

**CENTER FOR EMERGING
AND INNOVATIVE SCIENCES**

ANNUAL REPORT 2022–2023

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A modular μ SiM-MVM tissue chip platform, used to observe leukocyte-endothelial cell interactions in unprecedented detail, is pictured in the lab of James McGrath, the William R. Kenan, Jr. Professor in the Department of Biomedical Engineering at the University of Rochester. The μ SiM-MVM is a closed system used for flow and leukocyte transmigration studies. The platform is made of polydimethylsiloxane (PDMS), silicone gasket, and pressure-sensitive adhesive. Multiple imaging modalities and microscope systems are compatible with the platform, including confocal and lightsheet. Cells sit on an ultrathin silicon-nitride nanomembrane, which enables high-resolution imaging, unhindered cell communication between chambers, and studies on endothelial cell apicalbasal polarity.

Photo credit: J. Adam Fenster, University of Rochester

CEIS DIRECTORS' MESSAGE

I'm writing this while I'm watching a Buffalo Bills football game and pondering how economic development is like football. I suppose that almost everything in life is like football in some ways: the rewards of hard work and preparation, teamwork, and the elation of success. Or perhaps it's the other way around, and football mirrors life. Whichever way it is, the fans fill the stadium, and the players take the field hopeful for the "big play" and the win, and on rare occasions a kickoff is returned 100 yards, or a pass play goes 75 yards for a touchdown. In the past two years, New York State economic development had some huge plays, like Micron Semiconductor announcing its new Clay, New York, foundry facilities, Edwards Vacuum Pumps' investment in a new factory in nearby Genesee County, or the recently announced state partnership to bring a \$10 billion advanced semiconductor lithography research center to Albany. But in a football game, most plays are less spectacular, hopefully netting a few yards at a time and eventually adding up to a win. Our work at CEIS is more like that.

With the support of New York State, CEIS makes investments in University-Industry research collaborations, optimistic that it will lead to economic expansion and the creation of new jobs. That's how we keep score, and this past year a \$1 million investment of state funds in CEIS yielded \$30 million of regional economic impact, including the creation of 31 new jobs, a 30:1 return on taxpayer investments.

The football analogy is not complete. Happily, in economic development, unlike football, everybody can win. The cost savings, increased revenue, and new investments that accrue to the companies we work with are critical outcomes, but

creating new jobs is precious. Each new job changes a life, supports a family, and creates a brighter future for people. One may equate each new job to a yard gained in football, but creating one new job is like winning an entire game for the people affected. Enough of the football analogy.

In this annual report you can read about some of the collaborative projects we have encouraged and supported in the past year as well as a few broader initiatives that we have undertaken.

For example, this year we worked with ALLVAR Alloys in Syracuse, New York, which has developed a remarkable material with a negative coefficient of thermal expansion, which means that unlike most materials, when ALLVAR is cooled it expands. There are many possible applications of this material for a variety of precision systems, and we worked with Allvar to secure a manufacturing grant from New York State's Fuzehub organization to develop and test new precision optical uses of the material.

We also were awarded a \$100,000 matching grant from the New York State Division of Tourism to work with the Eastman School of Music and other community organizations to create the first annual Rochester Film Music Festival, a celebration and exploration of music and sound in cinema and modern media. This will be the only such event in North America, and the visitors and visibility that this event will bring to our region will be an important

step in fostering the growth of the emerging cluster of more than 20 regional companies working in music recording, sound and media production, and audio technologies.

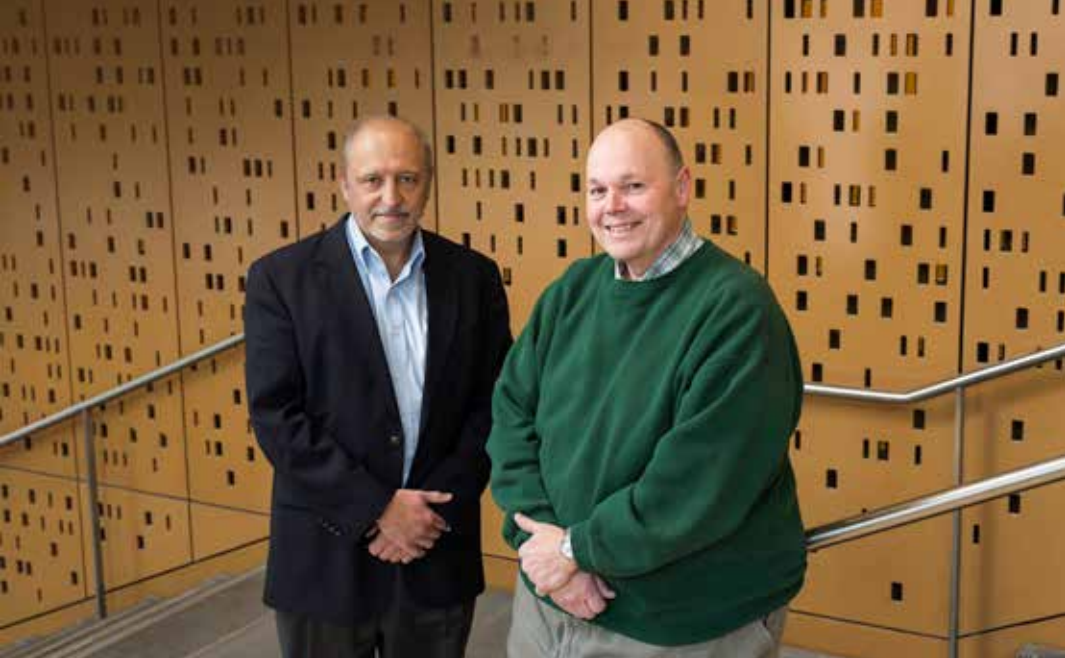
CEIS continued to explore ways that our region can contribute to the exciting developments in the semiconductor industry throughout New York. Our regional focus has been on chip packaging and semiconductor design—more about this topic later in this report.

We also want to give a big "Thank You" to the staff at CEIS: our business manager, Cathy Adams; our CEIS administrator, Margaret Urzetta; and our undergraduate program assistant, Jack Ager. We gratefully acknowledge the continued support and advocacy from Governor Kathy Hochul, New York State Assemblymember Harry Bronson, and NYSTAR. We also thank our many faculty Principal Investigators at the University of Rochester and Rochester Institute of Technology as well as our industry partners who continually amaze us with their creativity and dedication to progress.

Sincerely,

Mark F. Bocko
Mark F. Bocko, Director

Paul H. Ballentine
Paul H. Ballentine, Executive Director



OTHER CEIS INITIATIVES

UNIVERSITY TECHNOLOGY SHOWCASE



(Left) Event emcee Nick Koziol from the Data Science CoE (bottom row, left) with industry and academia participants at the inaugural Network Pitch Event

(Left, bottom) Haolin Liao presents his poster to the Hajim School's assistant dean for grants and contracts, Cindy Gary.



On April 20, 2023, CEIS and the CoE in Data Science cohosted the University Technology Showcase at the Memorial Art Gallery. The day began with the student-organized Western New York AR/VR Mini-Conference. This portion of the event, organized by PhD students working on the NRT-HDR: Interdisciplinary Graduate Training in the Science, Technology, and Applications of Augmented and Virtual Reality grant, brought in speakers from industry and academia to speak about advances in

the field. Students were also given the opportunity to present themselves and their research.

A new feature of the showcase was the Network Pitch Event, which allowed representatives from academia and industry to pitch ideas and opportunities for collaboration. Professor Wayne Knox, who participated in the event, commented, "Having an exciting new UR research project, I went to the CEIS/CoE meeting and immediately found an excellent commercial

partner. The meeting was excellently organized to promote efficient interactions like this." The recorded pitches can be seen on YouTube (www.youtube.com/watch?v=yGCZWeF7d_k).

Following the pitch event was a panel session on building a semiconductor supply chain in the Finger Lakes region. We had a distinguished panel consisting of experts from the state and federal governments, academia, industry, and a regional economic development organization.

The keynote panel's topic was Building a Semiconductor Ecosystem in the Finger Lakes Region. Panelists were Matt Hurlbutt, president and chief executive officer at Greater Rochester Enterprise; Chris Zeltmann, regional director of US Senator Charles E. Schumer's Rochester Finger Lakes Office; Laura Fox O'Sullivan, Finger Lakes regional director, Empire State Development; Karl D. Hirschman, Micron Professor of Microelectronic Engineering in the Electrical and Microelectronic Engineering Department at RIT; and Eric Bohannon, lead analog engineer at Advanced Micro Devices. The full panel discussion can be found on YouTube (www.youtube.com/watch?v=wmmxEdBb2o).

The day concluded with a research poster session. Posters presented by faculty and students from RIT and the University of Rochester covered topics in AR/VR; biomedical technology; data science; optics, photonics, and imaging; and sensors, acoustics, and materials. Attendees participated in a best poster contest. The winners were Tre DiPassio, Daniel Steiner, and Haolin Liao.

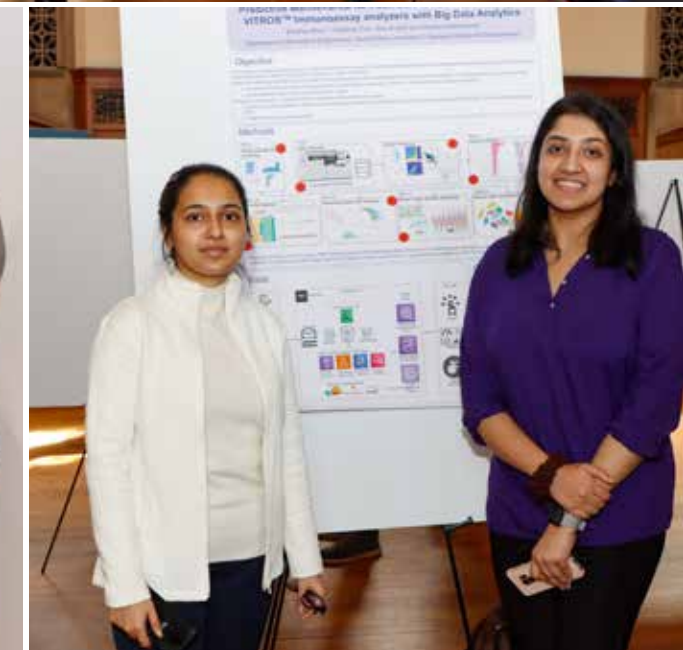
(Right) Annual technology showcase poster session in the Memorial Art Gallery's M&T Bank Ballroom

(Middle, left) Panelists for "Building a Semiconductor Ecosystem in the Finger Lakes Region" with CEIS Executive Director Paul Ballentine (moderator)

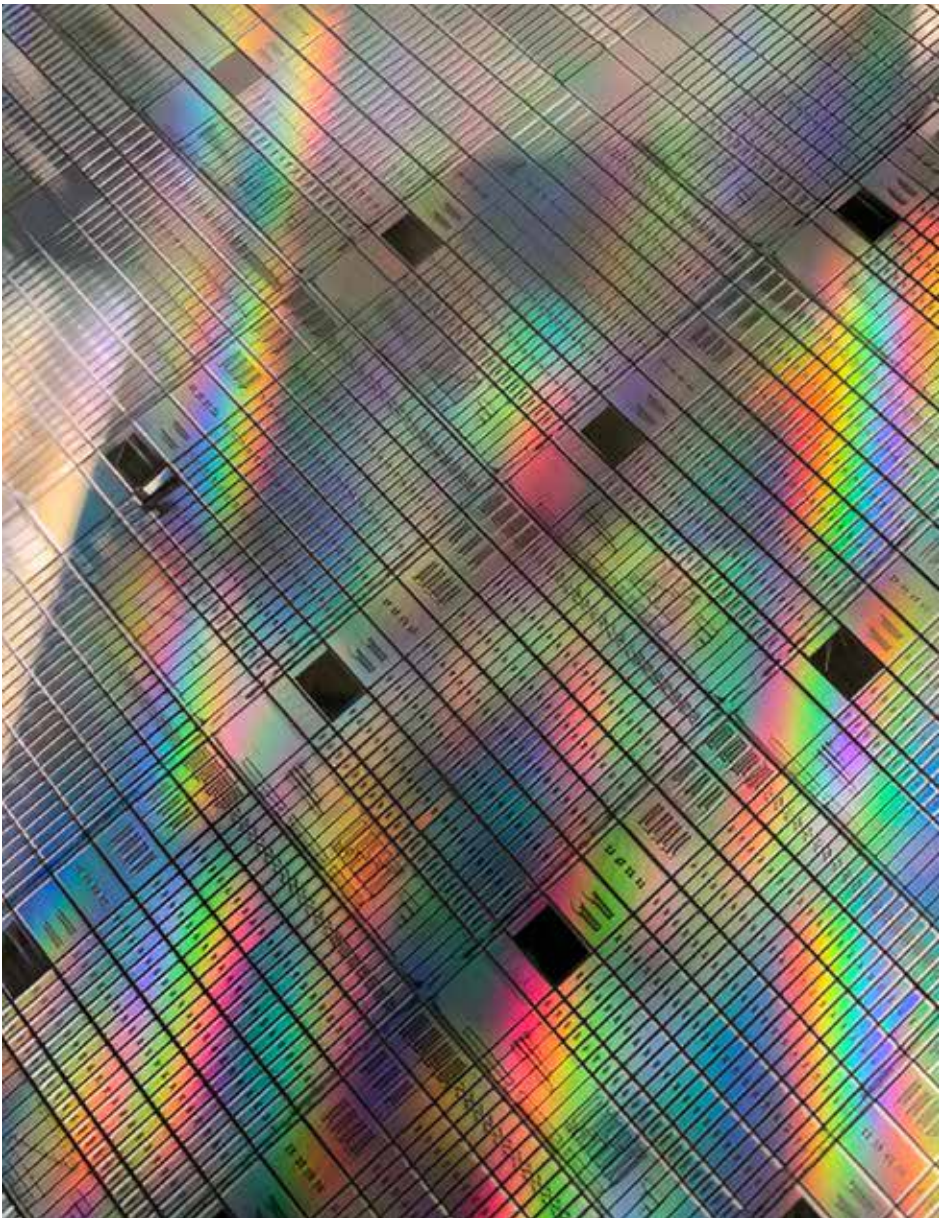
(Middle, right) Siladitya Khan presents a research poster in the Biomedical Technology category.

(Bottom, left) Audience Q&A during Western NY AR/VR Mini-Conference

(Bottom, right) CEIS and CoE staff tally the votes for the poster presentation awards.



BUILDING A SEMICONDUCTOR CLUSTER IN THE FINGER LAKES REGION



CEIS continues to heavily promote the building of a semiconductor supply chain hub in Rochester and the surrounding Finger Lakes region.

At the University Technology Showcase there was a plenary panel session entitled Building a Semiconductor Ecosystem in the Finger Lakes Region. The panelists were Matt Hurlbutt, president and chief executive officer at Greater Rochester Enterprise; Chris Zeltmann, regional director of US Senator Charles E. Schumer’s Rochester Finger Lakes Office; Laura Fox O’Sullivan,

Finger Lakes Regional Director, Empire State Development; Karl D. Hirschman, the Micron Professor of Microelectronic Engineering in the Electrical and Microelectronic Engineering Department at RIT; and Eric Bohannon, lead analog engineer at Advanced Micro Devices. We had a distinguished panel consisting of experts from the state and federal governments, academia, industry, and a regional economic development organization.

Coming eight months after President Biden signed into law the CHIPS Act and six

Benjamin Miller, the Dean’s Professor of Dermatology and a professor of biomedical engineering, of optics, and of biochemistry and biophysics at the University of Rochester Medical Center, is developing an optical chip on a disposable card that can detect exposure to multiple viruses—including the coronavirus that causes COVID-19—within a minute and from a single drop of blood. The research project, an industry, academic, and government collaboration, also includes AIM Photonics and Ortho Clinical Diagnostics.

months after the announcement that Micron Technology will build a \$20 billion fab in Syracuse, there was significant interest and enthusiasm from the audience. There was a clear sense that Rochester can and should be the home for the US semiconductor packaging cluster. The CEIS effort dovetails nicely with the announcement that the Rochester-Buffalo-Syracuse region has been designated as a Tech Hub for semiconductors by the US Economic Development Agency. This designation, heavily supported by Senator Schumer and backed by Representative Joe Morelli and members of congress from surrounding districts and supported by New York State Empire State Development was the result of a proposal by SMART-I, a consortium of more than 22 industry groups and firms, 20 economic development organizations, eight labor and workforce training organizations, and 10 institutions of higher learning.

The University of Rochester and RIT were instrumental in this designation. CEIS continues to work with individual companies looking to establish or expand semiconductor operations in Rochester and looks forward to its continued effort to build a semiconductor cluster in the Finger Lakes.

CEIS continues to work with TechSearch International, a global consultancy firm, to bring semiconductor supply chain companies to the Rochester region. So far

TechSearch has referred several companies to Greater Rochester Enterprise.

CEIS also supports a number of industry/ university collaborations in the semiconductor space. Among these are:

AMD—CEIS and the CoE in Data Science have been assisting AMD in building relationships with faculty at the University of Rochester and other regional universities. Partly as a result of this assistance and with the support of Empire State Development, AMD has announced expansion of its operations in Rochester and in Fishkill, New York, with the creation of 165 new jobs by 2025.

Phlotronics—Phlotronics, a spinout of Dr. Ben Miller’s lab at the University of Rochester Medical Center (URMC) specializing in biosensors utilizing integrated photonics, is collaborating with Dr. Miller on utilizing

a pick-and-place module for biosensor device assembly.

Corning—Over the past several years, CEIS has funded Professor Karl Hirschman, a professor of electrical and microelectronic engineering at RIT, for work with Corning on thin-film transistors on glass.

Ram Photonics—CEIS has been funding Professors John Marciante and Drew Maywar for their work with Ram Photonics to develop novel processes for handling, stripping, cleaning, cleaving, and splicing dual-clad optical fibers that are capable of handling multi-kW of optical power transmission.

L3Harris—For the past several years, CEIS has been funding University of Rochester

faculty for their work with L3Harris. CEIS is currently funding a collaboration between L3Harris and Professor Hui Wu to investigate integrated silicon photonic optical phased array (OPA) technologies and develop a new free-space optical (FSO) imaging and communication systems.

AN Jordan Scientific—Recently CEIS has funded Professor Jaime Cardenas for his work with AN Jordan Scientific to design, fabricate, and test an optical gyroscope integrated on a photonic chip with weak value amplification.

These and other industry/university collaborations funded by CEIS are helping Rochester to become the next semiconductor supply chain cluster in the US.

NEW ROCHESTER FILM MUSIC FESTIVAL



CEIS and the Eastman School of Music’s Beal Institute for Film Music are working together to create the new Rochester Film Music Festival, a celebration and exploration of music and sound in cinema and other modern media. The New York State Office of Tourism recently awarded a \$100,000 matching grant to help fund the inaugural event planned for next year. The new Rochester Film Music Festival will be the only such event in North America, although several other highly popular film music festivals are held annually throughout Europe.

Making the new festival a reality is a community effort with planning help and support from the Eastman School of Music,



Rochester Philharmonic Orchestra, the George Eastman Museum of Photography and Film, Visit Rochester, the Rochester/ Finger Lakes Film Commission, and the Little Theatre. Festival activities will include full-length feature film screenings accompanied by live musical performances by the RPO and Eastman School orchestras, screenings of short films with live musical accompaniment; explorations of music in games and interactive media; new mixed-media experiences via virtual and augmented reality; presentations and workshops by composers and creators; recognitions, awards, and emerging artist showcases; discussion panels on emerging trends at the intersection of music and visual media; and interactive sessions devoted to the enabling audio technologies and the coevolution of technology and music in media. The mix of the art, craft, and technology of sound in media will be the unique signature of the Rochester festival

reflective of the broad spectrum of talents and capabilities in the Rochester-Finger Lakes region.

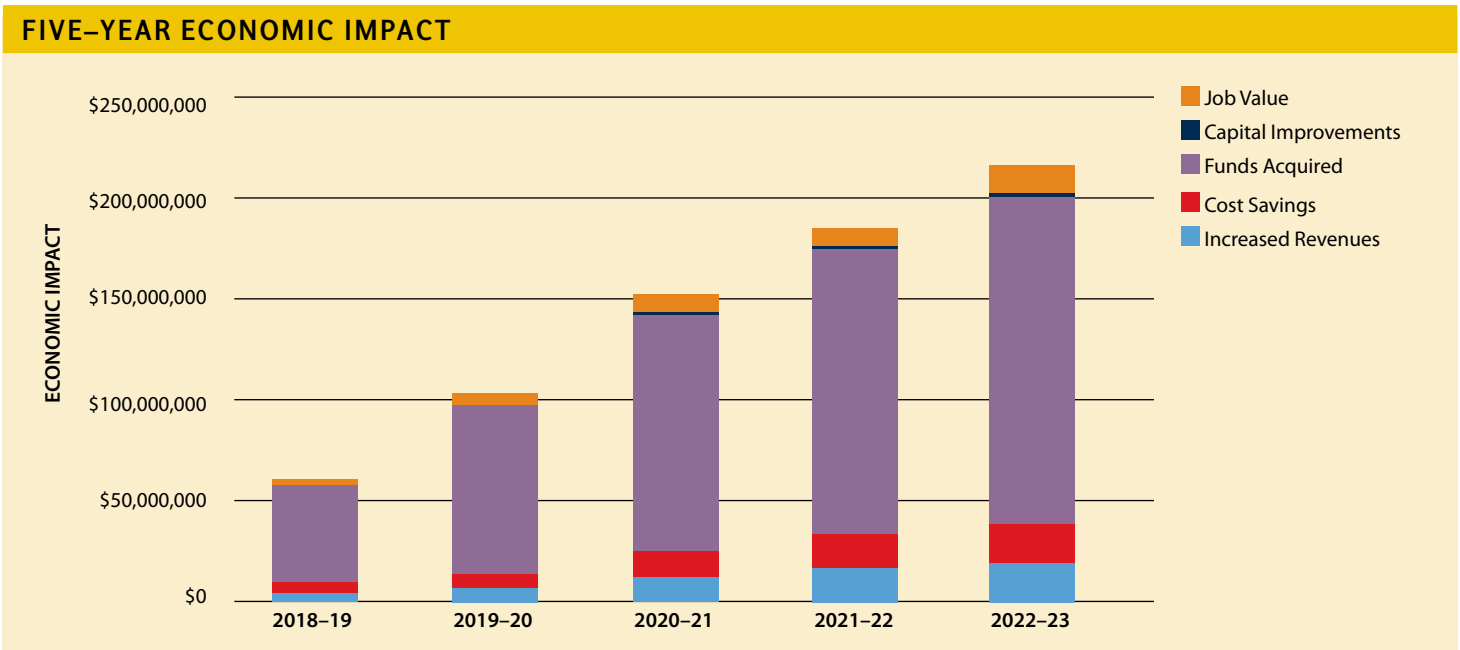
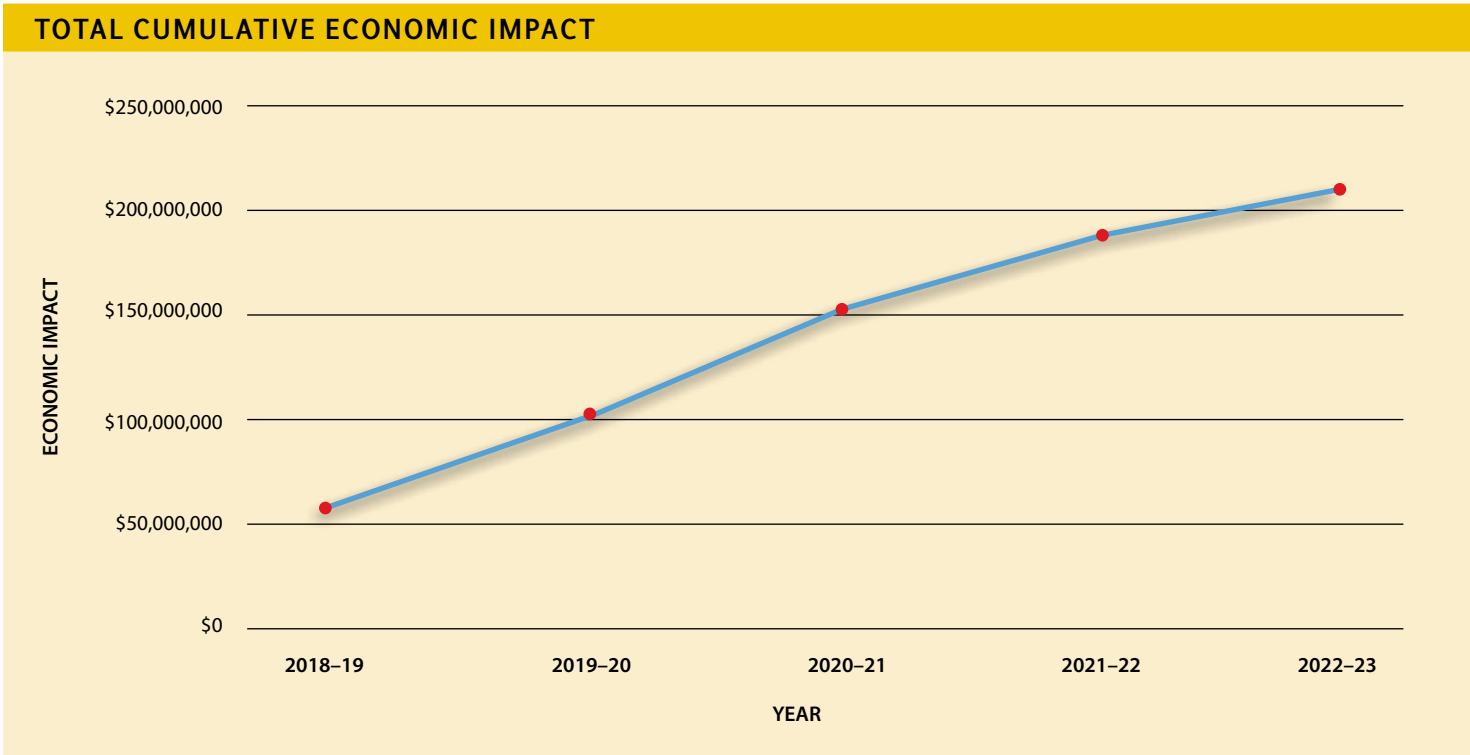
The essential role that our area plays in educating many artists and technologists throughout the music and sound industries and the emerging cluster made up of more than 20 regional companies in media production, recording, and audio technologies, makes Rochester a perfect location to host this new event. In addition to the anticipated boost to regional tourism, another long-term goal of the Rochester Film Music Festival is to bring the world’s attention to our regional resources in music, audio, and media and to spark greater university-industry collaboration to fuel the growth of existing companies and the creation of new ventures to further regional economic development and job creation in this unique creative hub. Please stay tuned for dates and further information. We look forward to seeing everyone at this event.

ECONOMIC IMPACT 2022–2023

For the fiscal year July 1, 2022, to June 30, 2023, the total documented dollar value of the economic impact of CEIS-supported research and outreach was over \$30 million. This self-reported data (new and retained jobs, increased sales, cost savings, capital investments, and additional funds acquired) from 13 of our partners provides a snapshot of the region’s economic successes. The five-year cumulative economic impact effect of CEIS investments in New York State entities is more than \$212 million.

A shout-out to the AIM Photonics initiative, which led the way with 17 new jobs along with reporting over \$18 million in monetary impacts. Longtime CEIS partner SiMPore reported nine new jobs and a significant capital improvement investment. Our partner OptiPro reported two new jobs and two retained jobs as well as more than \$3.6 million in non-job impacts.

FIVE-YEAR SUMMARY OF ECONOMIC IMPACT						
Year	2018–19	2019–20	2020–21	2021–22	2022–23	Total
Increased Revenues	\$4,620,662	\$1,916,467	\$4,051,507	\$3,972,963	\$2,317,144	\$16,878,743
Cost Savings	\$4,809,079	\$2,807,309	\$5,143,669	\$2,931,593	\$2,194,750	\$17,886,400
Funds Acquired	\$46,289,697	\$37,067,808	\$37,205,718	\$22,700,043	\$22,194,899	\$165,458,165
Capital Improvements	\$38,439	\$53,000	\$720,000	\$80,000	\$925,000	\$1,816,439
Job Value	\$2,361,460	\$2,226,413	\$2,308,974	\$1,234,327	\$2,528,410	\$10,659,584
New Jobs	26.5	20.25	17	11	31	106
Retained Jobs	12.5	14	18	9	10	64
Total Impact	\$58,119,337	\$44,070,997	\$49,429,868	\$30,918,926	\$30,160,203	\$212,699,331
Total Cumulative Impact	\$58,119,337	\$102,190,334	\$151,620,202	\$182,539,128	\$212,699,331	\$212,699,331



CAT PROGRAM FINANCIAL INFORMATION		
July 1, 2022–June 30, 2023		
FUNDING FROM NYSTAR		
Personnel Related		
Research and Center Management		\$558,984
Non-Personnel Related		
Research and Center Management		\$212,563
Total NYSTAR Contribution		\$771,547
OTHER SOURCES OF FUNDS—Cash from Companies		
Personnel Related		\$455,306
Non-Personnel Related		\$210,418
Total Other Resources		\$665,724

COMPANIES REPORTING ECONOMIC IMPACT IN 2022–23 FROM CEIS INTERACTIONS	
AIM Photonics NNMI	L3Harris Technologies
Aktiwave, LLC	LighTopTech Corporation
Clerio Vision, Inc.	OptiPro Systems, LLC
Corning, Inc.	SiMPore, Inc.
DinamicOR	Thermo Fisher Scientific
Imaginant	VisualDx
Kitware	



New York has hundreds of optics, photonics, and imaging companies clustered into active regional collaborations. These regions are home to abundant organizations and companies that can deliver complete R&D, engineering, and manufacturing capabilities, providing entrepreneurial vision combined with next-edge research. This map shows the entities—from public and private universities to corporations and governmental agencies—involved in the New York Photonics initiative.



Holly Coleman consults with researcher Diane Dalecki, the Kevin J. Parker Distinguished Professor in Biomedical Engineering and a professor of electrical and computer engineering at the University of Rochester. Coleman participated—through the University's Research Experiences for Undergraduates (REU) program—in a study exploring how ultrasound technology can be used to affect collagen microstructure.

Integration of Short-Wave Infrared (SWIR) Fabry-Perot Spectral Sensors
Elizabeth DeBartolo

Rochester Institute of Technology
Advanced Growing Resources, Inc.

A multidisciplinary design is required to enable existing short-wave infrared (SWIR) spectral detectors from Advanced Growing Resources' current sensor partner. A personality card, populated with the sensor and driver circuitry, must be designed and fabricated for compatibility with an existing processor baseboard. Updated firmware is also required for the new sensor architecture. The system must be validated with at least one of the three available SWIR sensors but would ideally function with all three.

Research in Support of High Speed and Stable LIRIC Manufacturing Processes at Clerio Vision

Wayne H. Knox
University of Rochester
Clerio Vision, Inc.

Research is proposed in three areas that could improve Clerio Vision's manufacturing processes. Using new advanced laser techniques, we will write 1D and 2D structures at high speeds using high energy low repetition rate lasers, and we will use newly developed phase profile writing to write multiple layers simultaneously. Furthermore, we will investigate new material processing conditions such as never-hydrated materials and new doping methods to increase photochemical stability and determine the thermal limits of damage and mechanical properties of various materials after LIRIC writing. Also proposed is a new method to write surface nanostructures for novel vision devices.

Innovation diligence in developing a system for remote detection of concealed weapons

Greg Gdowski
University of Rochester
Entry Point Technologies

Developing technology to detect guns from a distance at venue entrances is crucial for public safety and preventing mass shootings. It enables early threat detection, improves response time, enhances security measures, minimizes human error, and instills public confidence. While Entry Point Technologies

(EPT) has taken the initiative to develop a thermal imaging system for concealed weapon detection, the current limitations surrounding its utilization necessitate further collaboration with the University of Rochester. The principal investigator aims to work closely with EPT to conduct diligence on gun detection methodologies, identify a path forward, and explore opportunities for greater collaboration.

Laser Processed Surfaces for Durable Steam Condensation Heat Transfer Performance
Chunlei Guo

University of Rochester
Fluor Marine Propulsion, LLC

On a heat exchanger surface, it is desirable to condense hot steam in drop form rather than as a continuous film to enhance heat transfer rate in heat exchangers, power plants, and other heat transfer applications. The principal investigator's team has developed a laser surface processing technology that enhances dropwise water condensation. In this project, we will design a surface pattern for optimal steam condensation through computational fluid dynamic simulations. Based on the simulation results, the samples will be fabricated and their steam condensation and heat transfer performance will be tested.

Ultrasound Integrated Backscatter for Characterization of Tendon Microstructure
Diane Dalecki

University of Rochester
Imaginant, Inc.

Together, Imaginant and the Dalecki lab have begun advancing quantitative ultrasound for tissue characterization. The Dalecki lab developed imaging protocols and demonstrated experimentally that the angular dependence of the integrated backscatter coefficient (IBC) can be used to characterize collagen fiber microstructure noninvasively and nondestructively. Furthermore, these initial studies demonstrated the superior performance of the state-of-the-art, high-frequency ultrasound transducer and matched pulser received system designed by Imaginant specifically for quantitative imaging of collagen microstructure. Specifically, we will begin to translate our systems and methods toward a clinically relevant, load-bearing tendon, namely the Achilles tendon.

Pilot experiments toward elastographic microscopy in OCX™

Jannick Rolland
University of Rochester
LighTopTech Corporation

This proposal addresses the development of an optical coherence elastography (OCE) add-on for functional assessment of visco-elastic properties of tissue. OCX™, the imaging product launched by LighTopTech in 2021, combining optical coherence tomography (OCT) and optical coherence microscopy (OCM) for the first time in a single instrument, offers the opportunity to develop a multifunctional OCM/OCE system in a compact footprint. The dual-modality instrument will be used as a platform to investigate the impact of lateral resolution and field of view on OCE outputs. Given that no commercial OCE systems are available, there is a strong commercial opportunity to develop an elastography add-on module for the OCX™ product.

Optical Phased Array for Adaptive Free-Space Optical Imaging and Communication
Hui Wu

University of Rochester
L3Harris Technologies | Space & Airborne Systems

We propose to investigate integrated silicon photonic optical phased array (OPA) technologies and develop a new free-space optical (FSO) imaging and communication system to meet the challenges facing conventional FSO systems. We seek to leverage silicon photonic devices; 3D integration; and supporting optics, circuits, and software to develop an OPA-based FSO system for adaptive free-space optical imaging and communication. One of the target applications is ad-hoc FSO communication links at distances up to tens of kilometers and with hundreds of nodes. We expect that the proposed research project will lead to technological breakthroughs for FSO imaging and communication and generate significant economic impacts in New York state and beyond.

Antibacterial surface treatment for pharmaceutical applications

Chunlei Guo
University of Rochester
Pfizer, Inc.

Pfizer is launching a new project to have the principal investigator's lab apply antibacterial surface technology to Pfizer's medical liquid drug and vaccine containers. Pharmaceutical equipment and devices require sanitation and antibacterial surfaces. Recently, the Guo lab at the University of Rochester demonstrated a technique to create sanitation and antibacterial surfaces on a range of materials with laser treatments. In this project, the Guo lab will apply the developed antibacterial technology on surfaces of Pfizer's pharmaceutical containers.

Robotics for Biosensor Assembly
Benjamin Miller

University of Rochester
Phlotonics, Inc..

Phlotonics, Inc. aims to utilize an Epson Pick-and-Place robotic module within the Miller Group for short-term feasibility studies on biosensor device assembly and placement. This will include initial machine setup, programming, and protocol development where individual photonic die will be selected and placed, within a 100 um tolerance, into a final assembly for assays. The output of this pilot effort will be transferred to a partner manufacturing facility in New York state for manufacturing scale-up. This will address an important manufacturing milestone for the company.

High-quality integrated photonic devices on thin film lithium niobate platform

Qiang Lin
University of Rochester
POSPEA, LLC

To design, fabricate, and characterize high-quality integrated photonic devices on thin-film lithium niobate platform, with a special focus on wafer-scale fabrication and manufacturing process.

Analysis of CO₂ emission reduction using solar photovoltaics and viability of carbon credits for distributed systems

Santosh Kurinec
Rochester Institute of Technology
Power2Peer, Inc.

In this research study, we propose to analyze CO₂ emission reductions in using photovoltaics by analyzing exemplary residential rooftop PV systems. This will include emission in production and offsets in usage. Power2Peer is involved with the creation of a marketplace for accounting and marketing of the carbon credits generated by the distributed solar, wind, or geothermal systems. The carbon credits generated by the clean energy generation are assets that can be traded with the corporation seeking to offset generation of the fossil-fuel-based power with the clean energy. A technological solution that enables a marketplace for the growth of climate control by creating substantial incentive to generate clean energy needs to be established by a business case.

Dynamic Optical Return Loss from Optical-Fiber Arrays Under Vibration

Drew Maywar
Rochester Institute of Technology
RAM Photonics, LLC

Next-generation optical-fiber arrays solve communication-capacity issues at interfaces by packing multiple fibers into a small area. The automated manufacturing of such arrays is under development at RAM Photonics. A critical performance metric is the optical return loss (ORL), since reflected light can destabilize upstream optical sources. Although typically measured as a time-averaged quantity, ORL is expected to vary in time due to environmental vibrations, especially for communication systems used within marine, air, and land vehicles. We seek to demonstrate a time-resolved measurement of ORL and provide data to RAM Photonics to improve their fabrication process of optical-fiber arrays.

EV Display™ platform for detection of EV-associated proteins

James McGrath
University of Rochester
SiMPore, Inc.

SiMPore is currently commercializing an extracellular vesicle (EV) biomarker quantitation platform developed by the McGrath lab with prior support from a DOD Idea Award. The EV Display™ platform is being used in four laboratories for a wide range of practical applications. While SiMPore works to scale production and quality control of these devices, there is a demand for protocols that detect colocalization of multiple biomarkers on individual EVs and detection of rare EV biomarkers in complex biofluids. This proposal will develop solutions for detection of these biomarkers on EVs present in blood.

Femtosecond laser-based fabrication of waveguide lasers

Jie Qiao
Rochester Institute of Technology
Aktiwave LLC

The objective of this proposal is to further innovate and demonstrate a waveguide laser, enabled by femtosecond laser inscription of low-loss waveguides in laser materials such Neodymium-doped yttrium aluminum garnet crystals. Performance of waveguide lasers inscribed by both 515nm and 1030nm will be compared. Confinement of light in waveguides with small cross section can significantly lower the lasing threshold in a laser medium and enhance the effective nonlinearity of a nonlinear medium. Many commercial and defense applications require such waveguide lasers for integrated optical circuits on the micron scale, providing weight, power, and cost reductions for spacecraft microprocessors, communication buses, advanced data processing, free-space communications, and integrated optical systems.

Research in Support of High Speed LIRIC Manufacturing Processes at Clerio Vision

Wayne H. Knox
University of Rochester
Clerio Vision, Inc.

Research is proposed in several areas likely to impact the manufacturability of custom contact lenses and other ophthalmic materials of interest to Clerio Vision. First, an extensive testing plan that compares LIRIC writing in dehydrated hydrogels to our current hydrated materials program is proposed. As part of this, it is also proposed to develop new methods to provide direct measurements of thermal contributions to LIRIC writing. Furthermore, new advanced laser methods writing that could lead to very high-speed LIRIC writing of contact lenses are proposed.

Optimization of LIRIC multifocal lens design

Susana Marcos
University of Rochester
Clerio Vision Inc.

Multifocal lenses extend the eye’s depth of focus, restoring vision for near objects in presbyopic patients. However, multifocal optics, in general, come with the trade-off of reduced distance image quality. The goal of this project is to optimize the wavefront design of LIRIC diffractive multifocal optics for presbyopia correction. Several variables have been identified for investigation for minimizing the inherent trade-off of distance image quality with near vision. Furthermore, our goal to improve the optics of multifocal lens designs by reducing unwanted side effects, such as halos and ghosting, will help patients in low-light-level tasks, such as night driving. Adaptive optics vision simulators (AOVS) are a convenient tool for rapidly testing multifocal lens designs because they enable head-to-head comparisons of various designs without the need for fabricating physical lenses. The spatial light modulator (SLM) device within the AOVS is particularly well suited for representing diffractive LIRIC wavefront patterns. The project will investigate visual function and visual quality with SLM-simulated multifocal patterns as a function of two lens design parameters (piston and diffraction efficiency).

Global Surveillance Augmentation for Deep Learning

Andreas Savakis
Rochester Institute of Technology
Kitware

Deep convolutional networks have become the standard in computer vision for image classification tasks. Recently, vision transformer networks, inspired by natural language processing, emerged as an alternative to convolutional networks that offer excellent performance due to their attention mechanism. In this project we propose to investigate visual transformer architectures for domain generalization and adaptation in unconstrained settings where training takes place in a labeled source domain and the model is deployed in a target domain where few or no labels are available.

Optical Phased Array for Adaptive Free-Space Optical Imaging and Communication

Hui Wu
University of Rochester
L3Harris Technologies

We propose to investigate integrated silicon photonic optical phased array (OPA) technologies and develop a new free-space optical (FSO) imaging and communication system to meet the challenges facing conventional FSO systems. Integrated OPAs are becoming the critical building block for future FSO applications, such as lidars for autonomous vehicles, thanks to their advantages in size, weight, and energy consumption as compared to conventional solutions. We seek to leverage silicon photonic devices; 3-D integration; and supporting optics, circuits, and software to develop an OPA-based FSO system for adaptive free-space optical imaging and communication. One of the target applications is ad-hoc FSO communication links at distances up to tens of kilometers and with hundreds of nodes. We expect that the proposed research project will lead to technological breakthroughs for FSO imaging and communication and generate significant economic impacts in New York state and beyond.

Predictive Maintenance for Fault Detection and Diagnosis of VITROS™ Immunoassay Analyzers with Big Data Analytics

Stephen McAleavey
University of Rochester
Ortho Clinical Diagnostics

Ortho Clinical Diagnostics OCDX (now Quidel-Ortho, Inc.) plays a critical role in the global in vitro diagnostics business. OCDX solutions support successful blood transfusions, typing, screening, and COVID testing solutions, including immuno-hematological testing of about 70 percent of the nation’s blood donations. A critical need for OCDX is to be able to deliver accurate and reliable test results while having to perform in a variety of operational conditions that require regular monitoring and maintenance of its instrumentation fleet. The current approach to scheduling maintenance for OCDX analyzers is labor intensive, subject to high service costs, and results in high customer downtimes. This award proposes to develop a suite of autonomous algorithms and infrastructure for the predictive maintenance (PdM) of OCDX biochemical analyzers with Big Data analytics. We propose an artificial intelligence–based

Development of Multi-kW-survivable Fiber Preparation

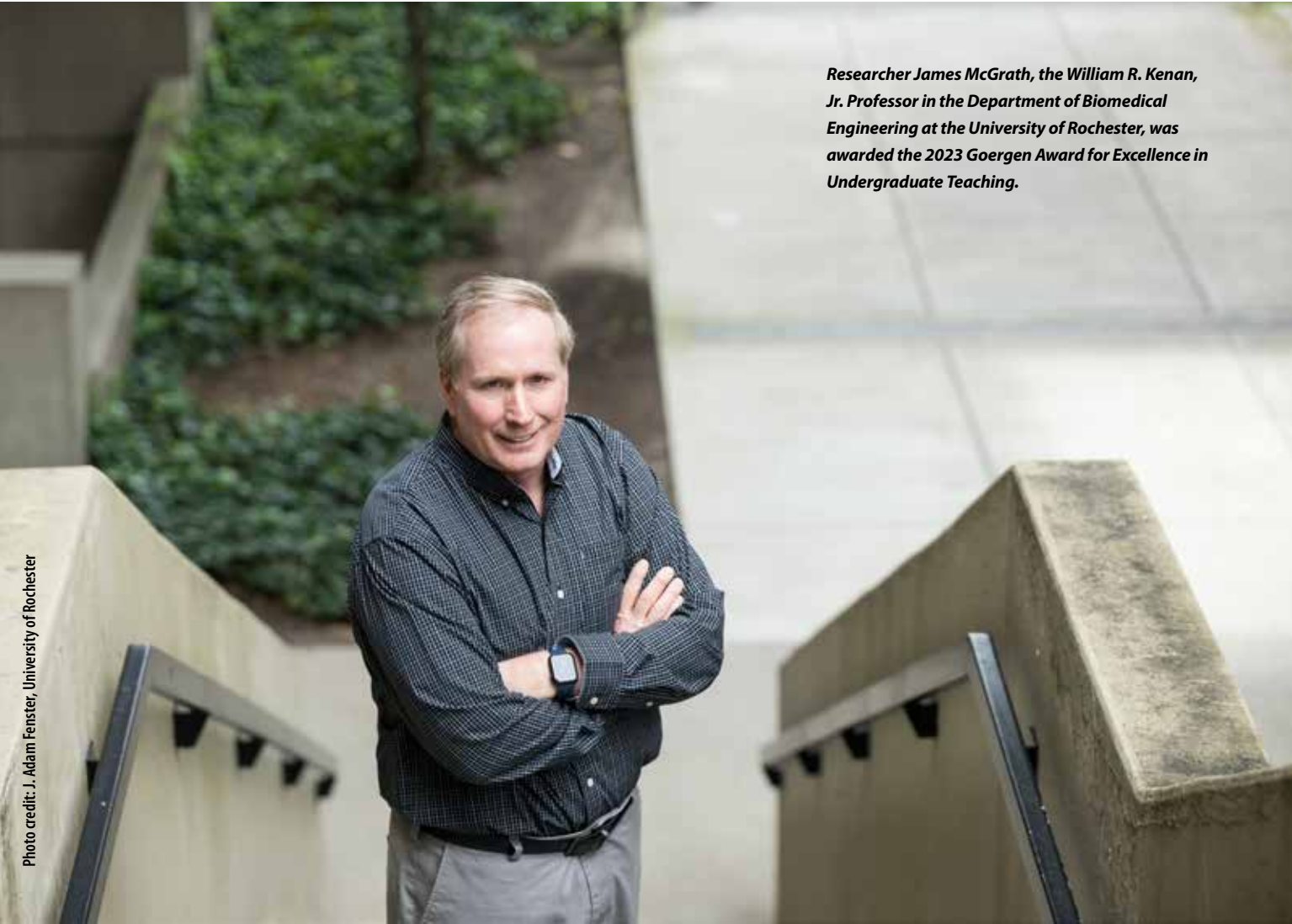
John Marciante
University of Rochester
RAM Photonics LLC

As fiber laser systems move to increasingly higher power levels, manufacturing processes are required to keep up with multi-kW power handling capability that does not rely on subject matter experts. The goal of this project is to develop novel processes for handling, stripping, cleaning, cleaving, and splicing dual-clad optical fibers that are capable of handling multi-kW of optical power transmission. While this is done routinely by subject matter experts in laboratories around the world, the goal of this effort is to develop and define such processes that can be done by non-SMEs and can ideally be automated.

Arrayed μSiM Platforms for Advanced Cell Culture Applications

James McGrath
University of Rochester
SiMPore, Inc.

SiMPore is currently commercializing a cell culture platform developed by the McGrath lab with support from an NIH Phase II Award. The cell culture platform, the μSiM (microfluidic device featuring silicone membrane) is being used in more than a dozen laboratories for a wide range of practical applications. Last year, the McGrath lab distributed components for more than 4000 μSiMs. While SiMPore works to create a commercial solution to meet this demand for single μSiM units, there is a new demand for arrayed systems to increase experimental throughput. This proposal will develop prototype solutions for arrayed μSiM devices.



Researcher James McGrath, the William R. Kenan, Jr. Professor in the Department of Biomedical Engineering at the University of Rochester, was awarded the 2023 Goergen Award for Excellence in Undergraduate Teaching.

CORPORATE PARTNERS



CEIS corporate partner Pfizer's locations in the US and Europe position them well for global distribution of COVID-19 vaccines. The equipment shown is used to formulate the vaccines at Pfizer's facility in Puurs, Belgium.

CORPORATE PARTNERS



ADVANCED GROWING RESOURCES INC.
www.agrsensors.com/

At AGR®, we see the invisible® by bringing revolutionary optical sensing technology to the palm of your hand. We aim to remove guesswork from visual inspection with our proprietary optical scanning platform—Spectre®. AGR® is focused on the analysis of light frequencies, or “colors,” that span beyond what the human eye can see to bring lab-grade material identification to the field. Spectroscopy, or frequency analysis, is only our first step toward changing the way everyday users harness the power of emerging optical technology.



AKTIWAVE LLC
www.aktiwave.com

Aktiwave LLC is dedicated to providing customized optical components and consulting services in optical technologies. Our beam shapers and coronagraphs have been used in a large variety of applications such as astronomy and laser engineering. We have experience in a wide range of domains such as optical system design and modeling, optical pulse diagnostic for ultrafast and telecommunication systems, spatial and temporal shaping, and intellectual property analysis.



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 brass.



ALLVAR ALLOYS
www.allvaralloys.com/

ALLVAR was founded in 2014 and manufactures revolutionary metal alloys. The unique negative thermal expansion of these alloys helps compensate for and eliminate the detrimental effects thermal expansion has in a variety of applications. Negative thermal expansion alloys can be used to athermalize optic designs, reduce thermal stress in assemblies, maintain a constant force load, and maintain thermal stability. We currently offer our negative expansion alloys in bar (up to 2.25” round) and tube (up to 3.00” OD), depending on wall thickness. We also offer thermal compensating washers and spacers to maintain constant preloads to control the margin of safety of bolted joints. These negative thermal expansion washers and spacers are available as Type B washers and in custom sizes.



AN JORDAN SCIENTIFIC, LLC

A.N. Jordan Scientific is a scientific consulting company based in Rochester, New York, focused on precision measurements with optics as well as developing new sensors.



CARESTREAM
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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.

CORPORATE PARTNERS



CLERIO VISION, INC.
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 noninvasively. 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, INC.
www.corning.com

Corning, Inc. 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.



DINAMICOR
www.dinamicor.com

DinamicOR is a medical equipment manufacturer whose mission is to standardize operating room organization with an ergonomic and intuitive Workflow Management System—improving the efficiency and reproducibility of surgical processes, which will enable perioperative staff to focus on providing thoughtful patient care.

ENTRY POINT TECHNOLOGIES

Entry Point Technologies was formed after the Las Vegas mass shooting to explore technology for detecting concealed weapons at a distance.



FLUOR MARINE PROPULSION, LLC
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Fluor Corporation is building a better world by applying world-class expertise to solve its clients’ greatest challenges. Fluor’s 40,000 employees provide professional and technical solutions that deliver safe, well-executed, capital-efficient projects to clients around the world. In 2023, Fluor was ranked 303 among the Fortune 500 companies. With headquarters in Irving, Texas, Fluor has provided engineering, procurement, and construction services for more than 110 years.



IMAGINANT, INC.
www.kodakalaris.com/en-us

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

CORPORATE PARTNERS



KITWARE, INC.
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.



L3HARRIS TECHNOLOGIES
www.l3harris.com

L3Harris Technologies is an agile global aerospace and defense technology innovator, delivering end-to-end solutions that meet customers’ mission-critical needs. We provide advanced defense and commercial technologies across air, land, sea, space, and cyber domains. We bring speed, innovation, and flawless execution together with our commitment to make the world safer and more secure.



L&C ORTHOPEDIC & INNOVATION (LCOI)
www.lcorthopedicsinnovation.com

L&C Orthopedics & Innovation was founded in 2016 with a focus in bio-mechanical analysis of individuals in the orthopedics and sports performance world. Our goal is to use automated software to guide rehabilitation, prevent injuries, and improve sports performance to benefit individuals and clinics.



LIGHTOPTECH
www.lightoptech.com

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



OPTIMAX SYSTEMS, INC.
www.optimaxsi.com

Founded in 1991, Optimax continues to enhance its unique capabilities for fast, reliable delivery of precision optics with superior quality and service, enabling customer success and employee prosperity. We leverage our optics manufacturing technology for programs that benefit mankind and projects that defend our freedom. Our know-how, innovation, and speed enable quicker production of precision optics to meet emerging market needs. Some of the most sophisticated programs in the world trust Optimax to produce the most complex optics reliably.



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.

CORPORATE PARTNERS



ORTHO CLINICAL DIAGNOSTICS
www.orthoclinicaldiagnostics.com

Ortho Clinical Diagnostics is an in vitro diagnostics company that makes products and diagnostic equipment for blood testing. Ortho serves two primary industries in the medical field: clinical laboratories, by producing platforms and assays that test for a variety of diseases, conditions, and substances; and immunohematology, by providing the means to ensure blood transfusion recipients receive appropriate and compatible blood.



OVITZ
www.o-vitz.com

Ovitz Corporation 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.



PARVERIO INC.
www.parverio.com/

Parverio was founded to address the rising containment known as microplastics. With our revolutionary technology, we aim to bring microplastic testing and awareness to concerned individuals everywhere.



PFIZER INC.
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Pfizer Inc. is an American multinational pharmaceutical and biotechnology corporation in relentless pursuit of breakthroughs that change patients' lives. We innovate every day to make the world a healthier place. It was Charles Pfizer's vision at the beginning and it holds true today.



PHLOTONICS, INC.
www.phlotonics.com/

Phlotonics designs integrated photonics for point-of-care diagnostics.

POSPEA, LLC
www.pospea.com/

POSPEA is dedicated to developing narrow linewidth, broadband tuning lasers and aims to fill the need of LiDAR and 3-D display used on robotics and self-driving cars. Functionalities of nanophotonic devices/ circuits rely crucially on the properties of underlying device materials. We explore new material platforms with outstanding characteristics (electrical, optical, mechanical, thermal, etc.) for diverse applications, with specific focus currently on lithium niobate.



POWER2PEER, INC
www.power2peer.com/

Power2Peer is leading the charge to a greener future. Founded in 2018 by veteran innovator Dr. Nish Sonwalkar (MIT), our diverse staff has decades of experience in clean energy innovation, software design, and systems management. Our team of experts developed a platform that makes it easier than ever for solar and other renewable energy sources to take hold of the market. By enhancing returns on capital investments in renewable energy while simultaneously reducing energy costs for consumers who opt into the clean energy marketplace, Power2Peer is providing a market-oriented solution to the looming climate crisis.

CORPORATE PARTNERS



RAM PHOTONICS, LLC
www.ramphotonics.com

RAM Photonics, LLC, was founded in 2009 for the express purpose of transitioning high-risk technology into commercial hardware. The company portfolio includes specialty optical and optoelectronic systems for defense, commercial, and industrial applications, including advanced signal processing, high-power laser, and instrumentation systems. Our company focuses on translational R&D, developing commercial-grade modules for technical risk reduction and technology demonstrations, intellectual property directly coupled with targeted technologies, and robust and reliable commercial hardware for sale to the general public.



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.



SUNDENSITY, INC.
www.sundensity.net

SunDensity Inc. produces photonic smart coatings (PSC) for utility solar power producers who need to reduce the cost of energy. Their nano-optical coating improves PV efficiency by downshifting UV rays for greater power output from solar modules, thus lowering overall power costs and accelerating solar energy adoption into the next generation of clean power.



THERMO FISHER SCIENTIFIC, INC.
www.thermofisher.com

Thermo Fisher Scientific Inc. 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. We offer an unmatched combination of innovative technologies, purchasing convenience, and comprehensive support.



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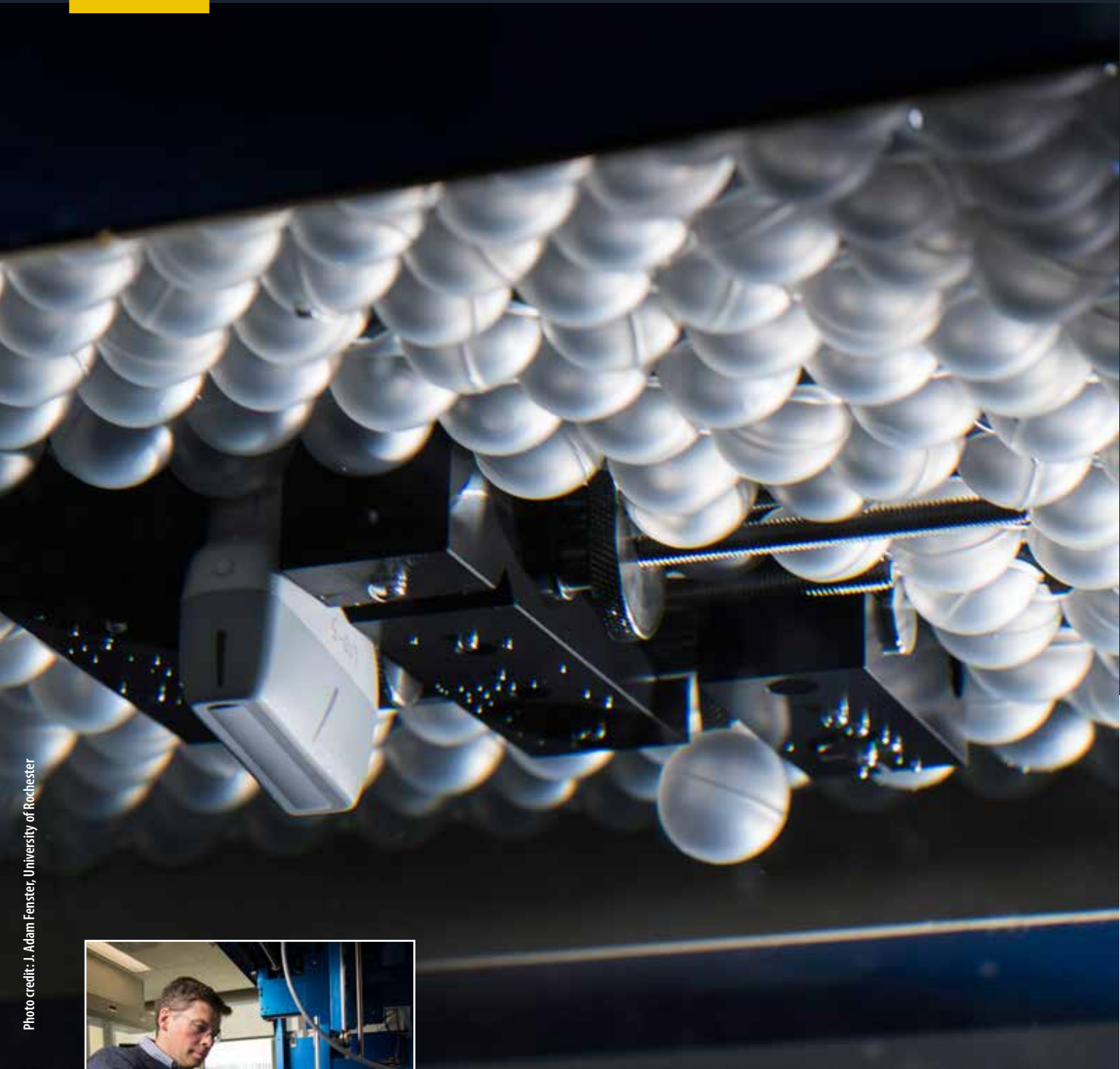
When unsure of a diagnosis, VisualDx is the go-to tool for fast, accurate decision making. Quickly build a differential to evaluate the possibilities, compare variations, and improve diagnostic accuracy at the point of care. VisualDx is the leader in clinical decision support, used in more than 1,500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



WETWARE BIOSYSTEMS, LLC
www.wetwarebiosystems.com

WetWare BioSystems, LLC is an early stage biotechnology firm located in Rochester, New York, dedicated to the invention, research, and distribution of technologies aimed at addressing Traumatic Brain Injury (TBI) in the defense and civilian sector. Our portfolio of devices provides a potential means to arrest TBI in a number of use scenarios, including improvised explosive device (IED) blast, first response to blunt impacts, and explosive munitions training for soldiers.

FACULTY RESEARCHERS



Stephen McAleavey, the chair of the biomedical engineering department and an associate professor of biomedical engineering and of electrical and computer engineering at the University of Rochester, is photographed in his lab with a tank used to measure the acoustic field of an ultrasound transducer, allowing for degassed and deionized water. Plastic balls (viewed from below in the large photo) prevent oxygenation of the water.

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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 Multimedia signal processing, Imaging microelectronics, Wireless sensors

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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THOMAS BROWN



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Education PhD, University of Rochester, Optics, 1987; BS, Gordon College, Physics, 1979

Research Interests Optical polarization and metrology, Optoelectronic modeling Integrated optoelectronics

Recent Research Projects Adaptive Nulling for Steep Aspheres using a Holographic Reference Surface, Focusing and coherence properties of polarization vortex beams, Stress-engineered optical elements, Polarization properties of nanostructures, Waveguide mode resonances in SOI waveguides

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Research Interests Photonic packaging, 2D materials, Integrated photonics, Nonlinear photonics, On-chip quantum photonics

Recent Research Projects Integrated optical frequency detection and weak value amplification, Fiber-to-chip fusion splicing for low-loss photonic packaging, Carrier envelope offset detection via simultaneous supercontinuum and second-harmonic generation in a silicon nitride waveguide, A reconfigurable nanophotonics platform for sub-millisecond, deep brain neural stimulation

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SCOTT CARNEY



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Research Interests Computed imaging, Spectroscopy, Coherence theory

Recent Research Projects Light scattering by plasmonic disks and holes arrays: different or the same?, Metal-Dielectric-Enhanced Upconversion: Going “Meso,” clustering diffused-particle method for simulating electromagnetic fields among large ensembles of electromagnetically polarizable particles

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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 Mechanical behavior of novel materials, Diffusion-bonded high-temperature alloys, Polymers used in human tissue simulations

Recent Research Projects The TEAK Project: Students as Teachers, Terrain characterization using modified RANSAC analysis of human gait data, Minimum constraint design analysis and modification of a biaxial tensile test fixture for hyperelastic materials

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Research Interests Neuro-ophthalmology, Oculofacial plastics and orbital surgery

Recent Research Projects Efficacy of visual training for recovering sight in stroke patients, 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 Refining and validating a model to characterize shape changes due to LIRIC writing on cornea, 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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Education PhD, Boston University, Biomedical Engineering, 1996; MS, Boston University, Biomedical Engineering, 1988; BS, Boston University, Biomedical Engineering, 1985

Research Interests Vestibulo-collic reflexes (VCR), Neural mechanisms underlying postural control, Vestibulo-spinal (VS) pathways

Recent Research Projects A testing platform to evaluate thermal profiles of balloon catheter-based bipolar radiofrequency ablation devices in the treatment of resistant hypertension, Photodynamic antimicrobial polymers for infection control

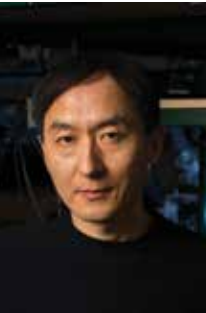
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Research Interests Structural acoustics and vibration, Loudspeaker design, Audio signal processing perception, Spatial audio
Recent Research Projects Measures of vibrational localization on point-driven flat-panel loudspeakers, The evolution and design of flat-panel loudspeakers for audio reproduction, Near-field object-based audio rendering on flat-panel displays
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Research Interests Multimedia communication, Wireless sensor networks, RFID systems, Cloud computing, Heterogeneous networking
Recent Research Projects Support for distributed computing and network management in mobile ad hoc networks, 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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Research Interests Silicon device integration on nontraditional substrates, Metal-oxide semiconductors for thin-film electronics, Silicon-based optoelectronics
Recent Research Projects MicroLED display technology development, 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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KRYSTEL HUXLIN



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Education PhD, University of Sydney, Neuroscience, 1994; BS (Med), University of Sydney, Neuroscience, 1991
Research Interests Optics of the eye, Femtosecond laser micro-machining in cornea and lens, Visual perception and psychophysics, Biomedical imaging
Recent Research Projects Biological Impact of LIRIC in the cornea, 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, Imaging Science, Rochester Institute of Technology, 2005; MS, Imaging Science, Rochester Institute of Technology, 1999; BS, Imaging Science, Rochester Institute of Technology, 1996; AAS, Optical Engineering, Monroe Community College, 1989
Research Interests Global surveillance augmentation for deep learning, Low-Light-Level (LLL) modeling, Incorporation of LiDAR and physics-based (target) modeling into structured hybrid hyperspectral sub-pixel detection algorithms with the addition of a geometric infeasibility metric
Recent Research Projects Global surveillance augmentation for deep learning, Atmospheric and radiative transfer modeling, Scattering from small particles related to bio-aerosols, Long-wave spectral variability, Remote sensing instrumentation and sensor calibration, Advanced atmospheric compensation, Spectral bi-directional reflectance (BRDF) measurements and modeling from objects such as vehicles
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Research Interests A/D conversion, CMOS analog circuits, Low power circuit architectures, Image sensors
Recent Research Projects Compressive beamforming for portable ultrasound, 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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Research Interests Ultrafast laser physics and prototyping, Femtosecond micromachining and applications in vision science, dispersion micromanagement in holey and photonic crystal fibers, Ultra-short pulse lasers, Novel fiber components based on fiber tapering, Dispersion compensation devices High nonlinearity fiber devices, Ultrafast mid-infrared sources, Dispersion—limits, measurements, compensation schemes, Biomedical optics

Recent Research Projects Multiphoton LIRIC: modeling, scaling, and material modification studies, Femtosecond micromachining of ophthalmic polymers

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Education PhD, Mechanical Engineering, University of Michigan, 1996; BS, Mechanical Engineering, University of Delaware, 1990; BS, Textile Science, Apparel Design, 1983

Research Interests Role of gender, obesity, ethnicity, activities, and meniscal injuries in the development of osteoarthritis, Using models based on medical imaging techniques such as micro-computed tomography and magnetic resonance

Recent Research Projects Refining and validating a model to characterize shape changes due to LIRIC writing on cornea, Biomechanical modeling of the human cornea, Characterizing growth of the knee joint, Finite element models of the knee meniscus, Knee flexion mechanics, Modeling vision correction with LIRIC writing modalities, MR imaging of musculoskeletal joints and bone properties, Understanding the risks for knee osteoarthritis

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Research Interests Fundamental physics of novel nonlinear optical, quantum optical, and optomechanical phenomena in micro-/nanoscopic photonic structures, Chip-scale photonic signal processing in both classical and quantum regimes

Recent Research Projects Perfect soliton crystals on demand, Athermal lithium niobate microresonator, Shallow-etched thin-film lithium niobate waveguides for highly efficient second-harmonic generation, Silicon carbide zipper photonic crystal optomechanical cavities

JIEBO LUO



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Education PhD, University of Rochester, Electrical Engineering, 1995; MS, Electrical Engineering, University of Science & Technology (China) 1992; BS, Electrical Engineering, University of Science & Technology (China) 1989

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

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

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KARA MAKI



Associate Professor, School of Mathematical Sciences, Rochester Institute of Technology

Education PhD, University of Delaware, Applied Mathematics, 2009; MS, University of Delaware, Applied Mathematics, 2006; BS, University of New Hampshire, Mathematics, 2003

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 Improved mathematical modeling and computer simulation of contact lens dynamics, Effect of contact lens distortion on exchange of tears, Model for suction pressure under a contact lens

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Associate Professor of Optics, Laser and Photonic Systems Group, University of Rochester

Education PhD, University of Rochester, Optics, 1997; MS, University of Rochester, Optics 1992; BS, University of Illinois at Urbana-Champaign, Engineering Physics, 1991

Research Interests Large-mode area fibers, High-efficiency high-power fiber lasers and amplifiers, High-power ultrafast fiber lasers, Fiber lasers at exotics wavelengths, Brightness improvement of high-power semiconductor lasers, Power scaling/beam combining of fiber and semiconductor lasers

Recent Research Projects Review of ultrafast fiber oscillators based on Mamyshev and dissipative soliton resonance mechanisms, Observations of spatial coherence collapse in high-power, broad-area lasers using fiber-assisted self-heterodyning

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Education PhD, University of Salamanca, Physics, 1996; MS, University of Salamanca, Physics, 1992; BS, University of Salamanca

Research Interests Visual optics, Ocular imaging

Recent Research Projects Functional integration of eye tissues and refractive eye development mechanisms and pathways, Vision with spatial light modulator simulating multifocal contact lenses in an adaptive optics system, Simulating outcomes of cataract surgery: important advances in ophthalmology

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Education PhD, Optical Engineering, University of Rochester, 2000; MS, Optical Engineering, University of Rochester, 1997; BS, Optical Engineering/BA, Religion, University of Rochester, 1993

Research Interests Fiber-optic communication systems, Optical and photonic components, Optical phenomena and physical processes

Recent Research Projects Image processing for optical weld-joint failure protection, Avionic fiber-optic networks, Improved RF-signal propagation over fiber, Terabit-per-second fiber-optic system, Metamaterial distributed feedback lasers, All-optical data-wavelength converters, All-optical digital gates, Optical-domain RF spectrum analyzer, Nonlinear dynamics of polarization rotation, Time transformation, Adiabatic wavelength conversion, Self-phase modulation, Four-wave mixing

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Education PhD, University of Rochester, Electrical and Computer Engineering, 2002; MS, University of Rochester, Electrical and Computer Engineering, 1998; BS, University of Rochester, Electrical and Computer Engineering, 1996

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 Development of novel, clinically applicable ultrasound imaging techniques, Acoustic radiation force imaging techniques, Spatially modulated ultrasound radiation (SMURF) imaging, Single tracking location (STL), Shear wave elastography imaging (SWEI)

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Education PhD, Division of Health Sciences and Technology, Harvard/MIT, 1998; MS, Massachusetts Institute of Technology, Mechanical Engineering, 1994; BS, Arizona State University, Mechanical Engineering, 1991

Research Interests Nanoparticle and molecular separations, Nanotechnology, MEMS and micro fabrication, Cell culture technologies, Biological tissue models, Small format hemodialysis, Biosensors, Electrokinetic devices

Recent Research Projects 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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Education PhD, Stanford University, Organic Chemistry, 1994; BS, Chemistry/BA, Mathematics, German, Miami University, 1988

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

Recent Research Projects Control of biomolecular interactions through the synthesis of new small-molecule probes and the observation of biomolecular interactions through the development of novel optical sensing technologies, In the area of control 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 quantum dot coated detector arrays, 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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Education PhD, Electrical Engineering, Biomedical Concentration, Massachusetts Institute of Technology, 1981; MS, Electrical Engineering, Massachusetts Institute of Technology, 1978; BS, State University of New York at Buffalo, 1976

Research Interests Medical imaging, Image processing, Novel scanning techniques, Fundamentals of wave propagation with signal and image processing techniques

Recent Research Projects Techniques and methods for Gabor-domain optical coherence elastography, The blue noise mask, The development of sonoelastography, The development of crawling waves, Tissue biomechanics and the microchannel flow model, The H-scan for identification of scatterers, The reverberant shear wave fields, The needle pulse, OCT elastography, Enhanced resolution, Advanced 3D-4D analytics, The new view of tissue scattering

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STEFAN PREBLE



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Research Interests Silicon photonics, Quantum optics

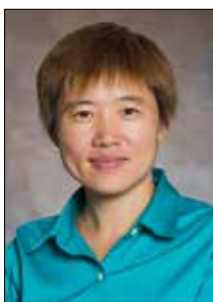
Recent Research Projects Integrated quantum photonics for photon-entanglement, System, device and method for aligning and attaching optical fibers, High extinction ratio microring modulator, Highly-confined, low-loss visible photonics using foundry-fabricated silicon nitride circuits

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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 Femtosecond laser-based fabrication of photonic waveguides toward wavelength lasers, Development and investigation of an integrated laser-based optics polishing and manufacturing technology, Laser polishing for additive manufacturing

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FACULTY RESEARCHERS

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Research Interests Theoretical and application-oriented research topics covering several aspects within the fields of ergonomics, biomechanics, work physiology, safety, and rehabilitation

Recent Research Projects Lumbar time-varying muscle synergies in trunk flexion and bending movements at different velocities, A systematic review of fall risk factors in stroke survivors toward improved assessment platforms and protocols, Abstract TP61: Can a single motion sensor identify lower limb movement alterations among stroke survivors?

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Education PhD, University of Arizona, Optical Science, 1990; MA, University of Arizona, Optical Science, 1987; Diplôme Grandes Ecoles, Institut d’Optique (France), 1984

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

Recent Research Projects Techniques and methods for Gabor-domain optical coherence elastography, 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 Real-time computer vision, Multimedia systems, Medical imaging

Recent Research Projects Global surveillance augmentation for deep learning, 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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Education ScD, Polish Academy of Sciences, Physics, 1992; PhD, Polish Academy of Sciences, Physics, 1983; MS, Warsaw Technical University, 1975

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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Education PhD, University of Padova (Italy), Information Engineering, 2012; MSc, University of Padova (Italy), Computer Engineering, 2008; BSc, University of Padova (Italy), Computer Engineering, 2005

Research Interests Wireless communication and networking, Mobile cloud computing, Smart and connected health care solutions, Stochastic modeling and optimization, Design of novel techniques to facilitate the development and diffusion of smart and connected health care solutions

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

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NICK VAMIVAKAS



Professor of Quantum Optics and Quantum Physics, University of Rochester

Education PhD, Boston University, Electrical Engineering, 2008; BS, Boston University, Electrical Engineering, 2001

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

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

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Clinical Assistant Professor of Ophthalmology, University of Rochester

Education Fellowship, SUNY College of Optometry, 2002; OD, SUNY College of Optometry, 2001; BS, McMaster University, Biochemistry, 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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HUI WU



Professor of Electrical and Computer Engineering, University of Rochester

Education PhD, Electrical Engineering, California Institute of Technology, 2003; MS, Microelectronics, Tsinghua University, Beijing, 1998; BS, Tsinghua University, Beijing, 1998

Research Interests Wireless sensors for smart health care, Spintronic and nanoelectric integrated circuits, On-chip interconnect and power distribution for high performance

microprocessors, Silicon photonics, optical interconnect and electronic-photonic integrated circuits, High-performance clock generation and distribution, High-speed and ultra-wideband integrated circuits, High-speed passive devices and on-chip interconnect

Recent Research Projects Optical phased array for adaptive free-space optical imaging, Free-space optical interconnect for future microprocessors, Transmission-line based shared-medium on-chip electrical interconnect, Ultrafast pulse generation, filtering and modulation, Ultrafast pulse shaping for Omega laser system, Injection-locked clocking, High-speed silicon photodetectors in standard CMOS, Ultra-wideband (UWB) impulse radios, CMOS-compatible on-chip transmission lines, Integrated microwave passive devices

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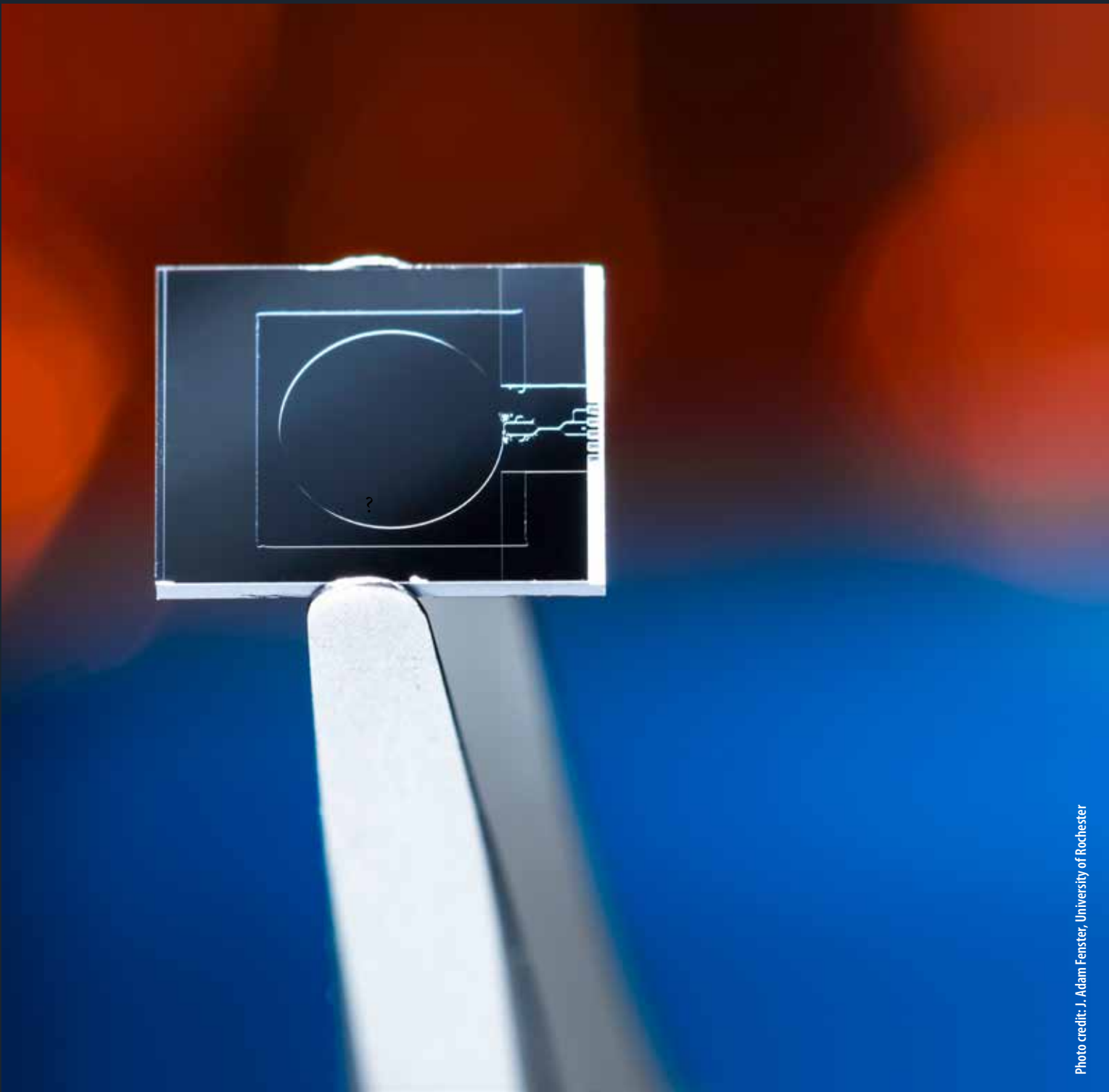
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With a grant from the National Science Foundation, University of Rochester researchers are developing photonic chips that use a quantum technique called weak value amplification to replace the mechanical gyroscopes used in drones, enabling them to fly where GPS signals are jammed or unavailable.

Photo credit: J. Adam Fenster, University of Rochester

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Cover image: Pictured is an integrated pockels laser assembly in the lab of Qiang Lin, a professor of electrical and computer engineering at the University of Rochester. A research team led by Lin has developed the first multicolor integrated laser. The technology will pave the way for new applications of integrated semiconductor lasers in LiDAR (Light Detection and Ranging) remote sensing that is used, for example, in self-driving cars. The technology could also lead to advances in augmented reality and virtual reality, microwave photonics, and atomic physics.



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