FINAL REPORT

1982 GORDON RESEARCH CONFERENCE
ON
HOLOGRAPHY AND OPTICAL INFORMATION PROCESSING

Prepared for
Dr. John Neff
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Air Force Office of Scientific Research (AFSC)
Bolling Air Force Base, D.C. 20332

Submitted by
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Chairman
1982 Gordon Research Conference
Holography & Optical Information Processing

Dr. Alexander M. Cruickshank
Director
Gordon Research Conferences

July 1982

Approved for public release;
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**Title:** GORDON RESEARCH CONFERENCE ON HOLOGRAPHY AND OPTICAL INFORMATION PROCESSING

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**Performing Organization:** Air Force Office of Scientific Research
Bldg. #410, Rolling AFB, Wash., DC 20332

**Project:** AFOSR - 82-0257

**Date Coveren:** 19 MAR 82 to 26 JUN 82

**Abstract:**

The conference was considered a major success by the majority of those who attended. The presentations were excellent and the personal interactions and knowledge interchange were very rewarding.
1. Technical Statement

The field of Holography and Optical Information Processing is an important and active one with many significant advances during the past twenty years. A family tree showing only the major interrelations is shown in Figure 1. It is adapted somewhat from a recent presentation by Professor Joseph Goodman of Stanford University.* This field is one with intense research activity at many universities, complemented by device research and high technology activities in industrial laboratories.

For the traditional part of the conference, twenty-one speakers were invited representing essentially all major sub-groups shown in Figure 1. A complete list of speakers is included in Appendix A with corrections to reflect last-minute cancellations and additions. An effort was made to attract a strong industrial component to this conference, so that there would be up-to-date presentations from scientists who are making the technology advancements. It will be interesting to study the conference evaluation forms in order to assess whether this unusual mixture of theoretical and practical types was well received by the audience. My general impression was that the invited talks were stimulating and that the speakers were subjected to much lively discussion.

* Winter Workshop on Optical Information Processing, Cuernavaca, Mexico, January 1982.
Fig. 1. Family Tree of Holography and Optical Information Processing. Many of the major developments in this field have occurred since the early sixties.
In the evening sessions, while Wednesday was devoted to invited speakers, some variety was provided as follows. On Monday, a Workshop Panel discussion was held on the topic "Diffraction Pattern Sampling and Optical Spatial Filtering." Here the concept was to promote discussion of a relatively mature field. By having several highly qualified speakers present short statements across the field, it was possible by means of audience participation to gain a good overview of a complex field. It also provided a good opportunity to hear the pros and cons of different approaches to the same problem in optical processing. All in all this discussion was very worthwhile. The outgoing chairman wishes he had scheduled two Workshop Panel sessions. The other topic would have been "Speckle."

Tuesday and Thursday evenings were used for discussions of Poster Papers. These papers were accepted as offered by the authors. In this regard, the conference facilities were excellent. The papers were posted early in the conference social rooms, so that it was relatively easy to have a short or lengthy session with a given author any time over a two-day period. The titles of poster papers are listed in Appendix A. Also on Thursday evening an ad-hoc group put together an informal, very lively discussion of pictorial holography. This discussion was led by Steven Benton who did a very able job on a topic to which he is dedicated.

2. Funding

The purpose of this document is to report on the expenditure of funds received from the Air Force Office of Scientific Research. Funding of $4,000.00 was granted in response to an unsolicited proposal. In the
proposal it was indicated that these funds would be spent to promote attendance of younger scholars in the field. They are listed in the following table:

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<th>Name</th>
<th>University</th>
<th>AFOSR Fund</th>
<th>GRC Special Fund</th>
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<td>Brian Brames</td>
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<td>Mark A. Title</td>
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<td>Moshe Tur</td>
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<td><strong>TOTAL AFOSR FUNDS</strong></td>
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<td>F.T.S. Yu</td>
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GRC Fund Total $7,380.00  
GRC Balance $120.00

* These figures are as submitted in the final recommendation of this conference Chairman on June 23, 1982. However, they are subject to final review and actual disbursement by the GRC Director and his personnel. Hence there may be slight discrepancies in the actual sums paid.
3. **Conference Attendance**

There were approximately 115 people attending this conference. A complete address list is included in Appendix B. The breakdown of attendees is as follows:

- 52 attendees from industry
- 63 attendees from universities, 26 of whom were doctoral students.

Participants came from every geographic area of the United States and from eight foreign countries: Canada, People's Republic of China, Germany, Israel, Japan, Mexico, The Netherlands, and Sweden.
PROGRAM

GORDON RESEARCH CONFERENCE

HOLOGRAPHY AND OPTICAL INFORMATION PROCESSING

JUNE 21-25, 1982
PLYMOUTH, NEW HAMPSHIRE

CHAIRMAN: NICHOLAS GEORGE
VICE-CHAIRMAN: JAMES C. WYANT

MONDAY 21 JUNE, MORNING SESSION

NICHOLAS GEORGE--Welcome
EMMETT N. LEITH--Presider

"The Role of Higher Order Correlations in Optical Information Processing"
ADOLF W. LOHMANN, Universitat Erlangen.

"An Overview of Titanium Diffused Lithium Niobate Integrated Optics Devices"
ROD C. ALFERNES, Bell Laboratories.

COFFEE BREAK

"Facts and Myths Regarding the Usefulness of the Technique of Phase Conjugation"
EMIL WOLF, University of Rochester.

EVENING SESSION

WORKSHOP PANEL
"Diffraction Pattern Sampling and Optical Spatial Filtering"

BRIAN J. THOMPSON--Chairman*
College of Engineering and Applied Science, University of Rochester
KEITH BROMLEY, Naval Ocean Systems Center
SING H. LEE, University of California San Diego
ROBERT D. LEIGHTY, U.S. Army Engineer Topographic Laboratories
G. MICHAEL MORRIS, The Institute of Optics
FRANCIS T. S. YU, Pennsylvania State University

*Adolf W. Lohmann presided in the absence of Brian J. Thompson.
TUESDAY 22 JUNE, MORNING SESSION

BOB D. GUENTHER--Presider

"The Total Internal Reflection Spatial Light Modulator"
ROBERT A. SPRAGUE, WILLIAM D. TURNER, LARRY N. FLORES,
RICHARD V. JOHNSON, DAVID L. HECHT, and ANTONIO NAFARRATE.
Xerox Palo Alto Research Center.

"Image Design"
BAHAA E. A. SALEH, University of Wisconsin.

COFFEE BREAK

"Optical Systolic Array Processors and Their Close Relatives"
H. JOHN CAULFIELD, Aerodyne Research.

EVENING SESSION

POSTER SESSION I

JAMES C. WYANT--Presider

"Incorporation of Gain Into a Coherent Optical Processor with Feedback"
ROBERT P. AKINS, University of California San Diego.

"Real-Time Generation of Wigner Distribution Functions for One-Dimensional Signals"
RAVINDRA A. ATHALE, JOHN LEE, and HAROLD H. SZU, Naval Research Lab.

"Phase Retrieval by Optical Phase Differentiation"
JOHN C. BORTZ and BRIAN J. THOMPSON, The Institute of Optics.

"Detection of Ampule Contaminants Using Far-Field Holography"
JOE S. CRANE, PAUL DUNN, and BRIAN J. THOMPSON, The Institute of Optics.

"Cycloramic Display"
WOLFGANG DULTZ, University of Regensburg.

"Projection Theorems and Their Applications in 3-D Tomographic Image Reconstruction and Display"
NABIL H. FARHAT, University of Pennsylvania.

"Near Infrared Holography by Two-Photon Scheme"
VOLKER G. GERBIG, IBM Research Laboratory.
POSTER SESSION I--Continued

"Medical Imaging"
GENE GINDI, Yale University; RICK PAXMAN and HARRISON H. BARRETT, Optical Sciences Center.

"Moire Deflectometry"
ODED KAFRY, Nuclear Research Center of the Negev.

"Particle Velocity Measurements Using Holographic and Diffraction Pattern Sampling"
PHILLIP MALYAK, The Institute of Optics.

"Realization of Optical Transfer Functions by Means of Random Multi-Aperture Filters"
LEIF A. OSTLUND, Royal Institute of Technology.

"Bandwidth of Holographic Optical Elements"
THOMAS W. STONE and NICHOLAS GEORGE, The Institute of Optics.

"Optical Signal Processing of Raster Formatted Data Related to the Projection-Slice Theorem"

"2-D Optical Processing of 1-D Acoustic Data"
HAROLD H. SZU, Naval Research Laboratory.

"Polarization Properties of Birefringent Phase Gratings"
ARMAND R. TANGUAY, JR., University of Southern California.

"Digital Optical Processing"
MARK A. TITLE, HOWARD BARR, and SING H. LEE, University of California San Diego.

"White Light Information Processing"
FRANCIS T. S. YU, TIEN-HSIN CHAO, and SONGLIN ZHUANG, Pennsylvania State University.
**WEDNESDAY 23 JUNE, MORNING SESSION**

STEPHEN A. BENTON--Presider

"Acousto-Optic Devices in Numerical Algebraic Processing"
WILLIAM T. RHODES, Georgia Institute of Technology.

"Iterative Phase Retrieval"
JAMES R. FIENUP, Environmental Research Institute of Michigan.

COFFEE BREAK

"Optical Logic Array Processor for an Optical Digital Computer"
YOSHIKI ICHIOKA, Osaka University.

**EVENING SESSION**

JOHN A. NEFF--Presider

"Recent Progress in Spatial Light Modulators for Coherent Optical Processing Applications"
ARMAND R. TANGUAY, JR., University of Southern California.

"Deformable Mirror Displays"
LARRY J. HORNBECK, Texas Instruments.

"2-D Magneto-Optic Spatial Light Modulator"
WILLIAM E. ROSS, Litton Systems.
THURSDAY 24 JUNE, MORNING SESSION

KEITH BROMLEY--Presider

"Laser Diode for the Optical Disk"
SEIJI YONEZAWA, Hitachi Central Research Laboratory.

"Integrated Optical Approaches to Numerical Processing"
CARL M. VERBER, Battelle Columbus Laboratories.

COFFEE BREAK

"Phase Conjugation in Optics and Electronics"
ADRIANUS KORPEL, The University of Iowa.

EVENING SESSION

MATT LEHMANN--Presider

CONFERENCE SOCIAL & POSTERS REVISITED

FRIDAY 25 JUNE, MORNING SESSION

ROBERT E. BROOKS--Presider

"Advances in the CCD-Liquid Crystal Light Valve"
UZI EFRON, Hughes Research Laboratories.

"Optical Processing in Radon Space"
HARRISON H. BARRETT, Optical Sciences Center.

COFFEE BREAK

"Partitioned Holographic Optical Elements"
STEVEN K. CASE, University of Minnesota.
APPENDIX B

1982 GORDON RESEARCH CONFERENCE
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