

Dust-obscured star formation at the Cosmic Frontier: New observations from the Large Millimeter Telescope

Speaker: Dr. Alexandra Pope (University of Massachusetts)

Time: May 11, 2016 - 2:00 PM

Location: Atrium 101

Abstract

While UV surveys have mapped out the unobscured star formation rate density over cosmic time, our observations of obscured star formation remain incomplete beyond $z \sim 3$. Millimeter observations are crucial to complete the census of star formation in the Universe. I will present new observations with the Large Millimeter Telescope including a 1.1 mm survey of the HST Frontier Fields. The clusters act as cosmic telescopes to amplify lower-luminosity galaxies, probing further down the millimeter luminosity function than possible with blank-field observations. With this survey we detect dust in galaxies with star formation rates as low as ~ 10 solar masses per year allowing us to measure the dust-obscured star formation in typical galaxies in the distant Universe. I will discuss the synergy between the wide surveys with the LMT and targeted programs with ALMA.

Exploring the properties of neutron-rich nuclei with Argonne's ATLAS facility

Speaker: Dr. Robert V.F. Janssens (Argonne National Laboratory)

Time: April 8, 2016 - 3:00 PM

Location: Atrium 101

Since the beginning of the 21st century, information on nuclei with large proton-to-neutron asymmetries has grown almost exponentially and this has led to a renaissance in low-energy nuclear physics. We have come to realize, for example, that nuclear shell structure – the way protons and neutrons are arranged within the nucleus – is not as immutable as once thought. In fact, “magic numbers” appear to come and go and their presence seems to depend on neutron excess. A large neutron excess also appears to impact global properties such as the nuclear shape or the nuclear mass for example. Much of this progress has been stimulated, on the one hand, by the advent of new facilities and experimental techniques and, on the other, by the development of new theoretical approaches. This presentation will review new developments at the Argonne Tandem Linac Accelerator (ATLAS) aimed at addressing this science. Thus, the Californium Rare Ion Breeder Upgrade (CARIBU) will be described and first results from this facility will be presented. The presentation will also discuss results on the structure of neutron-rich nuclei obtained at ATLAS with other techniques.

Real Life on Fake Mars: A Student Guide to Becoming an Everyday Astronaut

Speaker: Dr. Ross Lockwood (University of Alberta)

Time: March 11, 2016 - 3:00 PM

Location: Atrium 101

Abstract:

Mars seems tantalizingly close these days. With major missions being planned to the Red Planet over the next couple of decades, public interest in spaceflight is growing daily. While Mars offers the promise of a second home for humanity, the technical challenges of getting there and back again are on a scale humanity hasn't seen since humans first set foot on the Moon. To solve these challenges analog missions are being conducted around the world, replicating different environments and testing various aspects that will be critical to future missions.



With a modern version of the space race emerging alongside the rise of commercial spaceflight, the demand for astronauts is increasing. However, there is no clear career path to becoming an astronaut, but some career choices seem more effective than others. How then, can you prepare yourself for a possible future as an astronaut? Ross Lockwood shares his experiences as a lab-rat for NASA studies and his ongoing commitment to civilian training programs for astronaut hopefuls.

Bio:

Ross Lockwood is a graduate from the University of Alberta with a Ph.D. in Condensed Matter Physics. His doctoral research focused on silicon quantum dots: nanoscale light emitters with potential applications in quantum computing and high-performance chemical sensing. He is now working on human performance analytics and 3D printing technologies with space exploration as his central motivation.

For the last two years, Ross has been exploring the path to becoming an astronaut. In 2014 he participated as a research subject in the Hawaii Space Exploration Analog and Simulation (HI-SEAS), a 120-day Mars simulation where he played the role of the systems and communications engineer. In 2015, he trained as an Astronaut-Candidate with the Polar Suborbital Science in the Upper Mesosphere (PoSSUM) research group. He continues to volunteer and train for a future astronaut application with the Canadian Space Agency.

What can you do with a PhD in Astrophysics, outside Astrophysics?

Speaker: Dr. Fernando Pena (Ernst & Young LLP)

Time: February 12, 2016 - 3:00 PM

Location: Sobey 265

Thousands of students across Canada begin their PhD studies each year, many with the goal of becoming a tenured university professor. However, less than 20 per cent of PhD graduates ultimately achieve this goal. So where are the other 80 per cent of PhDs employed? What are the career prospects for those PhDs who work outside academia?

In this presentation, I will share my personal career path, starting with a BSc in Astronomy in Chile, passing through a PhD in Astrophysics at UofT, then taking a postdoctoral fellowship at SMU ICAs, and finally doing another postdoctoral fellowship at Dalhousie's Department of Medicine before moving to a non-academic position as a Senior Analyst / Data Scientist in late 2014.

I will highlight some of the challenges I think science PhDs (and perhaps Astronomy undergraduates and professors) face when having to decide their next career move. I will outline some tips and strategies to search for careers outside Astrophysics, and I will also discuss what I think are the strengths and skills of an Astrophysics PhD that are transferable to other fields and careers.

A day in the life of a clinical medical physicist

Speaker: Dr. Justin Sutherland (University of Ottawa)

Time: February 5, 2016 - 3:00 PM

Location: Atrium 101

A medical physicist is a professional who specializes in the application of the concepts and methods of physics to the diagnosis and treatment of human disease. The most common discipline in which a medical physicist works is the field of radiation oncology: the therapeutic application of ionizing radiation (x-rays, gamma rays, neutrons, electrons, and heavy charged-particles) to the treatment of cancer. In a radiation oncology department, physicists are responsible for daily clinical support, equipment acquisitions, site planning, quality assurance, dose calculations and act as liaisons between other medical professionals, manufacturers, and regulatory agencies. On a daily basis, a clinical medical physicist can be expected to make use of expertise in radiation physics, dosimetry, dose calculation, treatment planning, human anatomy, imaging, the production and safe use of radiation, and computer systems and networks.

This talk will further describe the role of the medical physics profession in Canadian health care, discuss the steps required to become a clinical medical physicist, and give an illustration of the daily work, research, and interesting clinical examples that arise during the stimulating and rewarding work of a medical physicist.

The Renewal of the Burke-Gaffney Observatory and its Exciting New Social Media Interface

Speaker: Dave Lane (Saint Mary's University)

Time: January 29, 2016 - 3:00 PM

Location: Atrium 101

I will review the recent renewal of the BGO and will describe the development, usage and future plans for the world's first (the Burke-Gaffney Observatory) and world's second (the Abbey Ridge Observatory) social media controlled observatory.

Solutions in the null-surface formulation of general relativity

Speaker: Dr. Tina Harriott (Mount Saint Vincent University)

Time: January 22, 2016 - 3:00 PM

Location: Atrium 101

The null-surface formulation of general relativity (NSF) describes gravity in terms of families of null surfaces rather than using the metric tensor. The NSF employs special spacetime coordinates that are naturally adapted to the surfaces and the equations of the theory are given in terms of two dependent variables, one being complex and the other real. So far, the degree of complication has hindered attempts to find exact solutions. This talk will give a brief review of the NSF and discuss the various strategies that have been employed to find solutions.

Pulsar Tests of General Relativity

Speaker: Dr. Ingrid Stairs (University of British Columbia)

Time: January 8, 2016 - 2:30 PM

Location: Dalhousie University (Dunn 135)

Pulsars are radio-emitting neutron stars, and therefore offer the opportunity to probe relativistic effects near strongly self-gravitating objects. Pulsars orbiting white dwarfs, which are far less dense, allow for tests of various equivalence principles. Pulsars in double-neutron-star binaries often permit the measurement of multiple relativistic corrections to a Keplerian orbit, resulting in self-consistency tests for different gravitational theories. I will review the principles of pulsar timing and the current status of these various tests, including the latest results from the only

known double-pulsar system. I will also discuss the prospects for direct detection of gravitational waves via pulsar timing.

Subatomic Physics Research in Canada

Speaker: Dr. Svetlana Barkanova (Acadia University)

Time: December 11, 2015 - 2:00 PM

Location: Atrium 101

The scientific mission of subatomic physics is to identify the elementary constituents of matter, study the fundamental forces through which they interact, and understand how they combine to produce larger systems we observe in our Universe. Canada is positioned especially well for discovery and innovation in subatomic physics, with Canadian researchers working together to plan long-term projects and train the next generation of physicists. The most recent example is 2015 Nobel Prize in Physics for neutrino oscillations awarded to Art McDonald (Canada) and Takaaki Kajita (Japan), a discovery which opened a new realm in particle physics.

Soon, we may see a revolution in our understanding of the nature of matter and its interactions, as we investigate the dark matter, matter vs antimatter dominance, and the role of neutrinos. The talk will discuss several broad categories of research in subatomic physics and describe major Canadian subatomic physics research institutes such as TRIUMF (Vancouver), SNOLAB (Sudbury) and Perimeter Institute (Waterloo), as well as the role of Canadian researchers at LHC (Switzerland), KEK (Japan) and JLab (USA). We will also discuss how subatomic physics research can involve undergraduate students at any school, especially at primarily undergraduate institutions.

Cold Dark Matter and the Interstellar Medium in Nearby Dwarf Galaxies

Speaker: Dr. Kristine Spekkens (Royal Military College)

Time: November 6, 2015 - 3:00 PM

Location: AT101

Abstract

The interstellar medium (ISM) in nearby dwarf galaxies provides important insight into how all galaxies form and evolve within the standard cold dark matter cosmology. In this talk, I will highlight some of my group's recent efforts to use observations of the ISM in nearby dwarfs as a cosmological probe. I'll first present results from our ongoing deep search for radio synchrotron emission from Galactic dwarf spheroidal galaxies (dSphs) to constrain the properties of the particle dark matter that may make up their halos. I'll then explain how upper limits that we

derive on the atomic gas content of some dSphs may elucidate key dynamical properties of both the Milky Way and its satellites. I'll finish the talk by discussing how these radio ISM studies are expanding from the Milky Way into other environments in the Local Volume, what this could mean for our understanding of dwarf galaxy evolution, and how the SKA and its precursors will revolutionize the field.

Quark-Novae : Implications to High-Energy and Nuclear Astrophysics

Speaker: Dr. Rachid Ouyed (University of Calgary)

Time: October 30, 2015 - 3:00 PM

Location: AT101

Abstract

After a brief account of the physics of the Quark-Nova (explosive transition of a neutron star to a quark star), I will discuss its implications and applications to High Energy and Nuclear Astrophysics. The talk will focus on Quark-Novae in the context of Super-Luminous Supernovae and in the context of the origin of heavy elements (r-process nucleosynthesis). I will also discuss Quark-Novae in binaries and its meaning to Type-Ia SNe as standard candles. The Quark-Nova has the potential to provide new insight into explosive astrophysical phenomena and the origin of some elements in the periodic table, by naturally combining the might of researchers in nuclear physics, sub-nuclear physics and astrophysics.

At the diffraction-limit: Next generation science using Adaptive Optics

Speaker: Dr. Jonathan Crass (University of Notre Dame)

Time: October 23, 2015 - 3:00 PM

Location: AT101

Abstract

The use of adaptive optics (AO) systems is now common-place at large ground-based observatories. These systems have the ability to correct for the effects of the Earth's atmosphere, allowing diffraction-limited imaging to be achieved up to near infra-red wavelengths. With this capability comes advances in instrumentation allowing astrophysical phenomena to be studied in evermore detail.

I will discuss two instruments currently under development which utilize the current generation of adaptive optics: The Adaptive Optics Lucky Imager (AOLI) and iLocater. AOLI combines AO with lucky imaging, a second atmospheric correction technique, to achieve diffraction-limited imaging at visible wavelengths. This combination provides some of the highest

resolution visible images ever taken in astronomy allowing the study of crowded fields within the Milky Way and providing additional detail for extra-galactic observations. iLocater is a radial-velocity (RV) spectrograph which is the first instrument to efficiently couple star-light to single-mode fibers. This overcomes the systematic effect of modal noise, allowing measurements of exoplanets with a RV precision of better than 1m/s for the first time. This provides an avenue to search for terrestrial planets around nearby stars which will be a vital tool for follow-up observations of future exoplanet surveys.

MacLennan Lecture

Speaker: Dr. Alex Filippenko (University of California, Berkeley)

Time: October 17, 2015 - 3:00 PM

Location: TBA

Abstract

TBA

The mysterious origins of the heaviest elements

Speaker: Dr. Rebecca Surman (University of Notre Dame)

Time: October 16, 2015 - 3:00 PM

Location: AT101

Abstract

While the origins of the light (hydrogen, helium) and intermediate mass (carbon through iron) elements found in our solar system are well understood, we still don't know where roughly half of the elements heavier than iron were made. From the solar system abundance pattern of these nuclei, we can tell they were synthesized via rapid neutron captures in the r-process of nucleosynthesis. Exactly where the appropriate astrophysical conditions for the r-process exist, however, is still uncertain. Here we will discuss the two most popular potential astrophysical sites---core-collapse supernovae and neutron star mergers---and describe how progress in open issues in neutrino and nuclear physics may be the key to unlocking this longstanding mystery.

The Transition from First Year Physics to a Second Year Major: Factors Contributing to Undergraduate Decision Making

Speaker: Ms. Laura Stiles-Clarke (St. Francis Xavier University, Saint Mary's University)
Time: October 9, 2015 - 3:00 PM
Location: AT101

Abstract

There has been concern since the 1980s in post-secondary physics education circles regarding low interest and enrollment in physics degree programs. This trend has proven very difficult to reverse. The purpose of this study was to explore why students at an Atlantic Canadian university pursue a major in physics, and why other eligible students make different choices. An instrumental case study of this university is presented, using a poststructuralist, constructivist paradigm, a qualitative online survey for first year physics students, and semi-structured interviews with their professors. Data from this study supports the theory of physics identity proposed by Hazari et al. (2010), specifically their four dimensions of physics identity: interest, recognition, performance, and competence. This study found interest to be the most important of the four dimensions. One additional dimension, the *career prospects problem*, was also observed. This dimension and the others are related to the physics education research literature and to the literature surrounding 'physics identity'. This research is of interest for physics educators interested in why first year students choose to major in physics, or not, and how physics professors and departments might influence their decisions.

Meet and Greet with Astronaut Hansen

Speaker: Canadian Astronaut Jeremy Hansen
Time: October 5, 2015 - 4:00 PM
Location: AT 305



Canadian Space Agency astronaut Jeremy Hansen will be visiting our Department on Monday October 5th. The Astronomy and Physics Department is invited to an informal meet-and-greet.

Adaptive Mesh Chemodynamical Simulations and Synthetic Observations

Speaker: Mr. Ben Thompson (University of Central Lancashire, SMU)

Time: October 2, 2015 - 3:00 PM

Location: AT101

Abstract

We live in an exciting time for the field of galactic archeology. With such large scale surveys such as the European GAIA-ESO project and with access to modern day equipment such as the Gaia satellite and the Very Large Telescope (VLT), we are able to access increasing numbers of age and metallicity properties of stars within our own galaxy. In this talk, I will discuss the

results of such surveys with the chemodynamical models employed within the adaptive mesh refinement code RAMSES-CH, which traces the chemical evolution of various elements including Hydrogen, Iron, Oxygen and Magnesium, in comparison with the Gaia-ESO survey with the use of a simulated Milky Way-like galaxy. Additionally, I shall be discussing how sampling simulations employing an apparent magnitude and gravity selection function - a more observationally-motivated approach - in addition with that traditionally adopted in simulations which are spatial cuts alone. Finally I shall also be briefly discussing highlights of my PhD thesis so far, focusing on my work on the baryonic properties of high resolution cosmological voids.

Evidence for New relations between Gamma Ray Bursts prompt and X-ray Afterglow Emission from (almost) 11 Years of Swift

Speaker: Dr. Dirk Grupe (Morehead State University)

Time: September 18, 2015 - 3:00 PM

Location: AT101

Abstract

Gamma-Ray Bursts (GRBs) are the most energetic transient events in the Universe. Not only do they represent the violent end of a massive star and the birth of a black hole, but their explosions allow us to trace them throughout the entire Universe. With the launch of the NASA Swift Gamma-Ray Burst Explorer Mission our knowledge of GRBs has been revolutionized. With its fast slew capacity it is able to be on the position of a GRB within a minute or two after the GRB is detected, giving us access to the earliest phases of a GRB afterglow. Since its launch in November 2004, Swift has discovered almost 1000 bursts, about 300 with spectroscopic redshift measurements - providing us the largest sample in history with prompt and afterglow observations. This unique sample enables us to perform unprecedented statistical studies of GRBs.

In my talk I will review the history of GRB discoveries and their importance to astrophysics. I will present the Swift mission and explain what is unique and exciting about it and how Swift has given us new evidence for connections between the GRB prompt and afterglow emission. The fate of the burst is already determined during the explosion of the star. I will finish the talk by looking into the future and explain how we can use predictive data mining tools to determine the afterglow light curves and the redshifts of the bursts based on observed properties of the burst.

The faintest galaxies as probes of cosmology and galactic evolution

Speaker: Dr. Michelle Collins (Yale University)
Time: September 16, 2015 - 3:00 PM
Location: L276

Abstract

As the faintest galaxies we are able to observe in the Universe, the dwarf spheroidals can be thought of as the fundamental galactic unit. Within our Local Group, we are able to study these objects in extremely high detail, resolving their mass profiles, chemistries, and evolutionary histories. These measurements have led to several surprising results. One is that the masses of these systems appear to be lower than predicted by cold dark matter simulations. Additionally, dwarf galaxies are not distributed isotropically around their hosts, as naively expected in the current cosmological paradigm. In this talk, I will discuss these observational peculiarities, and how we may account for them. I will then discuss a new class of ultra diffuse galaxy that was recently discovered in the distant Coma cluster. These wispy galaxies have luminosities similar to dwarf galaxies, but sizes similar to the Milky Way, which is 4 orders of magnitude brighter, intriguing astronomers. The key to understanding these unusual systems may lie in the detailed studies of nearby dwarf galaxies, whose properties are not so dissimilar to these more distant objects.

How to Publish a Paper in Nature

Speaker: Dr. Leslie Sage (University of Maryland; Nature)
Time: August 31, 2015 - 3:00 PM
Location: SB 255

Abstract

Nature is one of the world's leading scientific journals, publishing many papers that receive wide attention by the general public. But, Nature is very selective-- <7% of submitted papers are published. In order to maximize your chances of getting published, papers should present fundamental new physical insights, or startling observations/results. Theory papers pose additional problems, as we want only those papers that are likely to be the correct explanation, and not simply exploring parameter space. The writing should be clear, concise and directed at the level of a graduate course in the subject. I encourage authors to contact me in advance of submission of a paper, both to ascertain the appropriateness of the result for Nature, and to ensure that the writing is close to our standards. Posting to ArXiv is and always has been allowed, but authors should discuss the specifics with their institutional public affairs officers before doing so. Lapses in professional ethics seem to be on the rise – I will discuss some examples, and what we should be doing to keep astronomy clean.

Undergraduate Research Symposium

Speaker: Summer undergraduate research symposium

Time: September 11, 2015 - 9:30 AM

Location: SB160

Students will present their research work.