VOLUME 1

LASER LITERATURE

A PERMUTED BIBLIOGRAPHY

1958-1966

EDWARD V. ASHBURN, EDITOR AND COMPILER

WESTERN PERIODICALS CO.

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FORWARD

The aim in the preparation of this book has been to provide a comprehensive and convenient guide to the open literature relating to the physics and the applications of lasers. The material in the book has been arranged so that any given paper on lasers may be located through the name of the author or co-author, subject, year, journal or key word or words in the title of the article. The extensive bibliography thoroughly covers the theoretical and experimental papers of the electronic engineers, chemists, and physicists from the fields of optics, quantum electronics, solid state physics, and spectroscopy who have been active in the development of lasers. In addition, a lengthy list of papers relating to the applications of lasers to metal working, data processing, three dimensional photography (holography), metrology, ranging, navigation, meteorology, biology, medicine, and dentistry is included in the bibliography.

Because scientists and engineers from so many fields of interest have contributed significantly to the development of lasers and also, because of the pressure to publish the results of their work quickly, the laser literature is extensive, fragmented and repetitious. Hence, the adequate and efficient use of the laser literature has been difficult for those interested in lasers. This book has been designed to reduce these difficulties.

The basic bibliography contains 4357 entries obtained from monographs, published proceedings of symposia and 350 journals. Attention was focused upon the open archival literature because inclusion of the report literature, articles from trade journals and abstracts of talks presented before professional societies would nearly double the size of the book without adding much that was new or significant. Each entry in the bibliography presents a technical paper or monograph whose subject matter, in whole or in part, is a discussion of the theory of lasers, an experimental determination of the properties of lasers, the physics or chemistry of laser materials, or an application of lasers. The bibliography has approximately 1400 more references than any other bibliography on lasers that the author has seen. The closing date for the bibliography was 31 December 1966. This means that for some references in the bibliography the publishing date was as late as December 1966 but that the coverage for 1966 is not complete. Many of the journals whose publishing date is given as 1966 were not available to the author by 31 December 1967. For a few cases for which advance information was available a publishing date of

1967 is given. These few cases were included in the 1966 list.

The entries in the bibliography are arranged by year of publication and alphabetically by first author. A distinguishing feature of this compilation is the classification scheme that is used for each element of the bibliography. This classification scheme was first proposed by B.A. Lengyel. The study of lasers and their applications is subdivided into many topics and catagories which are assigned identification numbers patterned after the Dewey decimal system. These numbers are printed following each entry in the bibliography for each relevant catagory. The categories may be ascertained by consulting the subject index in Volume II. In this subject index the catagories are arranged in numerical order, and following each catagory name the serial number of every pertinent publication appears. The serial number consists of an assigned number for each bibliographic entry plus a two digit number that indicates the year of publication.

The development of lasers may be traced directly to the construction of the Fabry-Perot interferometer in 1898, the work in classical optical spectroscopy of the early twentieth century, the Bohr theory of the atom that was proposed in 1913, and the discussion of stimulated emission presented by Einstein in 1917. However, in this book the laser literature will be assumed to start with the first specific proposal for a laser. This was in paper by Schawlow and Townes published in 1958. The growth of the literature since 1958 is illustrated by the following Table.

TABLE 1. Number of laser papers published per year.

Year	Number of Papers
1958	2
1959	6
1960	17
1961	136
1962	304
1963	752
1964	957
1965	1290
1966	(Partial record)

In the six bibliographies published in the Journal of the Optical Society of America there was a slight change in the implied definition, from one bibliography to another, of the elements of the bibliography. In the preparation of the consolidated and extended bibliography for this book an effort was made to use a consistent definition for the entire period 1958-1966. Thus, the number of elements in the bibliography for this book differ slightly from the number in the previously published bibliographies in the Journal of the Optical Society of America. In addition, errors in the original bibliographies were corrected for this book. All the elements in the book were cross checked with other known published bibliographies. Only one of these other bibliographies contained as many as two thirds of the number of entries as are given in this book. In general the comparisons were tedious to make because of differing ordering systems and differing time periods covered.

Over four thousand different names are listed in the author index as being author or co-author of a paper or monograph relating to lasers or an application of lasers. These authors are associated with universities, government laboratories, industry or private research laboratories. They include physicists, engineers, biologists, physicians, dentists, and scientists and technologists from a scattering of other fields. The authors comprise a truly international group. Nearly every large or industrial nation is represented by at least several authors. An indication of the international character of work on lasers is given by recent decisions of the Nobel Prize Committee. N.G. Basov and A.M. Prochorov of the USSR, A. Kastler of France, and C.H. Townes of the USA have all been awarded a Nobel prize for their work contributing to the development of lasers.

An inspection of the author index indicates that most authors have published more than one paper on lasers. Some have authored many papers. N.G. Basov, for example has been author or co-author of 59 papers. Part of this proliferation of papers has been the result of publishing short notes or "Letters to the Editor" consisting of isolated bits of information. Further, often the same or nearly the same information is published repeatedly either in different journals or in a published "Proceedings of a Symposia". This practice is not restricted to the United States. It is also well established in Western Europe and in the USSR.

The permuted index found on pages 1-220 of Volume II may be used in two ways. First it may be used to locate and identify any of the papers listed in the bibliography given

in Volume I by any one or more key words in the title of the article. Second, the permuted index may be used to select key words upon which to base a future search of the literature for laser papers. This aspect of the permuted index could be important in what is typically the first phase in a search by a system such as the Massachusetts Institute of Technology TIP. A judicious selection of key words from the permuted index would significantly reduce the work required in the second phase of the search (use of common citations).

The word laser was omitted in the printing of permuted index elements because approximately fifty three percent of the papers had the word "laser" in the title. Optical maser and quantum generator have often been used synonomously with the word laser. The permuted index indicates that the term "optical maser" has been used in approximately ten percent of the titles. Quantum generator was found to have been used in less than one half of one percent of the titles. In those cases where neither "laser", "optical maser", or quantum generator" has been used in the title the word "stimulated" combined with either amplification, emission, Brillouin, Raman, recombination, or transitions is often observed. These combinations account for a total of five percent of the total number of papers.

The subject classification system that is used in this book was devised by B.A. Lengyel. In this classification system there are five major catagories. These catagories are General Works, Theory, Experiment, Laser Applications in Science, and Laser Applications in Technology. Each major catagory is subdivided into many topics. Each catagory and subdivision is assigned a number patterned after the Dewey Decimal System. In the Subject Index each catagory and subdivision is listed by number and title and under this heading the serial numbers and publication year for all relevant references taken from the bibliography are listed. A relatively high percentage of the references were assigned more than one classification number. Approximately ten percent of the references were assigned subject classification numbers by B.A. Lengyel. The remainder were classified by the author.

No subject classification scheme of comparable detail has been used in laser bibliographies published to date, except those prepared by the author for the Journal of the Optical Society of America. In addition, the subject classification schemes that have been proposed by others do not permit easy multiple classifications. The semi-annual

subject index of Physics Abstracts is limited to three catagories, lasers, gaseous lasers, and solid lasers. Approximately one hundred and forty subject classifications have been used in this book.

Journals, journal subject indexes, lists of books in print, Physics Abstracts, Chemical Abstracts, Electrical Engineering Abstracts, Biological Abstracts, Index Medicus, Engineering Index, International Aerospace Abstracts and published laser bibliographies have been used as sources of information for the preparation of the bibliography presented in this book. A comparison between the number of entries in this bibliography and the number found in other principle sources is as follows:

Physics Abstracts	55%
International Aerospace Abstracts	48%
D. Rӧss	68%

International Aerospace Abstracts includes a significant percentage of reports and other forms of laser articles that are not generally considered to be part of the open literature and hence are not included in the bibliography presented in this book.

The bibliography for 1964 and 1965 was prepared and checked, in part, through the use of the Massachusetts Institute of Technology "TIP" machine program. The TIP system was used to search twenty five of the leading physics journals for papers relating to lasers. The search was performed using key title words and common citations.

Papers relating to the physics and chemistry of lasers or to applications of lasers were found in over 350 technical journals. The journals in which at least five papers were published are listed in the index of journals given on page 281 in Volume II. The journals represent a wide variety of fields of interest and many nations. A relatively large number of the papers were published as notes or as letters in journals such as Applied Physics Letters, Physics Letters, Physical Review Letters, Nature, JETP Letters, and the Proceedings of the Institute of Electrical and Electronic Engineers. These short publications account for the major part of the fragmentation and duplication in the laser literature. The major papers on the theory of lasers were published largely in journals such as The Physical Review, Journal of the Optical Society of America, Applied Optics, and the Journal of Applied Physics.

Where the laser papers have been published in a foreign journal that is regularly translated into English, the transliterated title of the foreign journal and the title of the translation journal are both given. Appropriate volume numbers, page numbers and publication dates are given for both journals. The titles of the papers have been translated into English.

In the bibliography the journal names have been abbreviated according to a system suggested by the editorial staff of the American Institute of Physics. To avoid possible confusion, the full name of the journal has been used in the Journal Index.

ACKNOWLEDGEMENTS

This book evolved from the six bibliographies of the open literature that were published in the Journal of the Optical Society of America during the period May 1963 to January 1967. The author extends this acknowledgement and his thanks to David L. MacAdam, Editor of the Journal of the Optical Society of America for his permission to use the material in the six bibliographies for the foundation of this book. The original suggestion for the preparation of the bibliography on lasers was made by Deane B. Judd, the previous Editor. Thus, the start and the continuation of the laser bibliography work has been largely the result of the encouragement and support given to the author by the editors of the journal. Special thanks are also due to Bela A. Lengyel, co-author of bibliographies numbers II and VI and originator of the subject classification system used in this book. Raymond W. Merry was also a co-author of bibliography II. Pauline A. Atherton, Stella Keenan and others of the staff of the American Institute of Physics contributed significantly to the preparation of bibliography VI. M. Kessler of the Massachusetts Institute of Technology also extended significant help in the preparation of bibliography VI through the use of a programmed (TIP) search of twenty five leading physics journals for articles relating to lasers. To all of these and to others too numerous to mention the author extends his sincere thanks for their assistance.

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