A large complete ULIRG sample at z~2

Speaker: Dr Jiasheng Huang
Time: March 27, 2015 - 3:00 PM
Location: SB 160 (Sobey Building)

Abstract
I will presnet a multiwavelegth study of a large MIPS selected galaxies and satisfy a certain IRAC color criterion. Stellar population modeling and IRS spectra together demonstrate that the double criteria used to select this sample have efficiently isolated massive star-forming galaxies at z ~ 1.9. This is the first starburst (SB)-dominated ultraluminous infrared galaxies (ULIRG) sample at high redshift with total infrared luminosity measured directly from Spitzer, Herschel FIR and millimeter photometry, and as such gives us the first accurate view of broadband spectral energy distributions for SB galaxies at extremely high luminosity and at all wavelengths. The HST images in optical and NIR bands show that most objects have very extended morphologies in the rest-frame ultraviolet and optical band, thus extended distribution of PAH molecules. We conclude that objects in this sample are ULIRGs powered mainly by SB; and the total infrared luminosity density contributed.

Quantum Physics in Your Light Bulb: A Colourful Story

Speaker: Dr. Kris Poduska, Memorial University
Time: March 26, 2015 - 2:30 PM
Location: Dalhousie Physics

Abstract
A white light bulb is just a light bulb...or is it? Edison's incandescent bulbs are now a thing of the past, and solid-state

lighting, which is based on inorganic or organic light emitting diodes (LEDs or OLEDs), is gaining popularity. This talk will shed light on the many aspects of quantum physics that are required to produce white light from an LED-based bulb. Along the way, you'll also see why the human perception of light and colour plays a critical role in the evolution of this technology.

Short Bio

Kris Poduska is an experimental condensed matter physicist based at Memorial University of Newfoundland, where she has been on the faculty in the Department of Physics & Physical Oceanography since 2003. Originally from the United States, Dr. Poduska holds an undergraduate degree in physics from Carleton College (Northfield, Minnesota, USA), and a Ph.D. in physics from Cornell University. Her research is a blend between physics and chemistry, focusing on understanding structural and physical property relations in inorganic materials. The applications of the work span from technologically relevant semiconductors, to medically interesting biomaterials, to ancient archaeological materials.

Studying the Epoch of Inflation with the Cosmic Microwave Background — Lithographic Fabrication of Cold, Superconducting Electronics

Speaker: Dr. Scott Chapman, Dalhousie University
Time: February 27, 2015 - 3:00 PM
Location: Loyola 177

Abstract

In the first fraction of a second after the birth of the Universe, space underwent a period of superluminal expansion which we call cosmic inflation. The theory of cosmic inflation was originally proposed in the 1980s to explain the observed geometry and smoothness of the universe. The residual quantum fluctuations

from this epoch of inflation seeded the formation of structure in the Universe and left behind a relic background of gravitational waves. These gravitational waves imprint a unique pattern of polarization onto the CMB which may have been recently detected by the BICEP2 experiment operating at the South Pole. This groundbreaking measurement would suggest that the epoch of cosmic inflation occurred t~1e–36 seconds after the Big Bang. The energy-density of the universe at this epoch was 13 orders-of-magnitude larger than the energies probed by the LHC and near the GUT scale, where the strengths of the strong, weak and electromagnetic forces are thought to converge. The detection of this signal is a revolution in our understanding of the beginning of the Universe. It ties together the most disparate scales possible in science: quantum mechanics and cosmology; the beginning of the universe to the present day. If confirmed by the POLARBEAR-2 and SPT-3G experiments, the BICEP2 result may be the most important scientific discovery of this century.

Dr. Chapman will present an overview of the scientific questions which are currently being addressed by studying the cosmic microwave background (CMB). He will discuss the signature of inflation, experimental techniques, and focus on detector technology for POLARBEAR-2 and SPT-3G. Dr. Chapman's group has initiated a program to lithographically develop cold, superconducting electronics for reading out arrays of Transition-Edge Sensor (TES) Bolometers. The POLARBEAR experiment, faced a challenging problem in that the LC resonators used in previous experiments were found to have too much loss to be used at the higher frequencies needed for the high multiplexing factor in second generation POLARBEAR-2 / Simons Array / SPT-3G experiments. Our group has played a key role in lithographically developing a new fully superconducting resonator which is now these experiments' baseline. The two layer process has explored Nb, Va, and Al, along with various etch and lift-off techniques. We describe the fabrication process and testing of devices leading to a

mature technology which is entering a ‘mass production’ phase for the POLARBEAR-2 and South Pole Telescope experiments.

Femtosecond Pulse Shaping for Tailored Control of Semiconductor Quantum Bits

Speaker: Dr. Kimberley Hall, Dalhousie University
Time: January 30, 2015 - 3:00 PM
Location: L 177

Abstract
Femtosecond pulse shaping provides a flexible approach to tailoring the Hamiltonian governing the interaction of light with matter. Together with powerful adaptive feedback algorithms, this approach is now used routinely in the control of a variety of physical processes. For quantum computing applications, pulse shaping provides a means to optimize the speed and fidelity of elementary quantum gates, and may enable the realization of schemes for complex instruction set quantum computing. In this presentation, I will discuss our recent experiments demonstrating ultrafast quantum control of charge based (exciton) qubits in semiconductor quantum dots. Using optimal quantum control techniques, we show that pulse shaping provides a means to optimize the fidelity of a C-ROT gate in single quantum dots [1,2], and enables parallel single qubit gates on distant quantum dots within the laser focal spot [3]. We also demonstrate adiabatic rapid passage on a subpicosecond time scale in single semiconductor quantum dots, yielding new insight into the role of phonons in dephasing of exciton qubits [4].
1. A. Gamouras, R. Mathew, and K. C. Hall, J. Appl. Phys. 112, 014313 (2012).
2. R. Mathew, C. E. Pryor, M. E. Flatte, and K. C. Hall, Phys. Rev. B 84, 205322 (2011).
3. A. Gamouras, R. Mathew, S. Freisem, D. G. Deppe, and K. C.

Hall, Nano Letters 13, 4666 (2013).
4. R. Mathew, E. Dilcher, A. Gamouras, A. Ramachandran, Hong Yi Shi Yang, Sabine Freisem, Dennis Deppe, and Kimberley C. Hall, Phys. Rev. B 90, 035316 (2014).

A video-plankton and microstructure profiler for the exploration of in-situ connections between zooplankton and turbulence

Speaker: Dr. Tetjana Ross, Dalhousie University
Time: January 23, 2015 - 3:00 PM
Location: SB 160

Abstract

Turbulence and mixing are both ubiquitous in the environment of marine organisms and a critical part of large-scale physical and chemical oceanographic budgets. Recent studies have shown conflicting results about whether zooplankton contribute to ocean mixing and whether turbulence affects zooplankton feeding and swimming behavior positively, negatively or not at all. At least some of the confusion likely arises from the lack of properly resolved, simultaneous and co-located observations of zooplankton and turbulence. This talk introduces and discusses results from preliminary deployments of a Video Plankton Recorder – Vertical Microstructure Profiler (VPR-VMP), which is shown to provide this type of data. There is evidence of avoidance of the VPR-VMP by krill, which raises questions as to whether any microstructure profiler can accurately assess zooplankton-generated mixing.

Exploring the Frontiers of Stellar Astrophysics with classical Cepheids: Rotation, Convection, Mass Loss and Multiplicity

Speaker: Dr. Hilding Neilson (University of Toronto)
Time: December 5, 2014 - 3:00 PM
Location: SB 265

Abstract
Classical Cepheids are evolved intermediate-mass stars that have formed a foundation of both cosmology and stellar astrophysics thanks to their brightness and the Leavitt Law (period-luminosity relation) for about a century. Thanks to their pulsation, these stars have been employed as laboratories for stellar structure and evolution models. In the past decade, new observations, from X-ray to infrared to interferometric, are changing our view of these stars, leading to new insights into the details of their structure and evolution. In this talk, I will discuss these recent observations and how they are allowing us to probe the details of stellar rotation, convection, stellar winds, and binary star evolution.

Globular Clusters, Dark Matter, and Galaxy Masses

Speaker: Dr. William Harris (McMaster University)
Time: November 21, 2014 - 3:00 PM
Location: AT101

Abstract

Recent work from many directions clearly shows that the total stellar mass of a galaxy is a strongly nonlinear function of its the total "halo mass" dominated by the dark matter potential; both dwarfs and supergiants are much more dominated by dark matter than mid-range galaxies where the star formation efficiency was largest. But is there any type of stellar subpopulation that behaves linearly with halo mass? It seems that the total mass in the globular cluster population does exactly that, remarkably independent of galaxy size, type, or environment. I will review the recent evidence for this claim and discuss what it may mean for understanding early star formation in a galaxy.

Feedback and tidal stripping in dwarf galaxies

Speaker: Dr. David Williamson (Laval University)
Time: November 14, 2014 - 3:00 PM
Location: AT101

Abstract
The observed mass-metallicity relation demonstrates the metallicity of a galaxy increases tends to increase with its mass. Various mechanisms have been proposed to explain this trend, including suppression of outflows by a strong halo potential or by inflowing material, as well as processes such as ram-stripping and tidal-stripping of metal-rich ejecta. Although tidal stripping is not thought to be a key factor, it may have a significant contribution in the depletion of metals from dwarf galaxies. We are performing simulations to quantify the strength of this effect. Producing realistic dwarf galaxies necessitates the use of suitable star-formation and feedback methods, which I will review.

A New Path Towards Machine Intelligence

Speaker: Dr. Chris Adami (Michigan State University)
Time: November 7, 2014 - 3:00 PM
Location: AT101

Modified Title and Abstract

Abstract :
For over fifty years, engineers have attempted to achieve intelligence that rivals human performance, but with only limited success in some specialized arenas such as chess. I will discuss

what I believe is the central reason behind this failure, and how using the biological process of evolution can overcome that problem. I then discuss several applications of our "evolutionary intelligence" approach to understand brains and behavior.

GrayStar: A Web application for pedagogical stellar atmosphere and spectral line modelling and visualisation

Speaker: Dr. Ian Short (Saint Mary's University)
Time: October 31, 2014 - 3:00 PM
Location: AT101

Abstract
GrayStar is a stellar atmospheric and spectral line modelling, post-processing, and visualisation code, suitable for classroom demonstrations and laboratory-style assignments in courses such as ASTR 2400 (Physics of Stars) at Saint Mary's. It has been developed in Java and deployed in JavaScript and HTML. The only software needed to compute models and post-processed observables, and to visualise the resulting atmospheric structure and observables, is a common Web browser. Therefore, the code will run on any common PC or related X86(-64) computer of the type that typically serves classroom data projectors, is found in undergraduate computer laboratories, or that students themselves own, including those with highly portable form-factors such as net-books and tablets. The user requires no experience with compiling source code, reading data files, or using plotting packages. More advanced students can view and capture the JavaScript source code using the developer tools provided by common Web browsers. The code is based on the approximate gray atmospheric solution and runs quickly enough on current common PCs to provide near-instantaneous results, allowing for

real time exploration of parameter space.
I will describe the user interface and its inputs and outputs and suggest specific pedagogical applications and projects, and comment on the computational strategy and methodology as necessitated by Java and JavaScript, and on the vagaries of emulating a plotting package in HTML.
I have made the application itself, and the HTML, CSS, JavaScript, and Java source files available to the community.
The Web application and source files may be found at www.ap.smu.ca/~ishort/GrayStar.

Toward model-independent calculations of atomic nuclei

Speaker: Thomas Papenbrock)University of Tennessee, USA)
Time: October 24, 2014 - 3:00 PM
Location: AT101

Abstract
In recent years, nuclear theory started to shift away from models to approaches with a stronger theoretical foundation. Effective field theory and renormalization group techniques are used for the development of nuclear interactions that are systematically improvable and linked to the strong interaction. The increasing availability of computational cycles has allowed practitioners to solve the nuclear quantum many-body problem for medium-mass nuclei, with a particular focus on neutron-rich isotopes. The goals of these calculations are reliable predictions for experimentally relevant nuclei with a quantification of theoretical uncertainties. This colloquium talk reviews some of the recent developments and highlights in the field.

Exoplanetary Worlds: Atmospheres and Architectures

Speaker: Dr Stanimir Metchev (University of Western Ontario)
Time: October 17, 2014 - 3:00 PM
Location: AT101

Abstract
The detection of global weather phenomena in irradiated extrasolar hot Jupiter planets has provided tremendous insights into their atmospheric structure. Non-irradiated substellar atmospheres probe weather in an entirely different regime, where global atmospheric flows result primarily from a combination of rapid rotation and internal convection - e.g., as in the atmosphere of Jupiter - rather than from external forcing. Isolated brown dwarfs are ideal targets for such investigations because they possess planet-like atmospheric dynamics, yet have greater intrinsic brightnesses and lack nearby bright stars to contaminate observations. I will overview recent results on non-irradiated brown dwarf atmospheres, focussing on a finding that large atmospheric features analogous to Jupiter's Great Red Spot are ubiquitous in cool substellar atmospheres.
I will also discuss results on the occurrence of asteroid belts around solar neighborhood stars, as found in a recently completed study on WISE. Together with the direct characterization of exoplanetary atmospheres, resolved imaging of the frost lines and terrestrial zones of nearby planetary systems offers exciting prospects for the generation of extreme-contrast imaging telescopes.

The monsters within: The cosmic evolution of black holes, galaxies, and dark matter halos

Speaker: Dr. Ryan Hickox (Dartmouth College)
Time: October 10, 2014 - 3:00 PM
Location: AT101

Abstract
Recent years have seen remarkable advances in our understanding of how supermassive black holes form and grow over cosmic time, and how energy released by active galactic nuclei (AGN) connects the growth of black holes to their host galaxies and large-scale structures. Still a basic and essential question has remained largely unanswered: Does the fueling of AGN activity occur along with star formation in galaxies, or does feedback from AGN suppress star formation? I will argue that both scenarios are correct, depending on the properties of the galaxy and its dark matter halo. Specifically, I will review recent results suggesting that the long-term rate of black hole accretion is closely tied to the rate of star formation, so that essentially *all* star-forming galaxies may be thought of as hosting an AGN after accounting for rapid stochastic variability. I will further discuss the strong evidence that in passive galaxies in massive halos, mechanical feedback from AGN serves to heat gaseous atmospheres and suppress further star formation. These results suggest that the connection between black holes and their host galaxies changes significantly as halos grow and galaxies evolve from star-forming to passive systems.

The Advanced Spectral Library Project

Speaker: Dr Thomas Ayres (CASA, University of Colorado)
Time: October 3, 2014 - 3:00 PM
Location: AT101

Abstract

The Advanced Spectral Library (ASTRAL) is a Hubble Space Telescope (HST) Large Treasury Project, whose aim is to collect high-quality ultraviolet (115-310 nm) echelle spectra of representative stars with resolution and signal-to-noise rivaling the best that can be achieved at ground-based observatories in the visible. During HST's Cycle 18 (2010-2011), ASTRAL was allocated 146 orbits to record eight iconic bright late-type ("cool") stars -- all well-known cosmic denizens with vaguely unpronounceable names like Procyon and Betelgeuse -- utilizing the powerful Space Telescope Imaging Spectrograph (STIS). In current HST Cycle 21, ASTRAL was allocated an additional 230 orbits to extend the project to the hot side of the H-R diagram: 21 targets including equally iconic objects like Vega, Sirius, and Regulus. I will describe some of the scientific motivations for observing hot and cool stars in the ultraviolet, the unique instrumental characteristics of STIS that enable a broad survey like ASTRAL, the progress in the program to date, and prospects for the future.

Gamma-ray spectroscopy with rare isotope beams at NSCL – observatory for femtoscale objects

Speaker: Dr Hiro Iwasaki (Michigan State University)
Time: September 26, 2014 - 3:45 PM
Location: AT101

Abstract
The advent of rare isotope beams opens the possibility to study exotic nuclei which are more neutron-rich or neutron-deficient compared to stable nuclei in nature. Unexpected properties, such as nuclear shell evolution and emergence of halos, have been discovered in the past two decades, which has modified our vision

of atomic nuclei and can even alter scenarios of nucleosynthesis in the Universe. As a way to observe unique forms and dynamics of new, exotic isotopes which are often produced in very low amounts, the advanced gamma-ray tracking array GRETINA (Gamma-Ray Energy Tracking In-beam Nuclear Array) has recently been commissioned at LBNL and employed in physics campaign programs with fast rare isotope beams at NSCL. This talk will provide an overview of our physics motivation and implementation of gamma-ray Doppler-shift techniques with GRETINA. Recent physics highlights from nuclear structure and astrophysics studies will also be introduced and discussed.

The Studio physics program at Florida State University

Speaker: Simon Capstick (Florida State University)
Time: September 19, 2014 - 3:00 PM
Location: AT101

Abstract
By changing the way that introductory physics courses are taught, using the results of more than a decade of physics education research, it is possible to make measurable improvements in student understanding of basic concepts and in their satisfaction, while retaining a focus on their ability to solve physics problems. The experience of a group at Florida State University who have established and offered a two-semester introductory 'Studio' physics sequence is described. This talk will outline our implementation of the studio physics program, what we have learned, and how we have adapted the most effective practices to improve the parallel traditional lecture, lab and recitation sections of the same course.

Exploring the Outskirts of Galaxy Clusters

Speaker: Dr Eric Miller (MIT Kavli Institute for Astrophysics and Space Research)
Time: September 12, 2014 - 3:00 PM
Location: AT101

Abstract

As the largest collapsed systems in the Universe, galaxy clusters grow and evolve under the dominant force of gravity. This process produces simple predictions about the thermodynamics of the diffuse hot intracluster medium (ICM), the dominant baryon component in these systems. Yet the state of the ICM can be substantially altered by non-gravitational processes such as radiative cooling, feedback from star formation and AGN activity, and turbulence, bulk motion, and gas clumping. These effects are especially important in the outskirts of clusters, where much of the mass resides and where accretion is ongoing. Understanding the conditions of the ICM here has consequences for cosmology, chemical enrichment, and cluster astrophysics.

Recent studies have traced the hot, X-ray-emitting ICM to the virial radius and beyond in several galaxy clusters, beginning to clarify the thermodynamics at the cluster edge and constrain models of cluster growth. In this talk, I will summarize these studies and describe our own program to observe a large sample of relaxed clusters with the Suzaku X-ray Observatory. Our results show that the ICM is not in simple hydrostatic equilibrium in the outskirts, where we see indications of in-falling, low-entropy substructures and evidence for azimuthal variations in temperature and surface brightness. The large sample of clusters now assembled is remarkable for the apparent "universality" of thermodynamic profiles out to large radius, yet there are notable deviations which I will explore. I will finally discuss the host of systematic effects that can bedevil these challenging, low-surface-brightness observations, and future prospects for probing the outer frontier of galaxy clusters.

Modelling Far-UV Photoevaporation in Protoplanetary Disks

Speaker: Dr Jon Ramsey (Institut für Theoretische Astrophysik, Heidelberg)
Time: July 10, 2014 - 2:01 PM
Location: AT101

It is well-established that protoplanetary disks transition from optically thick to thin in ~10 ^5 yr, much faster than the viscous accretion timescale. One of the proposed mechanisms to explain this rapid clearing is photoevaporation by stellar UV and X-ray photons. While extreme-UV and X-ray photoevaporation have been well-studied in the literature, due to its complexity, far-UV photoevaporation has so far been limited to 1D viscous evolution or static 2D thermochemical models. In this talk, I will present the first self-consistent radiation hydrodynamic models of far-UV photoevaporation in disks, and discuss the resulting consequences for disc structure and evolution.

Unveiling Fundamental Physics from the Cosmic First Light, revealing Simplicity and Complexity in the Universe at Large

Speaker: Dr J. Richard Bond (CITA)
Time: April 4, 2014 - 3:00 PM
Location: AT 101

The remarkable precision-cosmology results from the satellites Planck and WMAP and the the earth-bound higher resolution ACT and SPT unveiled over the past two years follow two decades of experimentation since the COBE satellite discoveries and the first proposal for Planck. We have revealed a story of simplicity at the time the first-light photons were freed from matter 380000 years after the (so-called) Big Bang, 13.8 billion years ago, encoded in seven (or so) numbers which so-far fully characterize the photon distribution then. Even more astounding is currently just two numbers characterize the energy-density-phonons whose condensate drives the accelerated inflation of the ultra-early Universe and whose fluctuations grow into the Cosmic Web of galaxies we observe. A third number is the long-sought amplitude of quantum-generated primordial gravity waves, apparently now revealed by the South-Pole-based BICEP/KECK. I'll talk about the glorious experimental ride we have been on, our near-term future, and the theoretical implications we derive, with a focus on early Universe physics. Data-tensions exist which may point to more early-Universe complexity.

X-ray Astrophysics with Innovative Non-Dispersive Imaging Spectroscopy

Speaker: Dr. Megan Eckart, NASA Goddard Space Flight Centre
Time: March 24, 2014 - 10:35 AM
Location: AT101

Abstract: High-resolution imaging spectroscopy in the soft x-ray waveband (0.1-10 keV) is an essential tool for probing the physics of the x-ray universe. Unique line diagnostics available in this waveband allow transformative scientific observations of a wide array of sources. For example, measurements of outflow processes from supermassive black holes may identify the key mechanism that regulates the co-evolution of host galaxies and their central black holes, and measurements of turbulence in the intra-cluster medium of galaxy clusters can be used to calibrate hydrodynamic simulations used in cosmology. I will introduce the microcalorimeter, a low-temperature detector capable of x-ray photon counting with high spectral resolution, and I will talk about the scientific potential of upcoming space-based experiments using arrays of such detectors, including the Soft X-ray Spectrometer, a pioneering microcalorimeter instrument that will launch aboard the Japanese-led Astro-H mission in 2015. Finally, I will discuss our recent advances in detector technology development that will enable the next-generations of x-ray spectrometers.

Lorentz Contraction in Electron Interferometry

Speaker: Dr. Peter Marzlin, St Francis Xavier University
Time: March 14, 2014 - 3:00 PM
Location: AT101

Abstract: Over a century after its discovery, Special Relativity stills inspires scientists and laymen alike because its predictions often defy common sense. This is highlighted by thought experiments such as Bell's spaceship paradox, which is a direct consequence of Lorentz contraction. Special Relativity has been confirmed in many experiments, but surprisingly Lorentz

contraction has so far only been confirmed indirectly.
In this talk I will describe a proposal to measure Lorentz contraction by means of electron interferometry. The proposed experiment may also be viewed as a realization of Bell's spaceship paradox. We suggest to use the Kapitza-Dirac effect to split and recombine a beam of relativistic electrons by transferring momentum and energy from the photons in a laser beam to the electrons. Lorentz contraction will then prevent a perfect recombination of the electron beam and thus be visible by the appearance of an additional peak in the interference pattern.

Winds Launched Near the Event Horizons of Supermassive Black Holes

Speaker: Dr. George Chartas, College of Charleston
Time: March 7, 2014 - 3:00 PM
Location: AT305

Abstract: Some of the most fascinating properties of quasars arise from the strong gravitational field that dominates over all other forces near the supermassive black hole SMBH). Observations of the X-ray spectra of quasars have the potential of testing the theory of General Relativity in a region of strong gravity, constraining the structure of the X-ray emitting region, and further
our understanding of the quasars' role in feedback, quenching of star formation and galaxy evolution.
I will present results from the detection of near-relativistic winds launched near the innermost stable circular orbits of SMBHs. The two main mechanisms proposed for accelerating the ultra-
fast outflows observed in active galactic nuclei are radiation and magnetic driving. I will briefly review these acceleration mechanisms and test them against current observations of ultra-fast

outflows.

Relativistic magnetospheres of spinning bodies

Speaker: Dr. Ted Jacobson, University of Maryland
Time: February 28, 2014 - 3:00 PM
Location: AT305

Abstract: Some of the most spectacular and mysterious astrophysical processes involve spinning magnetized neutron stars and black holes, whose rotational energy is converted via plasma to electromagnetic flux, accelerated particles and jets. In this setting, the energy of the matter in the plasma is often negligible compared with that of the field, allowing a "force-free" description via non-linear equations for the field alone. In this talk I will discuss some of the basic physics of these phenomena and their description using force-free electrodynamics.

New Insights into the Formation and Evolution of the Most Massive Galaxies

Speaker: Dr. Danilo Marchesini, Tufts University
Time: February 14, 2014 - 3:00 PM
Location: AT305

Abstract: In the past decade, our understanding of the galaxy population in the last 12 billion years of cosmic history (i.e., since z=4) has improved significantly, thanks to the increasing ability to construct representative snapshots (in time) from z=4 (when the universe was ~1.5 billion years old) to the local universe. I will

summarize our current knowledge of the evolution of massive galaxies since z=4, with an emphasis on the recent results from the the UltraVISTA survey. I will conclude by presenting new findings on the evolution since z=3 of the progenitors of local ultra-massive galaxies, challenging previously proposed pictures for the formation and evolution of elliptical galaxies.

Planck and Inflation

Speaker: Dr. Joel Meyers, CITA, University of Toronto
Time: February 13, 2014 - 3:00 PM
Location: AT101

Abstract: The results from the Planck satellite have provided excellent constraints on many cosmological parameters allowing us to probe the physics of inflation. While all observations are currently consistent with the simplest models of inflation, many more complicated scenarios are also consistent with the data. In this talk, I will focus on the theoretical aspects of inflation in light of the Planck data. I will highlight a few observables which are measured by Planck and discuss how future observations will give us non-trivial information about the physics of the early universe.

The Dynamics of Galaxy Pairs in a Cosmological Setting

Speaker: Dr. Jorge Moreno, University of Victoria & CITA, Canada
Time: January 31, 2014 - 3:00 PM
Location: AT101

Abstract: Galaxy pairs provide a unique view of the interaction sequence experienced by merging galaxies. Observationally, interactions have a dramatic influence on galaxies, even during the earliest stages. Theoretically, a large industry of numerical merger simulations has developed. Unfortunately, the latter depend on the assumption that interacting galaxies evolve in isolation. A central goal of this work is to investigate the validity of this assumption. Using the Millennium Simulation, we built a large catalogue of simulated galaxy pairs. For each pair, we searched for a more massive 'third' galaxy in the vicinity. A comparison of the binding-energy of the pair to the binding energy to the third galaxy allows us to rank pairs in terms of their probability of merging. The results are as follows: (a) 10% of the pairs are inevitable mergers in isolation; (b) 35% are likely mergers, with minimal influence of a third massive galaxy in the vicinity; (c) 25% will most likely interact, but not merge because the third galaxy will split them apart; and (d) 30% are chance pairs orbiting a third massive galaxy, and will never merge. This work demonstrates the importance of connecting galaxy pairs to the rest of the Universe, and provides guidance to both observers and simulators on how realistic it is to treat merging galaxies in isolation. Lastly, I will discuss ongoing work based on binary merger simulations. These two complementary methods (semi-analytics and hydro-simulations) will help us bridge the gap between galactic and cosmological scales, and enrich our understanding of the physical processes governing the interaction sequence.

The Canadian ASTRO-H Metrology System - Laser-Based Image Correction and Calibration for an X-Ray Telescope

Speaker: Dr Casey Lambert, CSA and SMU
Time: January 24, 2014 - 3:00 PM
Location: AT101

Abstract: ASTRO-H is an x-ray astronomy telescope being built by the Japan Aerospace and Exploration Agency and it is designed to improve the sensitivity of wideband observations of high energy radiation. The Canadian contribution to this mission, through the Canadian Space Agency and built by Neptec Design Group, is an internal alignment measurement tool termed the Canadian ASTRO-H Metrology System (CAMS). This instrument uses a pair of lasers to actively measure thermo-elastic distortions of the spacecraft during x-ray observations. Specifically the lateral motion between the telescope mirror (HXT) and the imager (HXI), which are separated by a focal length of 12-m, will be measured by each laser. The two measured offsets will be used to estimate the in-plane translation as well as the rotation about the boresight axis. This information will be used to correct and enhance images obtained by the telescope.
The presentation will feature a brief description of the CAMS hardware, an overview of the data processing algorithms with simulation results, results of the ground calibration, and the procedure for in-flight calibration. The introduction includes background information for the ASTRO-H mission and the general design and operation of the CAMS, highlighting the advanced technology of its laser transmitter, corner-cube reflector, and image sensor. The geometric relationships required to obtain the three required relative-motion variables from the two CAMS measurements will be established. The performance of the image correction algorithm based on CAMS data will be studied as simulated x-ray images will first be corrupted by structural distortions of the telescope and then corrected using simulated CAMS data.
The calibration of the CAMS system is a two-step process. The internal CAMS optics are calibrated on the ground while the

overall calibration using observations from the x-ray telescope will be performed on-orbit. Results of the ground calibration will be presented and details of the in-flight calibration will be included also. The in-flight calibration involves observations of known x-ray sources to estimate the angular and translational shifts of laser metrology system experienced during integration and launch. Simulation results will be presented to assess the expected performance of the calibration procedure.

The X-ray View of Galaxies in High-Density Environments

Speaker: Tyler Desjardins, University of Western Ontario
Time: January 17, 2014 - 3:00 PM
Location: AT305

Abstract: The environments of galaxies strongly influence their evolution. In the local Universe, more than half of galaxies live in groups and clusters, therefore understanding how this environment affects galaxies is important. Using multi-wavelength observations, we can quantify many aspects of the galaxies from the neutral gas to the stellar mass. I will present results of Chandra and XMM-Newton X-ray observations of the diffuse X-ray emission in groups and the X-ray point sources in the Coma infall region, respectively. In groups, we see the formation of the hot IGM and I will show how the IGM scales with other parameters. Regarding cluster infall galaxies, I will discuss known galaxy X-ray scaling relations and how the Coma cluster compares to other environments. I will also comment on the fraction of active galaxies in the Coma infall region in contrast to high-redshift clusters and field galaxies.

Life and Death at Cosmic High Noon

Speaker: Dr. Marcin Sawicki, Saint Mary's University
Time: March 24, 2014 - 10:17 AM
Location: AT101

Abstract: Galaxies are giant machines that turn gas into stars and the rate at which they were doing this was highest around redshift z=2, when the universe was only 1/4 of its present age. This is "cosmic high noon", and I will discuss both starforming (live) and quiescent (dead) galaxies at z~2. My choice of this live/dead terminology here is not just a fanciful analogy but is central to my talk: I will show how the starforming-to-quiescent transition follows rules that are very similar to those that govern human death, leading not only to a well-justified "live/dead" terminology for star forming and quiescent galaxies, but to a simple and direct explanation for the Schechter-like stellar mass function for massive galaxies along with potential insights into the quenching mechanism itself.

X-ray Astrophysics with Innovative Non-Dispersive Imaging Spectroscopy

Speaker: Dr. Megan Eckart, NASA Goddard Space Flight Centre
Time: March 28, 2014 - 3:00 PM
Location: AT101

Abstract: High-resolution imaging spectroscopy in the soft x-ray waveband (0.1-10 keV) is an essential tool for probing the physics of the x-ray universe. Unique line diagnostics available in this

waveband allow transformative scientific observations of a wide array of sources. For example, measurements of outflow processes from supermassive black holes may identify the key mechanism that regulates the co-evolution of host galaxies and their central black holes, and measurements of turbulence in the intra-cluster medium of galaxy clusters can be used to calibrate hydrodynamic simulations used in cosmology. I will introduce the microcalorimeter, a low-temperature detector capable of x-ray photon counting with high spectral resolution, and I will talk about the scientific potential of upcoming space-based experiments using arrays of such detectors, including the Soft X-ray Spectrometer, a pioneering microcalorimeter instrument that will launch aboard the Japanese-led Astro-H mission in 2015. Finally, I will discuss our recent advances in detector technology development that will enable the next-generations of x-ray spectrometers.

Discovering Rare AGN with the Stripe 82X Survey

Speaker: Dr. Stephanie LaMassa, Yale University
Time: March 21, 2014 - 4:00 PM
Location: AT301

Abstract: Supemassive black holes grow by accreting matter in a phase where they are observed as active galactic nuclei (AGN). Astronomical surveys are key for studying representative samples of AGN at various luminosities and redshifts. AGN at high luminosity and high redshift are rare and can only be identified when large volumes of the Universe are explored through wide area surveys. Until recently, no large area X-ray survey has existed, meaning that a key phase in SMBH growth and SMBH/galaxy co-evolution is missing. To rectify this gap, we have begun a wide area X-ray survey in the Sloan Digital Sky Survey region Stripe 82

which contains a veritable treasure trove of multi-wavelength coverage, expediting follow-up of identified X-ray sources. In this talk, I will review the highlights of our first release of "Stripe 82X" which covers ~16.5 deg^2 with ~3300 X-ray sources identified. I will discuss our current ground-based follow-up campaigns to target interesting classes of AGN a! nd will comment on what we expect to learn with the addition of 20 deg^2 awarded to our team in the upcoming XMM-Newton observing cycle.