cyril Ponnamperuma, Michael Arbib, John McCarthy and Samuel Aronoff review the biological and sociological stages leading to the development of man as a technological creature. This suggests that perhaps 10^{-2} of the planets capable of sustaining life may actually develop a technological species with a level of communication at least comparable to our own. If this is the case, the number of civilizations in the Galaxy in the communication stage at any given time is just $N = (t/10 \text{ years})$ where t is the mean lifetime of each civilization in this stage. Since this is not a very interesting number unless t is much greater than 10 years, which is about the length of time Man has spent in this stage, it is evident that if any significant number of civilizations exist in the Galaxy, they must be much older and presumably much more advanced than our own. Thus the logical procedure in first establishing contact with such an advanced civilization is to assume a passive role by trying to detect signals from it rather than trying to signal it.

The second half of the book considers the strategy for doing this. Ronald Bracewell, Frank Drake and Bernard Oliver discuss the state of this work. The most optimum strategy that can be envisioned at the present state of our perception is to search for microwave emission from such a civilization, although interstellar probes may be valuable if a civilization is within a few hundred parsecs of the Sun. A particularly interesting part of this section of the book is the discussion by Oliver of Project Cyclops, a colossal aperture-synthesis telescope with a collection area of up to 20 km^2 designed to search for interstellar signals in the microwave band. The funding of such a moderately expensive venture must wait for a more inquisitive, less self-centered generation than our own. Philip Morrison gives an excellent summary of the present state of study of interstellar communications in the last lecture in the book.

The most valuable part of the book may be the appendix, which contains about 1000 references pertaining to the study of interstellar communication. This alone is probably worth the price of the book.

I found the book intellectually entertaining. It would be most suitable as fun supplemental reading in an undergraduate astronomy course designed for science majors, although much of it is suitable for nonscience majors.

JACK G. HILLS
University of Michigan
Ann Arbor

The Laue Method

J. L. Amorós, M. J. Buerger, M. C. de Amorós
375 pp. Academic, New York, 1975.
$37.00

The x-ray study of crystals began with Max von Laue in 1912. However, it was soon found that more could be learned about the arrangement of atoms in a crystal by moving the crystal in a monochromatic x-ray beam. One might wonder, then, why a book about the Laue method appears at this late date, especially because one of the authors,