



The Graduate Program and Research in Physics at
Wake Forest University, Winston-Salem (NC), USA

Program Director: Fred Salsbury

email: salsbufr@wfu.edu

Our department conducts research in computational and experimental biophysics, computational and experimental condensed matter physics and material science and gravitational and particle physics.

Computational Biophysics

Machine learning and AI: there is a strong interest in applications of machine learning and AI in computational biophysics at WFU.

Sam Cho's interdisciplinary research group interests encompass biophysics and computer science. They are interested in the theoretical and computational studies and methods development of biomolecular coarse grained and atomistic molecular dynamics (MD) simulations in collaboration with experimental groups.

Fred Salsbury's research focuses on computational molecular biophysics. Current research interest include drug discovery for chemotherapeutic development, development and application of statistical methods, machine learning and GAI to macromolecular dynamics and drug development studies of dynamic allostery computationally, and studies of effects of mutation on dynamics.

PhD student support as of AY 2025-26 includes: \$30,470 annual stipend, WFU Health Insurance, 100% tuition and mandatory fee scholarships.

MS Student support includes a partial (75% as of AY 2025-6) tuition scholarship. They may receive stipend support as an RA or TA; not guaranteed and unlikely for AY 2025-6.

Application deadline: 01/08/26

Check out our graduate program information, FAQs and application links with this QR Code!



Check out our research in more detail with this QR code!

Experimental Biophysics

Daniel Kim-Shapiro leads a laboratory that uses a variety of biophysical and biological techniques to understand blood flow. The lab studies how the important signaling molecule nitric oxide is compromised in various disease states, stored blood, and various cardiovascular disorders and ways to restore nitric oxide in these conditions. The work focuses on basic mechanistic science but also involves translation to the clinic including several clinical trials.

Martin Guthold's lab's research interests are in the general areas of biophysics, molecular biology, nanotechnology, microscopy techniques, – especially atomic force microscopy (AFM) and fluorescence microscopy, and next generation sequencing. Current projects include, among others, studies of mechanical and structural properties of fibrin fibers and blood clots and physical properties of cancer cells and normal cells.

Gravitational Physics

Alejandro Cárdenas-Avendaño's research concentrates on gravitational physics, high-energy phenomena associated with compact objects, and the dynamics of nonlinear system. He uses both analytic and computational methods to investigate black holes and neutron stars, analyzing their electromagnetic and gravitational signatures to challenge the boundaries of general relativity. Present projects involve creating high-resolution imaging methods for black holes and studying the intricate dynamics of extreme mass-ratio inspirals for future gravitational wave detection with LISA.

Caitlin Witt's research interests are in the areas of observational and computational astrophysics. Her research is centered on studied supermassive black hole binaries using multimessenger astrophysics, where she combines electromagnetic and gravitational-wave data. Witt and her collaborators use pulsars to search for decades-long gravitational wave signals, time-domain optical surveys to search for binaries, and supercomputers to analyze the data to provide a complete picture of the aftermath of galaxy mergers.



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Quantum Information Sciences

Multiple faculty members are performing research in quantum materials (**Hoffman, Winter and Carroll**), quantum optics (**Kandada**) and quantum computing (**Carroll**), or supporting such research (**Jureschu, Thonhauser**).

As of Fall 2026, we will have an MS and certificate in Quantum Information Sciences!

Computational Condensed Matter Physics

Timo Thonhauser's group conducts research in theoretical and computational condensed-matter physics and materials science with a focus on the development of ab-initio electronic-structure methods and their application to bio-, nano-, and energy-related materials. These theoretical studies go hand-in-hand with experimental research and provide the necessary framework to understand the behavior and characteristics of materials.

Steve Winter's group concentrate on theoretical condensed matter physics in the area of quantum materials. These are systems where macroscopic quantum effects manifest in the material properties, with prominent examples including quantum magnets, superconductors, and topological insulators. We use a variety of theoretical approaches to try to model experiments on real materials, as well as classify and predict new quantum phases.

Emilie Huffman's group simulates systems of many strongly interacting particles that can only be understood non-perturbatively. These systems consist of fermions (and sometimes quantum spins) on spatial lattices (or some other discretization) that are relevant to quantum materials, particle field theories, or nuclear theories. The group studies these systems with both classical hardware via quantum monte carlo methods, as well as recently developed quantum hardware platforms.

Experimental Condensed Matter Physics

David Carroll's group explores the fundamental roles that dimension, topology, and symmetry play in the emergent properties of low dimensional condensed matter systems and so called "quantum materials." Additionally, recently, quantum computing research has focused on the development of massively parallel and neuromorphic architectures in Q-registers based on topologically stabilized Qbits.

Oana Jurchescu's laboratory focuses on the study of charge transport in organic and halide perovskite electronic materials. They study single crystals of small molecule organic semiconductors to elucidate their intrinsic properties, establish the potential and limit of their use, and provide feedback for material and device design. A significant component of their effort is aimed at understanding the fundamental aspects of charge transport in these materials and how processing impacts the quality of various interfaces in devices.

Ajay Ram Srimath Kandada's group investigates the chemical and physical factors that govern these dynamics in a wide class of materials through advanced optical spectroscopic techniques. Their experimental toolbox is composed of sources of ultrashort optical pulses and quantum-entangled photons in the visible and near-infrared spectral regions and spectroscopic systems to measure optical coherences in materials. The group's primary interest lies in the coherent dynamics and control of excitons in two-dimensional materials.

Affiliate Faculty

Affiliate physics faculty member **Lauren Lowman** from the department of Engineering can mentor Physics graduate students. **Lauren Lowman's** research interests fall in the area of environmental physics. Her research is centered on understanding and quantifying how vegetation mediates fluxes of water, energy, and carbon between the land surface and atmosphere. Her lab uses numerical models, geospatial data analysis, and field experiments to explore questions related to how vegetation adapts to cloudy/wet conditions and responds to drought and wildfires. Contact Dr. Lowman before applying if interested.