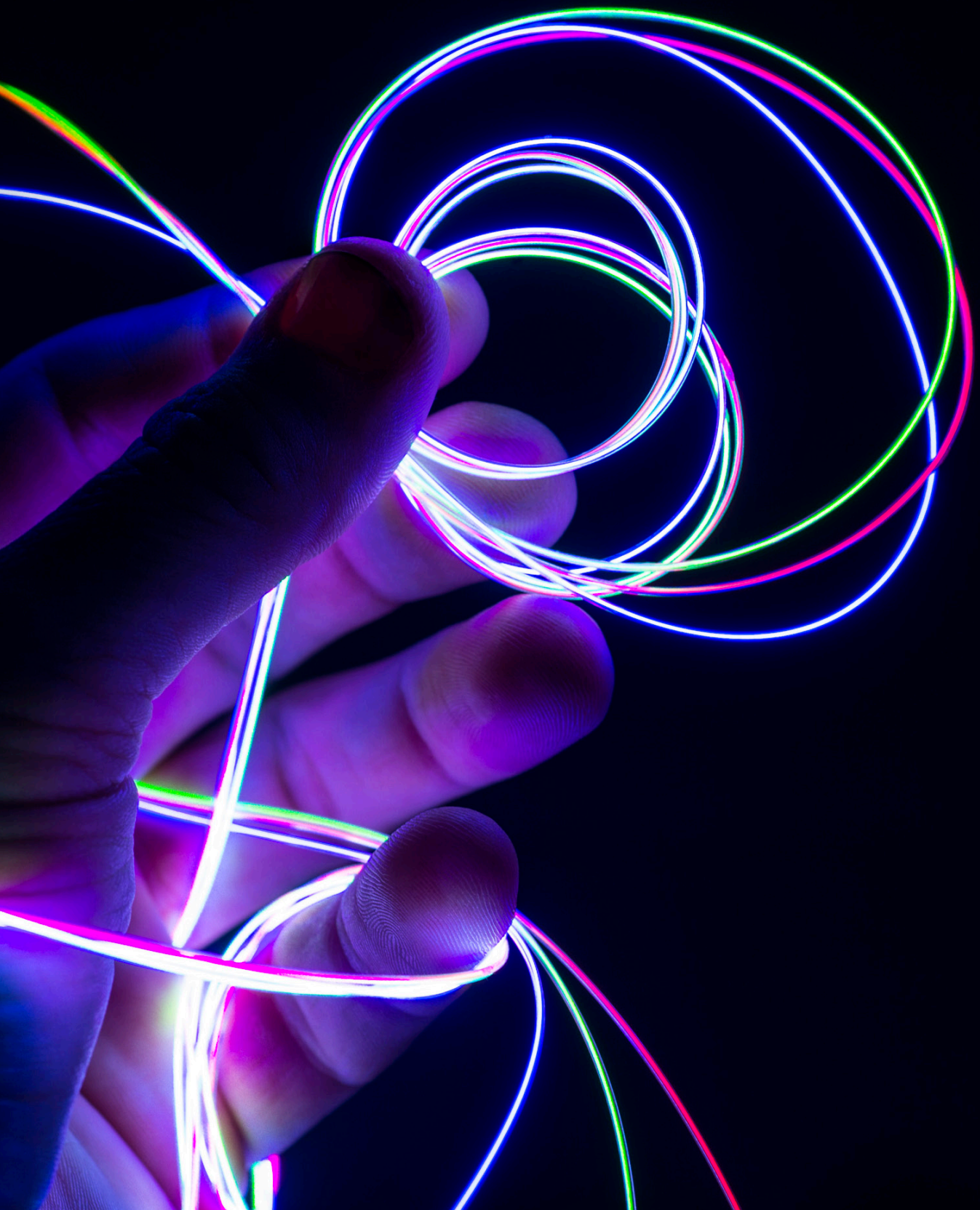
CEIS

Center for Emerging and Innovative Sciences

ANNUAL REPORT 2016–2017



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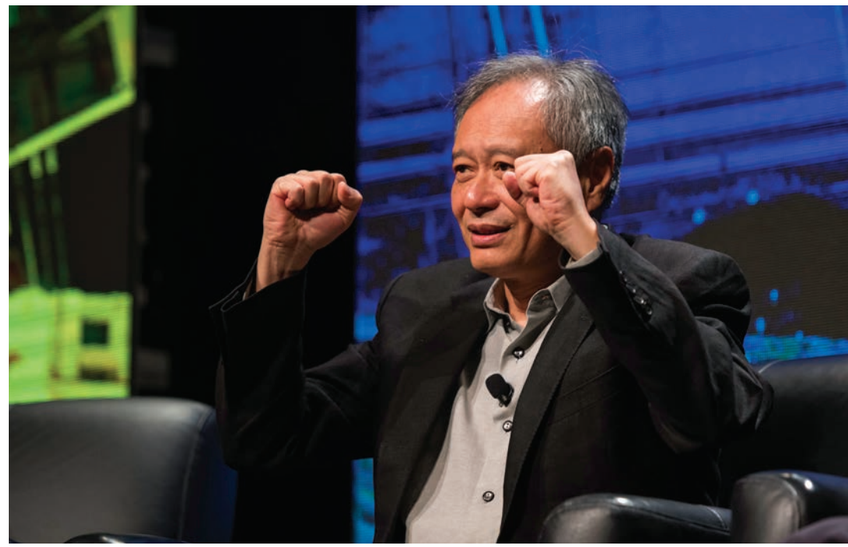
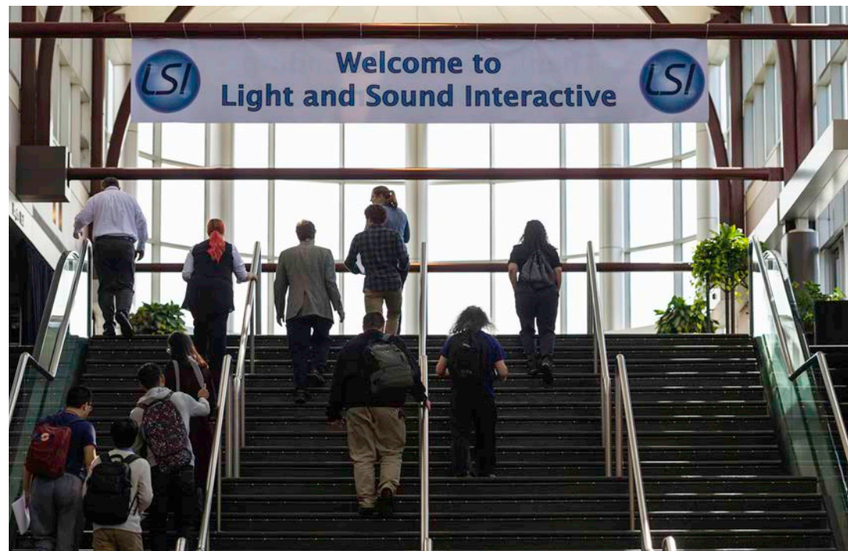


The first-ever Light and Sound Interactive (LSI) event, a three-day conference, expo, and career fair focused on light- and sound-based technologies and their applications, took place September 12 to 14, 2017, in downtown Rochester.



LETTER FROM THE DIRECTORS

Paul H. Ballentine and Mark F. Bocko

We're pleased to present our latest CEIS annual report and to take this opportunity to bring you up to date about some of the exciting developments and new initiatives in CEIS over the past year.

There are many bright spots to highlight from the past year as we continue our central mission of encouraging economic development through university-industry research collaboration. For example, in work with Harris Corporation, a research team from the University of Rochester and RIT developed a portable Terahertz camera employing readily available silicon chip technology that can "see" through plastics, cardboard, and even clothing, to detect metal objects or explosive materials and make airport security screening much faster and accurate. In another project, University of Rochester researchers developing freeform optics are collaborating with Oculus on technologies that will enable the next generation of highly compact head-mounted displays. And multiple CEIS supported researchers continue to work with Rochester-based Clerio Vision to develop new noninvasive laser vision correction methods. These are just a few of 26 collaborative projects currently being supported by CEIS. We also continue to work with AIM Photonics to capitalize on this unprecedented $600 million investment to help grow our regional photonics industry and the New York State economy.

All-tolled, employing NYSTAR formulae, over the past year CEIS accounted for $87.5 million of New York State economic impact, including more than 35 new jobs and 23.5 retained jobs for the region. We look to a bright economic future as our region continues to capitalize on the remarkable technologies that are being developed in the broad portfolio of research projects that CEIS continues to support.

Our most exciting new undertaking of the past year was the founding and successful running of the "Light and Sound Interactive" Conference and Expo held September 12–14, 2017. Light- and sound-based technologies underlie some of the fastest-growing industries in the world, such as augmented and virtual reality, imaging, photonics, and emerging health care applications, to name a few. The LSI event showcases the remarkable assets that our region possesses in light- and sound-based technologies, and it attracts the best in the world of light- and sound-based technologies and their creative applications to Rochester for an exciting and inspiring multiday celebration and get-together. One primary goal of LSI is to bring the community together and build excitement in the Rochester region about the many opportunities for light- and sound-based technologies and their applications and ultimately to grow our existing companies and to inspire the creation of new ventures. The other goal of LSI is to attract the major technology companies to our region to witness the unmatched technical and creative capabilities of our regional industry-university fabric and ultimately to inspire them to bring business and expand their operations into our region.

The inaugural LSI event was a huge success, with more than 1,000 attendees over the 2-1/2 day program, which encompassed more than 75 talks, panel discussions, demonstrations, a trade-show, and off-site events at our local museums and universities. We are deeply indebted and grateful for the generous donation of time and treasure by many from the Rochester community, local industry, the University of Rochester, and Rochester Institute of Technology. The great news is that we will continue to hold LSI as an annual event, with LSI 2018 scheduled for September 12–14, 2018. Hold the date!

As always, we would like to thank our dedicated and talented staff at CEIS. Everything we accomplish is because of their hard work and dedication to the CEIS mission. This includes our CEIS business manager, Cathy Adams; our CEIS administrative assistant, Margaret Urzetta; and our student program assistants: Nick Drogo, Vitumbiko Kambilonje, Anya Khalid, Jake Mitchell, Oliver Ostriker, and Andrew Regelski.

Sincerely,

Mark F. Bocko, Director

Paul H. Ballentine, Executive Director

CEIS TEAM

CEIS STAFF

CEIS staff prides itself on its commitment to fostering industry-university partnerships that lead to economic development for our region.

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CEIS ADVISORY BOARD

CEIS leadership meets with the advisory board to develop action-oriented plans to keep innovative technologies in the pipeline, connecting academic research with corporate product development. CEIS acknowledges and applauds its advisory board members for their leadership, expertise, and forward-thinking ideas.

Bob Naum
Chair

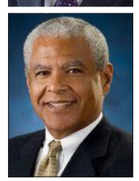
Ian Cox
IGC Consulting Group

Bob Fiete
Harris Corporation

Ellen Kosik-Williams
Corning, Inc.

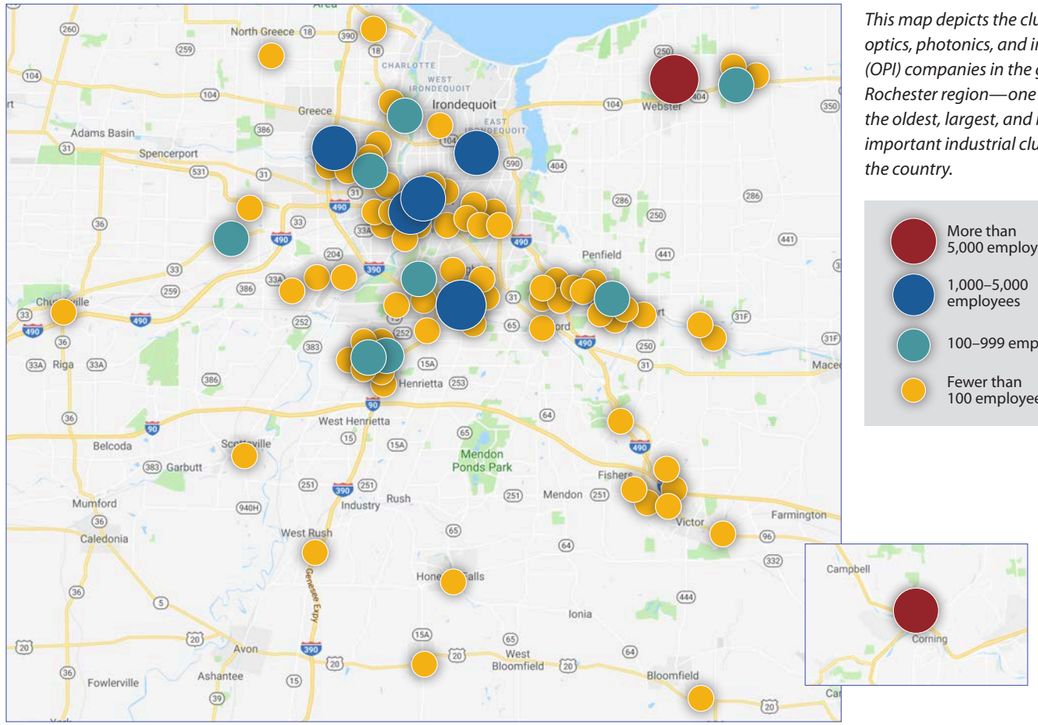
Ryne Raffaelle
Rochester Institute of Technology

Barry Silverstein
Oculus



Ed White
AIM Photonics

THE OPI CLUSTER



This map depicts the cluster of optics, photonics, and imaging (OPI) companies in the greater Rochester region—one of the oldest, largest, and most important industrial clusters in the country.

- More than 5,000 employees
- 1,000–5,000 employees
- 100–999 employees
- Fewer than 100 employees

SUPPORTERS

The important work of CEIS is supported by a number of governmental agencies and economic development partners, listed here in alphabetical order.

AIM photonics
U.S. Department of Energy
U.S. Department of Labor
EASTMAN Business Park
U.S. Department of Commerce Economic Development Administration
The Entrepreneurs Network
Finger Lakes WORKS
Flour City-Flower City-City of Rochester, N.Y.
GREATER ROCHESTER Chamber of Commerce
GRE Greater Rochester Enterprise
HIGH TECH ROCHESTER innovate. incubate. grow.
MEP • MANUFACTURING EXTENSION PARTNERSHIP
NIST National Institute of Standards and Technology U.S. Department of Commerce
NEW YORK PHOTONICS PHOTONICS ROCHESTER
NEW YORK STATE OF OPPORTUNITY. Division of Science, Technology & Innovation
Rochester Institute of Technology R·I·T 1829
SBA U.S. Small Business Administration

OUTREACH AND FEDERAL INITIATIVES

In addition to supporting industry/university collaboration by funding their research endeavors, CEIS has continued to promote economic development through a number of outreach activities and federal grants.

Our industry outreach included sponsoring the Veterans Business Council's annual Veterans Expo last October, hosting the University Technology Showcase in April, and having representation at the RBJ's Power Breakfast event "Rochester's Photonics Future" with other distinguished regional panelists.

Our American Manufacturing Jobs & Innovation Accelerator (AMJIAC) grant, the Rochester Regional Optics, Photonics & Imaging Accelerator (RRPA), concluded in November 2016. Through an approved yearlong no-cost extension, CEIS was able to continue work supported through the DOL/ETA portion to aid local companies and individuals with training geared toward the OPI cluster. Although no classes at RIT or University of Rochester sites were offered, we continued to survey the participants of those classes. The responses revealed that the participants felt they received valuable information, and they were complimentary of their instructors. CEIS also partnered with FAME for a portion of the AMJIAC funds, which allowed FAME to place 23 individuals in training programs at local OPI-related companies. All the candidates who completed the training program were offered a position at the company where they trained. In addition, the ETA grant supported efforts at three local small optics and imaging companies. One grateful company representative offered, "This training was geared toward our particular machines and products; however, the skills learned through this training would absolutely be applicable in other employment settings. These are skills which have enhanced the knowledge and employability of the trainees." Our second federal grant from NIST under the AMTech (Advanced Manufacturing Technology Consortia) program—National Technology Roadmap for Photonics (NTRP) ran from June 2014 through May 2017. The NTRP activities allowed CEIS to collaborate with stakeholders to bring AIM Photonics to Rochester and in identifying collaborations in advanced optics manufacturing, lasers, and the intersection of data science and imaging.

To this end, CEIS, the University of Rochester, and RIT teamed up with community leaders and local industry to organize a new conference called Light and Sound Interactive (LSI). LSI is modeled after the South by Southwest Interactive Conference in Austin, Texas. The inaugural LSI occurred September 12–14, 2017. The event showcased the remarkable assets that our region possesses in light- and sound-based technologies. Its success has energized organizers to move forward in planning the 2018 LSI event.

Our other commitments to the to the region's OPI cluster included Paul Ballentine co-leading the Finger Lakes Regional Economic Development Council (FLREDC) OPI Work Group and identifying viable projects for funding under the Upstate Revitalization Initiative.

As federal support for CEIS programs ends, we will continue to explore synergistic opportunities to leverage state, federal, and community resources to further our economic development mission.

AMJIAC ETA PROGRAM RESULTS

FAME/5% Pledge
23 trainees: 34% women, 30% minority, 13% veterans; if completed, 100% offered a position

Company Workforce Training
27 trainees: Advanced Imaging: 50% minority; JML Optical: 28% minority; Optimax: no detail on 16 trainees

Institute of Optics Summer School
53 trainees: 17% women, 13% minority, 7% veterans; 34% found employment or advanced career

RIT Continuing Education Courses
69 trainees: 23% women, 17% minority, 10 veterans; 20% found employment or advanced career

AMTECH NTRP DATA GATHERING

70% of New York State's 245 OPI companies have <100 employees

Since 2010, the 6 largest companies shed 35% of their employees; 123 of the smaller companies increased their workforce by 45%

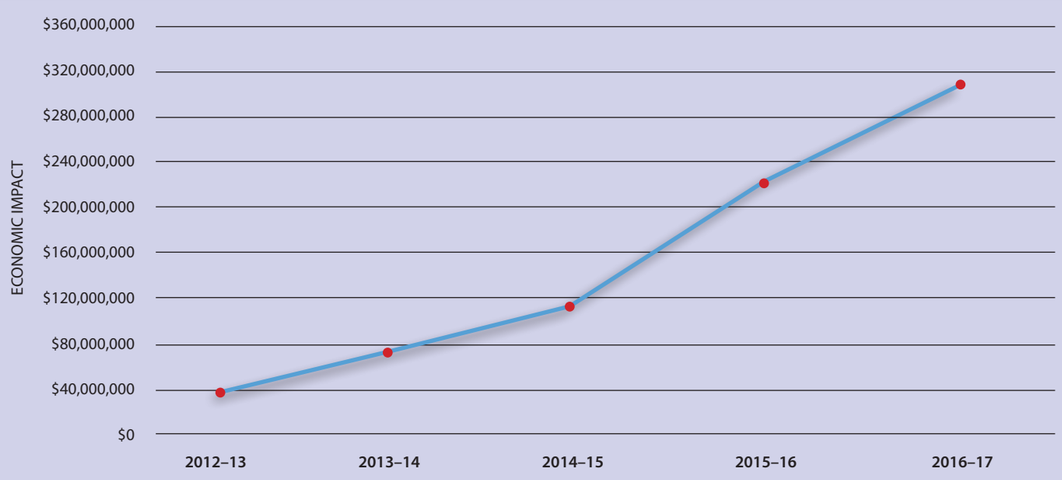
OPI-related Companies
245 statewide, including 130 in Finger Lakes region; 53 of 130 are optics related, while 35 of 130 are imaging companies

ECONOMIC IMPACT

For the fiscal year July 1, 2016, to June 30, 2017, the total documented dollar value of the economic impact of CEIS–supported research and outreach was more than $87 million. This self-reported data (new and retained jobs, increased sales, cost savings, capital investments, and additional funds acquired) from 18 of our partners provides a snapshot of the region's economic successes.

A shout out to Clerio Vision; the local start-up company reported 7 new jobs and 6 retained jobs, along with over $3 million in non-job impacts. Special recognition to OptiPro Systems as well, who reported 9 new jobs and 11 retained jobs, along with $2.7 million in non-job impact. Last, but not least, the AIM Photonics initiative led the way in non-job impacts, reporting a whopping $72 million in monetary impacts.

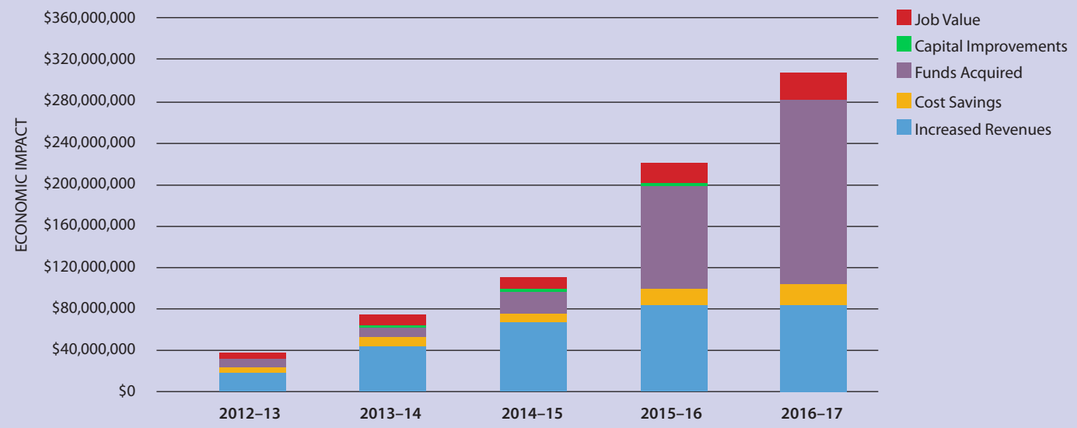
TOTAL CUMULATIVE ECONOMIC IMPACT



FIVE-YEAR SUMMARY OF ECONOMIC IMPACT

Year	2012–13	2013–14	2014–15	2015–16	2016–17	Total
Increased Revenues	$22,058,613	$20,816,657	$22,548,794	$18,635,000	$1,276,127	$85,335,191
Cost Savings	$3,146,200	$6,276,553	$1,989,100	$3,927,488	$4,586,060	$19,925,401
Funds Acquired	$7,380,774	$3,103,808	$8,050,720	$81,269,321	$77,548,500	$177,353,123
Capital Improvements	$679,000	$792,806	$263,421	$204,549	$113,000	$2,052,776
Job Value	$4,921,362	$4,245,605	$2,944,601	$6,106,332	$4,075,292	$22,293,192
New Jobs	28.35	21	20	61	37.75	168
Retained Jobs	43	40	26	28	23.5	161
Total Impact	$38,185,949	$35,235,429	$35,796,636	$110,142,690	$87,598,979	$306,959,683
Total Cumulative Impact	$38,185,949	$73,421,378	$109,218,014	$219,360,704	$306,959,683	$306,959,683

FIVE–YEAR ECONOMIC IMPACT



CAT PROGRAM FINANCIAL INFORMATION

	7/1/16–6/30/17
FUNDING FROM NYSTAR*	
Research Expenditures	
Personnel Related	$279,617
Non-Personnel Related	$192,504
Operational Expenditures	
Personnel Related	$297,775
Non-Personnel Related	$157,389
Total NYSTAR Contribution	$927,285
OTHER SOURCES OF FUNDS	
Cash from Companies	
Personnel Related	$1,233,854
Non–Personnel Related	$578,062
Other Contributions	
Personnel Related	$0
Non–Personnel Related	$0
Total Other Sources	$1,811,916

COMPANIES REPORTING ECONOMIC IMPACT IN 2016–17 FROM CEIS INTERACTIONS

AIM Photonics
AlchLight
Bausch + Lomb
Carestream
Clerio Vision, Inc.
Corning, Incorporated
Harris Space & Intelligence Systems
Harris RF Communications
HYPRES
Kitware
Kodak Alaris
LighTopTech Corporation
OptiPro Systems, LLC
Ovitz Corporation
SiMPore, Inc.
Thermo Fisher Scientific
UR Ventures Technology Development Fund
visualDx

A YEAR **IN REVIEW**

AUGUST 2016

FuzeHub announces the Jeff Lawrence Manufacturing Innovation Fund. This program will stimulate growth in the manufacturing sector within New York State. The fund plans to award successful applicants with grants ranging from $25,000 to $75,000 every quarter.

OptiPro's Mike Bechtold accepting 2016 Tibbetts Award

JANUARY 2017

OptiPro Systems LLC received the 2016 Tibbetts Award for its achievements in innovation and job creation as a participant in the federal Small Business Innovation Research program. The Ontario, Wayne County–based company was among 37 U.S. businesses to receive the award, presented during a White House ceremony.

SEPTEMBER 2016

Carestream Health, Inc. wins a $150 million federal contract to provide a digital imaging system for the U.S. armed services. Awarded by the Defense Logistics Agency, the contract calls for Carestream to supply, service, and maintain digital imaging equipment, a picture archiving system, and a communication system for the Army, Navy, Air Force, Marine Corps, and some service-related civilian agencies.

Carestream Health, Inc., a leader in medical and dental imaging, and an interdisciplinary team of University researchers (Departments of Surgery, Biomedical Engineering, Electrical and Computer Engineering) begin collaborating on developing new technologies to expand the use of ultrasound imaging for medical diagnosis. Projects jointly supported by the company and CEIS include characterizing the structure of aortic abdominal aneurisms and carotid artery blockages with Michael Richards (pictured) and Marvin Doyley.

JANUARY 2017

CEIS director and executive director begin planning for inaugural **Light & Sound Interactive** conference to be held in downtown Rochester in September 2017.

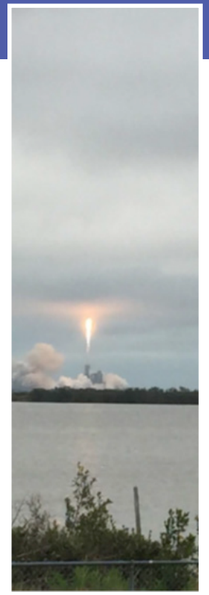
FEBRUARY 2017

iCardiac Technologies Inc. launched QPoint, a platform that supports the growing need for electronic clinical outcome assessment services, known as eCOA, in drug development. The platform delivers the shortest and most streamlined study configuration and start-up in the industry.

OCTOBER 2016

RIT hosts NYSTAR's Annual Partners Meeting. Panel discussions over the two-day event included public-private partnerships that are investing in manufacturing innovation and barriers/opportunities to boost commercialization. Lightning Rounds featured an asset from each NYSTAR program. CEIS Director Mark Bocko's presentation of the flat-panel speaker he has been working on was a big hit.


Photo: Mark Bocko (CEIS) and Mike Fancher (SUNY PI)



FEBRUARY 2017

At 9:39:00 am ET on February 19, 2017, SpaceX's Falcon 9 rocket successfully launched CRS10 toward the ISS. On board is a "2U" nano-lab experiment that Zoran Ninkov (through a project funded by Thermo Fisher Scientific and CEIS) and Daniel Batcheldor at Florida Institute of Technology have been working on for years. In 2012, the project was awarded the necessary funds and spot on a payload manifest. A successful demonstration of CIDs on ISS will put this technology at TRL-8, i.e., ready to fly as a primary instrument on a future space telescope. This will enable a new method for imaging planets (possibly Earth-like planets) around other stars. The successful launch is pictured here.

FEBRUARY 2017

Eastman Business Park selected as the home of the new AIM Photonics Test, Assembly and Packaging (TAP) manufacturing facility. The TAP facility is located near 50 acres of developable industrial land.

FEBRUARY 2017

CEIS hosted a joint meeting with ESD's Strategic Business and NYSTAR divisions to identify synergies/assets among the state's CATs and CoEs that would be leveraged when courting companies to locate in New York State.

APRIL 2017

Approximately 300 people attended the *Rochester Business Journal*'s Power Breakfast Series event "Rochester's Photonics Future." Paul Ballentine joined fellow panelists Tom Battley, Rick Plympton, Alexis Vogt, and Ed White in discussing Rochester's role in AIM Photonics, job opportunities in the optics and photonics fields, and the variety of organizations using optics and photonics.

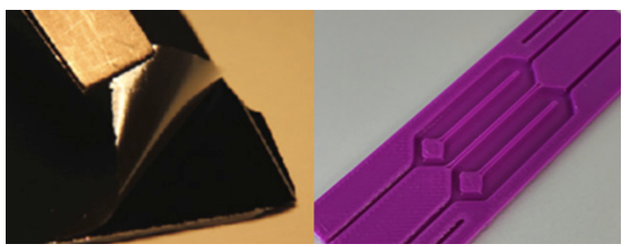

CEO Paul Travers demonstrating Vuzix eyewear to Dan Newman (Harris SIS) and Sam Samantha (FLCC)

Sitong Zhou receiving poster contest award

APRIL 2017

Bob Fiete, chief technologist of Harris Corporation Space and Intelligence Systems, and Paul Travers, president and CEO of Vuzix, were the featured speakers at the CEIS Annual University Technology Showcase. The Partner Appreciation Award was presented to Dan Newman of Harris Corporation to recognize him for his role in the continued collaboration with Harris, the University of Rochester, and RIT. Sitong Zhou of RIT won the poster contest for her entry "Erythrocytes Are Oxygen-Sensing Regulators of the Cerebral Microcirculation."


TAP facility at EBP


Large Area Silicon Nanomembranes for Miniaturized Hemodialysis. Supported by NSF Phase II, SiMPore is developing "lift-off" membranes (left) for prototype dialyzers (right) and plans to test these devices in kidney-disease animal models by early 2019.

MAY 2017

SiMPore successfully applied for a Phase II STTR from the NSF. They will be pursuing further development of membrane technology for blood dialysis. SiMPore is attempting to develop a miniaturized, continuously operating hemodialysis system incorporating SiMPore's membranes.

JUNE 2017

CEIS awarded more than $525,000 in 2017–18 CAT projects with 29 faculty researchers and 14 New York State companies, including 6 new faculty researchers and 4 new company partners.

2017–18 **ABSTRACTS**

Graduate student Sarah Wayson works in the lab of Diane Dalecki to develop and implement high-frequency quantitative ultrasound imaging of a collagen gel.

2017–2018 PROJECT ABSTRACTS

Development of Novel Topical Antimicrobial Therapeutics

Paul Dunman
University of Rochester
Arcum Therapeutics, Inc.

We are facing a catastrophic health care crisis—antibiotic resistance has jeopardized the use of drugs that have previously cured deadly bacterial infections. Simply put, current antibiotics are no longer working. In direct response, Arcum Therapeutics has developed agents for therapeutic intervention of the most problematic bacterial species that physicians encounter. The current proposal will extend the preclinical development of one of those products and directly create job growth in Rochester, New York.

Mathematical Model and Computer Simulation of the Motion of a Toroidal Contact Lens

Kara L. Maki, David Ross
Rochester Institute of Technology
Bausch and Lomb

In recent work with Bausch and Lomb, we have developed and applied models of the coupled fluid mechanics and solid mechanics of a contact lens on an eye: a model of suction pressure induced by a radially symmetric lens conformed to a rigid eye and a model of concentration of a perturbed contact lens. Here we propose to develop a model of the stresses the eyelid exerts on a contact lens during a blink. We will couple this model with the concentration model and simulate the displacement of a lens and its recentering under the influence of suction pressure gradients.

Understanding On-Eye Performance of Presbyopia Correcting Contact Lens

Geunyoung Yoon
University of Rochester
Bausch and Lomb

Presbyopia is a visual condition faced by all adults over the age of approximately 40. Individuals with presbyopia lose the ability to focus on nearby objects, which significantly impacts quality of life. Although extending depth of focus via a multifocal contact lens to overcome presbyopia is increasingly popular, clinical outcomes with these lenses are variable and often unpredictable. A better understanding of the role of practical factors when a multifocal lens is worn by patients improves our ability to predict its performance and moreover to develop advanced designs. The project is aimed toward the evaluation of through-focus performance of multifocal contact lens designs in which these realistic factors such as decentration and conformation of presbyopia-correcting contact lenses imaged by a real-time pupil camera and high-resolution optical coherence tomography.

Compressive Beamforming for Portable Ultrasound

Zeljko Ignjatovic
University of Rochester
Carestream Health, Inc.

We propose a compressive parallel-beamforming ultrasound imaging method that is a dramatic departure from conventional approaches and has the potential to disrupt the state of the art in ultrasound imaging. Rather than using an expensive linear array with hundreds of transducer elements and associated electronics, the new method eliminates the expensive electronic components (amplifiers, A/D and D/A converters) connected to each element of the array and replaces them with a single channel that is shared by the entire array, to significantly reduce array complexity and allow genuinely portable implementations. The proposed system uses unfocused imaging of the target medium via a binary-coded aperture, which gives much improved spatial resolution and reduces the sidelobe artifacts commonly seen in traditional ultrasound systems, and allows a significant speed up of image acquisition. This method could have a profound impact on health and quality of life for humans by providing a compact, portable, and easy-to-use ultrasound imaging system with improved performance.

Deep Learning for High-Resolution 3D Cone Beam CT Medical Image Analyses

Jiebo Luo
University of Rochester
Carestream Health, Inc.

Traditional approaches in medical image analysis rely on handcrafted features that are not effective and robust when the image analysis task is complicated. In contrast, deep learning, which has made significant progress in recent years, can learn feature representations automatically. For this reason, deep learning has recently gained much attention in the medical image analysis community. In this study, we investigate a deep learning approach to analyzing images of multiple medical imaging modalities, ranging from CT and x-ray to 2-D and 3-D ultrasound. In particular, we intend to demonstrate the effectiveness of deep learning through a number of subprojects that involve different medical imaging modalities. To ensure that the algorithms will be robust for data from diverse clinical sources, we will rely on large-scale and diverse datasets with detailed annotations in collaboration with Carestream Health. The developed algorithms will be integrated with the existing Carestream systems, when possible, to validate the benefit of deep learning–driven image analysis.

Towards Automated Clinical Evaluation of Tendon Through Shear Wave Elastography

Stephen McAleavey, Mark Buckley
University of Rochester
Carestream Health, Inc.

Musculoskeletal (MSK) conditions, including rotator cuff and ACL injuries, are the leading cause of disability in the US. The realignment of health care delivery in the US toward "accountable care" necessitates the development of effective yet low-cost methods to diagnose MSK conditions. Ultrasound technologies, including shear wave elastography (SWE), Acoustic Radiation Force Impulse Anisotropy, and Quantitative Angular Backscatter, have high potential to address this need. Building on our expertise in SWE and tendon biomechanics, we will experimentally validate these methods in ex vivo tendon and perform pilot human in vivo evaluation and comparison with invasive methods.

2017–2018 PROJECT ABSTRACTS

Plane Wave and Elastographic Imaging of AAA and Carotid Arteries
Michael S. Richards
University of Rochester
Carestream Health, Inc.

The continuing goal of the proposed research is to improve the patient-specific assessment of the pathological severity associated with the onset of cardiovascular diseases such as aneurysms and atherosclerosis. The recent development of clinical ultrasound (US) based tissue mechanical property measurements (e.g., elastography) has motivated the use of these technologies to measure the spatial variations of in-vivo vascular mechanical properties in real time or pseudo real time. This patient-specific information gathered in a diagnostic or screening mode can then be used to improve treatment recommendations for a variety of life-threatening vascular diseases. This second year will expand upon our previous work in which we developed computational tools that allowed us to accurately measure pulse velocities and material properties in vessel mimicking phantoms. In year two, our goal is to test our methods in a limited patient population and consider more quantitative model based approaches to estimating the material properties of vessels with complicated geometries.

Assessing the Link Between Refractive Change and Mechanical Properties in IRIS Contact Lenses
Paul Funkenbusch
University of Rochester
Clerio Vision Inc.

Our long-term goal is to use femtosecond micromachining to customize refractive corrections in human eyes, be it in the cornea, contact lenses, or implanted IOLs. This requires understanding the optical and now mechanical changes induced in the sample once treated with IRIS. We have used previous CEIS support to develop a scalable manufacturing platform for manufacturing clinically relevant refractive devices and demonstrated the visual acuity of the refractive correction. The goal of this research is to understand the link between optical and mechanical properties.

Biological Impact of LIRIC in the Cornea
Krystel R. Huxlin
University of Rochester
Clerio Vision Inc.

LIRIC (Laser-Induced Refractive Index Change) is being developed as a new method for refractive correction in humans and a less-damaging alternative to traditional laser refractive surgeries (e.g., PRK, PTK, and LASIK). The proposed preclinical study will assess the safety of LIRIC at 405 nm in living rabbit corneas. Aim 1: use optical coherence tomography and in vivo confocal imaging to assess how LIRIC alters the macro microscopic structure of the cornea and the lens. Aim 2: assess whether LIRIC induces inflammation or other cellular/tissue of ocular health (transparency, intraocular pressure, epithelial integrity). These aims are critical to translate this technology to humans, where it stands to revolutionize the field of refractive correction.

High Power Femtosecond Ytterbium-Doped Fiber Laser-based System for Optimization of Femtosecond Micromachining Ophthalmic Devices
Wayne H. Knox
University of Rochester
Clerio Vision Inc.

Our ultimate goal is to use femtosecond micromachining as a nondamaging method of custom-correcting refractive error in human cornea and intra-ocular lenses (IOLs). The proposed experiments will investigate new regimes of low repetition rate (10-40 MHz), wavelengths of 1030 nm and 515 nm, and high-power scaling (<30W) to achieve ultrafast writing speeds in ophthalmic materials such as hydrogels and cornea.

Computer Modeling of Telecom Signals in Multimode Optical Fibers
Govind P. Agrawal
University of Rochester
Corning Incorporated

In this project my research group will work with Dr. William Wood of Corning to develop a comprehensive computer model for studying transmission of optical pulses through multicore and/or multimode fibers capable of supporting several optical modes. A computer model will be developed in stages and tested through experimental verification whenever possible. This work is important to Corning because multimode and multicore fibers are likely to be used in the near future for implementing the technique of space-division multiplexing.

Light Diffusing Fiber as a Disinfectant and/or Antimicrobial Agent
Paul Dunman
University of Rochester
Corning Incorporated

Blue-violet (405 nm) light displays antimicrobial activity toward bacteria of health care concern. However, product development has been hampered by the absence of an applicable light delivery system. Corning® Fibrance® Light-Diffusing Fiber may overcome light delivery issues. In studies made possible by an earlier CEIS Collaborative Innovative Research award, we characterized the antimicrobial spectrum of activity and established the safety profile of the Fibrance technology. Remarkable antibacterial effect was seen against two important Gram-positive pathogens. The current goal is to explore a broader range of pathogens and to define the cellular mechanism of action with which 405 nm light kills bacteria.

Efficacy of Visual Training for Recovering Sight in Stroke Patients
Steven Feldon
University of Rochester
Envision Solutions LLC

Every year, half a million stroke patients become cortically blind in the US. This blindness impairs the ability to read, drive, and navigate, impacting other rehabilitation efforts and the capacity to live independently. Yet there is a complete lack of validated vision rehabilitation treatments available to those afflicted. Patients are told that recovery is improbable, and that they should learn to live with their blindness. Here, we propose the first randomized, blinded, placebo-controlled study to test the efficacy of a visual discrimination training treatment developed at UR for eliciting visual recovery in the blind field of stroke patients. Validating this treatment in the proposed trial is a critical first step for deploying this technology clinically.

Support for Distributed Computing and Network Management in Mobile A
Wendi Heinzelman
University of Rochester
Harris Corporation

Performing communication and computation in an ad hoc network of mobile devices is challenging yet critical for next-generation military networks. Not only must we ensure that data can be securely communicated where it is needed, when it is needed, even in the face of network dynamics, but we must also ensure that computation can be accomplished quickly using available resources within the network. The goal of this research is to develop technologies and approaches for achieving robust data connections in heterogeneous network platforms using a mixture of ad-hoc and hierarchal networks. Techniques that will be investigated include combining the advantages of point-to-multipoint access systems such as Wi-Fi and/or commercial cellular systems with mobile ad-hoc networking (MANET) technology. Network hierarchy, heterogeneous assets, and cognitive networking will be considered in the solution.

Further Development of THz Imager Array in Support of Harris' Commercial THz Imaging Development
Zeljko Ignjatovic, Vikram Dogra
University of Rochester
Harris Space and Intelligence Systems

Our group at the University of Rochester proposes to conduct a variety of THz measurements, parameter characterization, and develop design methodologies for THz focal plane arrays in standard CMOS technologies in support of Harris's (formerly ITT Exelis, Inc.) THz imaging initiative. The proposed work is a continuation of our current efforts with Harris. Preliminary experimental results indicate that our technology shows a great deal of promise in detecting THz radiation up to 2THz with responsivities that far exceed that of more expensive and less scalable pyroelectric detector. During the 2017–18 academic year, we will begin tests on the CMOS THz prototype imagers fabricated during 2016–17. The results of this analysis will be used to model and optimize noise performance of our THz focal plane array, which will be fabricated and tested subsequently.

Developing THz Detector Technology for Inspection Applications
Zoran Ninkov
Rochester Institute of Technology
Harris Space and Intelligence Systems

The THz region provides a means of using non-ionizing radiation to perform a variety of noninvasive sensing tasks. Commercial camera systems are available that utilize microbolometer or pyroelectric detectors (e.g., from Gentec and IMO), but these devices lack sensitivity, stability, or readout speed. The proposed collaborative development by Harris/RIT/UR seeks to design, fabricate, and test suitable CMOS-based devices that, through iteration, will result in a commercial product marketed by Harris. The CMOS devices are fabricated in commercial foundries using standard chip manufacturing techniques to keep costs low. The ultimate goal of this multiyear effort is to develop a room-temperature, compact, inexpensive THz imaging system that our sponsor (Harris) can market to commercial (e.g., package inspection, crowd monitoring) and military (e.g., on aerial drones for short-range imaging) customers.

Further Development of THz Detector Arrays and Extension to the IR
Judith L. Pipher
University of Rochester
Harris Space and Intelligence Systems

In collaboration with RIT PI Ninkov, ECE PI Ignjatovic, and Harris Space and Intelligence Systems, our group in PAS has been developing THz and long-wave IR arrays exploiting thermionic emission in CMOS Si arrays. Currently, Generation 6 designs have been submitted to MOSIS foundry by the ECE group, the first of "smart" chips with memory, an A/D converter and S/H circuity on-chip. We will concentrate on noise reduction of the more recent generation chip deliverables, IR characterization of the ~10 micron devices, and on conducting the necessary experiments on the new Gen 6 arrays. Our group specializes in array technology and measurement. We will obtain array data after finding the optimal values of Vgs for each of the 90 pixels in the Gen 6 array, saving them to memory, and operating the array with optimum Vgs for the purposes of imaging. We have already developed routines to determine noise characteristics, dark current and quantum efficiency as well as other salient parameters.

Smart Sensors for Classical and Quantum Data Links
Roman Sobolewski
University of Rochester
HYPRES, Inc.

The project is devoted to development of novel optical smart sensors, based optical, superconducting single photon detectors (SSPDs) integrated with the Josephson junction based mixed-signal circuits to provide readout, tuning, and control of the detector. These digitally assisted detectors will have performance characteristics far surpassing those of the traditional, analogue-type SSPDs and will unlock their scalability to larger SSPD arrays. We will target high-value applications in quantum networks for quantum information applications, including high data rate quantum key distribution. We will also pursue SSPD applications in interfacing optics with digital superconducting electronics and study novel SSPDs based on superconductor/ferromagnet nanobilayer stripes.

2017–2018 PROJECT ABSTRACTS

High-Frequency Quantitative Ultrasound Systems for Tissue Engineering
Diane Dalecki, Denise Hocking
University of Rochester
Imaginant

Technologies for monitoring engineered tissues quantitatively are critically needed to advance the field of tissue engineering. The overall goal of this project is to develop and implement high-frequency quantitative ultrasound systems for nondestructive characterization of engineered tissue constructs. These ultrasound technologies will (i) provide important quantitative tools for monitoring the functionality of tissue engineered products, (ii) offer rapid feedback for optimizing construct design and fabrication parameters, and importantly (iii) circumvent destructive testing. Imaginant is a world leader in high-frequency, nondestructive ultrasound instrumentation. This project will unite experts in biomedical ultrasound and tissue engineering (Dalecki and Hocking) with Imaginant's technical expertise.

Global Surveillance Augmentation for Deep Learning
Andreas Savakis, John Kerekes
Rochester Institute of Technology
Kitware Inc.

In this project we will continue to explore deep learning algorithms for global surveillance applications, including object detection and change detection in satellite imagery. Our goal is to train various architectures of deep networks and compare them with graph-based change detection methods. To that end, we will generate additional datasets of augmented data that are sufficiently large and diverse to train our deep networks. We will develop, test, and compare both supervised and unsupervised change detection methods to identify important changes in panchromatic or color satellite imagery taken at different times.

Nondestructive/Noninvasive Three-Dimensional Imaging with Gabor-domain
Jannick Rolland
University of Rochester
LighTopTech Corporation

Real-time, high-resolution nondestructive inspection methods are needed to characterize materials through their depth, including plastics, glass, and human tissue. Fast, accurate metrology brings value to the manufacturing industry by improving quality, increasing productivity, and reducing costs. This project will supplement the development of Gabor-domain optical coherence microscopy (GD-OCM) instrument, the Explorer4D, to explore a long working distance for industrial and medical imaging applications.

Host/Emitter Interactions in OLED Emitter Layers
Lewis Rothberg
University of Rochester
Molecular Glasses, Inc.

Molecular Glasses is developing a novel class of noncrystallizable organic semiconductors for OLED application. We have already demonstrated significant increase in OLED device lifetime in yellow phosphorescent OLEDS using our material as a host. One key OLED problem is the short life of high efficiency blue emitters. Our materials have the potential to help solve this problem.

This project will help us develop the necessary hosts for long-life blue emitters. Photophysical characterization of hosts / emitters interaction is essential for choosing the most promising host candidates.

Augmented Reality Display Exploiting Advanced Optical Surfaces
Jannick Rolland, Nick Vamivakas
University of Rochester
Oculus

Augmented reality display optics exemplify extreme challenges in designing and packaging complex optical surfaces when a sunglass format is sought. In this project we explore how advanced optical surfaces such as freeform or diffractive surfaces may enable the technology of tomorrow.

Electrical Monitoring of Exosome Capture on Nanomembranes
James McGrath
University of Rochester
SiMPore Inc.

Our work on compact hemodialysis devices has revealed an unexpected benefit: the ability of nanomembranes to capture 30 nm-100 nm vesicles that naturally occur in biological fluids. These vesicles, called exosomes, are powerful diagnostic markers for cancers and other disease. We wish to develop a robust exosome capture system and propose that transmembrane electrical resistance (TMER) can be used as a real-time measure of the capture process. We will first develop a nanomembrane capture device with integrated electrodes. We will then test the hypothesis that TMER increases in proportion to the fraction of pores occupied by exosomes.

Development of Quantum Dot Coated Detector Arrays
Zoran Ninkov
Rochester Institute of Technology
Thermo Fisher Scientific

Improving the sensitivity of silicon-based CMOS and CCD in the deep-UV is an area of interest. Lumogen has been previously used for this purpose but has limitations in its use in both vacuum and radiation harsh environments. Quantum Dots (QD) offer a robust alternative to Lumogen. The fluorescence wavelength of QDs is tunable and can match the peak sensor quantum efficiency. Aerosol jet printing (AJP) is being used at RIT for the deposition of QDs on substrates and commercial sensor arrays. Insights obtained and improvements in the equipment will permit commercially ready devices to be fabricated and tested this year.

In-Vivo Photoacoustic and Ultrasound Imaging Probe for Human Thyroid Cancer Detection
Jonathan D. Ellis, Vikram Dogra
University of Rochester
Navalgund Rao
Rochester Institute of Technology
UR Ventures

The scientific hypothesis is photoacoustic imaging can classify thyroid cancer from non-cancer. We are developing an innovative acoustic-lens-based photoacoustic imaging (PAI) system combined with ultrasound (US), to yield real-time co-registered photoacoustic (PA) and US frontal plane images. Data was collected on in-vitro, ex-vivo phantoms and human ex-vivo tissues (prostate, thyroid, kidney, and fibroid) using PAI. Collected data helps to build a causal relationship and identify the important features for classification and check the validity of the hypothesis.

Octorotor as seen at the Light and Sound Interactive Conference. Highlighted at the conference were novel imaging technologies across a wide range of applications as well as new ways to use these systems.

2016–2017 PROJECT ABSTRACTS

Accelerating Optical Biosensor Development with Polymer Microgels
Benjamin Miller
University of Rochester
Adarza BioSystems, Inc.

Adarza BioSystems, a company with research and development headquarters in Henrietta, New York, and manufacturing operations in St. Peters, Missouri, is commercializing Arrayed Imaging Reflectometry (AIR), an optical biosensor platform that enables detection of up to hundreds of analytes in a biological sample (such as a drop of blood) using a simple work flow. This proposal seeks to address a significant challenge in Adarza's product development and manufacturing by testing the utility of antibody-conjugated polymer microgel particles on the AIR platform. We anticipate these will dramatically simplify the development process and provide substantial performance enhancements.

Mathematical Model and Computer Simulation of the Motion of a Contact Lens During and After a Blink
David Ross and Kara Maki
Rochester Institute of Technology
Bausch & Lomb

In recent work supported by Bausch & Lomb, we developed a model of the suction pressure induced in the tear film by a symmetric contact lens conformed to a rigid, symmetric eye. Here we will extend that work and model the motion of an asymmetric lens that is displaced by a blink and which resettles under the influence of shear stresses produced by gradients in the suction pressure. We will produce a code in collaboration with Bausch & Lomb engineers that can be used in development and design work.

Adaptive optics bench testing for presbyopia-correcting contact lenses
Geunyoung Yoon
University of Rochester
Bausch & Lomb

Presbyopia is a visual condition that all adults over the age of approximately 40 years face. Individuals with presbyopia lose the ability to focus on nearby objects, which significantly impacts quality of life. Although extending depth of focus via a multifocal contact lens to overcome presbyopia is increasingly popular, clinical outcomes with these lenses are variable and often unpredictable. A better understanding of the role of practical factors when a multifocal lens is on the corneal surface improves our ability to predict its performance. The project is aimed towards the evaluation of through-focus performance of multifocal contact lens designs in which these realistic factors are simulated by using an adaptive optics bench testing system.

Compressive Beamforming for Portable Ultrasound
Zeljko Ignjatovic
University of Rochester
Carestream Health, Inc.

We propose a Compressive Parallel-Beamforming ultrasound imaging method that is a dramatic departure from conventional approaches and has the potential to disrupt the state-of-the-art in ultrasound imaging. Rather than using an expensive linear array with hundreds of transducer elements and associated electronics, the new method eliminates the expensive electronic components (amplifiers, A/D and D/A converters) connected to each element of the array and replaces them with a single channel that is shared by the entire array to significantly reduce array complexity and allow genuinely portable implementations. The proposed system uses unfocused imaging of the target medium via a binary-coded aperture, which gives much improved spatial resolution and reduces the sidelobe artifacts commonly seen in traditional ultrasound systems and allows a significant speedup of image acquisition. This method could have a profound impact on health and quality of life for humans by providing a compact, portable, and easy-to-use ultrasound imaging system with improved performance.

Towards Automated Clinical Evaluation of Tendon through Shear Wave Elastography
Stephen McAleavey
University of Rochester
Carestream Health, Inc.

Musculoskeletal (MSK) conditions, including rotator cuff and ACL injuries, are the leading cause of disability in the United States. The realignment of health care delivery in the United States toward "accountable care" necessitates the development of effective yet low-cost methods to diagnose MSK conditions. Ultrasound shear wave elastography (USWE) is a promising technology with high potential to address this need, but existing implementations are challenged in their ability to characterize a tendon. Building on our expertise in USWE and tendon biomechanics, we will experimentally measure shear wave propagation in a tendon, characterize the interaction of tendon, bone, and ultrasound, and develop a tendon-appropriate USWE implementation.

Plane Wave and Elastographic Imaging of AAA and Carotid Arteries
Michael Richards
University of Rochester
Carestream Health, Inc.

The overall goal of the proposed research is to improve the patient-specific assessment of the pathological severity associated with the onset of cardiovascular disease such as aneurysm and atherosclerosis. The recent development of clinical ultrasound (US) based tissue mechanical property measurements (e.g., elastography) has motivated the use of these technologies to measure the spatial variations in in-vivo vascular mechanical properties in real time or pseudo real time. The patient-specific information gathered in a diagnostic or screening mode can be then used to improve treatment recommendations for a variety of life-threatening vascular diseases.

Visual Acuity of Clinically Relevant Refractive Correctors Using LIRIC
Jonathan Ellis
University of Rochester
Clerio Vision, Inc.

Our long-term goal is to use femtosecond micromachining to customize refractive corrections in human eyes, be it in the cornea, contact lenses, or implanted IOLs. This requires high-numerical aperture (NA) lenses (>0.6), placing severe limits on optical scanning. We have used previous CEIS support to develop a scalable manufacturing platform for manufacturing clinically relevant refractive devices. Our goal now is to use this platform to build arbitrary refractive corrections in contact lenses and assess the visual acuity of the refractive correction.

Modeling and Optimizing the LIRIC Writing Process
Paul D. Funkenbusch
University of Rochester
Clerio Vision, Inc.

LIRIC is a multiphoton absorption process that is used to locally change the refractive index of cornea tissue and hydrogels. The LIRIC process requires a high-numerical aperture beam with a known optical quality that is scanned rapidly through the material. This process depends on numerous parameters, including NA, beam quality, pulse width, laser repetition rate, focal spot velocity, and material properties. This project will establish a framework model of the LIRIC writing process and design experiments to determine the coupling between parameters. The overall objective is to optimize the LIRIC process for both hydrogel and cornea tissue applications.

Biological Impact of LIRIC in the Cornea (continuation)
Krystel Huxlin
University of Rochester
Clerio Vision, Inc.

We are now in advanced stages of developing femtosecond micromachining as a nondamaging method of custom correcting refractive error in humans. To date, all our pilot experiments have been performed in hydrogels and cat corneas. The proposed experiments will test the relative efficacy of different laser wavelengths with and without doping in cat cornea and contrast the relative efficacy of refractive index modifications in cat and human corneas. These experiments are critical for establishing parameters that will be used in our first in-human trials of this technology.

Polarization-Time-Space Multiplexer for Femtosecond Micromachining of Ophthalmic Devices
Wayne Knox
University of Rochester
Clerio Vision, Inc.

Our ultimate goal is to use femtosecond micromachining as a nondamaging method of custom correcting refractive error in human cornea and intra-ocular lenses (IOLs). The proposed experiments will investigate new methods of writing high-density line patterns faster using a new polarization time-space multiplexer.

Computer Modeling of Telecom Signals in Multimode Optical Fibers
Govind P. Agrawal
University of Rochester
Corning, Incorporated

In this project, my research group will work with Dr. William Wood of Corning, Inc. to develop a comprehensive computer model for studying transmission of optical pulses through multicore and/or multimode fibers capable of supporting several optical modes. A computer model will be developed in stages and tested through experimental verification whenever possible. This work is important to Corning because multimode and multicore fibers are likely to be used in the near future for implementing the technique of space-division multiplexing.

Light Diffusing Fiber as a Disinfectant or Antimicrobial Agent
Paul M. Dunman
University of Rochester
Corning, Incorporated

Antibiotic resistance has emerged as a major health care concern that has compromised common medical procedures, resulted in enormous monetary costs, and yielded unacceptable rates of morbidity and mortality. In response, the World Health Organization (WHO) has urgently called for the development of new antimicrobial approaches, warning that the population is facing a return to the pre-antibiotic era, in which patients will succumb to common bacterial infections, and therapeutic interventions that limit the patient immune status will be severely impacted (i.e., organ transplant and cancer). To that end, the application of high-intensity violet light ($\lambda = 405$ nm) is an exciting and newly appreciated approach to mitigate bacterial disease that is distinct from ultra-violet treatment and has far-reaching applications. The current proposal is designed to investigate the antimicrobial therapeutic utility of a newly developed Corning, Inc. product, Light Diffusing Fiber, as an antimicrobial $\lambda = 405$ nm delivery vector.

Hyperspectral imaging for noninvasive, comprehensive measurement of microvascular function in humans
Anthony P. Pietropaoli
University of Rochester
Corning, Incorporated

The purpose of this project is to determine whether hyperspectral imaging is capable of noninvasively quantifying microvascular blood flow, microvascular reserve, tissue respiration, and vascular permeability in healthy human subjects. Hyperspectral imaging has the potential to overcome current barriers to practical, precise, comprehensive, and noninvasive measurements of microvascular function. If so, this technology could provide an innovative window into the common and deadly microcirculatory derangements that occur in patients with sepsis and other acute and chronic illnesses. The business applications would include job growth and increased revenue at Corning Incorporated during the invention, design, and commercialization of this novel technology for biomedical applications.

2016–2017 PROJECT ABSTRACTS

Support for Distributed Computing and Network Management in Mobile Ad Hoc Networks

Wendi Heinzelman
University of Rochester
Harris Corporation

Performing communication and computation in an ad hoc network of mobile devices is challenging yet critical for next-generation military networks. Not only must we ensure that data can be securely communicated where it is needed, when it is needed, even in the face of network dynamics, but we must also ensure that computation can be accomplished quickly using available resources within the network. The goal of this research is to optimize and secure the formation and evolution of a robust network to support communication and computation within a mobile ad hoc network environment.

Further Development of THz Imager Array in Support of Harris's Commercial THz Imaging Development

Zeljko Ignjatovic
University of Rochester
Harris Space and Intelligence Systems

Our group at the University of Rochester proposes to conduct a variety of THz measurements and parameter characterization and develop design methodologies for THz focal plane arrays in standard CMOS technologies in support of Harris' (formerly ITT Exelis, Inc.) THz imaging initiative. Preliminary experimental results indicate that our technology shows a great deal of promise in detecting THz radiation up to 2 THz with responsivities that far exceed that of more expensive and less scalable pyroelectric detectors. During 2016–17 academic year, we will begin tests on the fourth generation of our CMOS THz prototype imagers designed and fabricated during the 2015–16 project period. The results of this analysis will be used to model and optimize noise performance of our THz focal plane array, which will be fabricated and tested subsequently. In addition, we will explore the use of our direct detection method in CMOS based on thermionic emission for long-infrared imaging.

THz Modeling and Testing

Zoran Ninkov
Rochester Institute of Technology
Harris Space and Intelligence Systems

A group consisting of Harris engineers, Rochester Institute of Technology scientists, and University of Rochester engineers and scientists have designed and manufactured a room-temperature silicon imager that is able to detect THz radiation. In order to optimize the devices, a variety of pixel architectures using various design dimensions, including with and without antennas, has been designed, fabricated, and tested. The RIT group from the Chester F. Carlson Center for Imaging Science has developed a testing system for terahertz single-pixel characterization. This effort will ultimately determine the ideal pixel structure and configuration for optimal THz response that will then enable a commercial imaging array design to move forward. A custom low-noise enclosure and cabling setup, along with a low-noise preamplifier, performs MOSFET voltage and current sweeps for transconductance, channel conductance and resistance measurements, and terahertz radiation responsivity.

A tunable, multiplied Gunn diode is the current primary radiation source for testing, with plans to move toward a tunable source with multiple bands from 0.1 to 1.0 terahertz. The ultimate goal of this multiyear effort is to build a (near) room-temperature, compact THz imaging system that our sponsor (Harris) can market to commercial (e.g., package inspection, crowd monitoring) and military (e.g., on aerial drones) customers.

Further Studies and Development of THz Detector Arrays

Judith Pipher
University of Rochester
Harris Space and Intelligence Systems

This project aims to continue development of THz detector arrays to be used in cameras for security and surveillance applications for stand-off distance threat detection, package inspection, medical imaging applications, and material testing, and to extend performance to the infrared (~10–15 μm). Our lab has designed the enclosures (vacuum-tight, cold) and has constructed and operates an array controller that can be programmed for each generation of array. Each generation has exhibited improvements derived from experimental results from the prior generation. Each generation focal plane (for past and future arrays which are not all-digital) requires changes to clocking and biasing, and our lab executes those programs; we can also address single pixels with our array controller design. We continue to support RIT colleagues with their needs—e.g., designing and constructing fanout boards, helping with thermoelectric coolers, consulting on radiometry. This year we will concentrate on completing the generation 3 testing and will work in tandem with the RIT group on testing of the various THz test structures, as well as verifying performance of the IR test structures. Once an IR focal plane is produced, we will work on that.

Smart Sensor for Classical and Quantum Data Links

Roman Sobolewski
University of Rochester
HYPRES, Inc.

The objective of the project is to explore the possibilities to develop the "smart sensor"—the superconducting nanowire single photon detector (SNSPD) integrated with Josephson junction based mixed-signal circuits to provide readout, tuning, and control of the detector. This digitally assisted sensor will have performance characteristics far surpassing those of the traditional analog SNSPDs and will unlock straightforward scalability to larger SNSPD arrays. We will target high-value applications in quantum networks for quantum information applications, including high-data-rate quantum key distribution. Our smart sensor will also find many applications in classical data channels for energy-efficient computing, LIDAR, and laser communications.

Global Surveillance Augmentation for Deep Learning

Andreas Savakis
Rochester Institute of Technology
Kitware, Inc.

In this project we plan to explore deep learning in algorithms for global surveillance applications, including object detection and change detection in satellite images. Our first goal is to train deep convolutional neural networks (DCNNs) for the detection of important object classes in panchromatic and color satellite imagery. To accomplish this goal, we will generate a dataset of augmented data that is sufficiently large and diverse for training DCNNs. Another goal is to develop change detection algorithms that identify important changes in satellite imagery taken at different times.

Determination of the Attributes of Aesthetically Pleasing Images and Methods to Improve Consumer Images to Make Them More Aesthetically Pleasing

David Messinger
Rochester Institute of Technology
Kodak Alaris

Kodak Alaris has selected RIT to conduct research to develop image-processing algorithms for improvement of consumer images through application of certain heuristics to make the images more aesthetically pleasing. Kodak Alaris will use these algorithms in their software to assist in the creation of imaging products that consumers find more appealing and pleasing.

Video Analysis and Summarization Research

Carl Salvaggio
Rochester Institute of Technology
Kodak Alaris

The goal of the research will be to propose and validate a unified Video Analytics Framework for automatically processing, analyzing, segmenting, and summarizing "unstructured" and "unrestricted" consumer videos published to the Internet (YouTube, Facebook, etc.). This research will also investigate and prototype new video and multimedia applications using the proposed framework and related algorithms developed.

Nondestructive/noninvasive three-dimensional imaging with Gabor-domain optical coherence microscopy

Jannick Rolland
University of Rochester
LighTopTech Corporation

Real-time, high-resolution nondestructive inspection methods are needed to characterize materials, including plastics, glass and human tissue, through their depth. Fast, accurate metrology brings value to the manufacturing industry by improving quality, increasing productivity, and reducing costs. This project will advance the development of a Gabor-domain optical coherence microscopy (GD-OCM) instrument, the Explorer4D™, to qualify materials in the manufacturing process. Hardware and software tools will be developed for fast, nondestructive metrology of contact lenses in manufacturing. GD-OCM will be applied to on-line, automated characterization of contact lenses.

Ultrafast Lasers for Advanced Optic/Photonics Fabrication

Jie Qiao
Rochester Institute of Technology
OptiPro Systems

This project develops an ultrafast laser-based polishing technology to enable the fabrication of freeform and integrated optics for sensing and imaging. This project will integrate a femtosecond laser with a high-speed beam-scanning system and investigate the optimum laser processing parameters via numerical modeling and experimental verifications.

High-Power, Low-Cost CO_2 Laser for Laser-Enhanced Pyrolysis

John Marciante
University of Rochester
Solid Cell

Laser-enhanced pyrolysis has recently been demonstrated to provide a substantial energy and cost savings over the conventional heat-only production method for generating olefin from shale gas (specifically, converting ethane into ethylene). To reap this cost benefit and enable a new market for otherwise wasted (burned) ethane at the refineries, high-power lasers must be realized at low cost, in direct opposition to the common trend. The goals of this program are to (a) develop a prototype laser system assembled from low-cost components, and (b) apply the laser system to Solid Cell's pyrolysis reactor to demonstrate the scalability of the low-cost approach.

Multimodal Displays: Sight, Sound, and Touch for Personal Computing Devices

Mark Bocko
University of Rochester
Synaptics, Inc.

In this collaborative project with Synaptics Incorporated, we will employ flat panel audio and haptic (touch feedback) technology developed at the University of Rochester to create integrated multimodal displays that provide users with visual, sound, and touch interfaces in handheld devices. The research plan is focused on developing low-cost piezoelectric force exciter arrays and the necessary control electronics for integration with ultra-thin OLED displays in smartphones and other handheld intelligent devices.

2016–2017 PROJECT ABSTRACTS

Enhancing the UV/VUV sensitivity of CMOS Image Sensors

Zoran Ninkov
Rochester Institute of Technology
Thermo Fisher Scientific

This project continues our effort to improve the UV/VUV/X-ray sensitivity of CMOS image sensors by coating the arrays with quantum dots (QD) that fluoresce at visible wavelengths. This year's work will proceed with developing the techniques to utilize aerosol jet deposition of commercially produced quantum dots onto CMOS detector arrays supplied by Thermo Fisher Scientific. In order for Thermo Fisher to proceed with the plans for commercialization, two key measurements are required. These tests are (a) radiation testing of the CMOS and (b) deep UV/VUV/X-ray absolute sensitivity measurements of the QD-coated devices. If these two tests are positive, these devices would see widespread application in the markets served by Thermo Fisher Scientific, namely UV/VUV/X-ray spectroscopy and radiation hard applications. We will be conducting the two tests at (a) the NIST SURF III Cyclotron Facility in Gaithersburg, Maryland, and (b) the Texas A&M Cyclotron. One exciting commercial application for these devices is to build an X-ray spectrometer on a CMOS chip where discrete areas of the chip are coated with different-sized quantum dots that have a cross-section for fluorescence tuned to specific X-ray wavelengths. NASA has already expressed interest in such devices to enable the use of miniaturized X-ray detecting spacecraft.

Skin Lesion Morphology Characterization and Disease Classification

Jiebo Luo
University of Rochester
VisualDx

In this study, we investigate a novel approach to greatly improve skin disease diagnosis. A direct approach is to target the ground truth disease labels, while an alternative approach instead focuses on determining skin lesion characteristics that are more visually consistent and discernible. We hypothesize that, for computer-aided skin disease diagnosis, it is both more realistic and more useful that lesion morphology tags should be considered as the target of an automated diagnosis system such that the system can first achieve a high accuracy in describing skin lesions and in turn facilitate disease diagnosis using lesion characteristics in conjunction with other evidences. To further meet such an objective, we propose to employ the state-of-the-art multilabel convolutional neutral networks (ML-CNN) for machine learning. To ensure that the system will be robust for data from diverse clinical sources, we propose to build a large-scale and diverse dataset with detailed annotations at both image and lesion levels in collaboration with VisualDx. The developed algorithms will be integrated with the existing VisualDx system to validate the benefit of automatic skin image analysis.

Kodak officials lit up a new marquee and digital sign in September 2017 at Kodak Center Theater on West Ridge Road in Rochester. The new sign will promote events to the estimated 40,000 vehicles that pass by the theater every day.

CORPORATE **PARTNERS**

CORPORATE PARTNERS

ALCHLIGHT
www.alchlight.com

Alchlight, based in Rochester New York, is the leading developer and distributor of advanced and proprietary laser-fabricated materials. Acclaimed by the *New York Times* as "optical alchemy," they use femtosecond laser processing to etch proprietary nanostructures on materials. Their procedure doesn't coat the materials; instead it changes the intrinsic properties of the materials. Their topographies can change the color of titanium to blue, make silicon attract water, or even make water bounce off of brass.

ARCUM THERAPEUTICS
www.arcumtherapeutics.com

Arcum is developing an antibiotic platform for the prevention and elimination of resistant bacterial infections. Their mission is to save lives and prevent a return to the days when simple infections were a common cause of death. We create combination drugs that target the Arcum proprietary resistance pathway, utilizing the FDA 505b2 accelerated approach to bring products to market faster with less risk for our investors.

BAUSCH AND LOMB
www.bausch.com

Bausch and Lomb offers one of the world's most comprehensive portfolios of eye health products. B+L markets five broad categories of products: contact lenses, lens care, pharmaceuticals, cataract and vitreoretinal surgery, and refractive surgery.

CARESTREAM
www.carestream.com

Carestream is a dynamic global company with more than 100 years of leadership. In today's rapidly changing global health care environment, where the mandate to provide better outcomes has never been greater, we add value by delivering personalized, affordable, and practical options to help our customers advance. Medical providers large and small, from clinics and single hospitals to large networks and even entire countries, are upgrading their radiology and IT systems using our latest solutions.

CLERIO VISION
www.cleriovision.com

Clerio Vision is developing a novel vision correction procedure based on technology licensed from the University of Rochester. Instead of changing the shape of the cornea, as current LASIK-based approaches do, its approach is to use a femtosecond laser to change the refractive index of the cornea with small pulses to "write" a corrective prescription onto the cornea non-invasively. Because this approach doesn't thin the cornea, it can be repeated as needed to correct vision changes over a person's lifetime. The approach, called LIRIC, is being commercialized by some of the original architects of the world's first LASIK systems. Clerio's core technology has been in development for over a decade and is based on more than 40 issued and pending patents.

CORNING INCORPORATED
www.corning.com

Corning Incorporated is a diversified technology company that develops breakthrough technologies that significantly improve people's lives. Corning pursues innovation and focuses on high-impact growth opportunities in the telecommunications, flat panel display, environmental, life sciences, and semiconductor industries.

ENVISION SOLUTIONS LLC

Envision Solutions LLC is a company that has been working to build efficacy of visual training for recovering sight in stroke patients.

FLINT CREEK RESOURCES
www.flintcr.com

Flint Creek Resources is a unique company that offers services to make your used rare earth and zirconia glass polishing compounds better than new. Spent polishing compounds are processed through a proprietary system that removes glass, polishing pad fragments, and contamination from the slurry. The resulting clean polishing particles are then custom formulated to produce excellent stock removal, surface finish, suspension, and cleanability.

FLUXDATA, INC.
www.fluxdata.com

FluxData develops and manufactures multispectral and polarimetric imaging systems for aerospace, defense, industrial, medical, and scientific markets. FluxData is a privately held, women-owned company located in Rochester, New York. FluxData's imaging and system integration expertise helps guide customers from camera specification to delivery of the final system. Our staff of imaging experts work with customers to frame problems and deliver optimized systems based on a broad suite of options. Every product comes with FluxData's commitment to first-rate customer support.

HARRIS CORPORATION
www.harris.com

Harris provides advanced, technology-based solutions that solve government and commercial customers' mission critical challenges. The company has approximately $8 billion in annual revenue and about 23,000 employees—including 9,000 engineers and scientists—supporting customers in more than 125 countries. Harris Corporation is a top-10 defense contractor providing mission-critical solutions through its Communication Systems, Critical Networks, Electronic Systems, and Space and Intelligence Systems segments.

HYPRES, INC.
www.hypres.com

Hypres Inc. manufactures superconducting microelectronics, including superconducting Integrated Circuits (ICs). Its products include voltage standard circuits and systems, wide bandwidth semiconductor-based amplifiers, and superconducting circuit foundry service. The company was founded in 1983 and is based in Elmsford, New York.

IMAGINANT
www.jsrultrasonics.com

Imaginant is a manufacturer of high-resolution digital cameras, ultrasonic NDT instruments, and handheld and robotic coating thickness measurement systems.

CORPORATE PARTNERS

KITWARE
www.kitware.com

Kitware Inc. is a leader in the creation and support of open-source software and state-of-the-art technology. Through our long-standing commitment to open source, detailed in our open source mission statement, we have become one of the fastest growing software companies in the country. By fostering extended, collaborative communities, Kitware is able to provide flexible, cost-effective visualization, computer vision, medical imaging, data publishing, and quality software process solutions to a variety of academic and government institutions and private corporations worldwide.

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We're a new company born from one of the world's most iconic brands. A company that is passionate about using technology to transform organizations and improve people's lives across the planet. From our digital scanners and intelligent state-of-the-art software services that power some of the world's largest companies to our photographic paper production, printing kiosks, and suite of consumer apps that help people capture and connect with the emotional moments that define all our lives. We're on a mission to unlock the power of images and information for the world. We work behind the scenes, making the connections, pushing the boundaries of technology, and helping you to make sense of and exploit the ever-expanding volume of data that is the hallmark of the 21st century.

LIGHTOPTECH
www.lightoptech.com

LighTopTech Corp., founded in 2013, is a women-owned optical technology company based in Rochester, New York. Our goal is to build innovative optical instruments to improve noninvasive imaging in medical and manufacturing fields.

MOLECULAR GLASSES, INC.
www.molecularglasses.com

Molecular Glasses, Inc. focuses on proprietary NONcrystallizable™ molecular glasses for stable and long-lived OLED and other organic electronics. Their unique technology enables them to design NONcrystallizable™ molecular glasses for superior performance. They have the ability to take their clients' favorite material sets and convert them to NONcrystallizable™ and soluble materials without affecting their original photo physical properties.

OCULUS
www.oculus.com

Oculus Rift and the Oculus-powered Samsung Gear VR provide the most immersive VR experiences and environments available, from games and movie scenes to exotic destinations and beyond. Founded in July 2012 by Palmer Luckey, Brendan Iribe, Nate Mitchell, and Michael Antonov, Oculus began as a Kickstarter campaign that raised $2.4 million in the first month and was acquired by Facebook in 2014.

OPTIPRO SYSTEMS LLC
www.optipro.com

OptiPro was founded on one revolutionary, yet simple, concept: optical fabricators deserve more. In the past 30 years, since we introduced the first affordable CNC machine designed specifically for the optics industry, we have consistently built a culture that cares—a culture of employees who live and breathe by our strong OptiPro values and a culture of best-in-breed customers who are collectively on a relentless pursuit of process efficiencies, design improvements, capability enhancements, and marketplace superiority.

OVITZ
www.o-vitz.com

Ovitz is an exciting medical device company specializing in developing, manufacturing, and marketing novel and portable ophthalmic equipment and accessories that facilitate the delivery of ophthalmic care in eye doctors' and primary care physicians' offices and in schools, rural areas, and developing nations.

SIMPORE INC.
www.simpore.com

SiMPore is a Rochester, New York–based nanotechnology company that designs and produces membranes and membrane-enabled products based on its unique patent-pending platform technology—the NanoBarrier™ ultrathin nanoporous silicon membrane. The NanoBarrier™ membrane is the world's first membrane to offer both tunable nanometer-scale thickness and pore size. SiMPore is developing products that take advantage of these one-of-a-kind features, including filters for separating and concentrating biological molecules and nanoparticles, cell culture substrates for growing cells, and electron microscopy grids for preparing and imaging samples at the nanoscale.

SOLID CELL
www.solidcell.com

Solid Cell is a developer of stationary and portable solid-oxide fuel cell technologies for residential, commercial, industrial, and other critical off-grid applications. The company's headquarters are located in New York City. Solid Cell's principal product development and manufacturing center is in Rochester, New York. Solid Cell's products provide clean energy using state-of-the-art fuel cell technology at commercially competitive costs. The company has targeted several specific applications to satisfy a wide variety of global power requirements. Widespread use of Solid Cell's fuel cells will reduce reliance on scarce natural resources like natural gas and oil.

SYNAPTICS INC.
www.synaptics.com

We are the pioneers and leaders of the human interface revolution, bringing innovative and intuitive user experiences to intelligent devices. From usability and R&D to supply chain and support, we collaborate with our partners to invent, build, and deliver human interface solutions that integrate seamlessly and optimize system value. The improved ease of use, functionality, and aesthetics of Synaptics-enabled products help make the digital lives of people more productive, secure, and enjoyable.

THERMO FISHER SCIENTIFIC INC.

www.thermofisher.com

Thermo Fisher Scientific Inc. (NYSE: TMO) is the world leader in serving science, with revenues of $17 billion and 50,000 employees in 50 countries. Our mission is to enable our customers to make the world healthier, cleaner, and safer. We help our customers accelerate life sciences research, solve complex analytical challenges, improve patient diagnostics, and increase laboratory productivity. Through our four premier brands—Thermo Scientific, Life Technologies, Fisher Scientific, and Unity Lab Services—we offer an unmatched combination of innovative technologies, purchasing convenience, and comprehensive support.

UR VENTURES

www.rochester.edu/ventures

UR Ventures develops University of Rochester innovations into valuable products and services to make the world ever better. Technology transfer functions are mandated by federal law. Even if they weren't, we would still do it because it's the right thing to do. Not only does the transfer of technologies make the world a better place, but the revenues generated are unrestricted and support the amazing research of the future. By rewarding our inventors, we also motivate them to solve real-world problems. Finally, the relationships we create help to attract and maintain industrial support for research.

VISUALDX

www.visualdx.com

When unsure of a diagnosis, VisualDx is the go-to tool for fast, accurate decision making. Quickly build a differential to evaluate the possibilities, compare variations, and improve diagnostic accuracy at the point of care. VisualDx is the leader in clinical decision support, used in more than 1,500 hospitals and institutions and over 50 percent of U.S. medical schools. Trusted by physicians and nurses all over the world, VisualDx is utilized across several professional specialties.

FACULTY **RESEARCHERS**

This portable device was designed by University spin-off LighTopTech, cofounded by company president Cristina Canavesi and her PhD advisor, Jannick Rolland, the Brian J. Thompson Professor of Optical Engineering at the University of Rochester. LighTopTech is one of 10 start-ups to advance in a competition sponsored by a New York accelerator focused on optical technologies.

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Research Interests Quantum electronics, Nonlinear photonics, Fiber-optic communications

Recent Research Projects Transmission of optical pulses, Semiconductor lasers, Nonlinear fiber optics, Optical communications

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Research Interests Propagation of waves, Connection between rays and waves, Integral transforms, Phase space representations, Uncertainty relations

Recent Research Projects Building accurate estimates of wave fields propagating based on ray information alone

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Education MD, Medicine, Italy-Fac Med U Naples, 1957; BA, Johns Hopkins University, Biological Sciences, 1952

Research Interests Ocular surface tear film, Cornea wound healing, Keratoprosthesis—artificial cornea transplantation

Recent Research Projects Ocular metrology and inflammatory mediator response to topical administration of anti-inflammatory drugs

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Research Interests Imaging microelectronics, Wireless sensors, Multimedia signal processing

Recent Research Projects Digital audio watermarking and steganography, Image sensors with built-in image compression, Digital CMOS image sensor read-out circuits

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Research Interests Optical polarization and metrology, Optoelectronic modeling, Integrated optoelectronics

Recent Research Projects Enhancing image contrast using polarization correlations, Stress engineering for polarimetry and imaging, Polarization control of optical nanostructures, Nonlinear properties of microstructured optical fibers

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Research Interests "Viscoelastic" soft biological tissues, Soft tissue aging, disease, and repair

Recent Research Projects Diseases of the musculoskeletal system

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Research Interests Rapid Prototyping, Rapid Manufacturing

Recent Research Projects Cu Ink Adhesion Solutions

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Research Interests Computational science and engineering, Numerical analysis, Applications of computer science in electrophysiological signaling stabilization, Refractometry, Flexure systems, Stage metrology

Recent Research Projects Noncontact video-based detector of cardiac arrhythmias

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Research Interests Diagnostic ultrasound imaging, Therapeutic applications of ultrasound, Low frequency underwater sound fields

Recent Research Projects Mechanisms for wound healing with ultrasound; Ultrasound technologies for tissue engineering, Effects of underwater sound on biological tissues

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Research Interests MR, CT, and GU radiology, Ultrasound

Recent Research Projects In vivo photoacoustic and ultrasound imaging probe for human thyroid cancer detection

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Education PhD, University of Medicine and Dentistry-NJ (UMDNJ), Microbiology, 1999; BS, Delaware Valley College, Arts and Sciences, 1992

Research Interests Novel strategies for the therapeutic intervention of bacterial infections, Modulation of mRNA turnover

Recent Research Projects Light Diffusing Fiber as a Disinfectant or Antimicrobial Agent, Efflux pumps and inhibitors of serum-grown *Acinetobacter baumannii,* Identifying new antimicrobial agents against *Mycobacterium tuberculosis,* Terfendine as a new *S. aureus* antibiotic

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Education PhD, Delft University of Technology (The Netherlands) Mechanical Engineering, 2010; MSc, BS, University of North Carolina at Charlotte, Mechanical Engineering

Research Interests Linear displacement interferometry, High-power gas laser frequency stabilization, Refractometry, Flexure systems, Stage metrology

Recent Research Projects Designing and developing smart optical sensors for compact, remote displacement sensing and for multi-DOF interferometry

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Education MBA, University of Southern California, 1997; MD, Albert Einstein College of Medicine, 1973; BA, University of California, Los Angeles, Psychology, 1969

Research Interests Neuro-ophthalmolgy, Oculofacial plastics and orbital surgery

Recent Research Projects Thyroid-associated eye disease

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Research Interests Computer graphics, Digital imaging, Data visualization, Visual perception, Low vision, Assistive technologies

Recent Research Projects Effects of image dynamic range on apparent surface gloss

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Research Interests Relationships among microstructure, properties, and processing of materials

Recent Research Projects Optical Probing for Freeform Optics Metrology

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Research Interests Nanomaterials and membrane fabrication, Microfluidics, separations, and device design, Cellular biophysics, Quantitative fluorescence imaging

Recent Research Projects Cellular co-culture screening assays

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Research Interests Femtosecond Laser-Matter Interactions at High Intensities

Recent Research Projects Superwicking cooling devices for computer CPU and microelectronics

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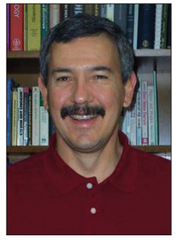

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Education PhD, University of Cincinnati College of Medicine, Microbiology, 1982; MS, Miami University, Microbiology, 1976; BA, Wittenberg University, Biology, 1974

Research Interests Mechanisms of pathogenesis, Host-microbe interactions and approaches to therapy

Recent Research Projects Infections in the immunocompromised host, Treatment of infections through photodynamic therapy

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Research Interests Multimedia communication, Wireless sensor networks, RFID systems, Cloud computing, Heterogeneous networking

Recent Research Projects Developing RFID systems for inventory management, Designing a QoS-aware protocol architecture to support real-time multimedia data transmission, Optimizing video-based sensor networks

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Education PhD, University of Rochester, Electrical and Computer Engineering, 2000; MS, Rochester Institute of Technology, Electrical Engineering, 1992; BS, Rochester Institute of Technology, Microelectronic Engineering, 1990

Research Interests Silicon device integration on nontraditional substrates, Metal-oxide semiconductors for thin-film electronics, Silicon-based optoelectronics

Recent Research Projects Development and characterization of high-performance transistors on glass, Development of bipolar and MOS high-power microwave transistors

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Research Interests Extracellular matrix, Fibronectin

Recent Research Projects Extracellular matrix protein, fibronectin and wound repair, Tissue Engineering, Therapy for tissue regeneration in chronic wounds

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Education PhD and MS, Pennsylvania State University, Physics, 2000; BS, Utah State University, Physics, 1995

Research Interests Optics of the eye, Femtosecond laser micro-machining in cornea and lens, Visual perception and psychophysics, Biomedical imaging

Recent Research Projects Femtosecond laser micromachining, Effect of corneal wound healing on physiological optics of the eye, Perceptual learning with a damaged visual system

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Education PhD, University of Rochester, Electrical and Computer Engineering, 2004; MS, University of Rochester, Electrical and Computer Engineering, 2001; BS, University of Novi Sad, Electrical Engineering and Computer Science, 1999

Research Interests A/D conversion, CMOS analog circuits, Low power circuit architectures, Image sensors

Recent Research Projects Developing and investigating focal plane compression techniques where majority of multiplication computations required by the compression are rendered unnecessary

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Research Interests Remote sensing, system modeling, and analysis, Pattern recognition; Digital imaging, Image processing

Recent Research Projects Global surveillance augmentation for deep learning

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FACULTY RESEARCHERS

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Education PhD, University of Rochester, The Institute of Optics, 1983; BS, University of Rochester, The Institute of Optics, 1979

Research Interests Ultrafast laser physics and prototyping, Ultra-broadband laser systems, Biomedical optics using novel ultrafast lasers, Femtosecond micromachining of polymers, Nonlinear fiber and semiconductor devices

Recent Research Projects Femtosecond micromachining of ophthalmic polymers

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Education PhD, Harvard University, Mechanical Engineering, 1984; MS, Harvard University, Applied Sciences and Mechanical Engineering, 1981; BS, Brown University, Applied Mechanics, 1980

Research Interests Describing macroscopic behavior of solids by examining underlying microstructural features; Mechanical, electrical, and/or optical affects to response of homogenous or heterogeneous materials

Recent Research Projects Optimization of optics manufacturing techniques such as deterministic microgrinding, loose abrasive lapping, Magnetorheological Finishing (MRF), and loose abrasive finishing of optical glasses and ceramics

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Research Interests Development, evaluation and preclinical integration of image guidance environments for surgical navigation of minimally invasive cardiac interventions

Recent Research Projects Predicting target vessel location in robot-assisted CABD interventions using feature-based CT to US registration

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Research Interests Computer vision, Machine learning, Social media data mining, Human computer interaction, Biomedical informatics, Mobile and pervasive computing, Computational photography

Recent Research Projects Fine-grained user profiling from multiple social multimedia platforms, Wine recommendation for grocery shoppers

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Research Interests Physical systems and industrial problems pertaining to flows of biological and complex fluids, Modeling, Ordinary and partial differential equations, Scientific Computing

Recent Research Projects Affect of contact lens distortion on exchange of tears, Model for suction pressure under a contact lens

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Education PhD, University of Rochester, 1997; MS, University of Rochester, 1992; BS, University of Illinois, 1991

Research Interests Lasers, Waveguides, Fiber Optics

Recent Research Projects Large-mode area fibers, Visible Fiber lasers, brightness semiconductor lasers, Fiber laser for display applications, High-efficiency fiber amplifiers, All-fiber optical components

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Research Interests Use of motion-tracking techniques to enhance the contrast of ultrasound images, Acoustic Radiation Force Impulse (ARFI), Magnetically induces vibration of brachytherapy seeds

Recent Research Projects Acoustic radiation force imaging techniques, Spatially Modulated Ultrasound Radiation (SMURF) imaging, Single tracking location (STL) Shear wave elastography imaging (SWEI)

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Research Interests Nanoparticle and molecular separations, Nanotechnology, MEMS and micro fabrication, Cell culture technologies

Recent Research Projects The interaction of nanoparticles with cells and protein mixtures, Ultrathin silicon-based nanomembranes for filtration of molecules and nanoparticles, Ultrathin silicon-based nanomembranes for biological co-cultures

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Research Interests Remote sensing and image exploitation, Advanced mathematical approaches for spectral image processing, Target detection in hyperspectral imagery

Recent Research Projects Spatial segmentation of multi/hyperspectral imagery by fusion of spectral-gradient textural attributes, Knowledge-Based Automated Road Network Extraction System Using Multispectral Images

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Research Interests Biomedical nanotechnology, Combinatorial chemistry, Biophysical methods, Biosensors

Recent Research Projects The AIR Flu Chip: A Multiplex Optical Biosensor of Influenza Serology

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ZORAN NINKOV

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Research Interests Novel 2-D CMOS detector arrays, Fundamental limitations of visible and IR arrays, Miniaturized multispectral systems

Recent Research Projects Development of novel two-dimensional detector arrays, Development of image processing techniques for optimal analysis of such two-dimensional astronomical image data

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Research Interests Internal Medicine, Pulmonary Disease, Critical Care Medicine

Recent Research Projects Protocols and Hospital Mortality in Critically Ill Patients: The United States Critical Illness and Injury Trials Group Critical Illness Outcomes Study

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Research Interests Cellular and molecular characterization of fibroblasts, Control of normal and malignant lymphocyte activation

Recent Research Projects Ocular surface metrology and inflammatory mediator response to topical administration of anti-inflammatory drugs

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Research Interests Infrared observations of star-forming regions, Infrared detector array development and applications to astronomy and to persistent surveillance

Recent Research Projects Teledyne HgCdTe 10 micron cutoff detector arrays for use in future space experiments with particular emphasis on NEOCam (Near Earth Object Camera), Characterization of Raytheon long-wavelength HgCdTe detector arrays, FIRE spectrometer development, Persistent surveillance-driven projects

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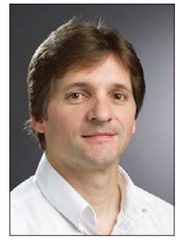

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Education PhD, Rochester Institute of Technology, Computer Science, 2013; MS, Rochester Institute of Technology, Imaging Science, 2002; BS, Rochester Institute of Technology, Electrical Engineering, 1988

Research Interests Machine learning, Computer vision and robotics, Embedded control

Recent Research Projects Computer vision algorithms for portable vision diagnostic devices

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Research Interests Optical metrology, Optical instrumentations, Adaptive and active optics, Segmented large-scale optics alignment and testing, Pulse compression, ultrafast laser systems and applications, Optical system design and performance evaluation

Recent Research Projects Development and investigation of an integrated laser-based optics polishing and manufacturing technology, Laser polishing for additive manufacturing

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Research Interests Diagnostic radiology, Imaging sciences

Recent Research Projects In vivo photoacoustic and ultrasound imaging probe for human thyroid cancer detection

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Research Interests Biomechanics of soft tissues and measuring the change in mechanical properties of diseased tissues using clinical imaging modalities

Recent Research Projects Development, validation, and implementation of elasticity imaging, or elastography, for diagnosing vascular diseases

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Research Interests Optical system design for imaging and non-imaging optics, Physics-based modeling, Image quality assessment

Recent Research Projects Gabor-domain optical coherence microscopy for detection of defects in manufacturing, Optical coherence tomography for quantification of contact lens properties

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Research Interests Organic device science, Metal nanoparticle enhanced spectroscopy and imaging, Bio-molecular sensing

Recent Research Projects Novel optical technologies for sensing of nucleic acids and proteins, Mechanistic studies of electronic polymers used in luminescent devices, Plasmonic enhancement of molecular absorption and luminescence, Small fragment removal for next-generation sequencing

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Research Interests Statistical physics of protein mixtures, Cell signaling dynamics, Fluid mechanics and solid mechanics of contact lenses and tear film

Recent Research Projects Affect of contact lens distortion on exchange of tears, Model of suction under contact lens

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Research Interests Three-dimensional geometry extraction from multiview imagery, Material optical properties measurement and modeling, Still and motion image processing for various applications, Thermal infrared phenomenology, exploitation, and simulation, Design and implementation of novel imaging and ground-based measurement systems

Recent Research Projects Signatures Modeling, Derivation, and Exploitation, RIT Immersive Living Room, START-X ISP Signatures and SWIR Measurement Support

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Research Interests Real-time computer vision, Multimedia systems, Medical imaging

Recent Research Projects Real-time systems for object tracking and activity recognition; Algorithms and systems for robust scene categorization and object classification in consumer photographs; Document processing algorithms for thresholding, compression, and rendering in high-speed scanners; Digital Image Processing; and Computer Vision

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Research Interests Ultrafast optoelectronics, Quantum optoelectronic and spintronic devices, Ballistic transport in electronic nanodevices, Quantum communication and information

Recent Research Projects Quantum key distribution using polarized infrared single photons for practical quantum cryptography and deep space optical communications, Subpicosecond electro- and magneto-optic characterization of electronic, optoelectronic, and spintronic materials and systems, Smart sensor for classical and quantum data links

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Research Interests Wireless communication and networking, Mobile cloud computing, Smart and connected health care solutions, Stochastic modeling and optimization

Recent Research Projects Design and optimization of large ad-hoc networks

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Research Interests Light-matter interaction at the nanoscale, Quantum optics, nanophotonics, and condensed matter physics

Recent Research Projects Solid-state and photonic approaches to quantum science

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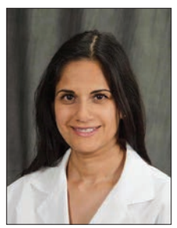

TARA C. VAZ

Senior Instructor in the Department of Ophthalmology, University of Rochester

Education PhD, SUNY College of Optometry, 2002; MS, SUNY College of Optometry, 2001; BS, McMaster University, 1996

Research Interests Contact lenses, Lens solution, Ophthalmic drops

Recent Research Projects High and low contrast visual acuity measurements in spherical and aspheric soft contact lens wearers, Continued development of portable low-cost wavefront sensors

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Education PhD, Osaka University, Laser Optics, 1998; MS, Osaka University, Laser Optics, 1995; BS, SungKyunKwan University, Physics, 1990

Research Interests Adaptive optics and in-vivo ocular surface and intraocular imaging, Customized vision correction, Presbyopic correction

Recent Research Projects Large stroke adaptive optics for correcting highly aberrated eyes, Investigation of accommodation and presbyopic lenses (multifocal and accommodative intraocular lenses)

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