Astrophysics

McGill Physics

McGill's Astrophysics group works at the front of major astrophysical research areas. This is a fascinating time in astrophysics, with new observational capabilities offering a more detailed view of the universe and its constituents than ever before. Many faculty in the Astrophysics group are also part of the McGill Space Institute, an interdisciplinary research centre that brings together researchers in Astrophysics, Planetary Science, Atmospheric Sciences, Astrobiology, and other space-related areas at McGill University

Prof. Cynthia Chiang

Prof. Chiang's research focuses on observational cosmology to piece together the history of our universe & the physical processes that govern it. Her team specializes in the design, construction, & fielding of custom instrumentation, as well as data analysis for these experiments.

Prof. Nicolas Cowan

Prof. Cowan focuses on characterizations of the surfaces & atmospheres of exoplanets, monitoring how their brightness & color change with time. He is a member of the scientific committee for the James Webb Space Telescope and the Ariel Mission.

Prof. Andrew Cumming

Prof. Cumming's group takes a theoretical approach to study the physics of neutron stars, white dwarfs, and planets, including thermonuclear burning, magnetic field evolution, fluid dynamics such as convection, and properties of dense matter.

Prof. Matt Dobbs

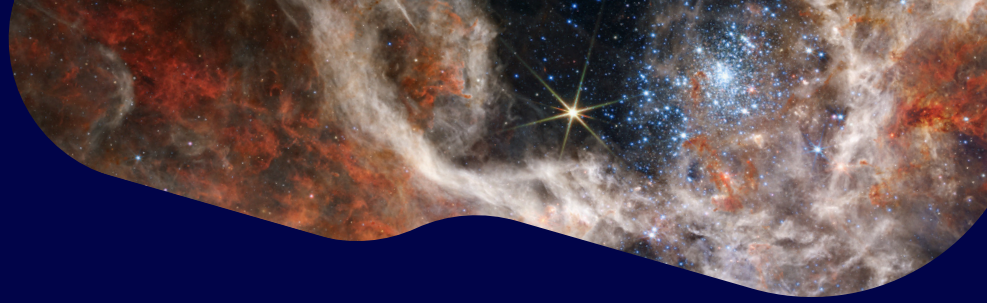
Prof. Dobbs' research group designs and builds novel instrumentation and experiments to explore the universe with millimetre and radio wavelength observations.His team is using these world-class instruments, enabled by technology his team developed, for observations of CMB radiation, 21 cm intensity mapping, and fast radio transients.

Prof. Daryl Haggard

Prof. Haggard investigates the extreme endpoints for matter in the universe: black holes and neutron stars. Her team conducts intensive, multiwave-length studies of the supermassive black hole at the heart of the Milky Way, Sag A*, and searches for electromagnetic counterparts to gravitational wave sources discovered by the LIGO-Virgo Observatories.

Prof. Jason Hessels

Prof. Hessels' research group focuses on transient astrophysical phenomena, events that can be observed only briefly such as Fast Radio Bursts, mysterious flashes from outside our galaxy that last for only milliseconds.



Prof. David Hanna

Prof. Hanna is a member of the HELIX collaboration, which is developing a detector for deployment on a long-duration stratospheric balloon flight. The goal is to measure the relative fluxes of stable and unstable isotopes of elements such as beryllium, in order to probe the nearby Galactic environment and determine the origins of antimatter in the cosmic rays.

Prof. Vicky Kaspi

Prof. Kaspi focuses on the CHIME telescope and Fast Radio Bursts (FRBs), to understand CHIME/FRB discoveries and their implications for the nature of FRBs. She also researches pulsars (rapidly rotating, highly magnetized neutron stars) using radio and X-ray telescopes.

Prof. Adrian Liu

Prof. Liu's group works on the boundary between theory and observation. Prof's Liu's research focuses on connections between theory, data analysis, and observation in 21cm cosmology to shed light on Cosmic Dawn.

Prof. Ken Ragan

Prof. Ragan focuses on particle astrophysics, observing astrophysical sources of high energy gamma rays. His group studies sources of black hole driven galaxies, supernova remnants, pulsar-wind nebulae, and microquasars. He is a member of the VERITAS collaboration.

Prof. Robert Rutledge

Prof. Rutledge's group is primarily interested in measuring the size of neutron stars through x-ray observation, which provides direct measurements of strong-force physics.

Prof. Jonathan Sievers

Prof. Sievers is developing analysis techniques for upcoming large cosmological surveys, including surveys of the cosmic microwave background and the 21 cm line of neutral hydrogen.

Prof. Tracy Webb

Prof. Webb's research focuses on galaxy evolution. She uses some of the world's most powerful telescopes to look deep into space, and back in time, to an epoch when galaxies were younger, and different, than they are today.

Condensed Matter

McGill Physics

McGill's condensed matter physics researchers focus on the synthesis, physical properties, and characterization, theory and large-scale modeling of novel materials.

Theory

Prof. William Coish

Prof. Coish's group studies the quantum properties of nanoscale condensed matter systems, & how to use these systems for quantum information processing.

Prof. Hong Guo

Prof. Guo's group is focused on two main areas: quantum electronic transport theory and modeling in nanoelectronics, and materials physics of nanotechnology.

Prof. Tami Pereg-Barnea

Prof. Pereg-Barnea's group focuses on condensed matter systems with unusual properties often related to exotic/topological order or strong interactions. More specifically, she is studying topological insulators, topological superconductors, graphene, and unconventional superconductors.

Prof. Nikolas Provatas

Prof. Provatas does research at the intersection of condensed matter physics, high-performance computing and multi-scale numerical modelling. His research explores the fundamental mechanisms controlling microstructure evolution in non-equilibrium phase transformations, and their role in controlling the propperties of advanced materials. His research has made advances in topics such as rapid solidification, solid-state transformations, nano-

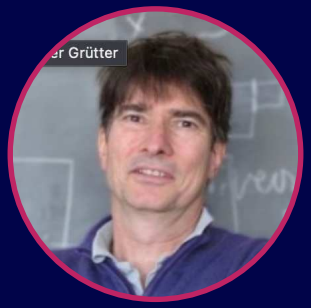
Experiment

Prof. David Cooke

Prof. Cooke studies photonics and ultrafast optical spectroscopy in the last portion of the electromagnetic spectrum to be controlled. Lab activities stretch from fundamental optical spectroscopy to the applied development of THz sources and detection technology.

Prof. Guillaume Gervais

Prof. Gervais' group works at elucidating new quantum phases of matter in semiconductor electronic and fluidic structures fabricated "on-a-chip".



Prof. Peter Grutter

Prof. Grutter pushes the limits of instrumentation and is an international leader in developing atomic force microscopes and applying them to understand how nanoscale objects can be used for information storage and processing (AKA nano-electronics).

Prof. Michael Hilke

Prof. Michael Hilke's research interests include graphene and other low dimensional systems, quantum nano-electronics, quantum computing, quantum communication and sensing, superconductivity, and disordered systems.

Prof. Dominic Ryan

Prof. Ryan's group focuses on magnetic materials, with particular emphasis on those with frustrated or competing exchange interactions.

Prof. Jack Sankey

Prof. Sankey's group strives to develop a coherent interface between solid mechanical sensors, photons, quantum emitters, and spin-transfer-controlled nanoscale magnetic circuits. Along the way, we also develop some of the world's most sensitive optomechanical systems, capable of responding to light at the level of a single photon.

Prof. Bradley Siwick

Prof. Siwick's laboratory is focused on developing technologies that will allow complex transient structures of molecular and material systems to be determined at the atomic level.

Prof. Kai Wang

Prof. Wang's research interests include the generation, manipulation, and imaging of quantum states of light using nanostructured meta-optics and integrated photonics. Our research efforts point to various applications in quantum information processing, sensing, and communications.

High Energy Physics

Experiment

What are the laws of nature at their most fundamental level? Is there an ultimate unified theory of elementary particles and gravity? This is the “holy grail” of theoretical physicists. In its broadest terms, research in particle physics has as its goals the discovery of the most basic constituents of matter and the forces through which they interact, and the understanding of how matter behaves when it is put under very extreme conditions. Our knowledge of the motions of matter in such conditions often relies on the limits of what we know about the most elementary particles and forces.

Prof. Francois Corriveau

Prof. Corriveau’s group studies high-energy collisions to get insights into the nature & structure of matter, & is involved in ATLAS & Zeus experiments.

Prof. Brigitte Vachon

Prof. Vachon’s research group studies the unique properties of top quarks in order to understand physics at the smallest distance scale, which ultimately dictates what today’s universe looks like. They are also involved in the ATLAS experiments (CERN).

Prof. Andreas Warburton

Prof. Warburton’s group works on the ATLAS (Switzerland) & Belle II (Japan) experiments using energetic matter-matter & intense matter-antimatter collisions to pursue new particle searches & precision measurements capable of revealing novel fundamental phenomena.

McGill Physics

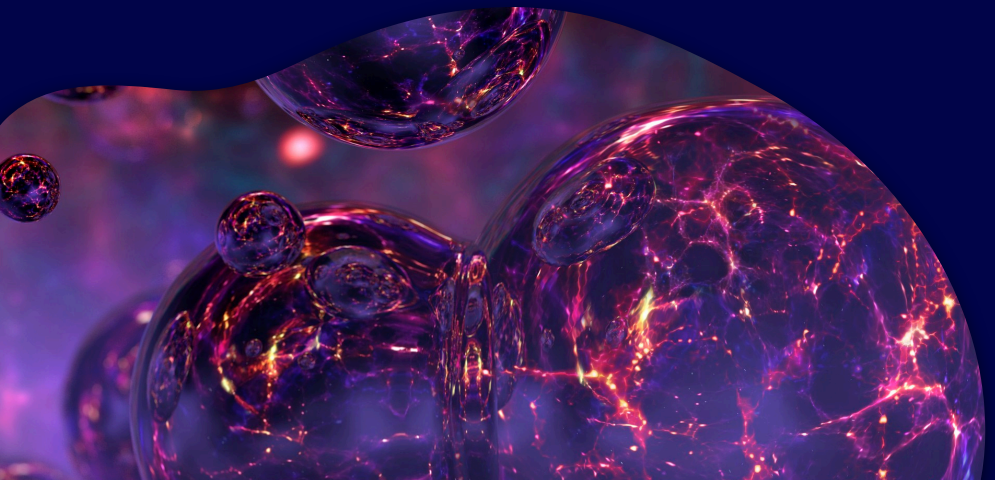
Theory

Prof. Robert Brandenberger

Prof. Brandenberger's focus is to explain the observed structure in the universe on large scales & to explain the history of the very early universe. He has made pioneering contributions to the emerging field of superstring cosmology.

Prof. Simon Caron-Huot

Prof. Caron Huot focus on scattering processes: can we calculate what comes out when two protons collide?



Prof. Jim Cline

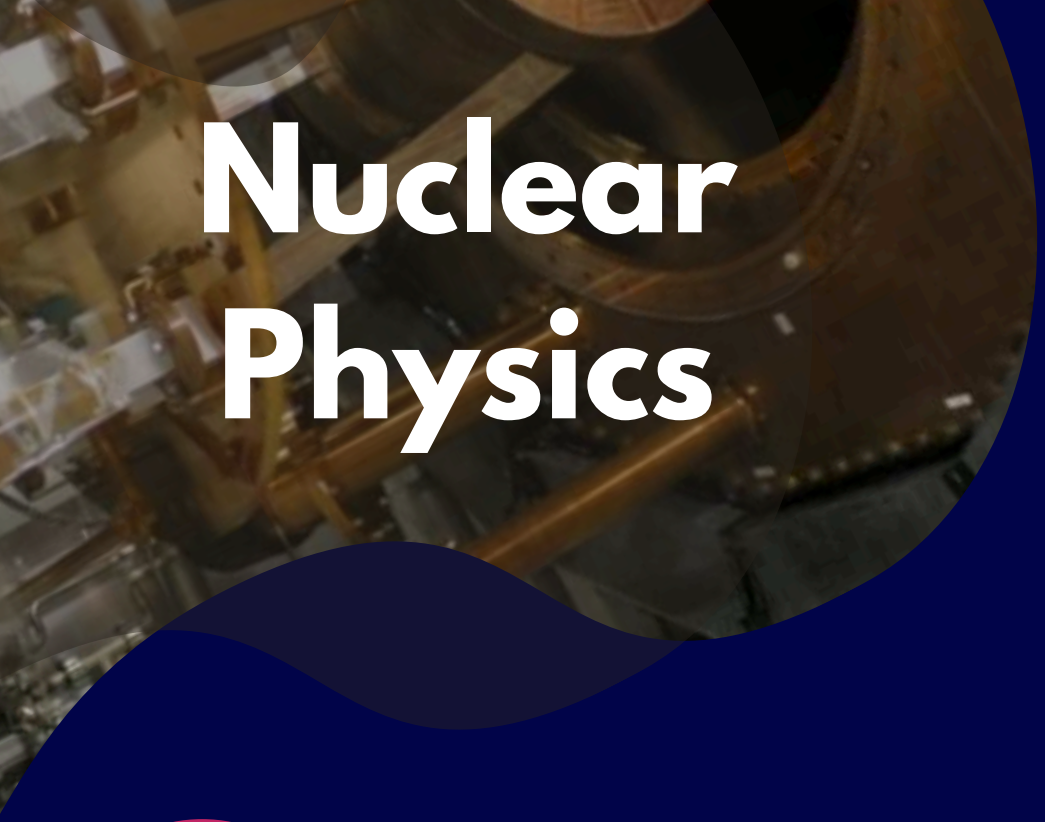
Prof. Cline's group focuses on explaining dark matter, which comprises most of the universe's mass density but still remains a mystery.

Prof. Keshav Dasgupta

Prof. Dasgupta's research interest spans a variety of topics such as, superstring theory, string cosmology, quantum field theories, and mathematics.

Prof. Katelin Schutz

Prof. Schutz's research is at the intersection of astrophysics, particle physics, and cosmology. The goal is to understand what our universe is made of by considering how astrophysical systems would be affected by undiscovered particles and interactions. Schutz's major focus is understanding the composition and behaviour of dark matter, as well as other extensions of the Standard Model.



Nuclear Physics

McGill Physics

McGill University's established tradition of excellence in nuclear physics began with Rutherford's tenure at McGill between 1898 and 1907 during which he discovered the transmutation of matter. The same tradition of excellence continues to this day. Today, nuclear physics encompasses a wide range of modern physics. The traditional study of nuclei and their reactions is still a vibrant part of modern nuclear physics. In the latter part of the 20th century, however, a new and exciting field of nuclear physics started to emerge. This is the study of nuclear matter under extreme conditions.

Prof. Fritz Buchinger

Prof. Buchinger's research group is focused on the investigation of fundamental nuclear properties, and specifically masses and radii. He is also involved with experiments at TRIUMF.

Prof. Thomas Brunner

Prof. Brunner explores whether or not neutrinos are their own antiparticles. With his nEXO collaborators, he searches for neutrinoless double data decays in Xe-136. If observed, this decay gives evidence for physics beyond the Standard Model and helps us understand the neutrino's nature.

Prof. Charles Gale

Prof. Gale deals with the theoretical study of matter under extreme temperature and density. This straddles nuclear and particle physics, as well as condensed matter and astrophysics. We aim to understand the phase diagram of QCD, the theory of the strong interaction. This work may help us understand the physics of the early universe, the theoretical modeling of neutron stars, and nuclear collision dynamics.

Prof. Sangyong Jeon

Prof. Jeon's research group studies Quark-Gluon Plasma created in ultra-relativistic heavy ion collisions using a variety of theoretical tools ranging from the non-equilibrium quantum field theory to numerical simulations of the heavy ion collisions.

Biophysics

Due to its complexity, we know far more about the inner working of stars than we do about a cell. Biophysics attempts to characterize complex networks that govern the essential cellular processes like the ability to sense, transmit, & generate signals.

Prof. Walter Reisner

Prof. Reisner's bionanofluidic lab explores how complex submicron nanotopographies embedded in a confined slit-like nanochannel can be used to perform manipulations of single biopolymers, such as DNA, in solution.

Prof. Paul Wiseman

Prof. Wiseman's lab is interested in understanding the molecular mechanisms involved in cellular adhesion & how cells dynamically regulate adhesion receptors to control cellular migration.

Nonlinear Physics & Atmospheric Physics

A particularly exciting geophysical paradigm is the idea that atmospheric dynamics repeat scale after scale from large to small scales in a cascade-like way.

Prof. Shaun Lovejoy

Prof. Lovejoy uses innovative nonlinear data analysis techniques to analyze state-of-the-art satellite, aircraft, and paleoclimate data or the outputs of Global Climate Models and weather models. The aim is to unravel the structure of our atmosphere in time & in space over scales ranging from milliseconds to millions of years, from millimeters to the size of the planet.

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