Springer Series in Optical Sciences Volume 42

Edited by Theodor Tamir

Springer Series in Optical Sciences

Volume 42 **Principles of Phase Conjugation**
By B. Ya. Zel'dovich, N. F. Pilipetsky, and V. V. Shkunov

Volume 43 **X-Ray Microscopy**
Editors: G. Schmahl and D. Rudolph

Volume 44 **Introduction to Laser Physics**
By K. Shimoda

Volume 45 **Scanning Electron Microscopy**
By L. Reimer

Volume 46 **Holography in Deformation Analysis**
By W. Schumann, J.-P. Zürcher, and D. Cuche

Volume 47 **Tunable Solid State Lasers**
Editors: P. Hammerling, A. B. Budgor, and A. Pinto

Volumes 1-41 are listed on the back inside cover

B.Ya. Zel'dovich N.F. Pilipetsky
V.V. Shkunov

Principles of Phase Conjugation

With 70 Figures

Springer-Verlag Berlin Heidelberg GmbH

Dr. Boris Ya. Zel'dovich
Dr. Nikolai F. Pilipetsky
Dr. Vladimir V. Shkunov

Institute for Problems in Mechanics, Academy of Sciences of the USSR,
Prospekt Vernadskogo 101, SU-117526 Moscow, USSR

Library of Congress Cataloging in Publication Data. Zel'dovich, B. Ya. (Boris Ya.), 1944- Principles of phase conjugation. (Springer series in optical sciences ; v. 42) Bibliography: p. Includes index. 1. Optical phase conjugation. I. Pilipetsky, N. F. (Nikolai F.), 1931-. II. Shkunov, V. V. (Vladimir V.), 1953-. III. Title. IV. Series. QC446.3.067Z45 1985 535'.2 84-23546

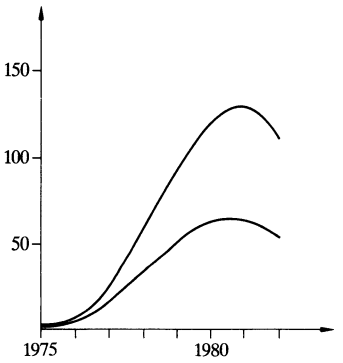
ISBN 978-3-662-13573-0 ISBN 978-3-540-38959-0 (eBook)
DOI 10.1007/978-3-540-38959-0

Originally published by Springer-Verlag Berlin Heidelberg New York in 1985.
Softcover reprint of the hardcover 1st edition 1985

Offset printing: Beltz Offsetdruck, 6944 Hemsbach/Bergstr.
2153/3130-543210

Preface

This book has been prompted by our desire to share with others our appreciation of the harmony and beauty in a particular sphere of modern optics known as "optical phase conjugation". Practical applications of the phase-conjugated wave are likely to be far-reaching. Optical phase conjugation (OPC) combines in itself aesthetic and pragmatic attractiveness, a synthesis that has made OPC a subject of general attention. The figure presents the approximate rate of publications (number of articles per year) on OPC in the world literature for recent years, the lower curve denoting the work carried out in the USSR. The efforts of a large unofficial international collective have yielded an impressive result.



At present, the physical processes underlying various OPC methods are quite understandable, and it is the physics of OPC to which our book is devoted. Practical and scientific applications of phase-conjugated waves, which are of no less interest, have been touched upon in short, as major achievements in this sphere are a matter of the future.

Today there are two main methods of OPC: i) by backward stimulated light scattering, ii) by four-wave mixing. Naturally, much attention is given to these methods in our book which, after the introductory Chap. 1, can be divided into two almost independent parts – Chaps. 2 – 5, and Chaps. 6 – 8.

We have made every endeavor to present the basic ideas and theoretical material as comprehensively as possible so that the reader does not need to refer to

the original papers. In discussing experimental work we have confined ourselves to the main results, avoiding particularities. We do not refer to theoretical work in the body of the book, which, in our opinion, makes the reading (and writing) of the book much easier. However, we do refer to original experimental work so that the reader may become acquainted with necessary details.

We express our deep gratitude to Academician N. G. Basov and Academician A. Yu. Ishlinsky for their support of our investigations into the OPC problem. We are thankful to Associate Member of the Academy of Sciences of the USSR D. M. Klimov, Professor V. B. Librovich, Professor Yu. P. Raizer, and Professor I. I. Sobelman for their help, attention, and interest in our work.

Valuable discussions and collaboration with V. V. Ragulsky played an important role in our presentation of the material. To him and many others at the Institute for Problems in Mechanics, the Academy of Sciences of the USSR, we are very much obliged, for scientific collaboration and help. In particular, we should like to mention the contributions made by V. N. Blaschuk, A. V. Sudarkin, A. V. Mamaev, O. L. Kulikov, A. L. Gyulamiryan, N. B. Baranova, M. A. Orlova, T. V. Yakovleva, V. I. Popovichev, and other coauthors of our work. We are also grateful to Yu. P. Alexeenko for help in the translation of our manuscript.

We are grateful to Dr. H. Lotsch of Springer-Verlag for encouragement and support of this book. The copy editor, Gillian Hayes, helped us enormously to improve both the scientific meaning of the text and the English, for which we are very indebted.

Moscow, December 1984

B. Ya. Zel'dovich
N. F. Pilipetsky
V. V. Shkunov

Contents