A Career Encompassing Optical Physics, Diversity and Mentoring

Dr. Anthony M. Johnson, Director*
Center for Advanced Studies in Photonics Research (**CASPR**)
Professor of Physics
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2002 President of the Optical Society of America (OSA)
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* Before January 1, 1995
Distinguished Member of Technical Staff
Photonic Circuits Research Department, AT&T Bell Laboratories
1995-2003 Chair, Physics Dept., New Jersey Institute of Technology (**NJIT**)

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CENTER FOR ADVANCED STUDIES IN PHOTONICS RESEARCH

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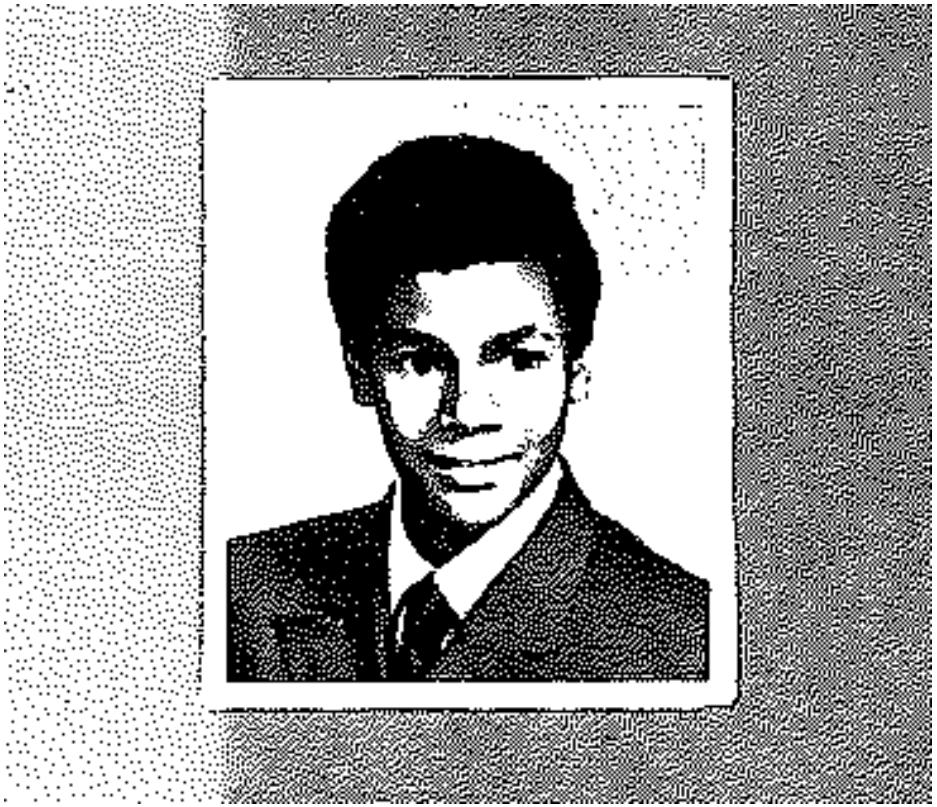
AN HONORS UNIVERSITY IN MARYLAND

1971 Yearbook, Samuel J. Tilden, High School, Brooklyn, NY



Anthony Johnson – Physicist – Arista Honor Society; Secretary to A.M. Dean; Worked in Chemistry Lab

Bell Labs Cooperative Research Fellowship Program (CRFP) for Minorities

- The CRFP, founded in 1972 was one of the first programs of its kind in the US to address the issue of under-representation of minorities at the PhD level in the fields of mathematics, science and engineering

- The Graduate Research Program for Women (GRPW) was founded in 1974 -- a companion program to CRFP to address the shortage of women scientists at Bell Labs

- To create a pool of undergraduate students eligible to enter the graduate CRFP and GRPW programs, the Bell Labs Summer Research Program for Minorities and Women (SRP) was established in 1974 – this 10-week summer program was for outstanding underrepresented minorities and women who have completed their Jr. year of undergraduate studies. The purpose of SRP was to provide a preview of the lifestyle of an R&D career to impact decisions to earn graduate degrees

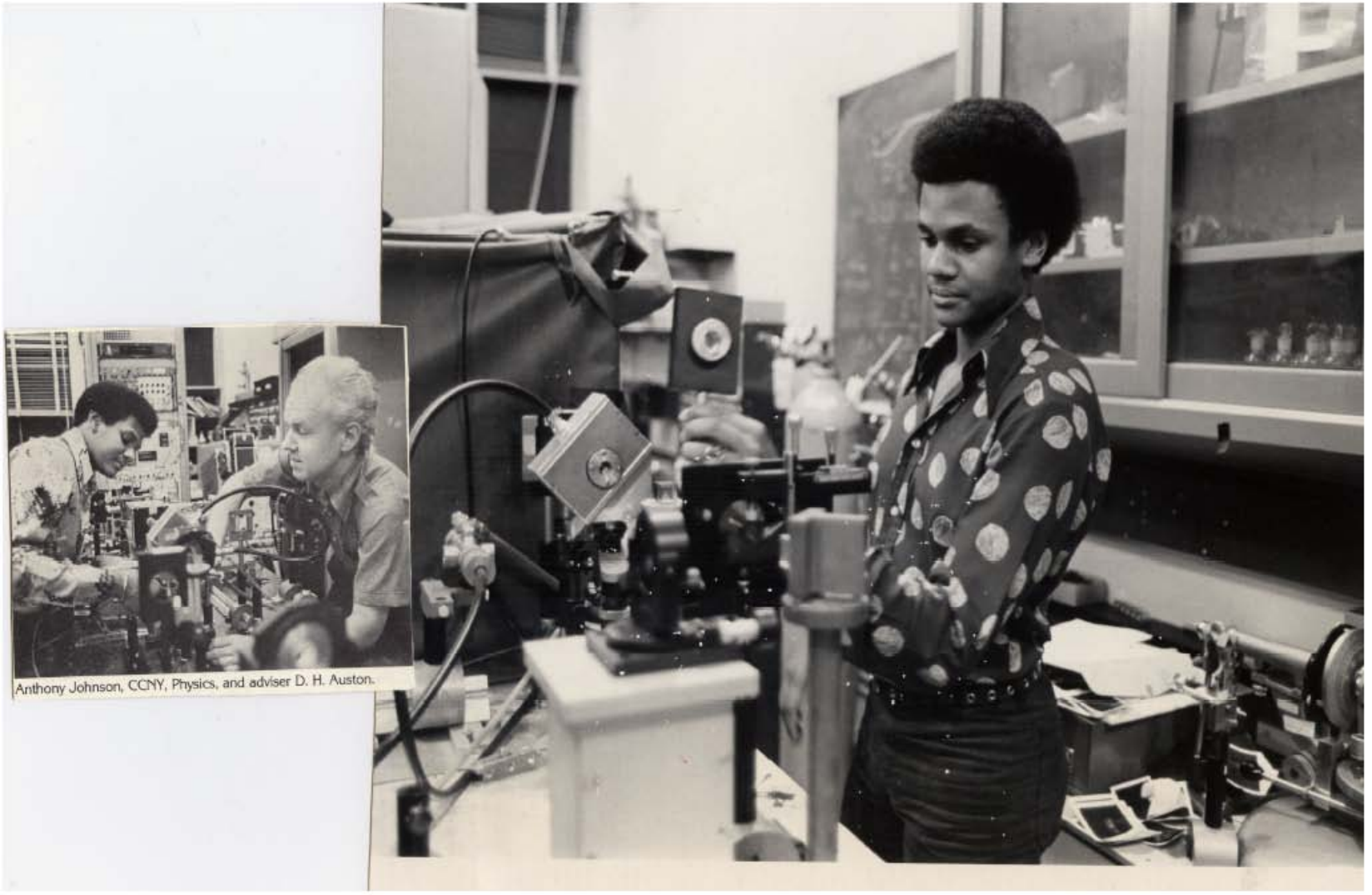
Dr. Alice White, Chief Scientist, Bell Labs, Alcatel-Lucent --1976 GRPW Fellow

Now at Boston Univ.

•The summers after her sophomore, junior and senior years of college, Dr. White participated in the Bell Labs Summer Research Program for Minorities and Women (SRP) which began in 1974

• Dr. White was awarded a 1976 Bell Labs GRPW Fellowship to pursue a PhD in Physics at Harvard University with Bell Labs Mentor, Dr. Doug Osheroff who went on to win the Nobel Prize in Physics in 1996

1974 Bell Labs Summer Research Program, Murray Hill, NJ



David H. Auston – Lasers and Picosecond Optoelectronics – Past President, Kavli Institute -- UCSB

Robert Dynes – Low Temperature Physics and Superconductivity – Past President of UC -- UCSD

lasers which operate continuously at room temperature," *Appl. Phys. Lett.*, vol. 17, pp. 109–111, Aug. 1970.
[12] L. R. Dawson, unpublished.
[13] J. C. Dyment *et al.*, "Proton-bombardment formation of stripe-geometry heterostructure lasers for 300 K CW operation," *Proc. IEEE* (Lett.), vol. 60, pp. 726–728, June 1972.
[14] J. C. Dyment, C. J. Hwang, and A. R. Hartman, "Dependence of threshold current density and differential quantum efficiency of the stripe width of proton-bombarded double heterostructure lasers," unpublished.
[15] T. H. Zachos and J. E. Ripper, "Resonant modes of GaAs junction lasers," *IEEE J. Quantum Electron.*, vol. QE-5, pp. 29–37, Jan. 1969.
[16] A. W. Smith and J. A. Armstrong, "Intensity noise in multimode GaAs laser emission," *IBM Syst. J.*, vol. 10, pp. 225–232, May 1966.

IEEE Journal of Quantum Electronics, vol. QE-11, pp. 283-287, June 1975

Microwave Switching by Picosecond Photoconductivity

A. M. JOHNSON AND D. H. AUSTON

Abstract—**Bulk photoconductivity produced by the absorption of picosecond optical pulses in silicon transmission-line structures has been used to switch and gate microwave signals. The technique permits the generation of microwave and millimeter-wave pulses as short as a single cycle, and requires only a few microjoules of optical energy. The basic features of the device are illustrated with switching experiments at 1 GHz and 10 GHz, and the results are discussed with reference to the physical properties of the high-density plasma responsible for the switching.**

I. Introduction

IN MANY CASES, both for experimental purposes and for applications, it is desirable to have a capability for generating very short bursts of microwave and millimeter-wave signals of relatively high power. The current state of the art, however, is limited to switching speeds of approximately 1 ns [1]. Furthermore, at these speeds, the semiconductor p-i-n diodes which are used for this purpose are limited to powers of a few tens of watts. In this paper, we describe a simple optical technique for switching microwave signals which offers a significant improvement of both speed and power handling.

Although bulk semiconductor plasmas have received considerable attention as microwave switching devices [2], the use of high-density, optically generated plasmas has not been given serious consideration. Aside from the obvious speed capability, picosecond optical pulses have the additional advantage of enabling the generation of extremely high-density plasmas without damaging the material. Longer optical pulses are less efficient since they tend to produce more heating, and consequently are more likely to cause damage. It has recently been demonstrated [3] that plasma densities in excess of 10^{20} cm^{-3} can be readily generated by the absorption of single-picosecond optical pulses in semiconductors. Plasmas such as these are highly degenerate and have quasi-metallic properties. Their high conductivities make them ideal for bulk switching applications. The research reported in this paper is an extension of related work [4] in which switching and gating of dc signals was achieved with solid-state plasmas produced by picosecond pulses.

Manuscript received December 9, 1974.
A. M. Johnson was with Bell Laboratories, Murray Hill, N.J. 07974. He is now at the Polytechnic Institute of New York, Brooklyn, N.Y. 11201.
D. H. Auston is with Bell Laboratories, Murray Hill, N.J. 07974.

II. Optoelectronic Microwave Switching

An example of a microwave switch which utilizes the photoconductivity produced by picosecond optical pulses is illustrated in Fig. 1. It consists of a 50-Ω microstrip transmission-line [5] structure fabricated on a high-resistivity silicon substrate. The microstrip line consists of a uniform aluminum ground plane on the bottom and a narrow strip for an upper conductor in which there is a gap. Input and output microwave signals are coupled to the silicon chip by 3-mm coaxial-to-microstrip launchers. In a typical application, one side of the device would be connected to a microwave-signal source and the other to a load or test instrument. The switching action is produced by two optical pulses; one in the green region of the spectrum at $\lambda = 0.53$ μm, which is used to turn on the switch, and the other in the infrared at $\lambda = 1.06$ μm, which turns it off. The absorption constant at $\lambda = 0.53$ μm in silicon is 8×10^3 cm^{-1}, and consequently the effect of absorbing a green pulse in the microstrip gap is to produce a thin surface

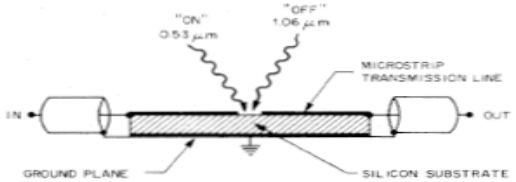


Fig. 1. An optoelectronic switch. The transmission of the switch is turned on by a surface layer of photoconductivity produced by the green pulse, and is turned off by volume photoconductivity produced by the infrared pulse, which shorts the device.

A president of Rensselaer Polytechnic Institute.

Dr. Shirley A. Jackson

First African-American Woman to receive a Ph.D. in Physics from MIT.

Joined Bell Labs in 1977.


GORDON RESEARCH CONFERENCES
"Frontiers of Science"
NONLINEAR OPTICS AND LASERS
AUGUST 3 - 7, 1981
CHAIRMAN: DAVID AUSTON V. CHAIRMEN: A. LAUBEREAU, C. WITTIG, R. FISHER
BREWSTER ACADEMY, WOLFEBORO, N. H.

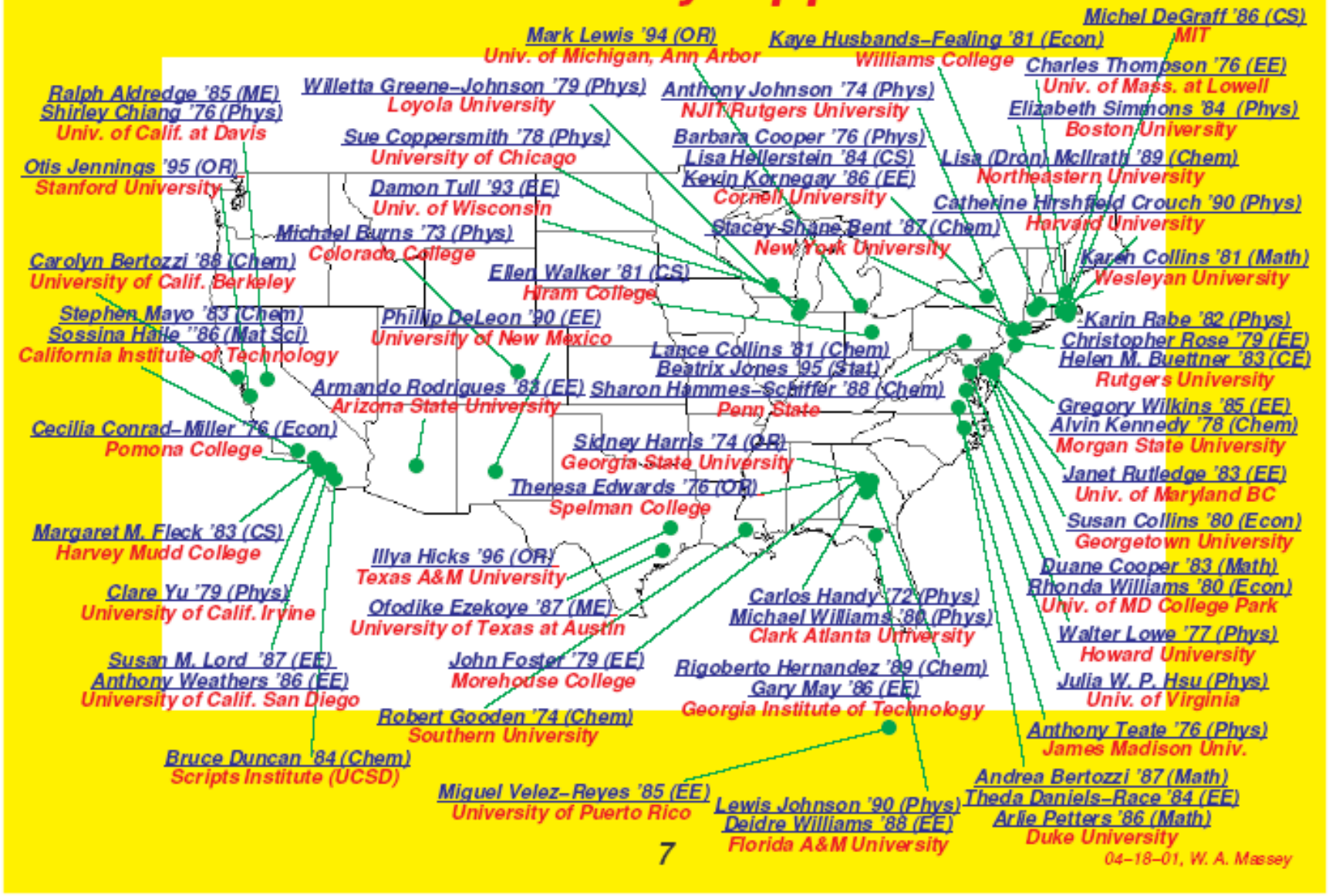
- Impact of Summer Internship
  - Pursue a PhD in Physics
  - Become a Member of Technical Staff in Research at Bell Labs
  - Summer Intern Mentor D. H. Auston → PhD Thesis Co-Advisor → Thesis Research Performed at Bell Labs, Murray Hill, NJ
  - Turned down interview at IBM Yorktown Heights – Not Smart!

- Job offers from Bell Labs Murray Hill and Holmdel, NJ
  - Despite a warm and fantastic relationship with my advisor, decided that distance was necessary to establish my own reputation
  - Accepted a position in Research at Holmdel in 1981

- Bell Labs Member of Technical Staff in Holmdel, NJ 1981
  - One of very few Black Physicists in Research
  - A proud product of Affirmative Action and Diversity and looking for a level playing field
  - The attrition rate for women and minorities was high
  - PhD thesis research at Murray Hill → I "knew" the system
  - Isolation → Death
  - Set up meetings with your colleagues to discuss research and the unique skills and qualifications you bring to the table
  - These interactions break down barriers and fosters collaboration – it did for me!
  - I had mentors that probably never knew they were important mentors to my career and survival at Bell Labs
  - My nearly 15 years in Research at Bell Labs were the best times in my career

1992 CRFP REUNION Murray Hill, NJ

62 Alumni Faculty Appointments

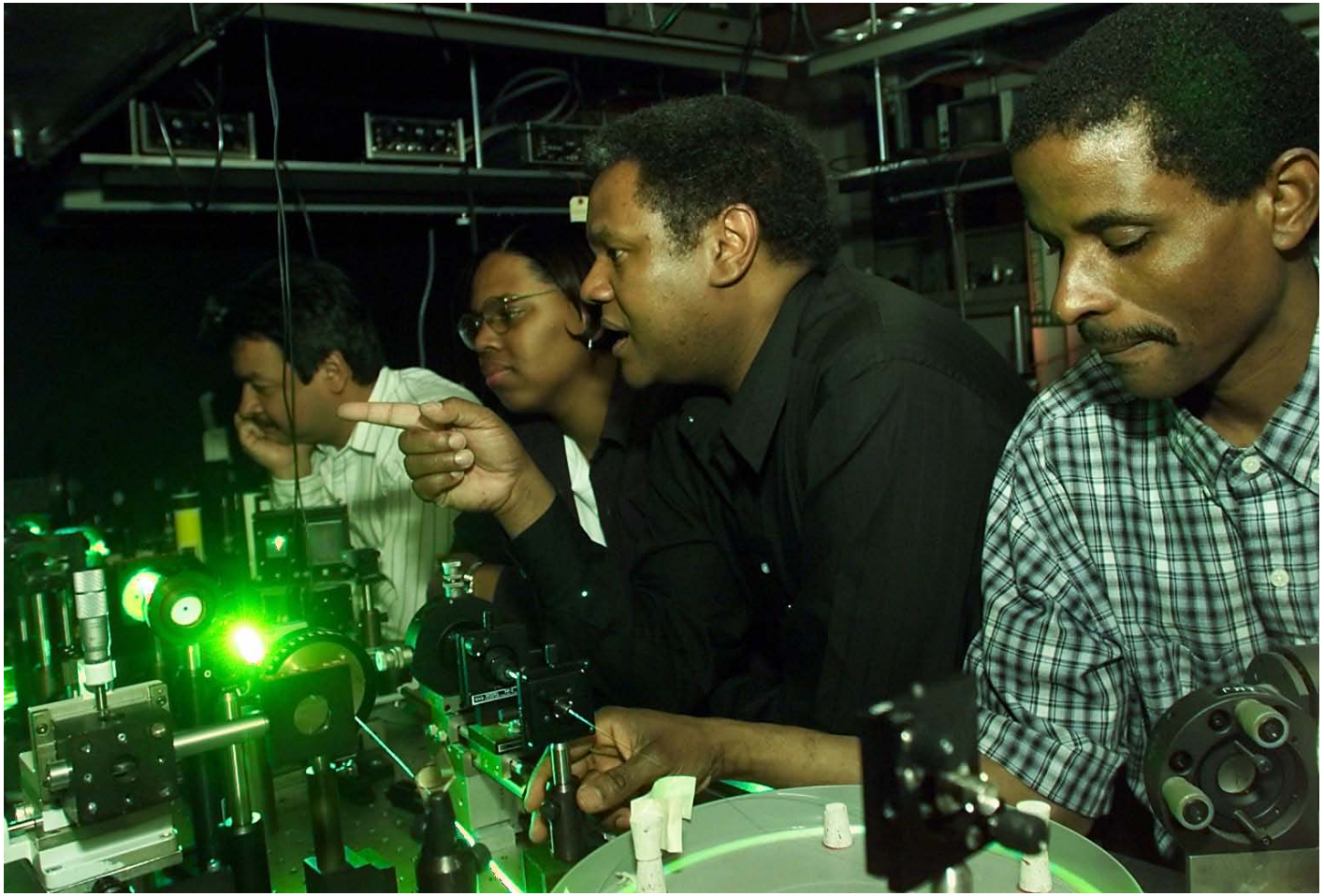


Observations and Lessons Learned

Though initially I was skeptical of the concept of a “role model”, when I left AT&T Bell Labs to join NJIT as Physics Dept. Chair, I discovered that I attracted under-represented minorities to my research group in a department that had no such students before my arrival. My second PhD student, Dr. Elaine Lalanne was the only African-American woman to receive a PhD in Physics in 2003. I now believe that this concept of a “role model” works for both foreign and domestic students and of course women. It is therefore imperative to increase the number of under-represented minority and women faculty to have an impact upon the diversity of S&E graduate students

Due to a typically “sub-critical mass” of under-represented minority and women students, a supportive and nurturing environment is usually very important for retention. I have found that under-represented minority and women students gravitate towards research groups led by under-represented minorities and women. I am very fortunate to have a nearly 100% retention rate in my research group.

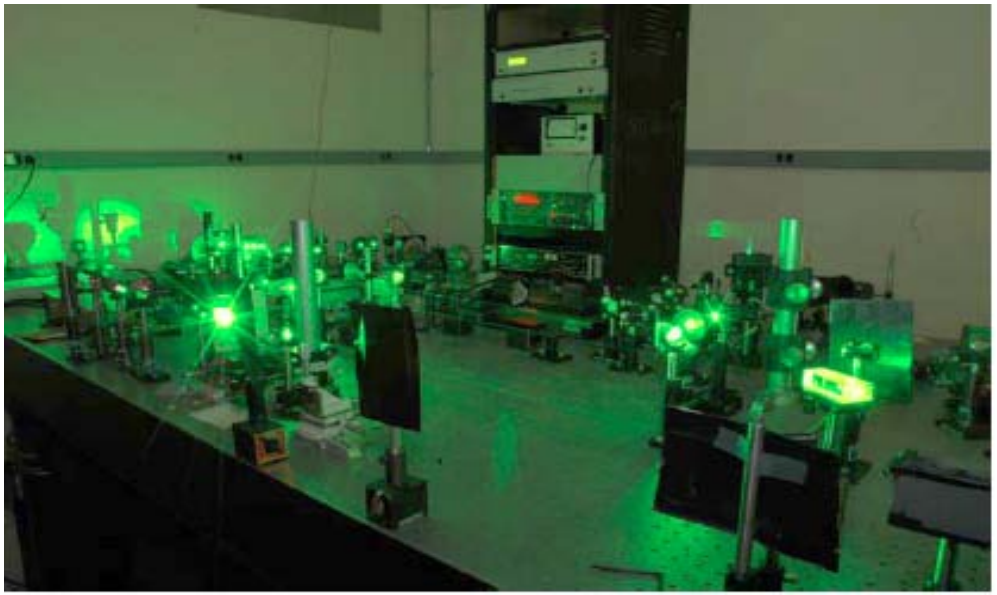
“Cultivating a field of dreams among a minority at NJIT”
by Caroline Brewer, Sunday Bergen Record
April 30, 2000, Living Section, page L-3

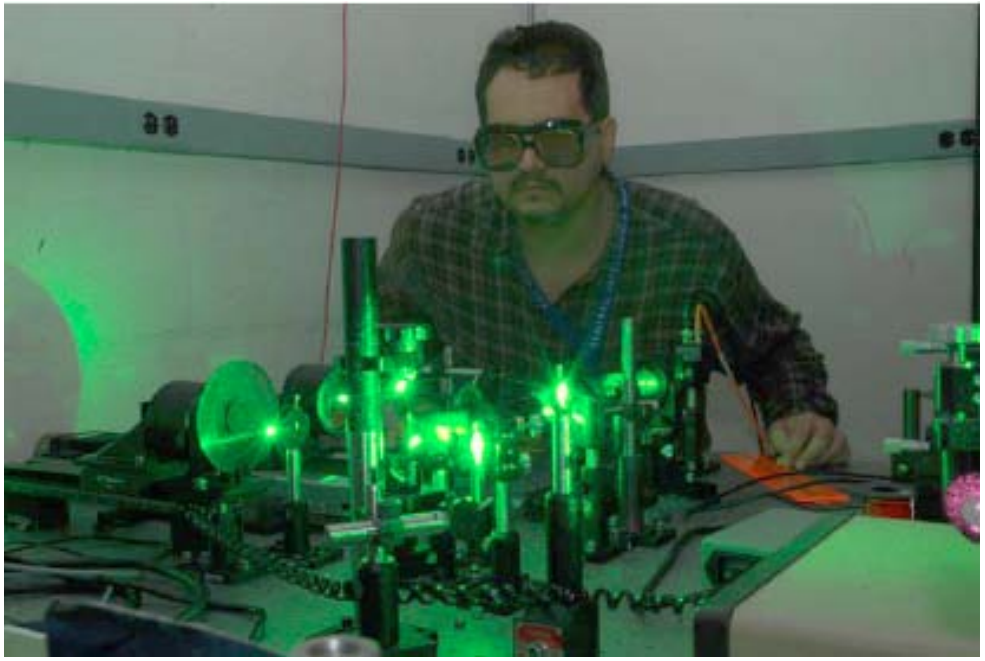


Former graduate students now Physics PhDs – Drs. Hernando Garcia, Elaine Lalanne and Ferdinand Oguama

Victor Torres – CSEE PhD student – full-time NASA Goddard employee

Non-collinear background free autocorrelation of a 7ps frequency doubled SESAM modelocked Nd:Vanadate laser





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The Ultrafast Optics and Optoelectronics Group

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Exhibit Floor CLEO'05, Baltimore Convention Center – Newport/Spectra Physics Booth


8th Annual National Conference of Black Physics Students
Georgia Institute of Technology
February 10 - 13, 1994

2011 Joint Annual Conference of NSBP & NSHP, September 21-24, Austin, TX

NSBP/NSHP 2011, Austin, TX; OSA/SPIE Poster Awards ’06, ’07, ’08, ’09, and 2011

OSA Presidents, past, present, and incoming at the Frontiers in Optics 2006, Rochester, NY

AMJ – 2002 President of the Optical Society of America (OSA)

Anthony Johnson, Kathie Olsen, John Marburger, James Harrington @ OSTP, 8/08/02

HOO Project Funding

- National Science Foundation, Division of Informal Science Education (ISE)
- NSF Program Director – Dr. Sylvia James
- PI – Anthony M. Johnson, 2002 President of the OSA
- Co-PI – Eugene Arthurs, SPIE Executive Director
- Co-PI and Project Director – Stephen Pompea (NOAO)
- $1.7M NSF ISE Grant for 3 Years – Currently in Year 4 of No-Cost Extension which officially ends August 31, 2007
- Support from SPIE, OSA and NOAO

OSA Optical Society of America

SPIE

NOAO

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NATIONAL SCIENCE FOUNDATION

Welcome From The HOO Team!

APS Bridge Program, National Advisory Board (NAB)

The goals of the APS Bridge Program (APS-BP) are to increase, within a decade, the number of physics PhDs awarded to underrepresented ethnic and racial minority (URM) students to match the fraction of physics Bachelor's degrees granted to these groups. Remarkably, this can be accomplished with 30 additional URM PhDs per year. The APS-BP also aims to develop, evaluate and document sustainable models that improve the access to and culture of graduate education for all students, with emphasis on URMs in doctoral programs in physics.

"One student in our program represents a case in point. She reported that she was unable to gain admission to graduate school because of a low undergraduate grade-point average. But once fully supported in a PhD program through an application to the APS-BP, she excelled at course-work. Although she had received Bs or lower in her core undergraduate physics courses, she earned As in the graduate level versions of the same course. What accounts for the difference? She had to work several jobs as an undergraduate to put herself though college and lacked the time to properly study. She has now passed her qualifying exams and is on the way to a PhD" – T. Hodapp and K. Woodle, "A bridge between undergraduate and doctoral degrees," *Physics Today* **70**, 50 (February 2017). This is but one example of a URM student that would not be in graduate school today without the APS-BP

2017 NAB Report – Anthony Johnson, Chair

Provocative Quotes on Diversity

"The fundamental problem, the panel notes, is not attracting women into science but retaining them once they are trained….It is not the lack of talent but unintentional biases and our outmoded institutional structures that are hindering the access and the advancement of women….Women from minority racial and ethnic backgrounds are virtually absent from the nation's leading science and engineering departments…" – National Academies report on the status of women in academic science and engineering – *Science, **vol. 313***, 22 September 2006.

"As a white male, I will never know what it's like to be an underrepresented minority." He also noted that a lot of people are simply not interested in diversity. "They are not necessarily openly hostile, but they are not interested in doing anything either." – Physics Dept. Chairs Conference, June 2012

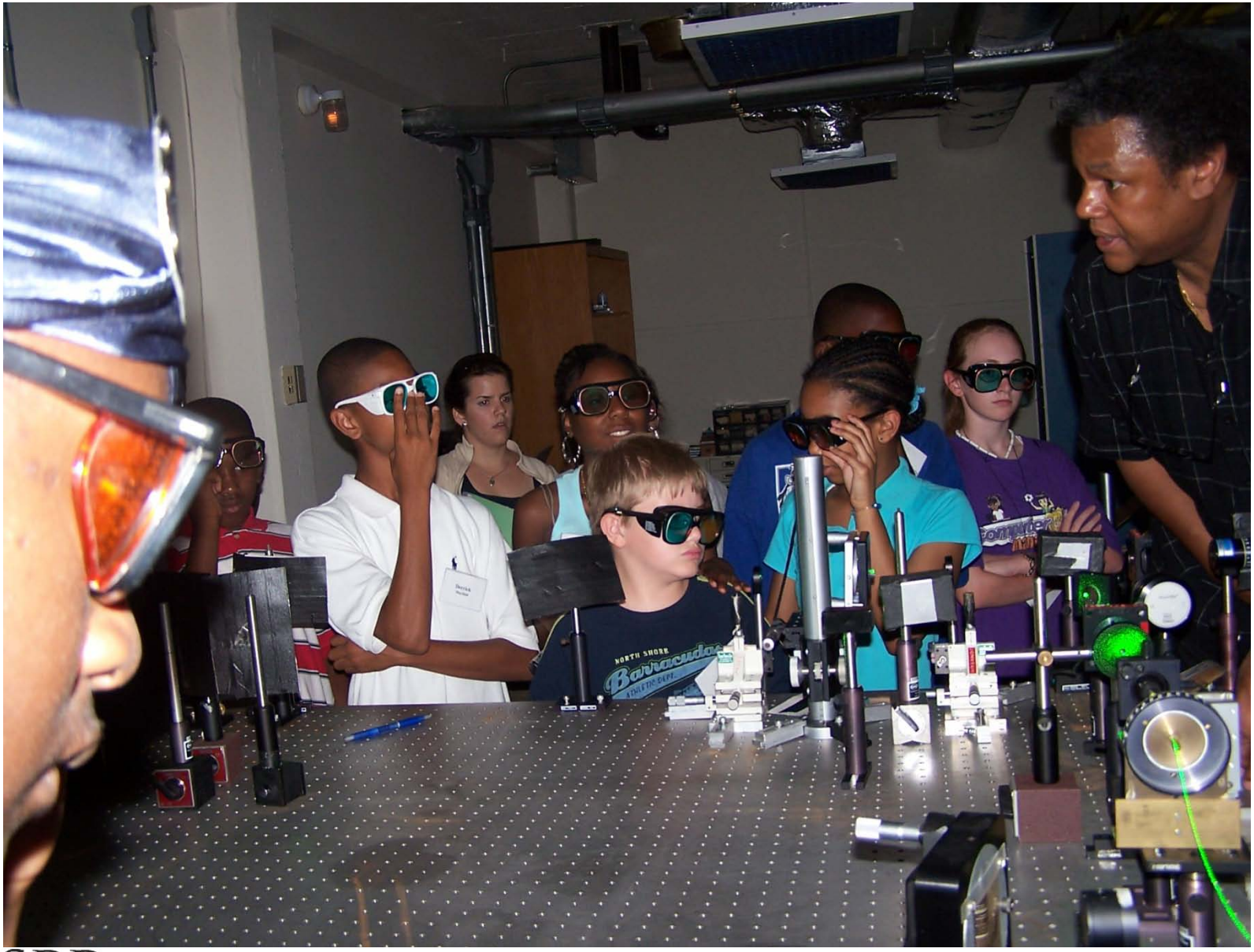
"I see no reason for a committee on women in physics. There are only two women in physics and I know both and they are very happy." – *CSWP Gazette*, October 1992.

More Provocative Quotes on Diversity

“There are ... those who contend that it does not benefit African--Americans ... to get them into the University of Texas where they do not do well, as opposed to having them go to a less- advanced school ... a slower--track school where they do well.... One of -- the briefs pointed out that ... most of the black scientists in this country don't come from schools like the University of Texas.... They come from lesser schools where they do not feel that they're ... being pushed ahead in ... classes that are too fast for them.... I'm just not impressed by the fact that ... the University of Texas may have fewer. Maybe it ought to have fewer. And maybe some—--you know, when you take more, the number of blacks, really competent blacks admitted to lesser schools, turns out to be less.... And ...-- I don't think it ... stands to reason that it's a good thing for the University of Texas to admit as many blacks as possible.” -- Supreme Court Justice Antonin Scalia
Physics Today December 2015

2200 Physicists signed an almost angry public letter challenging these comments

Middle School Students, Summer 2006 – Future Optical Physicists and Engineers



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