CAMBRIDGE STUDIES IN MODERN OPTICS: 1

Interferometry

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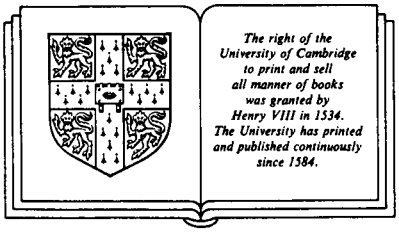
SECOND EDITION



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Preface to the first edition

To the astronomer, interferometry suggests the measurement of stellar diameters or the techniques of radio astronomy, both implying studies of the spatial distribution of radiation. For the spectroscopist, it measures spectral distributions and represents a new technique offering high resolving power and increased sensitivity. To the optical designer, it is a method of testing lenses and, to the biologist, it is a new branch of microscopy. To the metrologist and the engineer, it is the means of converting the international standard of length into a practical scale. Each user is familiar with the techniques and applications of his own field but not often those of other fields.

My aim in writing this monograph is to present a theory of interferometry and a description of its techniques that are valid for all applications and in all regions of the spectrum where interferometers are used. The treatment naturally reflects my own interests and prejudices, and is biased towards applications with visible light; in justification, however, it can be said that it is here that the greatest development of the interferometer has occurred, microwave and radio interferometers being simple instruments by comparison. These last instruments are included as well as the new field of infra-red spectroscopy by Fourier transform methods. Most of the mathematics is given in the earlier chapters, so that the later chapters on the various instruments and the different applications are mainly descriptive; those not interested in the details of the theory can thus omit Chapter 4 [Chapter 6 in the second edition]. I have aimed to include most techniques under the description of instruments, rather than under the particular application for which they were developed, with the hope of suggesting their wider use in other fields.

This book owes much to discussions with colleagues, chiefly at the Air Force Cambridge Research Laboratories, Bedford, the National Standards and Radiophysics Laboratories, Sydney, and the University of Sydney. A special debt is due to Professor A. Maréchal, under whom I first worked in Physical Optics, and I am grateful to Professor P. Rouard for giving me the opportunity of undergoing the important discipline of presenting these

ideas as a short course at Marseilles. Finally, I acknowledge with thanks the permission of those authors, publishers, and learned societies whose figures I have reproduced here.

Sydney, March 1967 W.H.S.

Preface to the second edition

When the first edition of *Interferometry* was written, most interferometers used light sources that were far from coherent. To emphasize this, I avoided the traditional treatment in terms of coherent sources and simple waves and gave only a theory in terms of coherence functions. But the rapid increase in the use of laser sources has given practical relevance to the wave treatment, which has now been added.

At the same time the great expansion of the subject has made it impossible to treat in detail the methods and techniques used in all spectral regions. To include new chapters on hologram and speckle interferometry, the sections on microwave and radio interferometry have been cut down, except where these fields provide the best illustration of some principle or technique. Since the first edition was published, radio astronomy has been treated by the monograph by Christiansen and Högbom. It has also been necessary to make drastic cuts to the number of references given.

I again acknowledge with thanks the permission of those authors, publishers, and learned societies whose figures I have reproduced, and the debt I owe to my colleagues here for their expert knowledge of interferometry, which has helped me so often. Finally, I have had the good fortune to have worked near two of the most interesting interferometers of recent times, the intensity interferometer of R. Hanbury Brown and J.P. Wild's radioheliograph.

Sydney (1983) W. H. STEEL