Colloquia Abstracts

Friday September 12

3:00 PM
SB 265

Dr. Dae-Sik Moon

University of Toronto

Infrared Observations and Instrumentation for Studying Core-collapse Supernova Explosions and New Hard X-ray Sources

Advances in modern astronomy are heavily dependent on the developments of new instruments which can sometimes dramatically change our understanding of the Universe. I will introduce new instrumentation and experimental efforts at the University of Toronto which are optimized for the developments of new near-infrared instruments for world's largest telescopes of the present and future. I will then connect the capabilities of the new instruments to the current research into the supernovae explosions and new hard X-ray sources, focusing on the asymmetric core-collapse supernova explosions revealed by dense iron ejecta and the new class of circumstellar material around highly-obscured hard X-ray binaries that have recently been discovered.

Friday September 26

3:00 PM
SB 265

Dr. Alex Razoumov

Saint Mary's University

Modelling outflows from high-redshift starburst galaxies

In this talk which is a continuation of the seminar I gave at Saint Mary's 1.5 years ago I will present results from a numerical study of the multiphase interstellar medium in high-redshift protogalactic clumps. Such clumps are abundant at z=3 and are thought to be a major contributor to damped Lyman-alpha absorption. I show that during star formation episodes these systems feature outflows with neutral gas velocity widths up to several hundred km/s. In these models thermal energy feedback from winds and supernovae results in efficient outflows only when cold (300K), dense (hundreds of solar masses per parsec cubed) clouds are resolved at grid resolution of 10 pc or so. At lower 20 pc resolution the first signs of the multiphase medium are spotted but thermal injection of feedback energy cannot yet create hot expanding bubbles around star-forming regions -- instead feedback tends to erase high-density peaks and suppress star formation. On the other hand, at high resolution feedback compresses cold clouds, often even boosting star formation; at the same time a larger fraction of feedback energy is channeled into low-density bubbles and winds. These winds often entrain compact neutral clumps which produce multi-component metal absorption lines.

Friday October 3

3:00 PM
SB 265

Dr. Isao Tanihata

Osaka University

Renaissance in Nuclear Physics

The invention of the radioactive beams opened a new research field in nuclear physics. Before the radioactive nuclear beams, only reactions between stable nuclei were the tools for studying nuclear properties. The radioactive nuclear beams enabled the study of reactions with short lived nuclei and thus the structure of nuclei in a much wider range of isospin (or neutron proton ratio) can now be studied. Form such studies many new structure and dynamical behaviors have been discovered, In particular the nuclei near the limit of existence show new phenomena such as neutron halo, neutron skin, and change of shells. In this talk, I present some of such new features obtained though the study of nuclear radii and related observables. Such new structure calls for the new development in nuclear theory and discussion will be given for the necessary direction for a next generation nuclear theory.

Friday October 10

3:00 PM
SB 265

Dr. Eduard Vorobyov

Saint Mary's University

Circumstellar disk masses in the embedded and T Tauri phases of stellar evolution

Motivated by a growing concern that masses of circumstellar disks may have been systematically underestimated by conventional observational methods, I present a numerical hydrodynamics study of disk masses around low-mass Class 0/I/II objects. Two mechanisms for radial transport of mass and angular momentum in circumstellar disks are considered: gravitational torques associated with gravitational instability and spiral structure, and viscous torques associated with the magneto-rotational instability. I find that circumstellar disks have similar mean masses (<M_d> = 0.11 - 0.13 Msun) in the Class 0/I phases but a factor of 2 lower mean mass in the Class II phase. The obtained mean disk masses are _larger_ than those recently derived by Andrews & Williams and Brown et al. The difference is especially large for Class II disks, for which Andrews and Williams report median masses of order 3*10^{-3} Msun. I also present relations between the time-averaged disk and stellar masses for Class 0/I/II objects.

Friday October 17

3:00 PM
SB 265

Dr. Niel Brandt

Pennsylvania State University

Recent Results from the Deepest X-ray Surveys: Adventuring Through the Distant X-ray Universe

The deepest X-ray surveys, such as the Chandra Deep Fields, continue to provide fascinating insights about active galactic nuclei (AGNs), starburst & normal galaxies, groups & clusters, and large-scale structures in the distant X-ray universe. I will briefly review the status of these surveys and describe some key recent results flowing from them. Topics covered will include (1) new constraints on the cosmic evolution of AGN accretion processes and spectral energy distributions; (2) the AGN content of forming galaxies at high redshifts, such as submillimeter sources; and (3) the X-ray evolution of non-active late-type and early-type galaxies over the last half of cosmic time. I will also discuss some key outstanding problems and prospects for short-term and long-term advances.

Thursday October 23

3:30 PM
B218

Dr. Patrick Hall

York University

Quasar Accretion Disk Winds and Broad Emission Lines

A quasar is the light produced as matter spirals into a supermassive black hole at the center of a distant galaxy. The matter forms a thin accretion disk which heats up through a kind of friction, giving off blackbody radiation at a range of temperatures. Quasars also show emission (and sometimes absorption) from ionized gas moving at speeds of thousands of km/s, usually with an overall blueshift. I will argue that this line-emitting gas traces an optically thick, outwardly accelerating wind at the surface of the accretion disk. I'll review why such winds are needed to explain the single-peaked emission lines of quasars, and present new modelling of them which aims to reproduce the observed velocity shifts as well as line shapes.

Friday October 31

3:00 PM
SB 265

Dr. Reiner Krucken

Technische Universitaet Muenchen

NuSTAR at FAIR: Shell structure in exotic nuclei and its relation to nucleosynthesis

The Nuclear Structure, Astrophysics and Reactions (NuSTAR) collaboration at the international Facility for Antiproton and Ion Research (FAIR) at GSI Darmstadt, Germany, aims at the investigation of the many facets of the structure and dynamics of atomic nuclei with extreme ratios of neutrons to protons. We already know that the well known shells structure in nuclei is modified when moving away from the valley of stability. Such changes can have profound effect on the path of nucleosynthesis processes such as the rp- and r-processes. An overview of the scientific aims and the technical plans for the NuSTAR facilty at FAIR will be given. Sample results are presented from recent experiments at GSI Darmstadt to highlight the thrust of the TU Munich group. The relation to the aims and projects of the Munich Cluster of Excellence "Origin and Structure of the Universe" will be included.

Friday November 7

3:00 PM
SB 265

Dr. James Taylor

University of Waterloo

Small-scale Structure in the Universe

The study of large scale structure in the universe – clusters of galaxies, associations of clusters, and the sheets and filaments that link them – is a venerable topic in cosmology. Over the past few decades it has provided important measures of the cosmological parameters, the expansion history and the equation of state of the universe, and has mapped out the basic scaffolding within which galaxies form. The non-linear part of structure formation, on smaller scales, is traditionally seen as a messy topic, intractable except through numerical simulations and greatly complicated by the effects of baryons. I will try to provide some counterweight to this traditional view by discussing several cases where small-scale structure formation should produce fairly simple patterns, patterns that are testable with current observations and stand to tell us a lot about dark matter, galaxy formation and galaxy evolution. These include substructure in galaxy clusters as inferred from gravitational lensing, small satellite galaxies such as those of the Local Group, and dark matter substructure within the Milky Way itself.

Friday November 14

2:00 PM
SB 265

Dr. Jens Dilling

TRIUMF and University of British Colombia

Understanding the universe, one rare isotope at a time

Many of the remaining big questions in understanding the universe, such as how and where the chemical elements in the universe are created, the life and death of stars, or the nature of neutrinos are intimately related to our fundamental understanding of the atomic nucleus. Progress in nuclear theory as well as the advent of rare-isotope beam facilities are key ingredient to getting closer to answering these questions. Rare isotopes are typically only generated in stars, but can also be produced at various facilities around the world and one of the leaders is the ISAC complex at TRIUMF, Vancouver. The isotopes, however, are often produced in minuscule quantities, and with half-lives as short as few ms, hence the name rare. The mass of an atom is a fundamental quantity, and provides relevant information of the binding of the many-body quantum mechanical system, as well as allows us to probe nuclear theory. To overcome the obstacles of rare isotopes and get information about the atoms, we have developed very sensitive and fast methods using ion trap techniques at TITAN (TRIUMF's Ion Trap of Atomic and Nuclear science). At TITAN we are able to measure masses, using one single ion in as short as 8ms with 10ppb precision, breaking a new world-record for precision mass spectroscopy. Using this, we are able to probe into the world of nuclear halos. Teetering on the edge of nuclear stability, the properties of halo nuclei have long been recognized as one of the most stringent tests of our understanding of the strong force. Nuclear halos are an exotic form of nuclear matter that continues to defy the considerable scientific efforts focused upon them in the last two decades. The example of 11Li belongs to a special category of halos called Borromean, bound as a three-body family, the two-body siblings 10Li and 2n are unbound as separate entities. In this talk. I will report on theses measurements and how they relate to answering the big questions. An overview of the TITAN facility and ISAC will be given, and plans for the extension of the TRIUMF rare-isotope beam complex.

Friday November 21

3:00 PM
SB 265

Dr. Alex Fullerton

Space Telescope Science Institute / HIA

What are the Mass-Loss Rates of O-Type Stars?

O-and B-type stars lose mass throughout their lives via their dense, radiation-driven winds. These outflows alter the course of stellar evolution, and also provide energy and chemically enriched material to drive the evolution of interstellar environments. Consequently, hot-star winds are important agents of change in a variety of astrophysical contexts. But how well do we know the mass-loss rates associated with O-type stars? In this talk, I will review the different techniques used to measure the mass-loss rates of early-type stars, and will describe the current state of confusion that results from the markedly different estimates provided by major diagnostics. I'll discuss the likely resolution of this mass-loss discrepancy and its implications for our understanding of the structure of hot-star winds. Along the way, I'll also highlight some results from the FUSE mission and emphasize the value of simple modelling techniques.

Friday November 28

3:00 PM
SB 265

Dr. Laura Parker

McMaster University

Mapping Dark Matter with Weak Lensing g

We can use gravitational lensing to study the amount and distribution of matter in the universe, which in turn may provide insight into the nature of dark matter. In this talk I will introduce the theory of weak lensing and then highlight some of the exciting results of recent years. I will then focus some attention on lensing results from the CFHT Legacy Survey and from a sample of intermediate redshift galaxy groups. Time permitting I will also discuss what we can hope to accomplish with future facilities.

Friday December 5

3:00 PM
SB 265

Dr. David Hanna

McGill University

Recent Results from the VERITAS Gamma-ray Observatory

At energies greater than about 100 GeV, gamma-ray astronomy can be carried out using ground-based telescopes which detect the Cherenkov light from air-showers caused by gamma rays impacting the upper atmosphere. A new generation of such detectors has been constructed in recent years; its newest member is the VERITAS detector in southern Arizona. VERITAS achieved 'first light' in the spring of 2007 and is currently the most sensitive such instrument viewing the northern skies. In this colloquium I will outline the scientific motivation for very-high-energy gamma-ray astronomy, describe the techniques involved, and report on the latest results from VERITAS.