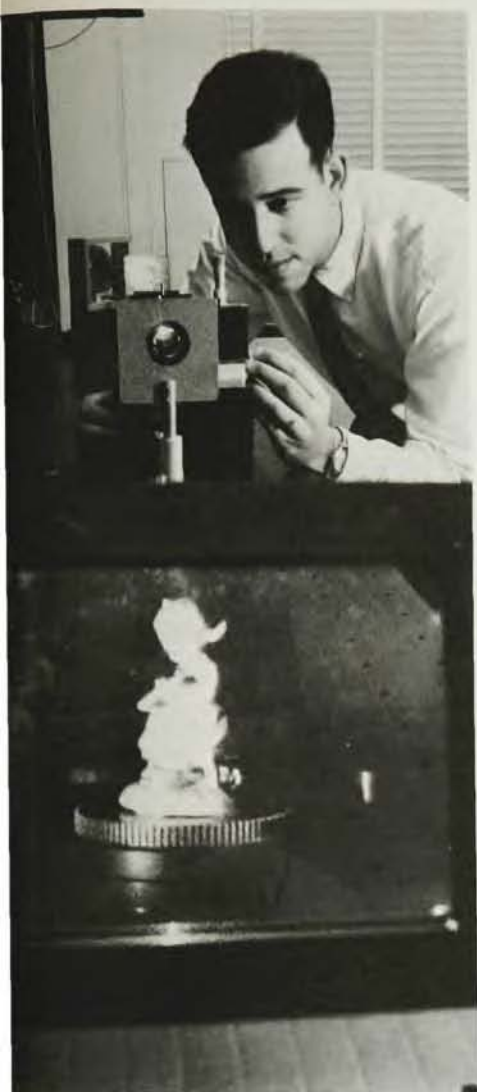




A NEW HOLOGRAM TECHNIQUE at Bell Laboratories allows the viewer to see a three-dimensional image rotate through a full circle simply by moving his head in front of the flat hologram. Viewing can be with a filtered white-light source.

either gas or solid state. As many diagrams are taken directly from the literature (often without sufficient references), the notation is not uniform. For example, in Figs. 7-2 through 7-4 the author uses energy units, while in Fig. 7-5 we have wavenumbers. On some of the energy-level diagrams there is spectroscopic notation, while on others Thorp uses group-theory notation. The general similarities of laser operations are presented clearly. However, the novel and unusual aspect of certain laser materials are barely touched upon. The emphasis is on the historically first operative system, rather than on the often physically simpler second-generation device.

The four chapters on the "science of maser and laser materials" (preface)

deal with crystallography. For anyone purchasing crystals for laser or maser applications, these chapters provide a good start on understanding the requirements for such crystals. However, insofar as the author merely summarizes current work in crystallography, more detailed references ought to have been given. Optical tests of strains and variations in index of refraction with lasers and microwave cavities provide the most interesting and potentially useful material in this section.

Often mistakes, typographical errors, omissions and confusing notation such as those occurring in this book can be overlooked in the first edition of a book that is well written. Such is not the case with this text. Expository sections are poorly written, often with insufficient content. Undergraduate students would find this book poor reading. Advanced research scientists might find some sections of value. However, since there are several excellent volumes on lasers and masers currently available, it is unlikely that they would use this book.

* * *

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Illumination for undergraduates

AN INTRODUCTION TO MASERS AND LASERS. By T. P. Melia. 162 pp. Chapman & Hall, London (Barnes & Noble, New York), 1967. \$5.50

by Robert J. Collier

The stimulated emission of little books bearing the title "Masers and Lasers" continues unabated. It would appear that there are many potential maser-laser book publishers in excited states and many potential authors capable of stimulating publication when they encounter excited publishers. Therefore the emergence of a maser-laser book is a highly probable event.

Terrence P. Melia, lecturer in chemistry at the University of Salford, has written an *Introduction to Masers and Lasers* aimed at the average science undergraduate. It is a pocket-sized book, and the text is necessarily abbreviated. After introducing some of the concepts basic to maser action and pausing briefly to describe the maser

itself, Melia devotes the majority of the book to identifying a variety of laser forms. Separate short chapters are allotted to solid-state lasers, gas lasers, Raman laser action, semiconductor, chemical and chelate lasers. The longest chapter and perhaps the most instructive is the one concerned with semiconductor lasers. A final portion of the book sketches some laser applications and outlines what is known about laser health hazards.

By emphasizing the variety of ways in which laser action can be obtained, the author conveys a sense of the untapped potential for laser development and application. However, the broad-brush, rapid-passage, cover-all treatment requires care in its use, and there is evidence that this ingredient is missing. No attempt has been made to assess the relative significance of the various possible laser systems. Melia's little book fails to focus on those lasers that are of practical importance. For example, "... laser oscillation also occurs at 0.6328μ ..." is the only reference to the most widely used laser wavelength. Barely mentioned as a "Miscellaneous Gas Laser" is the CO_2 - N_2 high-efficiency, high-power laser. The argon II ion laser, whose blue light is most useful for application to the laser surgery alluded to in Chapter 12, is not described at all. Nor is the YAG:Nd laser, the best of the cw solid lasers. These lasers were all on the scene in 1965 and should be prominent in any general laser book published by 1967 (see, for example, *The Laser*, W. V. Smith and P. P. Sorokin, McGraw Hill, 1966). The undergraduate reader may well be concerned with the value of his purchase upon discovering that such useful lasers, all commercially available now, were nearly invisible to Melia.

There is a general carelessness that tarnishes this book. On page 44, chapter 5, a discussion of the threshold condition is largely a reproduction of the text appearing on page 32 of B. A. Lengyel's book *Lasers* (John Wiley, 2nd printing, 1963). Quite likely an oversight accounts for failure to make specific mention of this. Most certainly lack of care is responsible for an error having been made in the transfer. (The condition for rapid buildup of radiation is $\alpha L > \gamma$, as Lengyel had it.) A further manifestation involves the figures. For example, it would be better to state explicitly that figure 7.2 and its caption as well as figure 7.7 are adaptations from an

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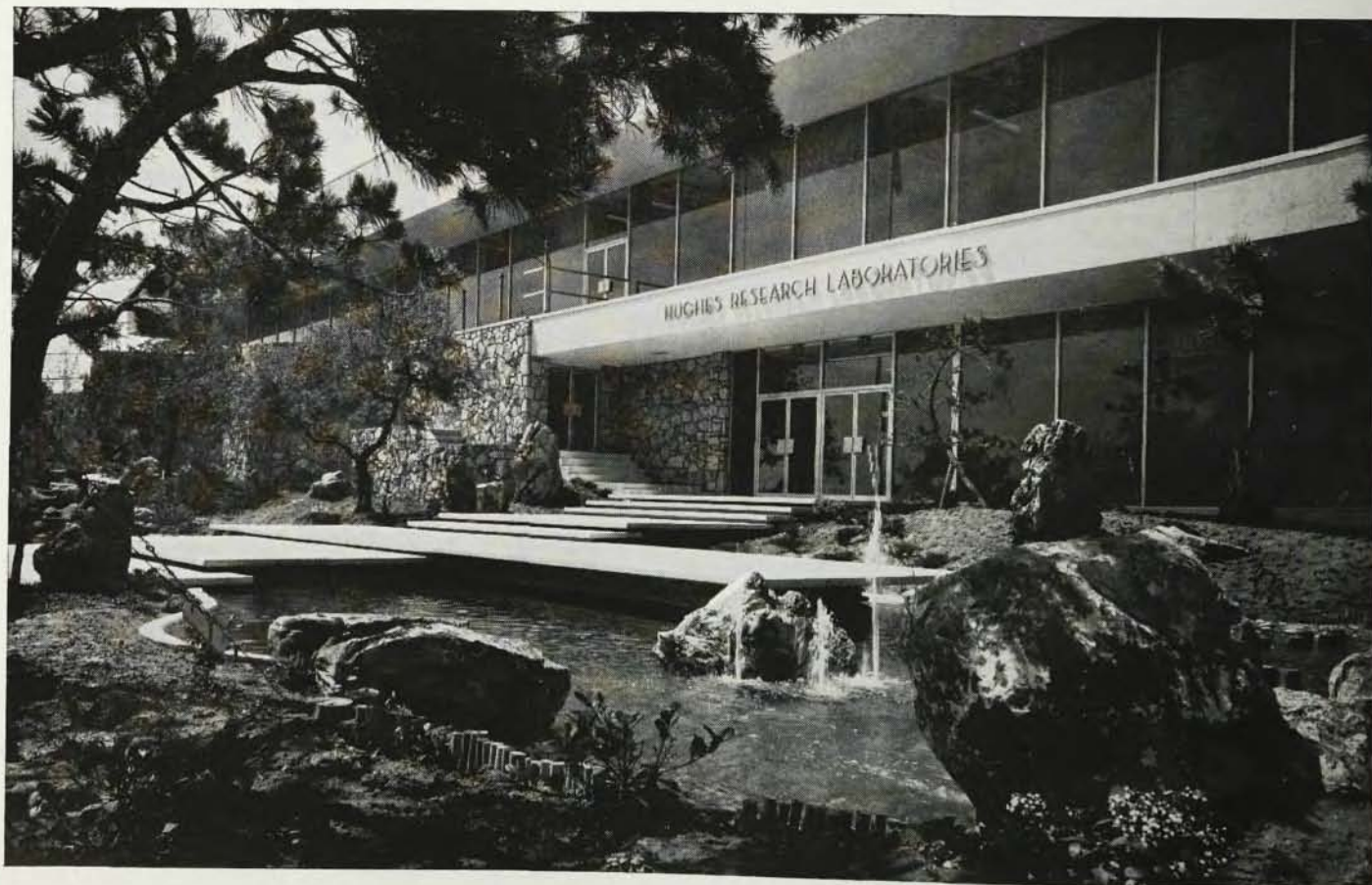
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article by W. R. Bennett, *Applied Optics Supplement*; "Optical Masers," pages 24-61, 1962, figs. 8 and 14, respectively. As it is, the article is listed under bibliography for additional reading. Similar remarks apply to a direct quotation near the top of page 17, taken from page 4 of William A. Shurcliff's *Polarized Light* (Oxford Press, 1962).

* * *

The reviewer is a physicist at Bell Telephone Laboratories and supervises a group in holography.

Administering science to society

FORMULATION OF RESEARCH POLICIES. Conf. proc. (Santa Barbara, Calif., Jan.-Feb. 1966) Bruce S. Old, Lawrence W. Bass, eds. 218 pp. American Association for the Advancement of Science, Washington, D. C., 1967. \$7.75, \$6.75 for AAAS members

by David Z. Robinson

A great deal has been written about national science policy as if there exists some magic, single formula or system that can guide decision makers and ensure the wisdom of their actions. The situation looks very different to people involved in the process. The organizers of a 1966 Gordon Research Conference on Formulation of Research Policies brought together people involved in science management in Western Europe, Canada and the US with students of science management and industrial research scientists to see if information exchange in the field would be useful. This collection of papers from that conference indicates not only the absence of magic formulas but the perplexity and universality of problems that must be faced.

The book is divided into three sections. The first includes papers describing national science policies in eight countries: Belgium, Canada, Denmark, France, West Germany, Ireland, England and the Netherlands. It concludes with a useful summary by Frederick Seitz. The second group of papers attempts some comparative analysis, particularly of international and cooperative research programs. The final section deals with research policies of individual organizations: two large European companies (Philips and Montecatini), a government

agency (Air Force Office of Scientific Research) and a discussion of research management in industrial companies by the organizers of the conference, Lawrence Bass and Bruce Old.

There are major differences between the US and other participating countries with regard both to conception and goals of national science management. The US has in the last ten years established an Office of Science and Technology in the Executive Office of the President. The office deals not only with "all" federal technological activity but with the effect of federal actions on nongovernment science activities. In none of the other countries is there a similar overview. The government agencies dealing with science as part of their mission—particularly those concerned with national defense—run their own show. There is little systematic interaction between the government, university and industrial communities.

The goals of national science policies in these seven European countries and Canada center on economic growth and economic return for scientific expenditure. In the US tradition and antitrust have kept government and industry apart except, of course, for defense, atomic energy and space research.

Problems facing countries with ten to 50 million people are also different from problems that face a nation of 200 million. Until recently in the US, Americans had to make few difficult choices. They could afford to do everything. Such is not the case for a small country or an individual firm. International collaboration becomes a necessity rather than a pleasant mechanism for doing research.

Despite those differences in goals and needs between various countries, there are surprising similarities in outlook.

How can state-sponsored research be made to succeed in the marketplace? How can cooperative research be made responsive to the needs of the cooperators? After all, how do we nurture good science? Again and again the same questions come up from different areas and from different people.

The papers on international cooperation provide a most interesting picture of the operation of the Organization for Economic Cooperation and Development (OECD). OECD has been doing fine work in comparative studies of its member nations (West-

ern Europe, Canada, US and Japan). Hopefully it can be a forum for defusing some of the explosive issues now confronting these nations such as the brain drain and the technology gap.

We can be grateful to the Gordon Research Conference trustees for making this exception to their usual policy forbidding publication. No similar material exists on how a number of countries and organizations are trying to "administer" science in a technological society. The frankness of the speakers, particularly Pierre Pigagnol from France and Sir Harry Melville from England, gives us an unusual glimpse into the minds of the policy-makers faced with this demanding task.

* * *

The reviewer is vice-president for academic affairs at New York University.

Mathematical virtuosity

MIXED BOUNDARY VALUE PROBLEMS IN POTENTIAL THEORY. By I. N. Sneddon. 282 pp. North-Holland, Amsterdam (Interscience, New York), 1967. \$12.75

by Joseph Gillis

Mixed boundary problems in which the different types of boundary conditions hold on distinct parts of the boundary, separable from one another in terms of a convenient coordinate system, go back at least to Poisson and Fourier. The essence of the problems discussed in this book is that different conditions hold in different regions of the same geometrical part of the boundary.

A number of classical problems of this type are described in the first chapter, including the potential due to an electrified disc, some punch problems in elasticity, and aperture-flow problems in hydrodynamics. In chapter 2 the author has collected a few mathematical tools needed later in the book (some Bessel-function formulas, a little about integral equations, fractional integration and Hankel transforms, Jacob polynomials). Much of this is applied immediately in chapter 3 to a thorough-going discussion of the electrified disc, beginning with Weber's and Beltrami's classical solutions of this problem. The method of oblate spheroidal coordinates, which effectively reduces the problem to one of the simpler type mentioned at the beginning of this review, is also pre-