



Optics and Modern Physics Science and Technology Research Laboratory

Director: Robert Latham

Educational Background

MS in Physics with Endorsement in Applied and Engineering Physics, George Mason University

Contemporary Optics Graduate Program, The Institute of Optics, University of Rochester

Certification in Radiation Safety

United States Army Holography Workshop Institute, Center for Photonics Studies, Lake Forest College

BA in Mathematics, College of William and Mary

Research Interests

Holography and other coherent optics, fiber optic sensors, nanotechnology, quantum and particle physics, material interactions with electromagnetic waves, perceptual optics and acoustics

Teaching Interests

Microcomputer based labs, experimental design, computational modeling, and problem solving in all areas of science and engineering

Background Information on the Laboratory

The **Optics and Modern Physics Science and Technology Research Laboratory** provides exciting opportunities for students to develop research and engineering projects in the areas of pure and applied physics centered around optics, modern physics (nuclear, atomic, solid state, and quantum physics, and applied technology areas of physics (nanotechnology, acoustics, electromagnetic physics, etc.)). Other students regularly make use of the lab's specialized technologies to develop projects with applications in a variety of other scientific and engineering areas.

Numerous student projects developed in this laboratory and through its mentorship links to outside scientists and laboratories have been honored with awards including finalist scholarship winners in the Intel Science Talent Search and top category and industry awards at science fairs. The laboratory's attention to developing strong verbal and written communication skills as well as strong scientific reasoning and technical skills has been recognized through numerous exemplary student awards for their project work.

The Optics and Modern Physics Lab currently serves students with three program offerings. In addition to its Senior Research Program, two electives are taught yearly, Advanced Optics (a course in laser optics, optical design, perceptual optics, and holography) and Quantum Physics (a survey of recent physics developments and

challenging study of quantum mechanics).

These elective courses supplement the school's Physics curriculum and provide an introduction to the research lab.

Strong collaborations have been established with area science and technology research firms to provide mentorship for student projects both at the school and on-site project work at the firms' laboratories. Many students of this lab have worked with the Mitre Corporation's Nanosystems Group on projects in nanotechnology. Scientists at the Naval Research Laboratory and the US Army's Night Vision Laboratory have provided a broad array of projects for our students in all areas of theoretical and applied physics.

Current facilities at the school laboratory include Newport vibration isolated breadboards, various optical components and optical positioning apparatus, HeNe and Argon gas lasers, a quantum tunneling microscope, a visible scanning spectrophotometer, a multi-channel scalar with scintillation detector, and a computer controlled x-ray system.

Recent Student Research Initiatives

One goal of the Optics and Modern Physics Lab is to motivate students to work on the challenges of contemporary research problems. Our students have a diversity of interests with some topics that change annually while others are extended for several years of study. Most of the student research is performed within several research topical groups either in the school lab or in government and corporate labs through our mentorship program:

- **Holography and Coherent Optics Group:** Computer generated holography and Fourier imaging, pseudo-color techniques, holographic materials, improvement of silver-halide methodology, interferometry and nondestructive testing, special holography applications.
- **Perceptual Optics Group:** Visual latency, color perception, visual deficiency, visual illusions, studies of and applications for binocular vision.
- **Technical Optics Group:** Binocular telemetry, anamorphic and virtual reality systems, optical systems design, photographic systems, image processing, object recognition, fiber optics and fiber optic sensors, optical information storage, optical computing, polarimetry, atmospheric optics, laser applications.
- **Quantum and Modern Physics Group:** Quantum tunneling, improved electrical conductivity from barrier potential studies, quantum computers, quantum cryptography, solid state physics, nuclear physics, particle physics.
- **Nanotechnology Group:** Students work in our lab and with the Nanosystems Group of Mitre Corporation on projects involving chiral selection of carbon nanotubes, applications for carbon nanotubes, molecular electronics (moletronics), molecular motor propulsion, structural self-assembly, analysis of surface topology.

- **Acoustics Group:** Speaker enclosure design, Doppler measurements, acoustical telemetry, environmental acoustics, perceptual acoustics, sonoluminescence.
- **Electromagnetics Group:** Electromagnet wave propagation through materials, measurement of dielectric constant, microwave power transmission, nondestructive microwave testing, semiconductors, superconductors, etc.
- **Astrophysics and Atmospheric Physics Group:** Gamma and other cosmic rays, solar corona physics, etc.
- **Computational Physics Group:** Improvement of computational modeling methodology for applications in physics and engineering design.