Graduate Studies in Physical Chemistry at Simon Fraser University

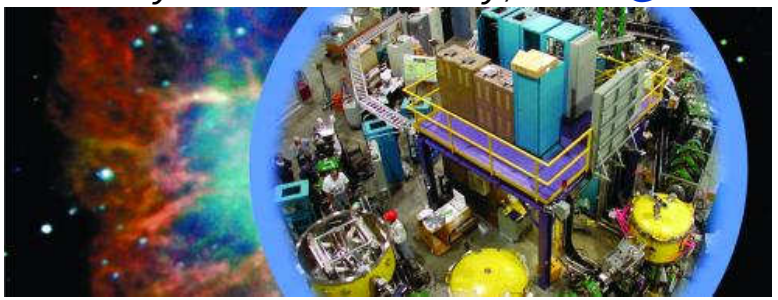
- **Nuclear Chemistry**
  Dr. Corina Andreoiu
- **Theoretical Chemical Physics and Fuel Cell Science**
  Dr. Michael Eikerling
- **Surface and Interface Chemistry**
  Dr. Gary Leach
- **Polymer Science and Fuel Cell Materials Science**
  Dr. Steven Holdcroft
- **Biophysical Chemistry**
  Dr. Melanie O'Neill
- **Muonium Chemistry**
  Dr. Paul Percival
- **Computational Chemistry**
  Dr. Joshua Wilkie

Aerial view of Simon Fraser University

SFU central Academic Quadrangle

Physical Chemistry at Simon Fraser University

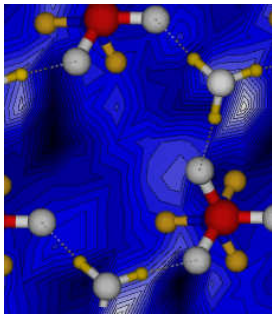
Dr. Corina Andreoiu, Assistant Professor, *Nuclear chemistry and Astrochemistry*, *caa12@sfu.ca*



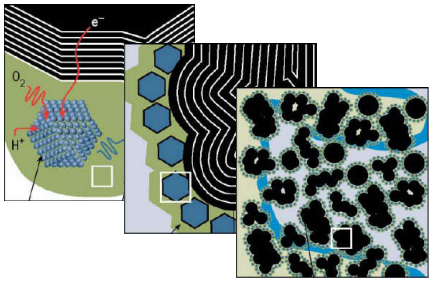
We conduct research in fundamental nuclear science with implications in astrochemistry. The main goal of our research is to create and explore atomic nuclei with an unbalanced number of protons and neutrons.

Such elements can be created at TRIUMF, Canada's National Laboratory for Particle and Nuclear Physics situated in Vancouver, or at similar laboratories around the world. The creation of such elements helps to decipher the origin of elements in the Universe and to improve our understanding of the chemistry of the stars, while giving insights about how nuclear structure evolves at the limits of nuclear stability.

Dr. Michael Eikerling, Assistant Professor, *Theoretical Chemical Physics and Electrochemical Materials Science*, *meikerl@sfu.ca*



Our work combines a spectrum of theoretical methods and molecular modeling approaches to unravel structure vs. property relations of electrochemical materials. A shared appointment with the NRC Institute for Fuel Cell Innovation provides excellent conditions for linking fundamental science with applied research on polymer electrolyte fuel cells.

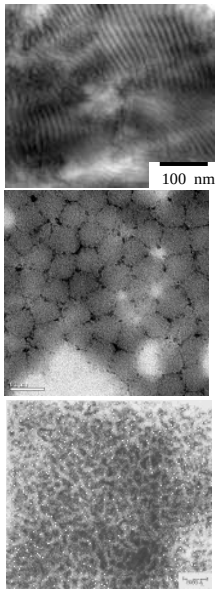


complex materials

Major themes of our research:

- proton transport at interfaces
- nanoparticle reactivity and stability
- self-organization in fuel cell materials
- water distribution and fluxes in fuel cells
- structural optimization of catalyst layers

Physical Chemistry at Simon Fraser University

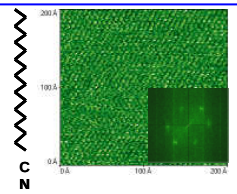


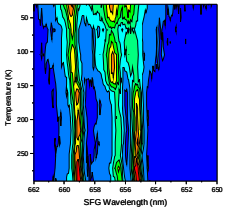
Dr. Steven Holdcroft, Professor, *Polymer Science and Fuel Cell Materials Science, holdcrof@sfu.ca*

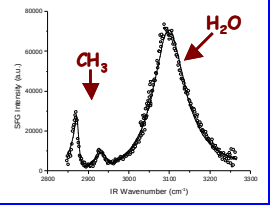
The common theme of our research program is the role of structure and morphology on the properties of advanced functional polymers. One theme concerns electronic and optical properties of π-conjugated polymer films with an emphasis on photovoltaics. The second theme concerns the polymer science and electrochemistry of proton conducting polymers and fuel cell technology. This research program involves monomer, polymer, and membrane synthesis; physical characterization of proton conducting membranes; and the study of gas diffusion electrodes and fuel cells. Dr. Holdcroft is also affiliated with NRC's Institute for Fuel Cell Innovation in Vancouver, where he leads a team investigating the design of next-generation membrane-electrodeassemblies.

Dr. Gary Leach, Associate Professor, *Surface and Interface Chemistry, gleach@sfu.ca*

We employ state-of-the-art ultrafast femtosecond lasers and atomic resolution scanning probe microscopy to investigate surface and interface chemistry in problems ranging from biochemistry to materials chemistry. Our emphasis is on the connection between the microscopic, molecular level and the macroscopic physical properties. We employ the exquisite time resolution of the fs lasers to follow surface chemical processes in real time as bonds break and new bonds form. Nonlinear optical spectroscopy is used to probe the interface specifically without competing signals from the bulk phases. Current projects include: (i) vibrational structure and dynamics at interfaces, (ii) chemistry in ordered environments, (iii) 3-D architectures of nanoparticles for materials applications, (iv) spectroscopy and dynamics of membrane-bound proteins, (v) magnetic nanostructures.







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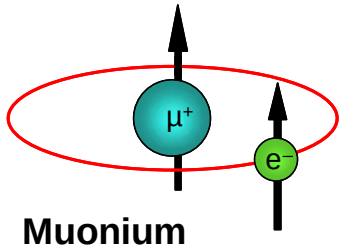
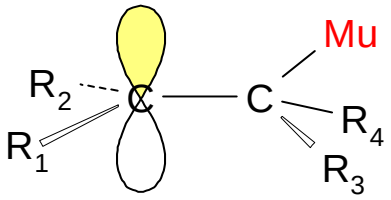


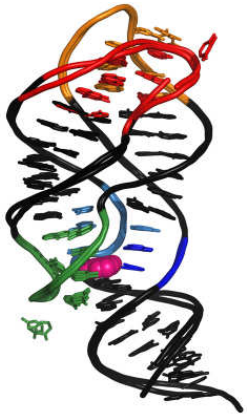
Muonium



Muoniated alkyl radical

Dr. Paul Percival, Professor, *Muonium Chemistry, percival@sfu.ca*

Muonium (Mu) is the exotic atom consisting of a single electron and a positive muon. From a chemical point of view, muonium is a light isotope of hydrogen; its mass is 1/9 that of H. Our experimental program is conducted at the TRIUMF accelerator facility in Vancouver, one of the few places in the world where high intensity muon beams are available. We use muon spin spectroscopy (a type of magnetic resonance) to investigate (1) muonium kinetics in superheated water; and (2) muoniated free radicals formed by Mu addition to unsaturated organosilicon and organogermanium compounds.



Dr. Melanie O'Neill, Assistant Professor, *Biophysical Chemistry, maoneill@sfu.ca*

Our research aims to describe the molecular-level mechanisms of biological processes, and origin of divergent functions in biological molecules that are significant to human health. Central themes include non-covalent interactions and conformational dynamics, and how these tune the photophysics, redox properties, ligand specificity, and folding of complex biomolecules. Current investigations focus on: (i) gene regulation by non-coding RNA; (ii) a family of structurally-homologous proteins with diverse functions from DNA repair to circadian rhythm regulation; (iii) an enzyme essential to cell wall biosynthesis in pathogenic bacteria; and (iv) a viral RNA-modifying protein required for virus replication.