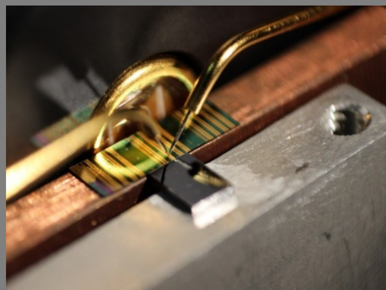
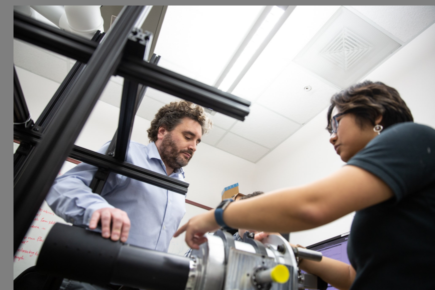
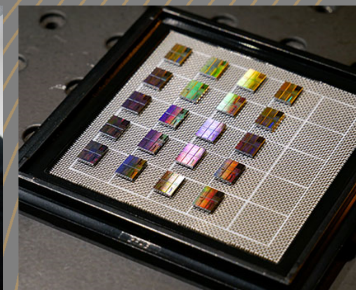
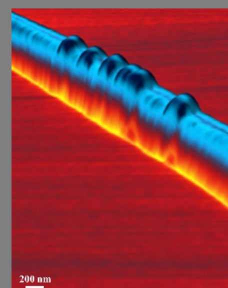
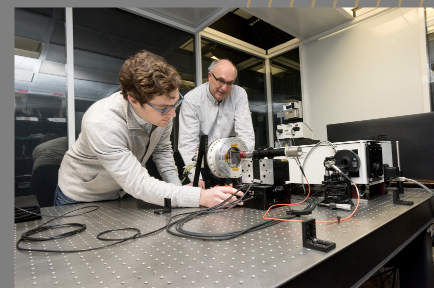
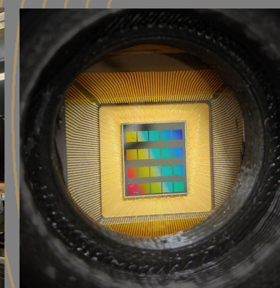
FUTURE PHOTON INITIATIVE

ritphotonics

RIT | Rochester Institute of Technology

Members | Research | Facilities

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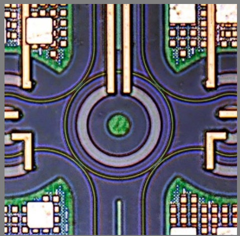
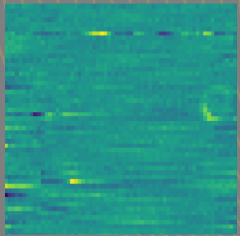
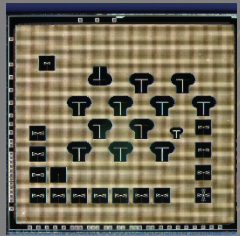
RIT Future Photon Initiative

The Future Photon Initiative (FPI) develops photonic devices in pursuit of answers to grand questions, leveraging efforts of existing RIT research groups who develop technology for the generation, transmission, manipulation, absorption, and detection of photons.



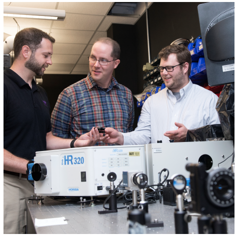




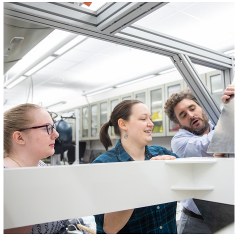
Research Members

FPI cross-disciplinary teams collaborate with external university groups, industry, and national laboratories to develop and commercialize new photonic device technology.

5 colleges
12 research groups



12 dedicated labs



50 students
21 professors

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Mishkatul Bhattacharya

Associate Professor | School of Physics & Astronomy

Dr. Bhattacharya researches the interplay of electromagnetic modes of radiation, such as laser light, with nanofabricated components, such as mechanical oscillators and rotors. Goals of his group are the cooling of macroscopic objects into the quantum regime and establishing the limits to quantum sensing of mechanical displacement, force, and rotation.

Richard DeMartino

Professor | Management
Director | Simone Center for Innovation and Entrepreneurship

Dr. DeMartino researches and teaches entrepreneurial motivations, technology commercialization, and small business growth. He continues to research the entrepreneurial motivations of the deaf community, in conjunction with RIT's National Technical Institute for the Deaf (NTID).

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rdemartino@saunders.rit.edu

Members

Don Figer

Director | Future Photon Initiative
Director | Center for Detectors
Professor | College of Science

Dr. Figer researches massive stars, massive star clusters, the Galactic center and advanced detectors for cross-disciplinary applications. Some of his other research interests include developing integrated sensor systems on a wafer and single-photon-sensing detectors that can also count photon numbers.

Ed Hach

Assistant Professor | School of Physics & Astronomy

Dr. Hach researches quantum information processing using entanglement as a practical manageable resource. His work considers single and multi-photon interactions that provide higher sensitivity and lower power operation than electronic components with similar functionality. He also investigates continuous variable quantum systems for use in quantum information in processing systems.

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eehsps@rit.edu

Karl Hirschman

Director | Semiconductor & Microsystems Fabrication Laboratory
Professor | Elec. & Microelectronic Eng.

Dr. Hirschman researches silicon and metal-oxide thin-film electronics in the Thin Film Electronics group. The group's thin-film transistors using sputter-deposited Indium-Gallium-Zinc-Oxide demonstrate results among the best reported in the literature. His current research focuses on low-temperature polycrystalline silicon to explore alternative methods of crystallization using a flash-lamp annealing process.

Gregory Howland

Assistant Professor | School of Physics & Astronomy

Dr. Howland studies how to create, manipulate, and detect quantum mechanical phenomena in the spatial degrees-of-freedom of quantum light. His research focuses on high-dimensional quantum information science in photonic systems, with a current emphasis on quantum integrated photonic circuits. Dr. Howland plays a major role in the Center for Detectors and FPI quantum activities.

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Seth Hubbard

Director | NanoPower Research Labs
Professor | School of Physics & Astronomy | Microsystems Engineering PhD

Dr. Hubbard leads a team of undergraduate and graduate students and research staff working on the design, epitaxial growth, fabrication, and characterization of nanostructured solar photovoltaic devices. He has received over $10M in external research funds, authored or co-authored over 170 journal and conference publications, and received an NSF CAREER Award as well as the RIT Trustee Scholarship Award.

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Santosh Kurinec

Professor | Electrical & Microelectronic Engineering

Dr. Kurinec's research activities include nonvolatile memory, photovoltaics, advanced integrated circuit materials and processes. Her nonvolatile memory research has focused on magnetic tunneling and phase change memory devices. Her photovoltaics research is collaborative with other research centers, where she brings her experience of integrating a wide range of electronic materials on silicon platforms.

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Cristian Linte

Associate Professor | Biomedical Engineering

Dr. Linte's research interests focus on exploring the use of medical imaging to generate new paradigms for image-guided visualization and navigation for minimally invasive therapy. His research endeavors employ both technologies and techniques toward the development, evaluation, and pre-clinical integration of image guidance environments for surgical navigation of minimally invasive cardiac interventions.

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Drew Maywar

Associate Professor | Electrical, Computer, and Telecommunications Engineering Technology

Dr. Maywar researches fiber-optic networks and communication systems, all-optical signal processing, photonics and opto-electronics, optical phenomenon, and nonlinear optics. His Photonics Systems Research group investigates both digital and analog optical-communication systems, with particular interest in polarization diversity, multi-level phase and power modulation schemes, and nonlinear optical-domain signal processing.

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Parsian Mohseni

Assistant Professor | Microsystems Engineering PhD

Dr. Mohseni's research interests are cross-disciplinary in nature, spanning the fields of solid state physics, optoelectronics, materials characterization, nano-engineering, and physical chemistry. His research aims to establish innovative synthesis paradigms that allow for precise manipulation of material properties at the nanometer scale and enable next-generation device technologies in optoelectronics, photonics, nanoelectronics, and photovoltaic energy conversion.

Raj Murthy

Associate Professor | MIS, Marketing, and Digital Business

Dr. Murthy's research is tied strongly to his experience and his teaching interests in the domain of quantitative analytics, research methods, and branding. His primary area of interest is in the design and execution of data driven consumer engagement strategies. His expertise encompasses consulting engagements across various companies including Sprint, The World Bank, Dun & Bradstreet, Nuance Communications, and Cognizant Technology Solutions.

pkmohseni@rit.edu

rajsmurthy@saunders.rit.edu

Zoran Ninkov

Professor | Chester F. Carlson Center for Imaging Science

Dr. Ninkov researches and develops instruments and detectors for astronomy, remote sensing, and other applications. His group is developing digital micromirror devices for use in space, Terahertz detector technology for inspection applications, and quantum dot coated detector arrays for enhanced deep ultraviolet sensitivity. He and his team are building a multi-object spectrograph for the SOAR 4.1 meter telescope in Chile.

Robert Pearson

Associate Professor | Electrical and Microelectronic Engineering

Dr. Pearson researches semiconductor processing, device characterization, micro-electro-mechanical systems design, device simulation, fabrication and testing. Dr. Pearson teaches VLSI design, semiconductor processing, semiconductor devices, memory systems, and electronics.

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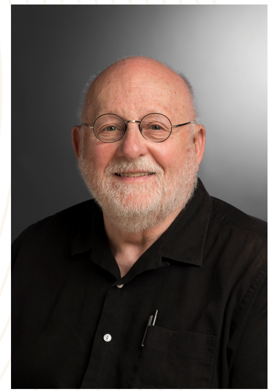
Members

Stefan Preble

Professor | Microsystems Engineering PhD

Dr. Preble researches silicon photonic devices with the goal of realizing applications that leverage high speed, high bandwidth, and sensitivity of light. His Integrated Photonics group develops silicon photonic chips that will revolutionize computing, communication, and sensing systems. The group's key research areas are optical interconnects for chip-to-chip and on-chip low energy communications, silicon compatible nonlinear optics, quantum optical computing and communication, and ultra-sensitive optical sensing.



R. Roger Remington

Director | Vignelli Center
Distinguished Professor of Design | Vignelli Center

Remington has been seriously engaged in the research, interpretation and preservation of the history of graphic design. At RIT he developed a unique scholarly resource, the Graphic Design Archive. This project involves preserving and interpreting the original source materials of 27 American Modernist design pioneers such as Lester Beall, Will Burtin, Cipe Pineles, William Golden and Alvin Lustig among others.

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Professor | Chester F. Carlson Center for Imaging Science

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Michael Zemcov

Assistant Professor | School of Physics & Astronomy

Dr. Zemcov's research focus is instrumentation for cosmological observations, including the cosmic microwave and infra-red backgrounds. He develops instruments and data analysis methods for a variety of platforms, including ground-based, sub-orbital rockets, and orbital observatories. Additional research areas in his group are the epoch of reionization, secondary anisotropies in the cosmic microwave background, and studies of the history of the star formation in the Universe using novel techniques and experiments.

Jing Zhang

Assistant Professor | Electrical and Microelectronic Engineering

Dr. Zhang's research focuses on developing highly efficient III-Nitride and GaO semiconductor based photonic, optoelectronic, and electronic devices. Her research group is working on the development of novel quantum well active regions and substrates for enabling high-performance ultraviolet and visible LEDs/ lasers, as well as engineering of advanced device concepts for nanoelectronics.

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Members

Ben Zwickl

Assistant Professor | School of Physics & Astronomy

Dr. Zwickl researches how students develop experimental and research skills in the undergraduate curriculum and how those skills are applied after graduation. His group investigates the early careers of technicians, engineers, and researchers in optics and photonics to better understand the transition from school to career.

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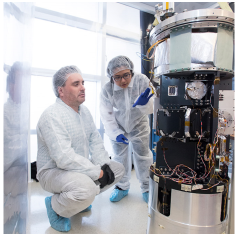
Research Areas

FPI applies and commercializes the efforts of existing RIT groups who develop technology for the generation, transmission, manipulation, absorption, and detection of photons. Our activities strengthen some of the strongest applied research groups at RIT while providing new conduits between those groups and commercialization opportunities.

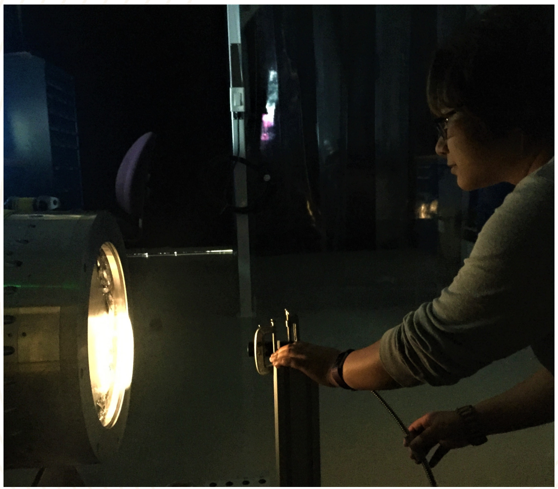


5 research thrusts

$28M external research funding

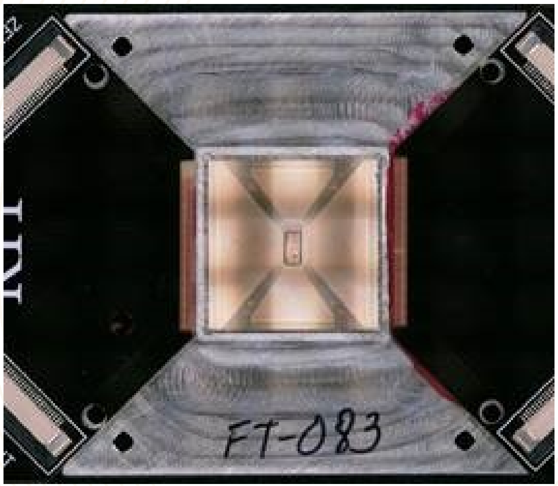
30 industry and academic partners

Suborbital Astrophysics Lab



The Suborbital Astrophysics Laboratory designs, integrates, and calibrates sounding rocket payloads for astrophysical science. It includes clean facilities to allow disassembly and assembly of rocket instruments, optical and electronic development and validation instruments, and cryogenic and vacuum capabilities.

Integrated Photonics



Integrating photons onto microchips for computing, energy, communications, and sensing challenges of the future

photon-ion entanglement, integrated photonics education, hybrid silicon electronic photonic integrated neuromorphic networks, AIM photonics development, wideband RF photonic link with real-time digital post processing, integration on interposer/chip

Photovoltaics

Improving the efficiency at which photovoltaics convert sunlight into electricity

solar cells, III-V nanowire array on silicon tandem junctions solar cells, high efficiency and radiation hard solar cells, development of high efficiency ultraviolet optoelectronics

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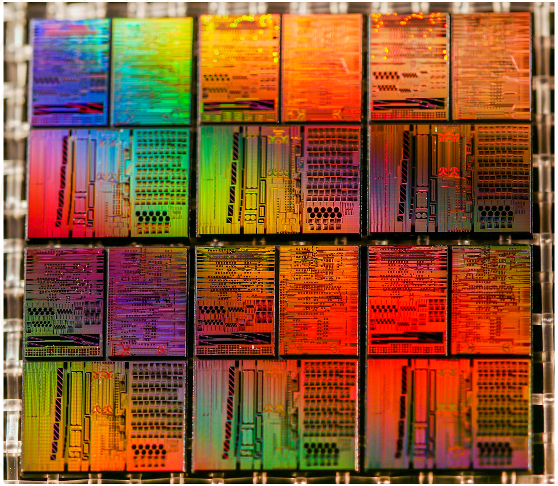
Research Areas

RIT

Quantum



Developing quantum photonic devices for quantum computing, communication, and sensing

quantum workface and education, quantum dot emitters, quantum dot detectors, on-chip quantum photonic sensors using entangled photons and squeezed states, theory of precision quantum sensing, high-dimensional quantum information science

RIT

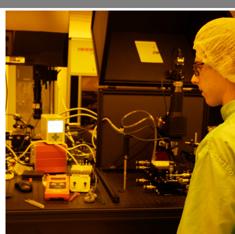
Scaled Electronics

Building structures in electronic devices that approach the single nanometer scale

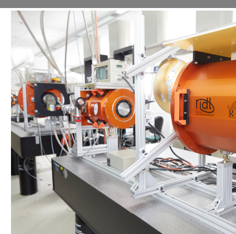
selective-area epitaxy of III-V nanocrystals on graphene for flexible optoelectronics application, readying optical nanopatterning for sub-22 nm nodes, education in nanophotonics, nanoelectronics and nanobio devices

Facilities

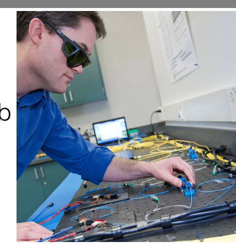
FPI cross-disciplinary teams utilize state-of-the-art labs on campus to develop and commercialize new photonic device technology. Potential markets include solar energy, biophotonics, high performance imaging, astrophysics, communication, electronics, and computing.



10K square feet of cleanrooms



20K square feet of lab space



Industry Partnership Program

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Epitaxially-Integrated Nanoscale Systems Lab

The Naonscale lab demonstrates enhanced III-V nanowire synthesis and integration methods for hybrid applications in solar energy conversion, solid state lighting, lasing, and high-speed nanoelectronics. This lab uses atomic-level semiconductor assembly and metalorganic chemical vapor deposition and develops devices used for photovoltaics, optoelectronics, and nanoelectronics.

Experimental Cosmology Lab

This lab develops technologies and instruments for experimental astrophysics. The lab has equipment for fabricating and testing components and software. The lab includes a millimeter wave spectrometric readout system for transition edge superconducting bolometers and two liquid helium cryostats and an electronic fabrication station.

Integrated Photonics Lab

This lab designs and develops scalable quantum computing, communication, and sensing circuits on silicon photonic chips. These chips densely integrate photon sources, entanglement circuits, and single-photon detectors onto a phase stable platform. The lab includes a PhotonSpot single-photon detector system.

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Facilities

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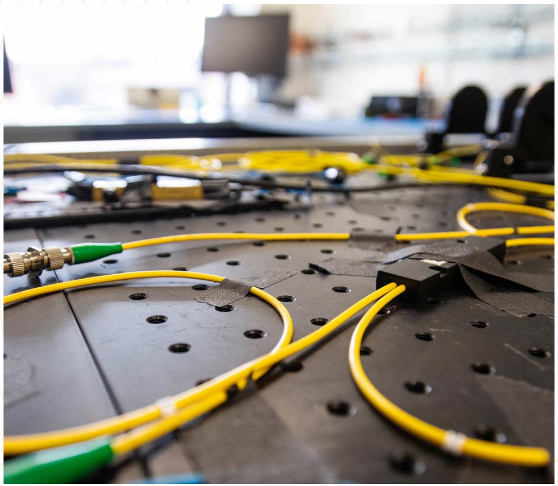
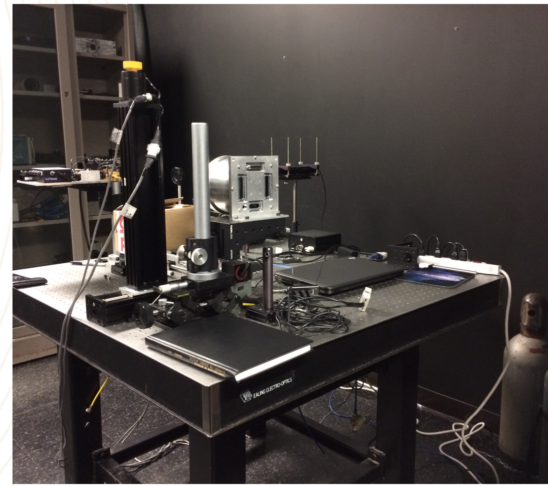
The Photonic Systems Laboratory



The Photonic Systems Laboratory researches fiber optic and photonic systems. The lab includes many oscilloscopes, spectrum analyzers, signal generators and fiber optic and photonic components.

Laboratory for Advanced Instrumentation Research

The LAIR develops novel instruments for gathering data from a wide variety of physical phenomena and trains the next generation of instrument scientists. It includes hardware and software for developing terahertz imaging detectors using Si-MOSFET CMOS technology.



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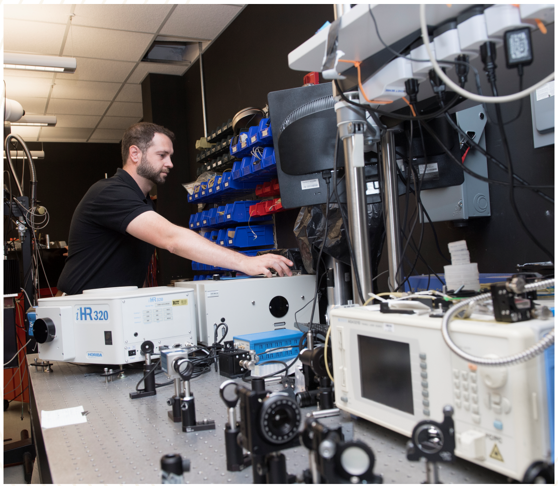
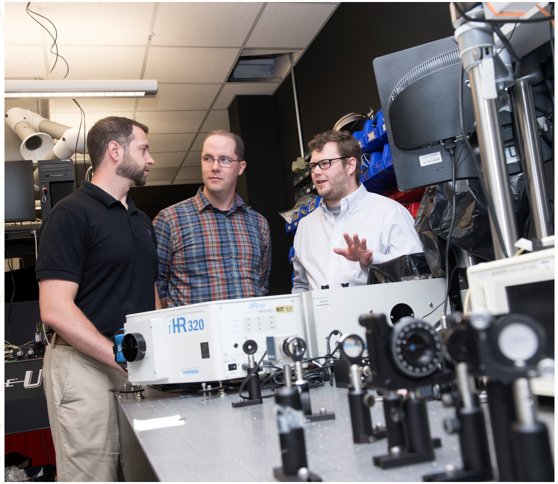
Lobozzo Photonics and Optical Characterization Lab



The Integrated Photonics group uses this lab to develop high performance nanophotonic devices and systems using complementary metal–oxide–semiconductor compatible materials and processes. It includes a Ti:sapphire laser, optical parametric oscillator, atomic force microscope, ion mill, cryogenic optoelectronic probe station, and telecom test equipment.

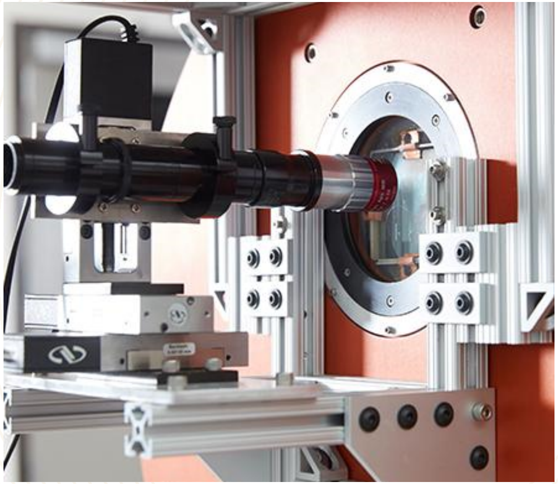
Quantum Imaging Information Lab

This lab is dedicated to advancing Quantum Imaging Science and Information to create, manipulate, and detect quantum mechanical phenomena in the spatial degrees-of-freedom of quantum light. The lab provides optical benches, laser sources, and single-photon detectors quantum-optical experiments using bulk, fiber, and integrated optics.



RIT

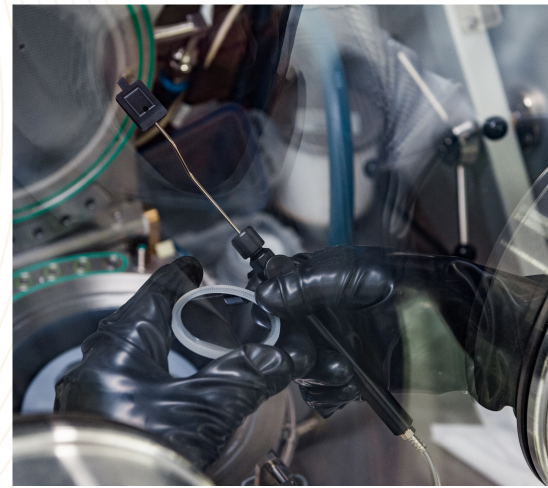
Rochester Imaging Detector Laboratory



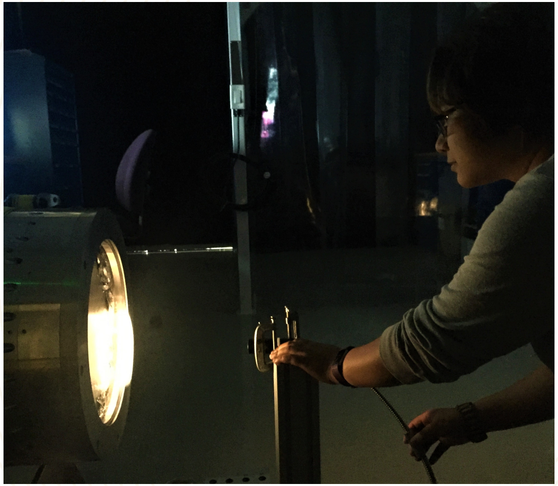
The Rochester Imaging Detector Laboratory develops advanced detectors for a broad range of applications. It houses automated detector testing systems and has five vacuum-cryogenic dewars with cooling capabilities down to below one Kelvin. The lab has many detector control and readout systems.

Semiconductor & Microsystems Fabrication Lab (SMFL)

The SMFL provides state-of-the-art facilities and support for undergraduate and graduate programs in microelectronic engineering, microsystems, and related disciplines. It supports the RIT research community by providing services, training, and access to research facilities for nano- and microscale fabrication and characterization.



Suborbital Astrophysics Lab

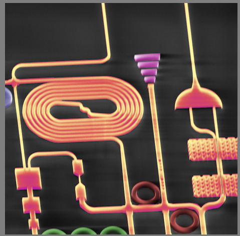


The Suborbital Astrophysics Laboratory designs, integrates, and calibrates sounding rocket payloads for astrophysical science. It includes clean facilities to allow disassembly and assembly of rocket instruments, optical and electronic development and validation instruments, and cryogenic and vacuum capabilities.

Albert J. Simone Center for Innovation and Entrepreneurship

This center promotes innovation and entrepreneurial learning across the RIT community by leveraging RIT's strengths in multi-disciplinary and experiential learning. Through a three-pronged approach, students are shown how to take an idea from the beginning stages all the way through to commercialization.

Contact



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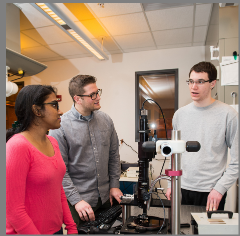

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