Research Center for Optical Physics

Education and Technology for the 21st Century

FINAL REPORT 1992 – 2003

Doyle A. Temple
Director

DEPARTMENT OF PHYSICS
HAMPTON UNIVERSITY

Funded by the Office of Equal Opportunity Programs
Minority University Research and Education Division
MURED
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Grant #NCC 1-251
# Table of Contents

1. PROGRAM OVERVIEW ..........................................................................................................................1

2. DEGREES AWARDED.............................................................................................................................3
   2.1 Ph.D. RECIPIENTS ...........................................................................................................................3
   2.2 BACHELORS DEGREES AWARDED ...............................................................................................4
   2.3 MASTERS DEGREES AWARDED .....................................................................................................5

3. OUTREACH PROGRAMS........................................................................................................................6
   3.1 PRE-COLLEGE PROGRAMS.............................................................................................................6
   3.2 TEACHER ENHANCEMENT ............................................................................................................7
   3.3 RECRUITMENT AND RETENTION WORKSHOP ............................................................................7
   3.4 SEMINAR SERIES ..........................................................................................................................7
   3.5 UNDERGRADUATE SUMMER PROGRAMS ....................................................................................8

4. RESEARCH OUTCOMES ........................................................................................................................9
   4.1 NATIONAL AND INTERNATIONAL RECOGNITION .......................................................................9
   4.2 EQUIPMENT AND FACILITIES ENHANCEMENTS .....................................................................9
   4.3 RESEARCH PRODUCTIVITY ...........................................................................................................10
   4.4 GOVERNMENTAL, INDUSTRIAL AND ACADEMIC PARTNERSHIPS ........................................10

APPENDIX A: PROFILES OF FACULTY PARTICIPANTS ........................................................................11

APPENDIX B: REFEREED PUBLICATIONS, PROCEEDINGS AND BOOK CHAPTERS ...............14

APPENDIX C: EXTERNAL FUNDING ....................................................................................................33
1. PROGRAM OVERVIEW

During the past eleven years since its inception, RCOP has excelled in its two primary goals: 1) training of the scientists and engineers needed for the twenty-first century with special emphasis on underrepresented citizens and 2) research and technological development in areas of relevance to NASA.

In the category of research training, as of May 2003, RCOP produced 36 Bachelors degrees, 25 Masters degrees, and 13 Doctoral degrees. Of these, all 36 Bachelors degrees, 16 of the Masters degrees and 9 of the Doctoral degrees were awarded to African Americans. Four of the Doctoral graduates and one of the Masters graduates are working at NASA Field Centers. RCOP has also provided research experiences to 130 undergraduate students and 22 high school students through a number of outreach programs held during the summer and the academic year.

RCOP has also been crucial to the development of the Ph.D. program in physics at Hampton University by providing high quality research training and technical electives required for a Doctoral degree in physics.

RCOP has also excelled in research and technological development. Since 1992, RCOP researchers have leveraged over $8 M in additional research funding, published 152 papers in refereed journals and proceedings, and given 125 presentations at refereed international conferences in the United States and eight other countries. RCOP also developed numerous collaborations with other research centers, universities and industries. In recognition of this outstanding work, RCOP is the first research center in the United States invited to join the Joint Open Laboratory for Laser Crystals and Precise Laser Systems headed by Dr. Alexander Kaminiskii of the Russian Academy of Sciences.

- Awarded 13 Ph.D.'s in Physics, 9 to African Americans (5 women and 4 men)
- Awarded 25 Masters degrees in Physics, 16 to African Americans
- Awarded 36 Bachelors degrees in Science and Engineering, all to African Americans
- 5 former students are working at NASA Field Centers (4 Ph.D. and 1 Masters)
- Leveraged more than $8M in additional grant funding
- Published 152 articles in international refereed journals and refereed proceedings
- Presented 125 scientific talks at refereed international conferences
- Students have given technical presentations at conferences in 8 countries
- Conducted numerous summer undergraduate intern programs with a total of 94 African American student participants from around the country
- Mentored 22 high school students through the NASA SHARPE program
- Held 12 Saturday science workshops for 79 elementary school students
- Held a student retention workshop in collaboration with the NSF AMP Program
- Held 3 high school teacher summer science workshops with more than 130 participants
- Students and faculty participated as judges in 42 HS science fairs
- Held elementary school model rocket clubs with more than 500 participants
- Student Awards
  - 2 National Research Council (NRC) Postdoctoral Fellowships
  - 2 National Science Foundation (NSF) Postdoctoral Fellowships
  - 3 Office of Naval Research (ONR) Graduate Fellowships
  - 1 Optical Society of America (OSA) Congressional Postdoctoral Fellowship
  - 8 Virginia Space Grant Graduate Fellowships
  - Undergraduate Mr. Boadu was elected President of the International Association of Physics Students
2. DEGREES AWARDED

Histogram of degrees awarded to Hampton URC students between 1992 and 2003.

2.1 Ph.D. Recipients

Kang Seo 1997
Research Associate, Norfolk State University

Kang Seo 1997

Florence Etop 1998
Full time homemaker

Hyung Rip Lee 1998
NASA Langley Research Center

 wcharas Hodari 1998
OSA Congressional Fellowship.

Melvin Spurlock 1998
(deceased 1998)
Postdoc at Norfolk State University.

Kenneth Samuel 2000
Research Scientist at the Naval Research Laboratory

Charles Terrell 2000
National Research Council (NRC) Postdoctoral Fellow at the NASA Jet Propulsion Laboratory.

Christophe McCray 2001
Project leader at DRS Technology in Florida.

Sang Lee 2002
Postdoctoral Fellow at the NASA Goddard Spaceflight Center

Renee Payne-Baggott 2003
Scientist, NASA Langley Research Center

Ei Ei Nyein 2003
Postdoctoral Fellow, Hampton University

Althea Bluett 2003
NRC Postdoc at the Naval Research Laboratory

Kenneth Samuel 2000

Erica Thompson 2001
Postdoctoral Fellow at the California Institute of Technology.
## 2.2 Bachelors Degrees Awarded

<table>
<thead>
<tr>
<th>Last Name, First Name</th>
<th>Gender/Ethnicity</th>
<th>Major</th>
<th>Citizenship</th>
<th>Year</th>
<th>Post Graduation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coleman, Craig</td>
<td>Male/African Am.</td>
<td>Physics</td>
<td>US</td>
<td>1993</td>
<td>Graduate school at George Mason Univ.</td>
</tr>
<tr>
<td>Johnson, Alicia R.</td>
<td>Female/African Am</td>
<td>Physics</td>
<td>US</td>
<td>1993</td>
<td>Graduate School in Nuclear Physics at HU</td>
</tr>
<tr>
<td>Moore, Michael</td>
<td>Male/African Am.</td>
<td>Comp. Sci.</td>
<td>US</td>
<td>1994</td>
<td></td>
</tr>
<tr>
<td>Dumas-, Keisha</td>
<td>Female/African Am</td>
<td>Physics</td>
<td>US</td>
<td>1995</td>
<td>Graduate School at William and Mary</td>
</tr>
<tr>
<td>Bonaparte, Justin</td>
<td>Male/African Am.</td>
<td>Physics</td>
<td>US</td>
<td>1995</td>
<td></td>
</tr>
<tr>
<td>Hairston, Brian</td>
<td>Male/African Am.</td>
<td>Physics</td>
<td>US</td>
<td>1995</td>
<td>Secondary school teacher Chesapeake City Schools</td>
</tr>
<tr>
<td>Lee, Krista</td>
<td>Female/African Am</td>
<td>Physics</td>
<td>US</td>
<td>1995</td>
<td>Commissioned in the Marine Corps</td>
</tr>
<tr>
<td>Lofton, Lakela</td>
<td>Female/African Am</td>
<td>Elect. Engr</td>
<td>US</td>
<td>1995</td>
<td></td>
</tr>
<tr>
<td>Bell, Raymond C.</td>
<td>Male/African Am.</td>
<td>Airway Science</td>
<td>US</td>
<td>1996</td>
<td>Commissioned in the Air Force</td>
</tr>
<tr>
<td>Goss, Tyhesha N.</td>
<td>Female/African Am</td>
<td>Physics</td>
<td>US</td>
<td>1996</td>
<td>Optometry School</td>
</tr>
<tr>
<td>Lane, Ryan</td>
<td>Male/African Am.</td>
<td>Physics</td>
<td>US</td>
<td>1996</td>
<td>Commissioned in the NAVY</td>
</tr>
<tr>
<td>Bath, Desireé</td>
<td>Female/African Am</td>
<td>Physics</td>
<td>US</td>
<td>1997</td>
<td>Graduate School Georgia Tech</td>
</tr>
<tr>
<td>Clingman, Chekesha</td>
<td>Female/African Am</td>
<td>Physics</td>
<td>US</td>
<td>1997</td>
<td>Graduate School Johns Hopkins</td>
</tr>
<tr>
<td>Fields, Aisha</td>
<td>Female/African Am</td>
<td>Physics</td>
<td>US</td>
<td>1997</td>
<td>Graduate School Alabama A&amp;M</td>
</tr>
<tr>
<td>Hudson, Tasha</td>
<td>Female/African Am</td>
<td>Physics</td>
<td>US</td>
<td>1997</td>
<td>Graduate school Cleveland State Univ.</td>
</tr>
<tr>
<td>Lucas, Michael</td>
<td>Male/African Am.</td>
<td>Physics</td>
<td>US</td>
<td>1997</td>
<td>Department of Defense Contractor</td>
</tr>
<tr>
<td>Pendergrass, LeRuth</td>
<td>Female/African Am</td>
<td>Elect. Engr</td>
<td>US</td>
<td>1997</td>
<td>Graduate School at Georgia Tech</td>
</tr>
<tr>
<td>McNeil, Jason</td>
<td>Male/African Am.</td>
<td>Physics</td>
<td>US</td>
<td>1999</td>
<td>Graduate School at HU</td>
</tr>
<tr>
<td>Brown, Terrence</td>
<td>Male/African Am.</td>
<td>Physics</td>
<td>US</td>
<td>1999</td>
<td>Lockheed Martin</td>
</tr>
<tr>
<td>Thomas, Brandi</td>
<td>Female/African Am</td>
<td>Physics</td>
<td>US</td>
<td>2000</td>
<td>Torch Technologies</td>
</tr>
<tr>
<td>Toppin, Crystal</td>
<td>Female/African Am</td>
<td>Physics</td>
<td>US</td>
<td>2000</td>
<td>Graduate School Univ. of Wisconsin</td>
</tr>
<tr>
<td>Jackson, Kim</td>
<td>Female/African Am</td>
<td>Physics</td>
<td>US</td>
<td>2001</td>
<td>Graduate School Univ. of Michigan</td>
</tr>
<tr>
<td>McNeil, Derrick</td>
<td>Male/African Am.</td>
<td>Physics</td>
<td>US</td>
<td>2001</td>
<td>Graduate School Univ. of Michigan</td>
</tr>
<tr>
<td>Mims, Kenneth</td>
<td>Male/African Am.</td>
<td>Physics</td>
<td>US</td>
<td>2001</td>
<td>Applying for graduate school</td>
</tr>
<tr>
<td>Ofori-Bodu, George</td>
<td>Male/African Am.</td>
<td>Physics</td>
<td>US</td>
<td>2001</td>
<td>Medical School Univ. of Virginia</td>
</tr>
<tr>
<td>Cyril Wiggins</td>
<td>Male/African Am.</td>
<td>Physics</td>
<td>US</td>
<td>2002</td>
<td>Masters program at Hampton</td>
</tr>
<tr>
<td>Rickey Wiggins</td>
<td>Male/African Am.</td>
<td>Physics</td>
<td>US</td>
<td>2002</td>
<td>Lawrence Livermore Lab</td>
</tr>
</tbody>
</table>
### 2.3 Masters Degrees Awarded

<table>
<thead>
<tr>
<th>Name Last, First</th>
<th>MI</th>
<th>Gender/Ethnicity</th>
<th>Citizenship</th>
<th>Major</th>
<th>Year</th>
<th>Post Graduation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cho, Yong Su</td>
<td></td>
<td>Male/Korean</td>
<td>Korean</td>
<td>Physics</td>
<td>1992</td>
<td></td>
</tr>
<tr>
<td>Choi, JaeHo</td>
<td></td>
<td>Male/Korean</td>
<td>Korean</td>
<td>Physics</td>
<td>1992</td>
<td></td>
</tr>
<tr>
<td>Allen-Wells, Donica</td>
<td></td>
<td>Female/African Am.</td>
<td>US</td>
<td>Physics</td>
<td>1993</td>
<td></td>
</tr>
<tr>
<td>Copeland, Randolph</td>
<td></td>
<td>Male/African Am.</td>
<td>US</td>
<td>Physics</td>
<td>1993</td>
<td>Continued in the Ph.D. Program at HU</td>
</tr>
<tr>
<td>Han, Goowan</td>
<td></td>
<td>Male/Korean</td>
<td>Korean</td>
<td>Physics</td>
<td>1993</td>
<td>Ph.D. Program Boston College</td>
</tr>
<tr>
<td>Veal, Trina</td>
<td></td>
<td>Female/African Am.</td>
<td>US</td>
<td>Physics</td>
<td>1993</td>
<td>Continued in the Ph.D. Program at HU</td>
</tr>
<tr>
<td>Lee, Sangwooc</td>
<td></td>
<td>Male/Korean</td>
<td>Korean</td>
<td>Physics</td>
<td>1994</td>
<td>Continued in the Ph.D. Program at HU</td>
</tr>
<tr>
<td>Lee, Hyung R.</td>
<td></td>
<td>Male/Korean</td>
<td>Korean</td>
<td>Physics</td>
<td>1994</td>
<td>Continued in the Ph.D. Program at HU</td>
</tr>
<tr>
<td>Hodari, Apriel K.</td>
<td></td>
<td>Female/African Am.</td>
<td>US</td>
<td>Physics</td>
<td>1994</td>
<td>Continued in the Ph.D. Program at HU</td>
</tr>
<tr>
<td>Nguyen, Dung X.</td>
<td></td>
<td>Male/Vietnamese</td>
<td>US</td>
<td>Physics</td>
<td>1994</td>
<td></td>
</tr>
<tr>
<td>Terrell, Charles A.</td>
<td></td>
<td>Male/African Am.</td>
<td>US</td>
<td>Physics</td>
<td>1994</td>
<td>Continued in the Ph.D. Program at HU</td>
</tr>
<tr>
<td>Johnson, Alicia</td>
<td></td>
<td>Female/African Am.</td>
<td>US</td>
<td>Physics</td>
<td>1995</td>
<td>Continued in the Ph.D. Program at HU</td>
</tr>
<tr>
<td>McCray, Christophe</td>
<td></td>
<td>Male/African Am.</td>
<td>US</td>
<td>Physics</td>
<td>1996</td>
<td>Continuing in the Ph.D. Program at HU</td>
</tr>
<tr>
<td>Brass, Eric</td>
<td></td>
<td>Male/African Am.</td>
<td>US</td>
<td>Physics</td>
<td>1997</td>
<td>Continued in the Ph.D. Program at HU</td>
</tr>
<tr>
<td>Spraggins, Darrell</td>
<td></td>
<td>Male/African Am.</td>
<td>US</td>
<td>Physics</td>
<td>1997</td>
<td>Thomas Jefferson National Laboratory</td>
</tr>
<tr>
<td>Khet, Marcie</td>
<td></td>
<td>Female/Asian</td>
<td>Burma</td>
<td>Physics</td>
<td>1998</td>
<td>Ph.D. program at Stony Brook, NY</td>
</tr>
<tr>
<td>Quiet, Carramah</td>
<td></td>
<td>Female/African Am.</td>
<td>US</td>
<td>Physics</td>
<td>2000</td>
<td>Continued in the Ph.D. Program at HU</td>
</tr>
<tr>
<td>David, Ronald</td>
<td></td>
<td>Male</td>
<td>Ghana</td>
<td>Physics</td>
<td>2001</td>
<td>Physics teacher, Pebbs High School</td>
</tr>
<tr>
<td>Payne-Baggott, Renee</td>
<td></td>
<td>Female/African Am.</td>
<td>US</td>
<td>Physics</td>
<td>2001</td>
<td>Continued in the Ph.D. Program at HU</td>
</tr>
<tr>
<td>Turner, Matthew</td>
<td></td>
<td>Male/African Am.</td>
<td>US</td>
<td>Physics</td>
<td>2001</td>
<td>NASA Langley</td>
</tr>
<tr>
<td>Jason McNeil</td>
<td></td>
<td>Male/African Am.</td>
<td>US</td>
<td>Physics</td>
<td>2002</td>
<td>Continued in the MS. Program at HU</td>
</tr>
<tr>
<td>Mike Fields</td>
<td></td>
<td>Male/African Am.</td>
<td>US</td>
<td>Physics</td>
<td>2002</td>
<td>Army Research Laboratory</td>
</tr>
<tr>
<td>Santiel Creekmore</td>
<td></td>
<td>Male/African Am.</td>
<td>US</td>
<td>Physics</td>
<td>2003</td>
<td>HU Ph.D. Program</td>
</tr>
</tbody>
</table>
3. OUTREACH PROGRAMS

The outreach program for RCOP consisted of three main components: precollege, undergraduate, and teacher enhancement. The overall goal of RCOP’s outreach program was to provide students with world-class education and training in optics and related disciplines, with a special emphasis on underrepresented students. The faculty of RCOP participated in every aspect of these outreach efforts.

3.1 Pre-College Programs

Adopt-A-Class Program

The "Adopt-a-Class" project was an outreach effort to provide hands-on experiences in science that were fun and educational, and to demonstrate to young students that science is exciting and interesting and that a career in science is possible for them. For instance, the third grade class at R. O. Nelson elementary school (shown at right) enjoyed building, painting and blasting off their own model rockets. The project was a great success and was replicated at several other schools. The students were excited to interact with a scientist who could answer their innocent and far out scientific questions with logical and understandable answers, while they worked on the construction of their rockets.

NASA SHARP PLUS

SHARP Plus is a program funded by NASA in order to provide outstanding underrepresented students from around the country the opportunity to study in a rich research environment. This program was a collaboration between Hampton University and NASA-Langley through the Quality Education for Minorities (QEM) program. RCOP faculty mentored one to three SHARP Plus students each year.

African American Male Math and Science Academy

Graduate students Ms. Valetta Davis, Ms. Apriel Hodari and Mr. Darrell Spraggins conducted introductory physics laboratory exercises with middle school African American male students.
3.2 Teacher Enhancement
The Summer Institute for Teacher Enhancement (SITE) was a program funded by the U.S. Department of Energy (DOE). This program was hosted by the Thomas Jefferson National Accelerator Facility formally CEBAF. SITE provided hands-on research experiences for 130 participating middle and high school teachers. The teachers learned how to use lasers as a teaching tool in their sciences courses, toured the Graduate Physics Research Center and received laser pointers as an additional benefit.

3.3 Recruitment and Retention Workshop
The Department of Physics hosted the Washington Baltimore Hampton Roads - Alliance for Minority Participation (WBHR-AMP) Workshop on Successful Outreach Programs: recruitment and Retention. This workshop was held in McGrew Towers on the campus of Hampton University on November 17, 1995. This workshop focused on successful outreach programs for recruitment and retention of underrepresented science students. The objectives of this workshop were to explore opportunities in establishing linkages between four year universities and community colleges and to address key issues concerning the matriculation of students. The agenda is listed on the next page. Dr. Warren Buck, Professor of Physics moderated this workshop. We had informative talks by people with success on the theme of recruitment and retention. There were also working groups that focused on specific topics. The overall workshop was very successful.

3.4 Seminar Series
RCOP held a colloquium series each year. In this colloquium, distinguished scientists presented seminars on their research. Just a few of the 73 presenters included: Noble Laureate and Harvard University Professor Dr. Nicolaas Bloembergen (shown at left with Ph.D. student Christophe McCray), Dr. M.S. Dresselhaus MIT Institute Professor of Physics and past President of the American Physical Society, and Dr. Gerard Mourou, Professor and Director, Center for Ultrafast Optical Science, University of Michigan.
3.5 Undergraduate Summer Programs

Every summer since 1993, RCOP has sponsored, either through URC funds or other grants, at least one summer intern program for undergraduates. In these programs, 94 undergraduates from around the country spent six to eight weeks on campus working directly with an RCOP faculty member on a specific problem. Students also received lectures on current topics in optical physics as well as field trips to other research and educational facilities. Seven African American students were recruited into the RCOP graduate program from the summer programs.

Post-Baccalaureate Summer Research Program 1993-1994

The Post-Baccalaureate Summer Research Program (PSRP) was an eight-week summer program held in 1993 and 1994 for undergraduates that have completed their junior year of college. The goals of this program were to provide underrepresented undergraduates with experiences in state-of-the-art computer technology, research methods, and improvement of mathematical skills and enhancement of technical writing skills.

Alliance for Minority Participation - Summer Physics Institute 1995 (AMP-SPI)

The Summer Physics Institute (SPI) was held from June 19 through July 28, 1995 for junior and senior physics majors. The academic training consisted of a three-credit hour course on optical and mathematical physics. The students were also paired with research scientists from RCOP and NASA/LaRC.

Undergraduate Institute in Physics (UnIPhy) 1996 - 2003
Principal Investigators
Dr. Claudia Rankins and Dr. Doyle Temple

The Undergraduate Institute in Physics (UnIPhy), funded by the NSF REU program, has been held every summer since 1996. This program targeted undergraduate physics students, who have completed at least their second year of course work in physics.

Advanced Undergraduate Research using Optical Radiation in the Atmosphere (AURORA) 1998 - 2000
Dr. Doyle Temple, Principal Investigator

AURORA was a six-week, undergraduate summer program established to provide undergraduates with quality research experiences in laser and atmospheric sciences and to encourage them to pursue graduate studies and careers in science. The participants conducted cutting edge research under the guidance of world-class research scientists at Hampton University.
4. RESEARCH OUTCOMES

4.1 National and International Recognition

- RCOP is the first research center in the U.S. to be invited to join an international network of research centers in The Joint Open Laboratory for Laser Crystals and Precise Laser Systems, Directed by Dr. Alexander Kaminiskii, of the Russian Academy of Sciences.
- The HU Ozone Lidar instrument was highlighted in the optics trade magazine *Photonics Spectra*.
- The first discovery of Er\(^{3+}\) ions in nanostructures of porous silicon by RCOP faculty was the feature article in *Laser Focus World*, September 1996.
- RCOP faculty have received the prestigious NSF Career Award.
- RCOP Students have presented their work at conferences in eight countries.

4.2 Equipment and Facilities Enhancements

Facilities

Currently, RCOP occupies 16 high quality laboratories with over 6,500 sq.ft. of laboratory space. These laboratories include:

- One Bridgman crystal growth laboratory
- One Czochralski crystal growth laboratory
- One materials preparation laboratory
- Two Lidar laboratories
- Eleven state-of-the-art laser spectroscopy laboratories

Equipment

RCOP currently has over $5 M of state-of-the-art research equipment including:

- Four Bridgman crystal growth furnaces
- Two Czochralski crystal growth furnaces
- Seven argon ion lasers
- Two ultrafast pulsed laser systems
- Four Yag lasers
- Three lidar instruments
- One eximer laser
- Twelve precision optics tables
- A high vacuum solar propulsion simulator
4.3 Research Productivity

Histogram of RCOP refereed publications, proceedings and conference talks. (see Appendix B)

4.4 Governmental, Industrial and Academic Partnerships

Agilent Technologies  
Brimrose Corporation  
California State University at Sacramento  
Coherent, Inc.  
Corning, Inc.  
European Army Research Office  
ITT Industries  
Laser Energetics, Inc.  
Howard University  
MIT  
NASA Glenn  
NASA Langley  
NASA Marshall  
Northrop-Grumman Aerospace  
Russian Academy of Sciences  
Stanford University  
University of Cincinnati  
University of Illinois
APPENDIX A: Profiles of Faculty Participants

Dr. Thomas Chyba, Associate Professor of Physics 1995 - 2001
Dr. Thomas Chyba received his Ph.D. in 1990 from the University of Rochester. From 1990 until 1993 he was a National Research Council Research Associate with Dr. Edward Browell’s Lidar Applications Group in the Chemistry and Dynamics Branch, Atmospheric Sciences Division, NASA Langley Research Center. From 1993 until 1995, he was a Research Scientist at the College of William and Mary associated with the same group. In 1995, Dr. Chyba joined the Department of Physics at Hampton University. He is now an Associate Professor and serves as Associate Director of the Research Center for Optical Physics (RCOP) and Co-Director of the Center for Lidar and Atmospheric Science Students (CLASS). His laboratory in RCOP specializes in laser development and lidar applications. Dr. Chyba has authored/co-authored over 30 technical articles and has presented numerous papers at conferences and technical meetings. Dr. Chyba is a member of the Optical Society of America, the American Association of Physics Teachers, the American Physical Society, and the International Society for Optical Engineering.

Usamah Farrukh, Professor of Electrical Engineering 1992 - 1994
Dr. Farrukh received his Ph.D. in Electrical Engineering from the University of Southern California. His areas of research include laser system modeling; optical systems and detectors; laser propagation in scattering media; atmospheric optical properties and analysis and software development for optical and ballistic systems. He has more than 30 publications in refereed journals.

Dr. Kwang Han, Professor of Physics 1992 - 1993
Dr. Han’s research interests are in plasma and laser physics. He has more than 27 years of service at Hampton University. He received his Ph.D. degree in physics from the College of William and Mary.

Dr. Uwe Hömmerich, Associate Professor of Physics 1995 - 2003
Dr. Uwe Hömmerich received his Ph.D. in physics from the University of Hamburg in 1994. His dissertation research was on the optical spectroscopy of new transition metal laser materials. He spent a postdoctoral year at the University of Wisconsin-Madison before he joined the Department of Physics at Hampton University in 1995. Dr. Hömmerich has authored/co-authored over 50 technical articles in the area of optical spectroscopy of rare earth and transition metal based solid-state laser materials.

In Hwang, Associate Professor of Physics 1992 - 1994
Dr. Hwang received his Ph.D. degree in physics from the Korean Advanced Institute of Science. His area of research includes the use of diode lasers in the development of a solid state lasers.

Dr. Nelson Jalufka, Associate Professor of Physics 1992 - 1994
Dr. Jalufka received his Ph.D. degree in physics from the University of Colorado at Boulder. He joined the physics department at Hampton University in 1990. Prior to that he was a senior research scientist at NASA LARC. His area of research is atomic and molecular spectroscopy.
Donald Lyons, Professor of Physics 1993 - 2003
Dr. Lyons received his B.S. degree in physics from Grambling State University and his M.S. and Ph.D. degrees in physics from Stanford University. Before coming to Hampton he was a Senior Research Scientist at Grumman Aerospace Corporation. He joined the Hampton University faculty in August, 1993 as an associate professor of physics. His area of research is the application of intrinsic and extrinsic fiber optic Fabry-Perot sensors to Smart materials and structures.

Arlene Maclin, Research Professor of Physics 1992 - 1994
Dr. Maclin received her B.S. degree in physics from North Carolina A&T State University, M.S. degree from the University of Virginia and her Ph.D. degree in theoretical solid state physics from Howard University.

Dr. Jae Tae Seo, Assistant Professor of Physics 1999 - 2003
Dr. Jae Tae Seo received his Ph.D. in laser and plasma physics from Hampton University in 1997. His dissertation was on the laser development based on transition metal ion-doped solid state and optical nonlinear materials, optical spectroscopy of dense plasma, and plasma pulse power development. He spent his postdoctoral years in the research center for optical physics before he joined as a faculty member in the Physics Department at Hampton University in 1999. Dr. Seo has authored or co-authored over 70 journal or technical articles in the areas of optical spectroscopy of optical materials, laser development, and plasma pulse power development. His current research interest areas are optical spectroscopy of rare-earth ion-doped solids, laser development based on rare-earth ion-doped solids and optical nonlinear materials.

Garfield Simms, Assistant Professor of Applied Mathematics 1992 - 1993
Dr. Simms received his B.S. Degree in physics from Delaware State University and his M.S. and Ph.D. degrees in electrical engineering from the University of Delaware. Dr. Simms has two patents in the area of fiber optic transmission lines.

Alphonso Smith, Associate Professor of Electrical Engineering 1992 - 1994
Dr. Smith is a faculty associate of Electrical Engineering. His research interest are in ultrasonics and the use of fiber optics to study smart materials. He joined the Hampton University community in 1991. He received his Ph.D. degree in electrical engineering from Virginia Polytechnic and State University.

Carl Spight, Adjunct Professor 1992 - 1993
Dr. Spight, Director of Scientific Research, Jackson and Tull and Graham has had extensive university and high technology experience, both as a manager and as a scientist-technologist. In industry he has directed a division with more than 30 software development efforts under government (DOD, FAA) contracts.

Bagher Tabibi, Associate Professor of Physics 1992 - 2003
Dr. Tabibi received his Ph.D. from Moscow State University. His area of research involves atomic and molecular spectroscopy, laser optics, and non-intrusive optical flow and plasma diagnostics. He has over 25 years of experiences in experimental research in the mentioned...
areas. He has 9 years research experience in the field solar-pumped lasers at NASA Lagley Research Center. He has developed optical diagnostic techniques – electron beam fluorescence, focusing Schlieren, and laser-induced fluorescence for the super/hypersonic flow diagnostics. These non-intrusive optical spectroscopic techniques offer the possibility of detecting molecules and atoms, measuring species concentrations, determining energy level population distribution and probing energy transfer processes (including relaxation) in molecules and atoms. He joined the Hampton University faculty in 1983 and is currently a Professor of Physics.

**Dr. Doyle Temple, Professor of Physics 1994 - 2003**

Dr. Temple received his B.S. Degree from Southern University and his Ph.D. from the Massachusetts Institute of Technology. He was an Assistant Professor of Physics at Louisiana State University from 1988 to 1994. Also during that time he was founder and president of Applied Physics, Inc. a high tech company that specialized in single crystal growth of optical materials with funding from Louisiana venture capitalists and the DOD SBIR program. In June of 1994 he joined Hampton University as Associate Professor of Physics and Chair. His research interests are in crystal growth and spectroscopy of new optical materials primarily for use in holographic data storage devices. He is a member of the American Association of University Professors, the American Association of Physics Teachers, the Institute of Electrical and Electronics Engineers, the International Society for Optical Engineering, the Optical Society of America and the Sigma Pi Sigma Physics Honor Society.

**Demetrius Venable, Vice President for Research 1992 - 1995**

Dr. Venable was the director and principal investigator of RCOP between 1992 and 1994. He has held prior positions at the university serving as professor and chairman of physics, Dean of the graduate school and Vice President for Research. He has more than 14 years of service to Hampton University and holds a Ph.D. degree in physics from American University.
APPENDIX B: Refereed Publications, Proceedings and Book Chapters

Many conference talks are accompanied by refereed conference proceedings. Therefore, refereed conference proceedings publications will also be listed under conference talks.

Book Chapter:

January – May 2003 Statistics

Refereed Publications and Conference Proceedings

Conference Talks

2002 Statistics

Refereed Publications and Conference Proceedings


Conference Talks


8. A. G. Bluiett, R. T. Shah, and U. Hömmerich, S. B. Trivedi, S. W. Kutcher, and C. C. Wang, Crystal-Field Effects on the Optical Properties of Cr\textsuperscript{2+}ions in Cr Doped II-VI Semiconductors,


2001 Statistics

Refereed Publications and Conference Proceedings


Conference Talks


2000 Statistics
Referred Publications and Conference Proceedings


17. F. Jin, J. B. Khurgin, C. C. Wang, S. Trivedi, Y. Gabay, E. Gad, D. Temple, U. Hömmerich, "Displacement measurement with submicron resolution using photo-electromotive force effects and


29. Chen-Chia Wang, Feng Jin, Jacob Khurgin, Sudhir Trivedi, Doyle Temple, Uwe Hommerich, Esam Gad, “Optical Path Length Measurements using Frequency-chirped Laser Pulses and an Optical


Conference Talks


Conference Talks


1999 Statistics

Refereed Publications and Conference Proceedings


**Conference Talks**


**1998 Statistics**

**Refereed Publications and Conference Proceedings**


Conference Talks


1997 Statistics

Refereed Publications and Conference Proceedings


Conference Talks


1996 Statistics

Refereed Publications and Conference Proceedings

12. X. Wu, V. R. Davis, U. Hämmerich, K. Grasza, S. B. Trivedi, and Zengchen Yu, "Optical properties of Cr\(^{2+}\) ions in Cd\(_{0.85}\)Mn\(_{0.15}\)Te", presented at the International Conference on Luminescence, Prague, August 1996.
17. Zenker, T., A. M. Thompson, D. P. McNamara, T. L. Kucsera, G. W. Harris, F. G. Wienhold, P. LeCanut, M. O. Andreæ, and R. Koppmann, Regional trace gas distribution and airmass


**Conference Talks**

1. Calvin W. Lowe, and S.C.Mathur; PERIODIC DIELECTRIC STRUCTURES: Theme lecture delivered at IX National Seminar on Ferroelectrics and Dielectrics held at National Physical Laboratory, New Delhi, India, from October 8 - 11, 1996.

2. Calvin W. Lowe, and S.C.Mathur, PHOTONIC BANDGAP CRYSTALS: INVITED TALK delivered at 3rd Intensive tutorial and International conference on semiconductor materials and devices held at Delhi University and National Physical Laboratory, New Delhi, India from December 16-21, 1996.


**1995 Statistics**

**Referred Publications and Conference Proceedings**


**Conference Talks**


1994 Statistics

Refereed Publications and Conference Proceedings

Conference Talks

1993 Statistics

Refereed Publications and Conference Proceedings

Conference Talks

1992 Statistics

Refereed Publications and Conference Proceedings

Conference Talks
## APPENDIX C: External Funding

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>K. Han</td>
<td>ONR</td>
<td>$81,276</td>
<td>$81,276</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K. Han</td>
<td>NASA</td>
<td>$109,733</td>
<td>$54,866</td>
<td>$54,866</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. Tabibi</td>
<td>AFOSR</td>
<td>$431,659</td>
<td></td>
<td></td>
<td>$215,825</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. Tabibi</td>
<td>AFOSR</td>
<td>$525,000</td>
<td></td>
<td></td>
<td></td>
<td>$12,500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. Tabibi</td>
<td>AFOSR</td>
<td>$462,264</td>
<td></td>
<td></td>
<td>$164,412</td>
<td></td>
<td>$168,440</td>
<td>$155,710</td>
<td></td>
<td></td>
<td>$143,743</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. Tabibi</td>
<td>NASA</td>
<td>$78,263</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$78,263</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. Tabibi</td>
<td>NASA</td>
<td>$12,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$12,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G. Simme</td>
<td>NSF</td>
<td>$312,069</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$70,017</td>
<td>$70,017</td>
<td>$70,017</td>
<td></td>
<td></td>
</tr>
<tr>
<td>J. Farahk</td>
<td>ARL</td>
<td>$30,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$30,000</td>
<td></td>
</tr>
<tr>
<td>D. Lyons</td>
<td>NASA</td>
<td>$275,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D. Lyons</td>
<td>NASA</td>
<td>$475,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$68,750</td>
<td>$68,750</td>
<td>$68,750</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D. Temple and W. Buck</td>
<td>NSF</td>
<td>$180,000</td>
<td></td>
<td></td>
<td>$118,750</td>
<td></td>
<td></td>
<td></td>
<td>$118,750</td>
<td>$118,750</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D. Temple and C. Rankin</td>
<td>NSF</td>
<td>$180,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$60,000</td>
<td>$60,000</td>
<td>$60,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D. Temple, T. Chyba &amp; J. Russell</td>
<td>NASA</td>
<td>$187,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$60,000</td>
<td>$60,000</td>
<td>$60,000</td>
</tr>
<tr>
<td>D. Temple &amp; T. Chyba</td>
<td>NASA</td>
<td>$2,500,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T. Chyba</td>
<td>NASA</td>
<td>$83,093</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T. Chyba</td>
<td>NASA</td>
<td>$247,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T. Chyba</td>
<td>NASA</td>
<td>$360,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T. Chyba</td>
<td>NASA</td>
<td>$200,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$90,000</td>
<td>$180,000</td>
<td>$90,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T. Chyba</td>
<td>AFOSR</td>
<td>$185,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$50,000</td>
<td>$100,000</td>
<td></td>
<td>$50,000</td>
</tr>
<tr>
<td>T. Chyba</td>
<td>VSGC</td>
<td>$8,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T. Chyba</td>
<td>VSGC</td>
<td>$8,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T. Chyba</td>
<td>Textron</td>
<td>$10,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T. Chyba</td>
<td>LeRC</td>
<td>$24,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U. Hommerich</td>
<td>ARO</td>
<td>$175,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U. Hommerich</td>
<td>ARO</td>
<td>$350,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U. Hommerich</td>
<td>ARO</td>
<td>$155,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U. Hommerich</td>
<td>ARO</td>
<td>$182,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U. Hommerich</td>
<td>ARO</td>
<td>$155,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U. Hommerich</td>
<td>NSF</td>
<td>$60,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U. Hommerich</td>
<td>NSF</td>
<td>$100,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>J. Seo</td>
<td>ARO</td>
<td>$180,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>J. Seo</td>
<td>ARO</td>
<td>$180,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>J. Seo</td>
<td>ARL</td>
<td>$185,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>J. Seo</td>
<td>ARL</td>
<td>$185,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>J. Seo</td>
<td>ARL</td>
<td>$185,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>J. Seo</td>
<td>ARL</td>
<td>$185,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
