CASCA MANITOBA 2016

Canadian Astronomical Society
Société Canadienne d'Astronomie

Annual General Meeting
May 30 - June 2, 2016

Fort Garry Hotel
Winnipeg, Manitoba

THE UNIVERSITY OF WINNIPEG

UNIVERSITY OF MANITOBA

BRANDON UNIVERSITY

ROYAL ASTRONOMICAL SOCIETY OF CANADA
WINNIPEG CENTRE

CANADIAN ASTRONOMICAL SOCIETY
SOCIÉTÉ CANADIENNE D'ASTRONOMIE

WITP
Winnipeg Institute for Theoretical Physics

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Physics and Astronomy Graduate Students' Association (PAGSA)

University of Manitoba Students' Union (UMSU)

University of Manitoba Graduate Students' Association (GSA)

Dunlap Institute for Astronomy and Astrophysics

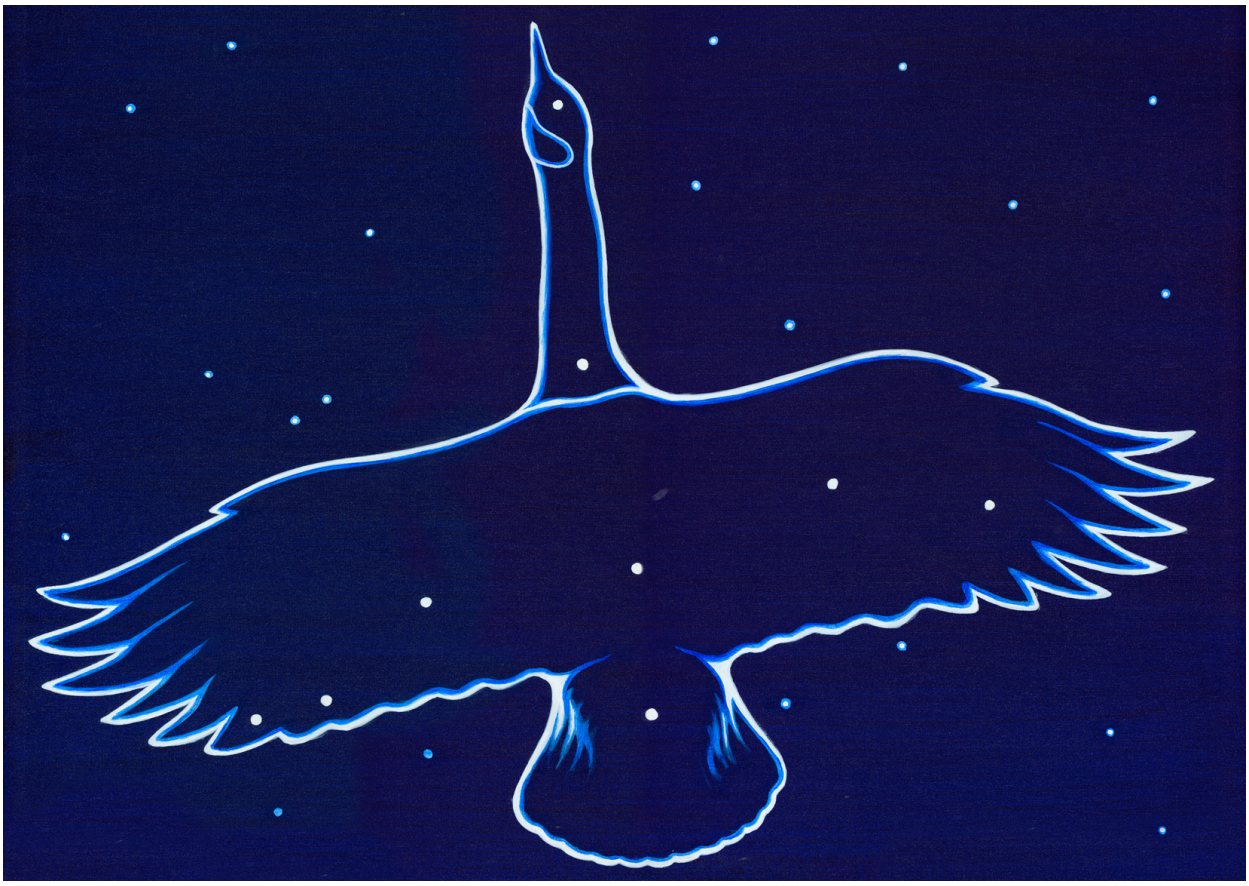
Canada France Hawaii Telescope

ABOUT OUR LOGO

The colours used in the logo are the traditional First Nations colours for representing the cardinal directions (North – white, South – red, East – gold, West – black).

The Canada Goose represents this Canadian conference as well as Manitoba, since this province is directly on the migratory path. In addition the goose may represent the travel of everyone as they journey to Winnipeg. This particular artwork of the goose has an astronomical connection as it is based off a commissioned work by Manitoba First Nations artist, Edwin Bighetty, and represents the First Nations concept of the constellation of Cygnus, which is called Niska (the stars of which are shown). In the First Nations tradition, the goose can be seen flying down the Milky Way as it heads south for the winter.

The two rivers, the Red and Assiniboine, in the background show the Forks, which has been a traditional meeting place for more than 6000 years.



Original artwork of Niska, by Edwin Bighetty. Used with permission.

CODE OF CONDUCT

The organizers are committed to making this meeting productive and enjoyable for everyone, regardless of age, race, ethnicity, sexual orientation, gender identity, gender expression, marital status, nationality, political affiliation, religion, ability status, physical appearance or educational background. We will not tolerate harassment of participants in any form. Attendance at a CASCA meeting implies consent to abide by this code of conduct. Explicitly, please follow these guidelines:

- Behave professionally. Harassment and sexist, racist, or exclusionary comments or jokes are not appropriate. Harassment includes sustained disruption of talks or other events, inappropriate physical contact, sexual attention or innuendo, deliberate intimidation, stalking, and photography or recording of an individual without consent. It also includes offensive comments related to gender, sexual orientation, disability, physical appearance, body size, race or religion.
- All communication should be appropriate for a professional audience including people of many different backgrounds. Sexual language and imagery is not appropriate.
- Be kind to others. Do not insult or put down other attendees.

Participants asked to stop any inappropriate behaviour are expected to comply immediately. Attendees violating these rules may be asked to leave the event or conference at the sole discretion of the organizers without a refund of any charge.

Any participant who wishes to report a violation of this policy is asked to speak, in confidence, to CASCA's designated contact(s) who will be identified by the LOC, a member of the LOC, a member of the Diversity & Inclusivity Committee or a member of the CASCA Board.

Consequences may range from verbal warning, to ejection from the meeting without refund, to notifying appropriate authorities. Retaliation for complaints of inappropriate conduct will not be tolerated. If a participant observes inappropriate comments or actions and personal intervention seems appropriate and safe, they should be considerate of all parties before intervening.

Protocol for dealing with violations of this policy

To avoid any confusion or bias in dealing with reports of violations of the code of conduct, the following protocol will be followed:

- The designated CASCA contact will request a written record of the complaint including time/date plus particulars;
- The designated CASCA contact will bring the incident to the attention of the LOC and the CASCA Board;

- The designated CASCA contact will inform the individual(s) indicated to have violated the code of conduct of the allegation and ascertain and record their version of events.

Based on the nature of the violation and the response, the LOC, in concert with representatives of the CASCA Board, will decide upon appropriate actions. Where a violation of the policy is deemed to have occurred, a record will be kept to that effect within CASCA.

This code of conduct is based on the "London Code of Conduct", as originally designed for the conference "Accurate Astrophysics. Correct Cosmology", held in London in July 2015. The London Code was adapted with permission by Andrew Pontzen and Hiranya Peiris from a document by Software Carpentry, which itself derives from original Creative Commons documents by PyCon and Geek Feminism. It is released under a CC-Zero license for reuse.

CODE DE CONDUITE

Les organisateurs s'engagent à ce que cette conférence soit une expérience enrichissante et agréable pour tous, et ce, sans égard à l'âge, race, ethnicité, orientation sexuelle, identité de genre (et son expression), état civil, nationalité, affiliation politique, religion, degré d'habileté, apparence physique ou formation académique. Nous ne tolérerons aucune forme de harcèlement envers un ou des participant(s). Votre présence à cette conférence de la CASCA est votre consentement à respecter et à suivre ce code de conduite. Vous êtes donc priés de suivre les consignes suivantes:

- Comportez-vous toujours de façon professionnelle. Le harcèlement et les commentaires/plaisanteries de nature sexiste, raciste ou d'exclusion sont inappropriés. Le harcèlement inclut les perturbations soutenues de présentations ou autres événements, contacts physiques inappropriés, sous-entendus ou attention de nature sexuelle, et prises de photos ou enregistrements sans consentement. Il inclut aussi les remarques désobligeantes liées au genre, orientation sexuelle, degré d'habileté, apparence physique, taille, race ou religion.
- Toute communication se doit d'être appropriée pour un auditoire professionnel dont les membres proviennent de milieux différents. Les mots et les images de nature sexuelle ne sont pas appropriés.
- Restez courtois envers tous les autres participants, et évitez toute insulte ou autre humiliation.

Les participants auxquels l'on demandera de mettre fin à un comportement inapproprié devront se plier à cette directive immédiatement. Faute de quoi, ils pourraient se voir expulsés de la conférence sans aucun remboursement de leurs frais d'inscription. Le recours à l'expulsion est à la seule discrétion des organisateurs. Tout participant qui désirerait rapporter une infraction au code de conduite est prié de le faire en toute confidence auprès d'une des personnes désignées par le comité organisateur ou de l'un des membres de ce comité, du comité « Diversité et inclusivité » de la CASCA ou du conseil d'administration de la CASCA.

Les conséquences d'une infraction pourront aller d'un avertissement verbal à l'expulsion de la conférence sans remboursement. Les autorités locales pourraient aussi être alertées si nécessaire. Aucune représaille suite à une plainte pour comportement inapproprié ne sera tolérée. Si un(e) participant(e) est témoin d'actions et/ou de commentaires inappropriés et qu'il/elle juge une intervention nécessaire et sécuritaire, il/elle se doit de prendre tous et chacun en considération avant de le faire.
Protocole suite à une plainte

Afin d'éviter toute confusion ou biais dans le traitement d'un constat d'infraction, le protocole ci-dessous sera suivi:

- La personne désignée de la CASCA demandera un constat d'infraction écrit avec date et tous les détails pertinents à l'appui;
- La personne désignée de la CASCA portera l'incident à l'attention du comité organisateur et du conseil d'administration de la CASCA;
- La personne désignée de la CASCA informera ensuite le (ou les) individu(s) présumément impliqué(s) de cette plainte et recueillera leur(s) version(s) des faits.

Selon la nature de l'infraction et sa suite, le comité organisateur, de concert avec les membres du conseil d'administration de la CASCA, décidera des actions à prendre en réponse à la plainte. S'il est établi qu'une infraction a effectivement été commise, elle sera entrée dans un registre interne de la CASCA.

Ce code de conduite est basé sur le « London Code of Conduct » écrit à l'origine pour la conférence « Accurate Astrophysics, Current Cosmology » tenue à Londres en juillet 2015. Le « London Code » a été adapté avec permission par Andrew Pontzen et Hiranya Peiris d'un document de « Software Carpentry ». Ce document a lui-même été dérivé des versions originales écrites par « PyCon » et « Geek Feminism » sous license « Creative Commons ». Il est diffusé sous une license « CC-Zero » afin qu'il puisse être ré-utilisé.

WELCOME MESSAGE

On behalf of the University of Manitoba and the local organizing committee, I would like to extend a warm welcome to all the astronomers, students, teachers, press, and members of the public attending this year's annual meeting of the Canadian Astronomical Society (CASCA). This is a national meeting that gathers the preeminent astronomers and astrophysicists from Canada and around the world. University of Manitoba and our partners University of Winnipeg and Brandon University are proud to be hosting the meeting May 30-June 2 at the Fort Garry Hotel in downtown Winnipeg. We are excited and honoured that Dr. Art McDonald from Queen's University, recipient of the 2015 Nobel prize in Physics, has agreed to attend and deliver a public lecture on the evening of June 1.

The program will include a rich scientific and social program, including 4 society prize lectures, 7 invited talks, a graduate student workshop, a school teachers' (Gr. 6-12) workshop and posters/education session, a banquet (May 31) including a special speaker on First Nations astronomy, a tour to our new Human Rights Museum, in addition to the public lecture by Dr. McDonald. Scientific results presented will include discussions of the ground breaking detection of gravitational radiation by the LIGO interferometer. These will make CASCA 2016 a truly memorable event!

In addition to the regular meeting, each year a special Graduate Student Workshop is held on the opening day (May 30). The theme of this year's workshop was chosen to be networking and will be facilitated by Judy Thomson, a leading expert on networking and co-author of the best-selling book, Work the Pond. The networking session will include representatives from industry, postdocs, and researchers from across Canada.

I wish you all an enjoyable, informative, and productive meeting.

Sincerely,

Dr. Stefi Baum
Professor and Dean, Faculty of Science
University of Manitoba

ORGANIZING COMMITTEE

Stasi Baran, University of Manitoba

Stefi Baum, University of Manitoba

Ian Cameron, University of Manitoba

Gilles Ferrand, University of Manitoba

Jason Fiege, University of Manitoba (LOC chair)

Tyler Foster, Brandon University

Andrew Frey, The University of Winnipeg

Maiko Langelaar, University of Manitoba

Vesna Milosevic-Zdjelar, The University of Winnipeg

Christopher O'Dea, University of Manitoba (SOC chair)

Adam Rogers, University of Manitoba

Samar Safi-Harb, University of Manitoba

Andreas Shalchi, University of Manitoba

Jennifer West, University of Manitoba

REGISTRATION DESK AND ROOM LOCATIONS

All conference events will be held in the following locations:

Broadway Room	Opening Reception	Main Floor
Concert Hall	Banquet	7th Floor
Provencher Room	Plenary Talks	Main Floor
La Verendrye Room	Parallel Session Room	Mezzanine Level
Gateway Room	Parallel Session Room	Mezzanine Level
Assiniboine B	Teachers' Workshop	Fort Garry Conference Centre, 5th Floor (access vis skywalk)
Salon A & B	Meeting Rooms	1st Floor

The registration desk is located in the main lobby, just outside the Provencher Room.

Registration Desk Hours of operation:

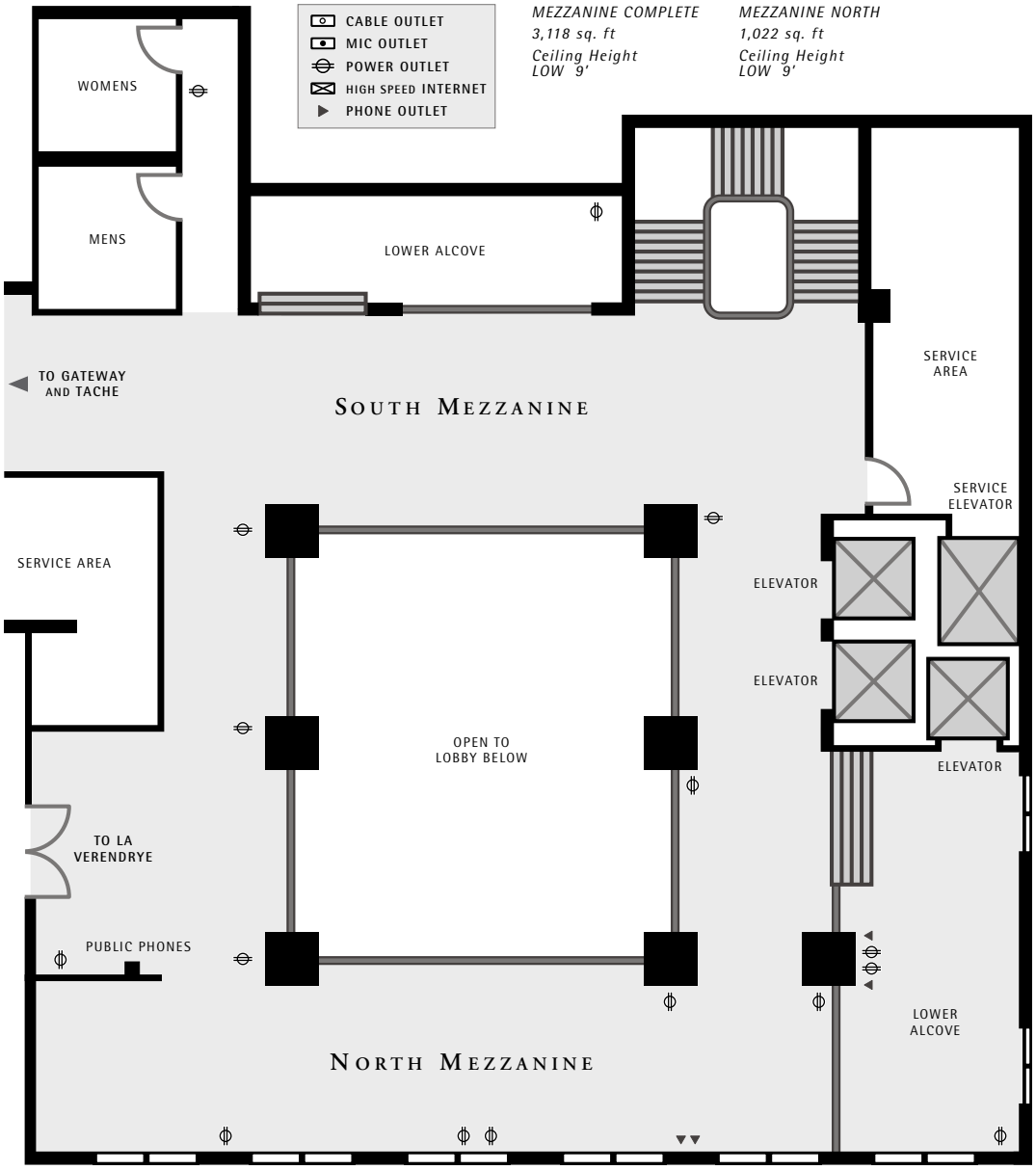
Monday May 30	8:00 AM - 18:30 PM
Tuesday May 31	8:00 AM - 12:00PM
Wednesday June 1	8:00 AM - 9:30 AM
Thursday June 2	8:00 AM - 9:30 AM

LOC contact phone number:

Samar Safi-Harb: 204-510-6497 (9:00AM - 5:00PM Tuesday - Thursday)
Jennifer West: 204-999-6344

WiFi Access

Conference attendees may access the Fort Garry Hotel WiFi network.
Password: broadway



Mezzanine Level

BRIEF PROGRAM

Monday, May 30

09:00	10:30	Graduate Students' Workshop	CASCA Board Meeting
12:30	13:30	Lunch	Lunch
13:30	17:00	Graduate Students' Workshop	CASCA Board Meeting
18:30	20:30	Opening Reception (Broadway Room)	

Tuesday, May 31

09:00	09:15	Opening Remarks
09:15	10:15	Beals Lecture: *Chris Pritchet*
10:15	10:45	Coffee Break
10:45	12:30	Parallel sessions: Galactic I/Instruments/Planets I
12:30	14:00	Lunch (Including NRC, CITA, and SITELLE Lunches)
14:00	16:00	Parallel sessions: Galactic II/High Energy Astrophysics/Cosmology I
16:00	16:30	Coffee Break
16:30	17:30	Dunlap Lecture: *Peter Stetson*
18:30	22:00	Banquet, Speaker: *Wilfred Buck* (Provencher Room)

Wednesday, June 1

09:00	10:30	Parallel sessions: Extragalactic I/ Techniques/Education	Teachers' Workshop
10:30	11:00	Coffee Break	
11:00	12:00	Diversity and Inclusivity Session	Teachers' Workshop
12:00	13:00	Qilak Lecture: *Jaymie Matthews*	
13:00	14:30	Lunch (Including Teachers', Gemini/Subaru, and CSA Topical Teams Lunches)	
14:30	16:30	Parallel sessions: Cosmology II/ CANFAR/Planets II	Teachers' Workshop
16:30	18:00	Poster Session/Reception (Hotel Mezzanine)	
19:00	21:00	Public lecture: Art McDonald (U. of Winnipeg, Rush seating, doors open at 18:00)	

Thursday, June 2

09:00	09:30	President's Science Talk: Chris Wilson
09:30	10:30	Plaskett Lecture: *Jonathan Gagné*
10:30	11:00	Coffee Break
11:00	12:30	Annual General Meeting
12:30	14:00	Lunch (Including CFHT and SKA Lunch)
14:00	15:00	Parallel sessions: Extragalactic II/Big Projects & Missions
15:00	15:30	Coffee Break
15:30	16:45	Parallel sessions: Extragalactic II/Big Projects & Missions
16:45	17:00	Awards Presentation
17:00	17:30	NSERC Presentation
17:30	17:45	Closing Remarks
19:00	21:00	Tour: Canadian Museum for Human Rights

Friday, June 3

09:00	17:00	ACURA/JCSA meetings

DETAILED PROGRAM - UPDATED

Monday, May 30

		Graduate Student Workshop ***Location: La Verendrye*** ***Chair: Jennifer West***	**CASCA Board Meeting** ***Location: Gateway***	**Registration Desk** ***Location: Provencher***
09:00	09:15	Opening Remarks	All day board meeting	
09:15	10:30	Why networking matters and the concept of *Positive Networking®*		
10:30	10:50	Coffee Break		
10:50	12:30	Networking tips and techniques for walking into a room, circulating, table tips and more (includes practicing with peers)		
12:30	13:30	Lunch		
13:30	15:00	Social intelligence, assessing and building your network, social networking tools and follow up (includes practicing with peers)		
15:00	15:30	Coffee Break		
15:30	17:00	Panel Discussion: Careers outside of academia		

18:30	20:30	Opening reception of the conference, ***Location: Broadway Room***

Tuesday, May 31

		Plenary Session ***Location: Provencher*** ***Chair: Chris Wilson***
09:00	09:15	Opening Remarks
09:15	10:15	Beals Lecture: Chris Pritchet (University of Victoria): The Progenitors of Type Ia Supernovae

10:15	10:45	Coffee Break, ***Location: Hotel Mezzanine***

		Galactic I ***Location: La Verendrye*** ***Chair: Erik Rosolowsky***	**Planets I** ***Location: Gateway*** ***Chair: Kelsey Hoffman***	**Instruments** ***Location: Provencher*** ***Chair: David Naylor***
10:45	11:00	Tony Moffat (Université de Montréal): The BRITE-Constellation Nanosatellite Mission: a First for Canada (invited)	Heidi Hammel (AURA): Catastrophic Collisions in the Solar System (invited)	David Andersen (NRC Herzberg Astronomy & Astrophysics): NFIRAOS: First Light Adaptive Optics System for TMT
11:00	11:15			Neil Rowlands (Honeywell Aerospace): Improved Performance of the JWST Fine Guidance Sensor
11:15	11:30			Simon Coudé (Université de Montréal): POL-2: The SCUBA-2 polarimeter and the study of magnetism in star-forming regions
11:30	11:45	Jared Keown (University of Victoria): Characterizing Starless Cores, Protostars, and Filaments in Cepheus	Jason Rowe (Institut de recherche sur les exoplanètes, iREx, Université de Montréal): Photometric Observations of Neptune and Uranus with K2: Weather, Solar activity and seismology.	Markus Kissler-Patig (Gemini Observatory): Gemini Observatory – news and perspectives
11:45	12:00	Nicole St-Louis (Departement de physique, Universite de Montreal): New Insights Into Dust Formation in Wolf-Rayet Winds from Spectroscopic Observations of 8 WC9 Stars	Matthew Russo (CITA University of Toronto): Radially Magnetized Protoplanetary Disks: Evolution and Planetary Migration	Doug Simons (CFHT): Current Status and Future Plans at CFHT
12:00	12:15	Erica Franzmann (University of Manitoba): Submillimetre Polarization Modelling with PolCat: Refinements and New Developments	Christa Van Laerhoven (Canadian Institute for Theoretical Astrophysics): Packing Planets Together: When Neighbors Turn Against Each Other	Lison Malo (CFHT): The SPIRou RV surveys
12:15	12:30	Jennifer West (University of Manitoba): Bilateral symmetry in supernova remnants and the connection to the Galactic magnetic field		Laurent Drissen (Université Laval): SITELLE: Commissioninng and Science Verification

		Location: La Verendrye	***Location: Gateway***	***Location: Provencher***
12:30	14:00	SITELLE Lunch	CITA Lunch	NRC Lunch

		Galactic II ***Location: La Verendrye*** ***Chair: Jason Fiege***	**High Energy Astrophysics** ***Location: Gateway*** ***Chair: Samar Safi-Harb***	**Cosmology I** ***Location: Provencher*** ***Chair: Renee Hlozek***
14:00	14:15	Erik Rosolowsky (University of Alberta): Remixing the Greatest Hits of the 80s (in Molecular Clouds)	Robert Petre (NASA / GSFC): Expanding the Horizons of X-ray Astronomy (invited)	Douglas Scott (UBC): The Spectrum of the Universe
14:15	14:30	Helen Kirk (Herzberg Astrophysics, NRC): Dense Cores Under Pressure : Early Results from GAS		J. Richard Bond (CITA, University of Toronto): Polarization at Low Multipoles from the Planck HFI Instrument and the Reionization Epoch of the Universe
14:30	14:45	Andy Pon (Physics and Astronomy, University of Western Ontario): Observations of Turbulence Dissipating in Low and High Mass Star Forming Regions		Dagoberto Contreras (University of British Columbia): Constraints on cosmic birefringence from Planck 2015 polarization data
14:45	15:00	Norman Murray (CITA, University of Toronto): Collapse in Self-gravitating Turbulent Fluids	Gregory Sivakoff (University of Alberta): Rapid evolution of the relativistic jet in the black hole X-ray binary V404 Cygni	George Stein (CITA): Primordial non-Gaussianity with Large Scale Structure
15:00	15:15	Laura Fissel (CIERA – Northwestern University): A Detailed BLASTPol Study of Magnetic Fields in Vela C: Modeling Polarization Fraction and Local Field Dispersion	Arash Bahramian (University of Alberta): 47 Tuc X9: the first ultra-compact X-ray binary identified in quiescence and its twisted accretion	Falk Herwig (University of Victoria): The rise of the elements in the early universe: from nuclear astrophysics to near-field cosmology
15:15	15:30	Terrence Tricco (CITA): Star formation with smoothed particle magnetohydrodynamics	Lorne Nelson (Bishop's University): Evolution of Cataclysmic Variables and Related Binaries Containing Accreting White Dwarfs	Gwendolyn Eadie (Physics & Astronomy, McMaster University): Inferring the mass of the Dark Matter Halo from Globular Cluster 3D Kinematics
15:30	15:45	Lauren Hetherington (Department of Astronomy and Astrophysics, University of Toronto): Extending and Measuring the Orphan Star Stream	Yasaman Yazdi (Perimeter Institute/ University of Waterloo): Accretion in Radiative Equipartition (AiRE) Disks	Gandhali Joshi (McMaster University): Hidden in plain sight: Mass segregation using galaxy analogues in simulations
15:45	16:00	James Campbell (University of Calgary): Measuring the C18O column density in hot cores	Zachary Shand (University of Calgary): Astrophysical r-process sensitivity studies	
16:00	16:30	Coffee Break, ***Location: Hotel Mezzanine***		

		Plenary Session ***Location: Provencher*** ***Chair: Chris Wilson***
16:30	17:30	Dunlap Lecture: Peter Stetson (NRC-Herzberg): Photometry – Old and New

18:30	22:00	Banquet, ***Location: Concert Hall, 7th Floor***

Wednesday, June 1

		Extragalactic I ***Location: La Verendrye*** ***Chair: Grant Tremblay***	**Techniques** ***Location: Gateway*** ***Chair: Jayanne English***	**Education** ***Location: Provencher*** ***Chair: Jennifer West***	**Teachers' Workshop** ***Location: Assiniboine B*** ***Chair: Julie Bolduc-Duval***
09:00	09:15	Tim Robishaw (Dominion Radio Astrophysical Observatory, NRC-Herzberg): Probing Extragalactic Magnetic Fields via Zeeman Splitting of OH Megamasers (invited)	Pauline Barmby (Western University): Pieces of Andromeda: machine-learning and big data techniques applied to M31	Rob Thacker (Saint Mary's University): Mass media comms: experiences and techniques	Grade 9 astronomy resources, Andrea Misner (Maples Collegiate)
09:15	09:30		Sahar Rahmani (Western University): Mining in nearby galaxies	Mary Beth Laychak (CFHT): Outreach Beyond Limits – How CFHT reaches its diverse constituents	
09:30	09:45		Gilles Ferrand (University of Manitoba): 3D visualization of astronomical data using immersive displays	Julie Bolduc-Duval (Discover the Universe): Update on Discover the Universe	
09:45	10:00	Ashley Bemis (McMaster University): Investigating Dense Gas and Star Formation in the Antennae Galaxies (NGC 4038/39) using ALMA	Cameron Van Eck (Radboud University): Faraday Tomography with LOFAR	James Hesser (NRC – Herzberg Astronomy and Astrophysics): Public Engagement at NRC's Dominion Astrophysical Observatory	High Altitude Balloon Launch, Jen Piaseki (Fort Richmond Collegiate) & Heidi Werner (St. James Collegiate)
10:00	10:15	Ismael Moumen (Université Laval): SITELLE at the CFHT : A 3D Spectroscopic Study of the Nearby Spiral Galaxy NGC 3344	Adam Rogers (University of Manitoba): Modeling X-ray Spectra Using Global Optimization Methods		
10:15	10:30	Joel Roediger (HIA): A Newfound Behaviour in the Red Sequence Towards Low Galaxy Masses	Martin Heusen (The University of Manitoba): The Transport of Energetic Charged Particles in Different Astrophysical Scenarios		
10:30	11:00	Coffee Break, ***Location: Hotel Mezzanine***			

		Plenary Session ***Location: Provencher*** ***Chair: Chris Wilson***	**Teachers' Workshop** **Location: Assiniboine B** ***Chair: Julie Bolduc-Duval***
11:00	12:00	Diversity and Inclusivity Session: Brenda Mathews, Pauline Barmby, Lauren Hetherington	Presentation and activity: Gravitational Waves, Heather Fong (CITA)
12:00	13:00	Qilak Lecture: Jaymie Matthews (University of British Columbia): N-body Kama Sutra: When galaxies, puppets and Ashton Kutcher collide	View from the Top: The Canada-France-Hawaii Telescope, Mary Beth Laychak (CFHT)

		Location: La Verendrye	***Location: Provencher***	***Location: Assiniboine B***
13:00	14:30	CSA Topical Teams Lunch	Gemini/Subaru Lunch	Teachers' Lunch with Scientists

		CANFAR Meeting ***Location: La Verendrye***	**Planets II** ***Location: Gateway Chair: Jason Rowe***	**Cosmology II** ***Location: Provencher Chair: Douglas Scott***	**Teachers' Workshop** ***Location: Assiniboine B Chair: Julie Bolduc-Duval***
14:30	14:45	CANFAR use case examples Helen Kirk: "JCMT Gould Belt Survey" Stephen Gwyn: "The Next Generation Virgo Cluster Survey" Falk Herwig: "NuGrid Nuclear Astrophysics"	Christian Marois (NRC Herzberg): Imaging Exoplanets: from young gas giants with GPI to habitable planets with ELTs	Manuela Campanelli (Rochester Institute of Technology): Simulations of Binary Black Hole Mergers (invited)	Presentation about the possible Planet Nine, Christa Van Laerhoven (CITA)
14:45	15:00		Ryan Cloutier (University of Toronto): Searching for the closest habitable worlds: cool stars with even cooler planets		
15:00	15:15		JJ Kavelaars (NRC): The Trans-neptunian Automated Occultation Survey – II : an opportunity for Canadian participation.		Presentation by Art McDonald (Queen's University)
15:15	15:30	David Schade/Severin Gaudet: "CANFAR at CADC: portfolio, developments and new directions"	Diana Dragomir (University of Chicago): The Nature of the Super-Earth 55 Cancri e	Prayush Kumar (CITA, University of Toronto): Gravitational Wave observation from a Binary Black Hole Merger by Advanced LIGO	
15:30	15:45		Henry Ngo (Planetary Sciences, Caltech): Friends of Hot Jupiters: Properties of the Directly Imaged Stellar Companion Population	Heather Fong (Canadian Institute for Theoretical Astrophysics/University of Toronto): Astrophysical implications of the gravitational wave observation by Advanced LIGO	
15:45	16:00	Falk Herwig "The CANFAR consortium - planning ahead to match data and computing intensive research needs with capabilities, infrastructure and resources"	Jacob White (University of British Columbia): ALMA Observations of HD141569's Circumstellar Disk	Renee Hlozek (Dunlap Institute for Astronomy and Astrophysics, Department of Astronomy and Astrophysics, University of Toronto): Current and future constraints on ultra-light axions	
16:00	16:15	Open discussion, brief inputs welcome.	Bryce Croll (Boston University): The Actively Disintegrating Minor Planet (s) Orbiting the White Dwarf WD 1145+017	Zhiqi Huang (Canadian Institute for Theoretical Astrophysics): Dark Energy: how much can we go beyond w.	
16:15	16:30		Kelsey Hoffman (NASA-Ames/SETI): Using Molecular Dynamics to Study the Material Properties of Exoplanet Interiors	Daniel Guariento (University of Waterloo and Perimeter Institute): A Cosmological black hole in shape dynamics	
16:30	18:00	Poster Session/Reception, ***Location: Hotel Mezzanine***			

19:30	21:00	Public lecture: Art McDonald, ***Location: Eckhardt-Gramatté Hall, University of Winnipeg, doors open at 6:30pm***

Thursday, June 2

		Plenary Session ***Location: Provencher*** ***Chair: Bob Abraham***		
09:00	09:30	President's Science Talk: Chris Wilson (McMaster University): ALMA Observations of Nearby Galaxies		
09:30	10:30	Plaskett Lecture: Jonathan Gagné (Carnegie Institution of Science, DTM): The search for brown dwarfs and low-mass stars in young associations of the solar neighborhood		
10:30	11:00	Coffee Break, ***Location: Hotel Mezzanine***		
		Plenary Session ***Location: Provencher***		
11:00	12:30	Annual General Meeting		
		Location: La Verendrye	***Location: Provencher***	
12:30	14:00	SKA Lunch	CFHT Lunch	
		Extragalactic II ***Location: La Verendrye*** ***Chair: Sarah Gallagher***	**Big Projects/Missions** ***Location: Gateway*** ***Chair: JJ Kavelaars***	
14:00	14:15	Grant Tremblay (Yale University): Cold, Galaxy-scale fountains with Black Hole Pumps (invited)	Judith Irwin (Queen's University): A New Look at Disk-Halo Dynamics with 'CHANG-ES' (invited)	
14:15	14:30			
14:30	14:45			
14:45	15:00	Sarka Wykes (University of Manitoba): HD simulations of internal jet-stellar wind interactions: the case of Centaurus A	David Naylor (University of Lethbridge): SPICA: the SPace Infrared telescope for Cosmology and Astrophysics v2.0	
15:00	15:30	Coffee Break, ***Location: Hotel Mezzanine***		

		Extragalactic II *Location: La Verendrye* *Chair: Sarah Gallagher*	Big Projects/Missions *Location: Gateway* *Chair: JJ Kavelaars*	
15:30	15:45	Ian Roberts (McMaster University): A Product of their Halo Environment: How galaxy properties depend on group X-ray luminosity and dynamical state	Doug Johnstone (NRC Herzberg): SPICA Key Science	
15:45	16:00	Angus Mok (McMaster University): Comparing the ISM and Star Formation Properties of Nearby Spiral Galaxies in Different Environments	John Hutchings (NRC Herzberg): Early results from the Astrosat observatory	
16:00	16:15	Fraser Evans (McMaster University): Red Misfit Galaxies in the Sloan Digital Sky Survey	Rene Doyon (Université de Montréal – iREx): Status of the James Webb Space Telescope	
16:15	16:30	Christopher O'Dea (University of Manitoba): ALMA observations of Molecular Gas in the Parsec-scale Torus of NGC1068	David Schade (Canadian Astronomy Data Centre, National Research Council Canada): Developing a new vision for astronomy computing	
16:30	16:45	Epson Masikiv Heringer (University of Toronto): The Ejecta-Nickel Mass Relation of Type Ia Supernovae		

		Plenary Session *Location: Provencher* *Chair: Chris Wilson*
16:45	17:00	Awards presentation
17:00	17:30	NSERC presentation
17:30	17:45	Closing Remarks

19:00	21:00	Tour: Canadian Museum for Human Rights, ***Location: Meet in Hotel Mezzanine at 18:45***

Friday, June 3

		Location: Salon A	*Location: Gateway*
09:00	17:00	JCSA meeting	ACURA meeting

GRADUATE STUDENTS' WORKSHOP

Monday, May 30, 09:00-17:00, La Vereyndre

The theme of this year's graduate student workshop is networking. We are planning a full day including a panel discussion and networking throughout the day where you can put what you learn into practice. We are planning to include representatives from industry, postdocs, and faculty members.

Get the knowledge you need to build your network! Your time at graduate school or during your post-doctoral fellowship will be filled with opportunities to make connections in and outside of your field. Building a strong personal and professional network may be one of the single most important things you can do for your career. Learn how to plan, prepare, build and foster your network and watch opportunities unfold in front of you.

We are excited to confirm that the facilitator of the workshop will be Judy Thomson, co-author of the best-selling book Work the Pond.

The workshop will include topics such as:

- The importance of building a strong diverse network
- The philosophy of Positive Networking® to build high-trust relationships
- How to walk into a room solo, circulate, get unstuck, make small talk, etc.
- Table tips for more effective networking during a meal, at a workshop, at a conference
- Understanding and employing the Strength of Weak Ties and Dormant Ties
- Assessing your network; building your strategic network
- Have a better understanding of social networking tools and how to use them
- Apply the knowledge gained and practice with peers

Panel discussion

Following the networking workshop component, we will have a panel discussion on the topic of "careers outside academia". Statistics show that many students with advanced degrees in astronomy and astrophysics will pursue careers outside the "traditional" academic path. We will discuss a broad range of career options that we hope may inspire some of your for the next steps of your career.

Our panel will include:

Ms. Jenny Chuang, Defense Research and Development Canada
Dr. Marjorie Gonzalez, Medical Physicist, Vancouver Coastal Health
Ms. Mary Beth Laychak, Outreach Program Manager, Canada France Hawaii Telescope
Mr. Bill Poluha, Science Librarian, University of Manitoba

BIOGRAPHIES - GRAD WORKSHOP PRESENTERS

NETWORKING FACILITATOR

Judy Thomson

Chief operating officer, Shepa Learning Company

Judy Thomson is the co-author of WORK THE POND! Use the Power of Positive Networking to Leap Forward in Work and Life which she wrote with Darcy Rezac and Gayle Hallgren-Rezac. This best-selling book has been called the "connectors handbook" and has been translated and published in China, Russia and Korea.

Helping people build networks that are diverse, rich, strategic and supportive — as well as helping them enjoy networking more — is how Judy and her business partners make a positive impact on people's lives and careers. She has given hundreds of presentations to corporations, associations, governments and graduate schools of business. For almost eight years, Judy and her business partner, Gayle Hallgren-Rezac have been teaching the skills of networking, communication and career professionalism to Masters, PhDs and Post-doctoral fellows as part of the Mitacs Inc. Step program. Their other clients include Industry Canada, Environment Canada, Procter & Gamble, RBC Royal Bank, Scotiabank, Schneider Electric, and TELUS.

Judy is a chartered professional accountant (CPA, CA) and business consultant who has held executive positions in human resources and administration with global companies in Canada and Asia. She was also part of the start-up management team and the first service director of the world-famous Rocky Mountaineer Railtours. In addition to her role as chief operating officer of Shepa Learning Company, Judy is an Honored Alumni of The Greater Vancouver Board of Trade's Women's Leadership Circle® advisory council (after serving as vice-chair for six years), is a director of the BC Women's Enterprise Centre and a corporate director of a publicly traded mining exploration company.

PANELISTS

Jenny Chuang

Defense Research and Development Canada

Jenny Chuang obtained her Bachelor of Science and Master of Science in Electrical Engineering from the University of Manitoba. She has worked in the telecommunication, energy and defense industries and now works for the Federal Public Service as a project manager with Defense Research and Development Canada in the area of radar and radar electronic warfare. Her interests include fostering scientific literacy and curiosity in the general population through primary-school programs. She is here to share her experiences and lessons she has learned from both

sides of the interview table with technically trained personnel considering scientific and non-scientific careers both inside and outside of the federal public service.

Marjorie Gonzalez

Medical Physicist, Vancouver Coastal Health

Marjorie Gonzalez is currently a Medical Physicist in Nuclear Medicine working at Vancouver Coastal Health. She started her career as an Astrophysicist, completing a BSc (2001) and MSc (2003) at the University of Manitoba, a PhD (2008) from McGill University and a Postdoc (2010) at the University of British Columbia. She had a great time using X-ray and radio observations to study supernova remnants and neutron stars, and she collaborated with many international colleagues. She then decided to pursue her interest of applying physics to medical problems, and completed a MSc (2012) in Medical Physics at the University of British Columbia. For her research, she had the opportunity to use brain imaging to study Parkinson's Disease. In 2013, she started working in the Department of Nuclear Medicine at Vancouver Coastal Health. Her current work helps to oversee the quality of medical images used to diagnose diseases, and to oversee the safe use of radioactive substances to treat diseases. She works with great teams of health care staff (physicians, technologists, engineers, etc) and helps to educate them about imaging data, physics and radiation safety.

Mary Beth Laychak

Outreach Program Manager, Canada France Hawaii Telescope

Mary Beth Laychak is the Outreach Program Manager at the Canada-France-Hawaii Telescope on the Big Island of Hawaii. Mary Beth has an undergraduate degree in astronomy and astrophysics from Penn State University and a masters degree in educational technology from San Diego State University. Her passions include astronomy, sharing astronomy with the public and astronomy based crafts.

Bill Poluha

Science Librarian, University of Manitoba

Bill completed a BSc (4yr) degree with a double major in Physics and Mathematics and a MSc in Health and Radiation Physics. He worked for 7 years as a Health Physicist and Manager of Radiation Protection Services for Monserco Limited, an engineering, safety and environmental services consulting company. Needing a change Bill completed a Master of Library and Information Science (MLIS) degree and was a Health Sciences Librarian for 10 years and is currently a Science Librarian liaising with the Astronomy, Physics and Statistics departments. Bill is currently planning yet another career change that more closely aligns with his passion for food and travel.

INVITED SPEAKERS

PUBLIC LECTURE

CASCA
MANITOBA 2016

Public Lecture

Nobel Prize Winner

Dr. Art McDonald

Queen's University

The Sudbury Neutrino Observatory:
Observing the Sun from 2 km Underground

Wednesday, June 1, 2016
7:30 PM (doors open at 6:30 PM, rush seating)
Eckhardt-Gramatté Hall, University of Winnipeg

Free admission, overflow seating available

BRANDON UNIVERSITY
THE UNIVERSITY OF WINNIPEG
UNIVERSITY OF MANITOBA
WITP
CANADIAN ASTRONOMICAL SOCIETY / SOCIÉTÉ CANADIENNE D'ASTRONOMIE
ROYAL ASTRONOMICAL SOCIETY OF CANADA WINNIPEG CENTRE

HOW TO GET TO THE PUBLIC LECTURE

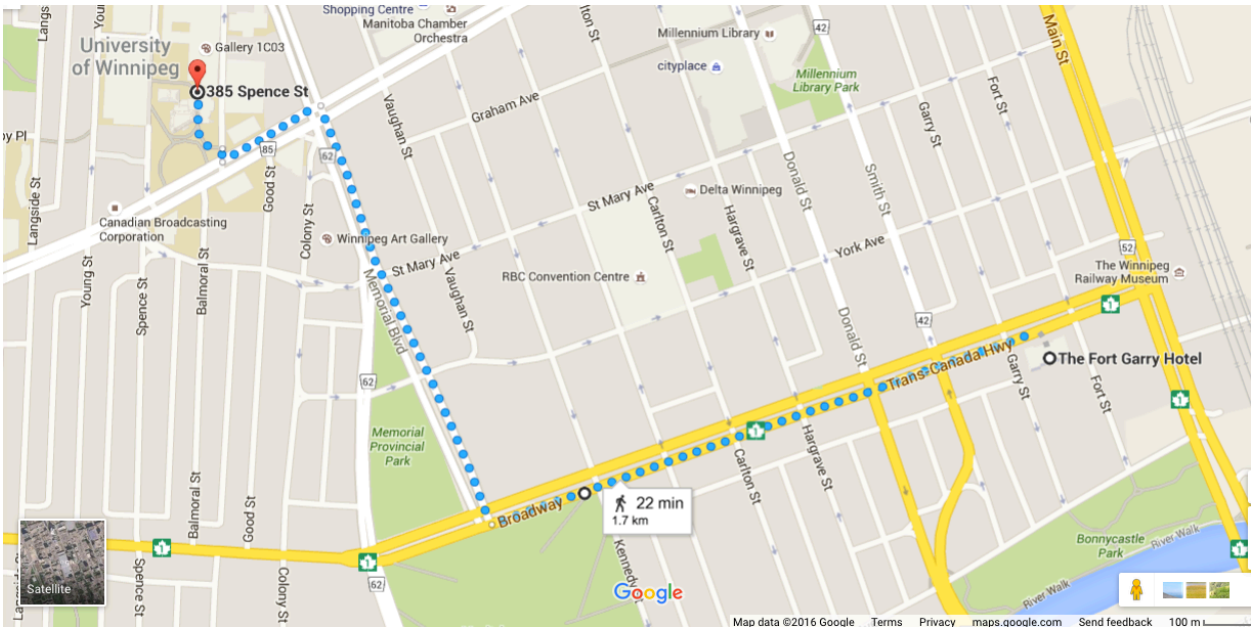
The public lecture by Dr. Art McDonald starts at 7:30PM on Wednesday, June 1. It is rush seating and the doors will open at 6:30PM. We recommend arriving early to ensure a seat. Overflow seating will be available in case the main lecture theatre fills up.

The lecture will take place at the University of Winnipeg, in the Eckhardt-Grammaté Hall. Proceed in the main entrance to the University of Winnipeg, Centennial Hall, and head up the escalator to the third floor.

The University of Winnipeg is approximately 1.7 km from the Fort Garry Hotel. This is a pleasant 20 - 25 minute walk that passes by several attractions including the Manitoba Legislature and the Winnipeg Art Gallery. Alternatively, public transit is available. Taxis are also available right outside the hotel.

Getting there on foot:

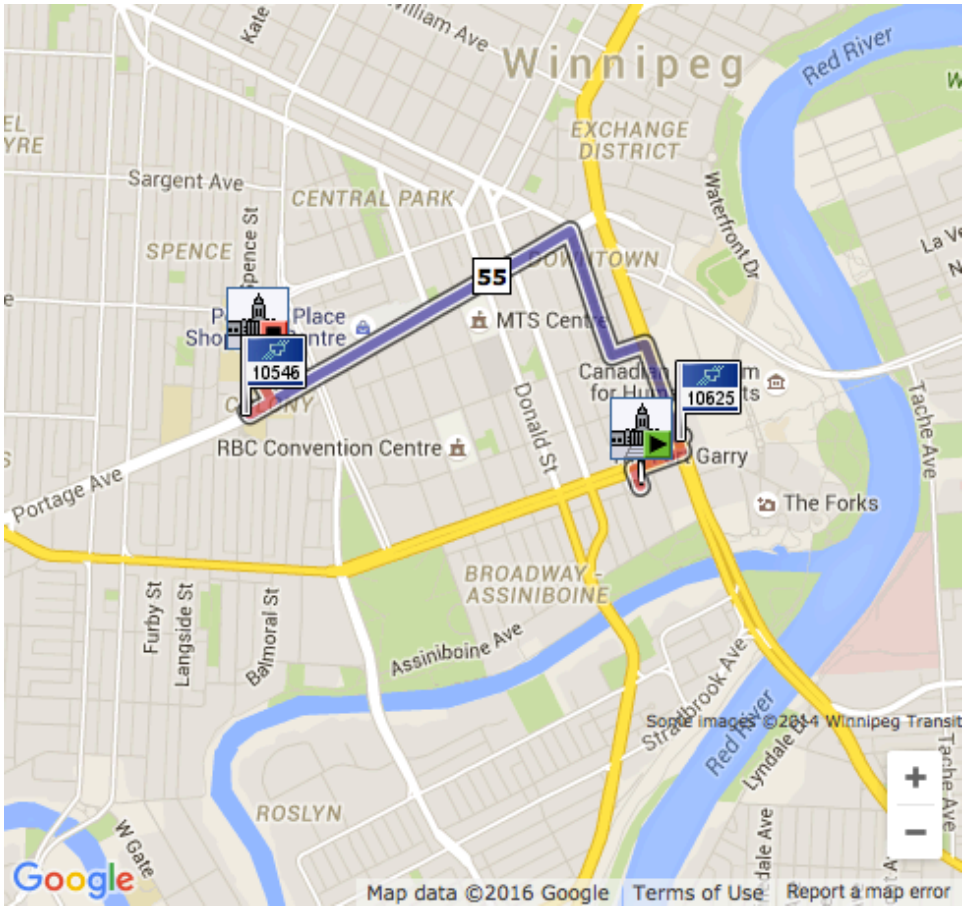
1. Head west on Broadway.
2. After 8 blocks you will have reached Memorial Blvd. The Manitoba Legislature will be on your left.
3. Turn right and proceed down Memorial Blvd. for 3 large blocks, until you reach Portage Ave.
4. Cross Portage Ave. The University of Winnipeg will be on your left.



Getting there by bus:

1. Head east on Broadway to Main St. (1 block, 4 minute walk).
2. Cross Main St., and find the Northbound bus stop in front of Union Station (Stop #10625).
3. Many busses will go by the University from this stop. Here are some options:
   i. Bus #68 (departs at 17:55)
   ii. Bus #53 (departs at 18:22)
   iii. Bus #55 (departs at 18:43 and 18:57)
4. Exit the bus at the Spence Street (University of Winnipeg) stop (this is announced).

The bus costs $2.65 cash fair. The ride to the University of Winnipeg will take approximately 8 minutes (total transit time, including time walking to and from the bus stops is ~15 minutes).



A **ASHDOWN HALL**
Accessibility Services

AN **ANX**
Balmoral Rapid Transit Hub
Brandon University Psychiatric Nursing
English Language Program Offices
Garbonzo's Pizza Pub
Starbucks
The Bookstore
University College of the North (UCN)

AS **AXWORTHY COMMUNITY STAGE**

AX **AXWORTHY HEALTH & RECPLEX**
Athletic Therapy Clinic

B **BRYCE HALL**
Canada's History Society
Carl Ridd Sanctuary
H. Sanford Riley Centre for Canadian History
Manitoba Conservatory of Music & Arts
Oral History Centre

BC **BUHLER CENTRE**
Faculty of Business & Economics
Graduate Studies
Professional, Applied & Continuing Education (PACE)
Stella's Café & Bakery

BL **BIKE LAB**

C **CENTENNIAL HALL**
Centre for Distributed & Distance Learning (CDDL)
Centre for Research in Young People's Texts & Cultures (CRYTC)
Centre for Innovation in Teaching & Learning (CITL)
Eckhardt-Gramatté Hall
Faculty of Arts
Gallery 1C03
Library
Security Office / Information / Lost & Found
The Malecón
Uplink/TSC Service Desk
UWSA Info Booth

D **DUCKWORTH CENTRE**
Bill Wedlake Fitness Centre
Café Bohdi
Campus Wellness Centre
Duckworth Café & Eatery
Gupta Faculty of Kinesiology & Applied Health
MPG Mondetta
Manitoba Basketball Hall of Fame
Smoothie Bar

DY **UWSA DAYCARE**

E **HELEN BETTY OSBORNE**
Global Welcome Centre
Wii Chiiwaakanak Learning Centre

ED **EDUCATION CLASSROOMS**

G **GRAHAM HALL**
Faculty of Education
Institute for Women's & Gender Studies
Tutoring Centre

L **LOCKHART HALL**
Aboriginal Student Services
index Used Bookstore & Café
UWSA HIVE

M **MANITOBA HALL**

MF **MCFEETORS HALL STUDENT RESIDENCE**

MS **MENNO SIMONS COLLEGE**
Global College
United Centre for Theological Studies

R **RIDDELL HALL**
Bulman Student Centre
Pangea's Kitchen
Health Plan Desk
University of Winnipeg Students' Association (UWSA)

RC **RICHARDSON COLLEGE FOR THE ENVIRONMENT & SCIENCE COMPLEX**
CISCO Innovation Centre
CN Indigenous Resource Centre
Elements—The Restaurant
Faculty of Science
Institute of Urban Studies
International Centre for Infectious Diseases Inc.
Joro Consultants Inc.
Sustainability Office

RI **RICE CENTRE**
Academic Advising
Admissions
Adult Learner Services
Aurora Family Therapy Centre
Awards & Financial Aid
Campus Living
Career Services
Convocation Officer
English Language Program (ELP)
International Student Services (ISS)
Registrar's Office (Graduate Studies)
Strategic Enrolment Management
Student Central
Student Financial Services
Student Records
Student Recruitment & Institutional Relations
Student Services Communications
Wellness & Student Life

S **SPARLING HALL**

T **ASPER CENTRE FOR THEATRE & FILM**

UC **UWINNIPEG COMMONS**
(Opening Fall 2016)

W **WESLEY HALL**
Convocation Hall
Model School
Muslim Prayer Space
The Collegiate

SATELLITE LOCATIONS
Urban & Inner-City Studies—527 Selkirk Ave
Legal Help Centre—Portage Place Mall

STUDENT CENTRAL
SECURITY
ESCALATORS
WHEELCHAIR ACCESSIBLE
RAPID TRANSIT
BLUELIGHT PHONES
(Direct link to security)

THE UNIVERSITY OF WINNIPEG

INVITED SPEAKERS

BANQUET SPEAKER

Tuesday, May 31, 20:30, Provencher

Wilfred Buck

Achakosuk (The Stars)

This presentation will focus on the Ininew (Cree) perspective of Kisic Aski (Sky World). Thirteen Ininew constellations and mythologies will be identified and discussed as well as touching on the sun, moon and some of the planets. The listener will get a glimpse of the night sky from a totally different perspective than the main stream Roman & Greek mythology.

Biography

Wilfred Buck is a member of the Opaskwayak Cree Nation, currently employed with the MFNERC as a Science Facilitator. He obtained his B.Ed. & Post Bacc. from the University of Manitoba.

As an educator Wilfred has had the opportunity and good fortune to travel to South and Central America as well as Europe and met, shared and listened to Indigenous people from all over the world.

He is a husband, father of four, son, uncle, brother, nephew, story-teller, mad scientist, teacher, singer, pipe-carrier, sweat lodge keeper, old person and sun dance leader.

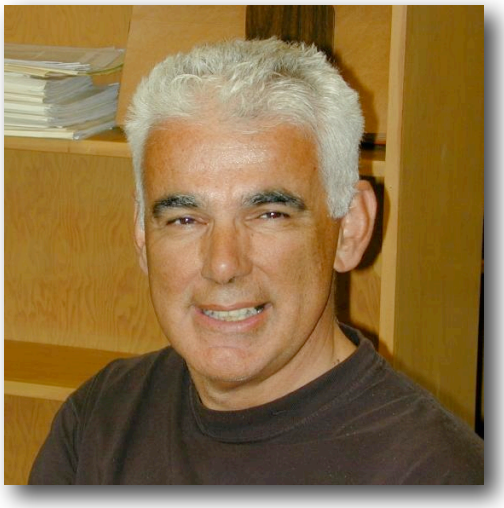
As a Science Facilitator with MFNERC was given the mandate to “put a First Nation perspective in the sciences”. The easiest way to go about doing this, he was told, was to look up. Researching Ininew star stories Wilfred found a host of information which had to be interpreted and analyzed to identify if the stories were referring to the stars. The journey began…

“The greatest teaching that was ever given to me, other than my wife and children, is the ability to see the humor in the world”…Wilfred Buck

PRIZE LECTURE

BEALS LECTURE

Tuesday, May 31, 09:15, Provencher



Chris Pritchet, Dept. of Physics and Astronomy, U. Victoria

The Progenitors of Type Ia Supernovae

Type Ia supernovae (SNe Ia) are among the most luminous explosions in the Universe; yet we know little about the nature of SN Ia progenitors beyond the basic fact that a white dwarf is somehow involved. In this talk I will review the basic properties of SNe Ia, and their (past and future) importance in establishing the acceleration of the Universe. I will then discuss two recent research directions that shed light on the progenitors. The first involves the colours of host galaxies - a somewhat prosaic tool that turns out to provide a surprisingly direct measure of the delay time distribution of SNe Ia, with little dependence on star formation history over a wide range of galaxy types. The second involves the spatial distribution of supernovae in their host galaxies, measured relative to the predictions of bulge/disk decomposition of the host galaxy light. Both of these methods provide support for the so-called “double degenerate” model of SN Ia explosions.

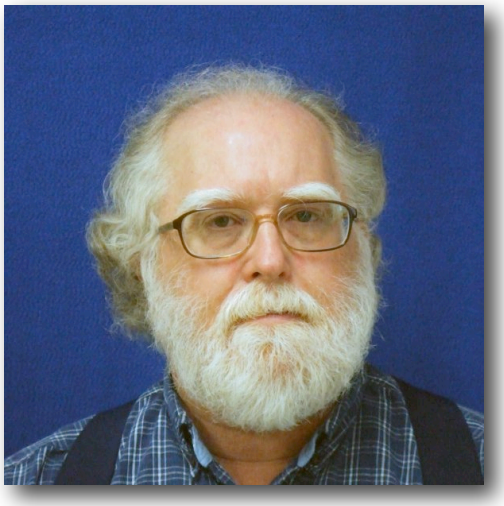
Biography

Dr. Pritchet obtained his Ph.D. in Astronomy from the University of Toronto in 1975. After holding positions at the University of British Columbia, the Dominion Astrophysical Observatory and the University of Calgary, Dr. Pritchet has been on faculty in the Department of Physics and Astronomy at the University of Victoria since 1982. He was Department Chair from 1995-1998, and the chair of the 2010-2020 Long Range Plan Committee for Canadian Astronomy. Dr. Pritchet has been an associate fellow of the CIfAR Cosmology and Gravity program as well as the principal investigator of CANFAR, which coordinates astronomical computing resources across Canada. Outside astronomy, Dr. Pritchet enjoys music, film, canoeing, kayaking, and back-country skiing.

PRIZE LECTURE

DUNLAP LECTURE

Tuesday, May 31, 16:30, Provencher



Peter Stetson, National Research Council Herzberg Astronomy and Astrophysics

Photometry - Old and New

I will probably just blather on about photometry for a while.

Biography

Peter Stetson received a BA and an MA in Astronomy from Wesleyan University (Middletown, Connecticut) in 1974. From Yale University (New Haven, Connecticut) he received an MSc in Astronomy in 1975 and a PhD in Astronomy in 1979. He had a Research Associateship at Yale during 1979-80. From 1980 to 1983 he had a Carnegie Fellowship at Mount Wilson and Las Campanas Observatories of the Carnegie Institution of Washington (Pasadena, California). In September 1980 he took up a Research Associateship at the Dominion Astrophysical Observatory of the Herzberg Institute of Astrophysics (Victoria, British Columbia). He was moved to the permanent staff of the DAO in the Spring of 1984, and has stayed there ever since. His current position is Principal Research Officer at NRC-Herzberg. Since 1987 he has also been Adjunct Professor in the Department of Physics and Astronomy at the University of Victoria.

PRIZE LECTURE

QILAK LECTURE

Wednesday, June 1, 12:00, Provencher

Jaymie Mathews, UBC

N-body Kama Sutra: When galaxies, puppets and Ashton Kutcher collide

Astronomers read the stories told by the Universe. They don't always understand the languages, so astronomers are like ESL students – or USL (Universe as a Second Language) students – looking for patterns that can translate nature's stories into terms they understand. Then translating those into terms others can understand. Readers become tellers, helping others to recognise the patterns, to see hidden connections, and to make connections to their lives. Those others share and extend the stories, and in doing so, become scientists in the most fundamental sense of the job description.

My Qilak Lecture is a story about telling stories, and making connections among the seemingly disconnected. How discovering the first exoplanet was like discovering your first dance partner. How Godzilla and hockey are a match made in physics education heaven. How an X-rated version of an N-body simulation can mean an A in a test on SB galaxies. With puppets and Ashton Kutcher as teaching assistants.

Viewer discretion is advised.

Biography

Jaymie Matthews is a Professor in UBC's Department of Physics & Astronomy, whose research revolves around exoplanetary science and asteroseismology. He serves as Mission Scientist for Canada's MOST space telescope, on the Science Team for the Canadian-Austrian-Polish BRITE Constellation cubesat mission, and on the Executive Council for NASA's Kepler mission. Jaymie is an Officer of the Order of Canada and Grand Poobah of the Tycho Brahe Society.

PRIZE LECTURE

PLASKETT LECTURE

Thursday, June 2, 09:30, Provencher

Jonathan Gagné, Carnegie Institution of Science, DTM

The search for brown dwarfs and low-mass stars in young associations of the solar neighborhood

I will present the BANYAN II statistical tool that our team developed to identify new candidate members of young moving groups in the solar neighborhood. This will be followed with a presentation of the BANYAN All-Sky Survey (BASS) in which the all-sky near-infrared catalogs 2MASS and AllWISE were cross-matched in conjunction with BANYAN II to identify new young brown dwarfs. This survey has allowed us to discover a large number of new young brown dwarfs in isolation, several of which have physical properties such as mass, age and temperature that make them similar to exoplanets that were recently discovered using the method of direct imaging.

Such isolated analogs of the giant, gaseous exoplanets are precious benchmarks that will allow a deep characterization of their atmospheres using high-resolution and high signal-to-noise spectroscopy, which is made possible due to the absence of a nearby and bright host star. I will end by describing the most recent developments in the search for young, planetary-mass objects in the solar neighborhood. This includes the discovery of SDSS J1110+0116, a new young ~10 Jupiter-mass object in isolation that displays signatures of methane in its atmosphere.

Biography

Dr. Gagné completed his doctoral studies at l'Université de Montréal under the supervision of Dr. David Lafrenière and Dr. René Doyon. His thesis, entitled "La recherche de naines brunes et étoiles de faible masse dans les associations cinématiques jeunes du voisinage solaire", identifies and characterizes new substellar mass objects that belong to nearby young associations of stars. Dr. Gagné developed a powerful new algorithm to select highly probable substellar objects in young associations that is now widely used by the community. He also carried out an all-sky survey to identify, follow-up and characterize actual candidates, more than doubling the number of confirmed brown dwarfs. Dr. Gagné is now widely recognized as a leading figure in the study of nearby young substellar objects.
Dr. Gagné is currently a Sagan Postdoctoral Fellow in the Department of Terrestrial Magnetism at the Carnegie Institution for Science, where he will work to identify and characterize young brown dwarfs with only a few times the mass of Jupiter.

INVITED SPEAKERS

PRESIDENT'S SCIENCE TALK

Thursday, June 2, 09:00, Provencher

Chris Wilson, McMaster University

ALMA observations of nearby galaxies

ALMA is revolutionizing our view of the universe, including our nearest neighbour galaxies. My students and I have been using ALMA to probe the properties of the dense, star forming interstellar medium in several nearby galaxies, including the prototypical ultraluminous infrared galaxy Arp 220. I will present some of our recent results, including measurements of very high surface densities and temperatures in Arp 220 and evidence for large changes in the 12C/13C abundance ratio in several nearby luminoous infrared galaxies.

Biography

Dr. Christine Wilson is a Professor in the Department of Physics and Astronomy at McMaster University and the Canadian Project Scientist for the Atacama Large Millimeter Array (ALMA). Dr. Wilson did her undergraduate work at the University of Toronto and her graduate work at the California Institute of Technology. While at Caltech, she discovered Comet Wilson, believed to be a comet on its first passage through the inner Solar System. After receiving her Ph.D. in 1990, she spent two years as a postdoc at the University of Maryland before joining the faculty at McMaster in 1992. Recently, she has been a recipient of the Ontario Premier's Research Excellence Award.

Dr. Wilson's is an observational astronomer whose current research interests are centered on the interstellar medium and star formation, both in nearby galaxies and in our own Milky Way. She is particularly interested in the properties of giant molecular clouds, the nature of the interstellar medium in dwarf galaxies, the mechanisms regulating star formation rates and efficiencies in galaxies, and the properties of low-mass protostars in nearby molecular clouds. Since many of these problems require a multi-wavelength approach, Dr. Wilson uses a wide variety of optical and radio telescopes, including the Submillimeter Array (SMA), the James Clerk Maxwell Telescope (JCMT), and the Canada-France-Hawaii Telescope (CFHT). A large part of her observational work is concentrated in the regime of millimeter-wave radio interferometry, where high-resolution images of the emission from molecules in the interstellar medium can be obtained.

INVITED SPEAKERS

GALACTIC SESSION

Tuesday, May 31, 10:45, La Verendrye

Tony Moffat, Université de Montréal

BRITE Executive and International Advisory Science Teams
The BRITE-Constellation Nanosatellite Mission: a First for Canada

Launched in 2013-2014, the five independently functioning BRITE (BRIght Target Explorer) nanosats are now producing excellent science data on the variable properties of a significant fraction of the brighter visible stars in the sky. (The sixth BRITE satellite is still attached to the orbiting 3rd stage launcher and unusable.) Equipped with a 30 mm telescope and an uncooled CCD detector along with either a blue or red optical filter, each satellite is producing high-precision light curves over 5-6 months non-stop and with a cadence of typically one data point every 20 seconds, leading to a typical precision of 1 part in 1000 during about 15 minutes of each 100-minute satellite orbit. With a field 24 degrees across, up to 30 stars brighter than about 4th magnitude can be observed simultaneously. The science mainly involves determining asteroseismic properties and spot rotations of stars to probe their interior and surface structure, as well as the study of binary stars. Sample results will be presented. Although faced with many challenges on the way, from first light to final validation, virtually all technical problems have been mitigated, leading to a precision as expected for unavoidable photon statistics, along with readout noise and flat-field detector errors. BRITE-Constellation involves astronomers from Canada (where the idea originated), and from Austria and Poland, plus guest observers and complementary (mainly spectroscopic) ground-based support worldwide. The latter involves both professional and amateur astronomers.

Biography

Anthony (Tony) Moffat received his B.Sc. degree in physics in 1965 and M.Sc. degree in astronomy in 1966 from the University of Toronto, followed by the degrees of Dr. rerus naturalus (= Ph.D.) in 1970 and Dr. Habilitation in 1976 at the Ruhr-Universitaet Bochum, Germany, both in astronomy. Since that time, he has been associate, then full and now emeritus professor in the Dépt. de physique at the Université de Montréal. His main interests are in the properties of massive stars of all kinds based mostly on observations at all wavelengths, with emphasis on the Wolf-Rayet stage, and in the structure and dynamics of the Galaxy. He gets a particular charge out of making new observational discoveries in these areas. Tony is author of numerous scientific papers and has received a number of prizes during his career.

INVITED SPEAKERS

PLANETS SESSION

Tuesday, May 31, 10:45, Gateway

Heidi Hammel, AURA

Catastrophic Collisions in the Solar System

Catastrophic collisions have shaped the destiny of the Solar System, and perhaps humankind. In 1994, a series of massive explosions on Jupiter occurred after the remnants of a fractured comet plunged into that planet's atmosphere. Hubble Space Telescope tracked these explosions (Hammel et al. 1995, Science 267, 1288), as did telescopes around the world. In 2009 amateur astronomer Anthony Wesley shocked the astronomical community with the discovery of a fresh impact site on Jupiter. Hubble again observed a massive black impact site (Hammel et al. 2010, Ap. J. Let. 715, L150). Three more giant explosions have since been seen on Jupiter, and such collisions are not limited to the giant planets. Just two years ago, residents of Chelyabinsk, Russia, were startled by a low-altitude airburst; thousands were injured when its shockwave shattered windows across the city. This talk will focus on these cosmic catastrophes, and the implications of such events for us here on Earth.

Biography

Dr. Heidi B. Hammel obtained her undergraduate degree from MIT, received her Ph.D. from U. Hawaii, and worked as a post-doc at JPL. She returned to MIT as a Principal Research Scientist, and from there moved to Space Science Institute as a Senior Research Scientist and co-Director of Research. She joined AURA in 2011, where she currently serves as Executive Vice President. For the 1994 impact of Comet Shoemaker-Levy 9 with Jupiter, Dr. Hammel led the Hubble Team that investigated Jupiter's atmospheric response to the collisions, and she also led the Hubble team that studied a 2009 Jupiter impact. She is an Interdisciplinary Scientist for the James Webb Space Telescope, scheduled for launch in 2018. Dr. Hammel has been lauded for her work in public outreach, including the AAS/DPS's 2002 Sagan Medal for outstanding communication by an active planetary scientist to the general public and the San Francisco Exploratorium's 1998 Public Understanding of Science Award. Asteroid "1981 EC20" has been renamed 3530 Hammel in her honor.

INVITED SPEAKERS

HIGH ENERGY ASTROPHYSICS SESSION

Tuesday, May 31, 14:00, Gateway

Robert Petre, NASA / GSFC

Expanding the Horizons of X-ray Astronomy

X-ray astronomy is experiencing a golden age as Chandra and XMM-Newton continue to enrich our knowledge of high-energy cosmic phenomena. Over the next two decades, a new generation of X-ray observatories, large and small, will deepen and broaden our observational capabilities, allowing more thorough study of known phenomena and revealing entirely new ones. In addition to the higher flux sensitivity and improved spectral resolution offered by future large missions such as ESA's Athena and NASA's X-ray Surveyor, new, smaller missions, developed on a much faster time scale, will open windows into previously unexplored domains. These domains include X-ray polarimetry, high-resolution spectroscopy with imaging, and ultra-high resolution X-ray timing. This talk will summarize new (Hitomi), upcoming (NICER), and potential future (PRAXyS, IXPE, X-ray Surveyor) capabilities provided by X-ray missions either led by NASA or with NASA involvement, and present examples of potential discoveries these missions will enable.

Biography

Robert Petre is the Chief of the X-ray Astrophysics Laboratory at NASA / Goddard Space Flight Center, one of the world's preeminent X-ray astronomy groups. He received his undergraduate degree from the University of Chicago (1976) and is Ph.D. from MIT (1982). After receiving his Ph.D., he became a member of the X-ray group at GSFC, first as an NAS/NRC research fellow, as a civil servant staff scientist since 1985, and as Lab Chief since 2000. He has held leadership roles on numerous NASA and international programs, including the Broad-Band X-ray Telescope (BBXRT), ROSAT, ASCA, Suzaku, Hitomi, and Athena. He also has led or participated in numerous mission studies, most notably Constellation-X/International X-ray Observatory (IXO) and X-ray Surveyor. Dr. Petre has maintained an active astrophysics research program, primarily studying supernova remnants (SNRs) and supernovae (SNe). He is an author of over 170 papers published in referred journals, and has presented numerous invited conference talks and colloquia.

INVITED SPEAKERS

EXTRAGALACTIC SESSION

Wednesday, June 1, 09:00, La Verendrye

Tim Robishaw, Dominion Radio Astrophysical Observatory, NRC-Herzberg

Probing Extragalactic Magnetic Fields via Zeeman Splitting of OH Megamasers

We provide an overview of a large Arecibo survey to measure magnetic fields in starburst galaxies via Zeeman splitting of hydroxyl (OH) megamaser emission. The first VLBI map of Zeeman splitting in an external galaxy will be presented. We discuss plans to further utilize OH megamasers as extragalactic magnetometers via observations with the new Five-hundred meter Aperture Spherical Telescope (FAST) and, eventually, the Square Kilometer Array (SKA).

Biography

Tim Robishaw received his Ph.D. degree from the University of California at Berkeley in 2008. He was a Postdoctoral Fellow in Radio Polarimetry at the University of Sydney then an Australian Research Council Super Science Fellow from 2008-2011, and a Covington Fellow at DRAO from 2011-2013. Tim is now a staff member at DRAO and is currently upgrading the 26-m John A. Galt Telescope for a large-scale survey of Zeeman splitting in the 21-cm emission from clouds of neutral atomic hydrogen in the Milky Way.

INVITED SPEAKERS

COSMOLOGY SESSION

Wednesday, June 1, 14:30, Provencher

Manuela Campanelli, Rochester Institute of Technology

Simulations of Binary Black Hole Mergers

On September 14, 2015, the advanced LIGO observatories detected gravitational waves (GW150914) coming from the coalescence of two black holes, occurred 1.3 billions year ago, with 29 and 36 solar masses merging into a final black hole with 62 solar masses. Numerical relativity simulations of binary black holes played a crucial role in the calculations of the expected gravitational wave signal that was just observed. I will review briefly the history of numerical relativity simulation efforts to model these systems, with an emphasis on the role that it currently plays in the new field of gravitational wave astronomy. I will also present some exciting new results in the context of magnetohydrodynamical simulation indicating that massive binary black hole sources might be also detectable in the EM spectrum, in some not too distant future.

Biography

Manuela Campanelli is a leading expert in computational General Relativity, the astrophysics of black holes and gravitational waves. Her groundbreaking work on numerical simulations of binary black hole space times enabled precise modelling of the signal measured in the first direct detection of gravitational waves by the Laser Interferometer Gravitational-Wave Observatory. Another of her papers was among those selected for a collection of landmark papers marking the centenary of General Relativity (http://journals.aps.org/general-relativity-centennial). Her current research focuses on computer simulations of accretion disks around merging supermassive black holes. Campanelli is a Fellow of the American Physical Society (APS), a former chair of the of the APS Topical Group in Gravitation and a winner of the RIT Trustee Scholarship.

INVITED SPEAKERS

EXTRAGALACTIC SESSION

Thursday, June 2, 14:00, La Verendrye

Grant Tremblay, Yale University

Cold, Galaxy-scale fountains with Black Hole Pumps

A new ALMA observation of the cool core brightest cluster galaxy in Abell 2597 reveals that a supermassive black hole can act much like a mechanical pump in a water fountain, driving a convective flow of molecular gas that drains into the black hole accretion reservoir, only to be pushed outward again in a jet-driven outflow that then rains back toward the galaxy center from which it came. The ALMA data reveal "shadows" cast by giant molecular clouds falling on ballistic trajectories towards the black hole in the innermost hundred parsecs of the galaxy, manifesting as deep redshifted continuum absorption features. The black hole accretion reservoir, fueled by these infalling cold clouds, powers an AGN that drives a jet-driven molecular outflow in the form of a 10 kpc-scale, billion solar mass expanding molecular bubble. HST reveals that the molecular shell is permeated with young stars, perhaps triggered in situ by the jet. Buoyant X-ray cavities excavated by the propagating radio source may further uplift the molecular filaments, which are observed to fall inward toward the center of the galaxy from which they came, presumably keeping the fountain long-lived. I will discuss this specific result in the larger context of galaxies as a whole, as the results show that cold molecular gas can couple to black hole growth via both feedback and feeding, in alignment with "cold chaotic accretion" models for the regulation of star formation in galaxies.

Biography

Grant Tremblay is an observational astrophysicist and NASA Einstein Fellow at Yale University. He was previously a Fellow at the European Southern Observatory (ESO) near Munich, and an astronomer at ESO's Very Large Telescope in Chile. Prior to that, he was at the Rochester Institute of Technology, the Space Telescope Science Institute, and the Johns Hopkins University. He uses ALMA, the Hubble Space Telescope, and the Chandra X-ray Observatory to study star formation and the dynamics of multiphase gas amid energetic feedback from accreting supermassive black holes.

INVITED SPEAKERS

BIG PROJECTS/MISSIONS SESSION

Thursday, June 2, 14:00, La Verendrye

Judith Irwin, Queen's University

New Look at Disk-Halo Dynamics with 'CHANG-ES'

The Continuum Halos in Nearby Galaxies -- an EVLA Survey (CHANG-ES) has exploited the new broad-band capabilities of the Expanded VLA in order to search 35 nearby edge-on galaxies for the presence of radio halos. With multiple array configurations, single-dish supplementary data, and uniquely, full polarization information, CHANG-ES has been probing the details of disk-halo dynamics with unprecedented sensitivity, including the structure of the magnetic field. This talk will provide an update on the project and present new results, including the sometimes surprising AGNs in the survey sample. The first CHANG-ES data release can be found at www.queensu.ca/changes.

Biography

Judith Irwin obtained her BSc in Mathematics at the University of Winnipeg and her MSc in Astrophysics at the University of Victoria during which time she spent a year at the Dominion Radio Astrophysical Observatory in Penticton, B. C., focussing on radio astronomical observations of a Galactic nebula. She then held a 3-year position running Alberta's Mobile Planetarium which took her all over the province of Alberta, developing and delivering presentations to school children and adults alike. She then returned to university, this time the University of Toronto, and obtained her PhD in Astronomy. It was during this time, that she became interested in the interstellar medium and outflows from nearby galaxies. Following her PhD, she held a Research Associateship with the James Clerk Maxwell Telescope Group in Ottawa at the Herzberg Institute of Astrophysics, and then took a position as Assistant Professor at Queen's University in Kingston. She is currently a Full Professor there and has just received her '25-year pin'. Sabbatical leaves have led her to extended stays in India at the National Centre for Radio Astrophysics in Pune, and to France for collaborative research at the Service d'Astrophysique, Saclay. In the Fall of 2016, she will be a Visiting International Professor in Bochum, Germany. Dr. Irwin has authored well over 100 scientific papers in peer-reviewed journals as well as an upper year undergraduate astrophysics textbook.

LIST OF POSTERS

Galactic-1 : **Improved modeling of molecular cloud cores : modeling in the visibility plane and with tensor stability calculations**
Victor Arendt *(University of Manitoba), Suraj Srinivasan, University of Manitoba Erica Franzmann, University of Manitoba Dr. Jason Fiege, University of Manitoba*

Galactic-2 : **Magnetohydrodynamic Models of Molecular Tornadoes**
Kelvin Au *(University of Manitoba), Jason Fiege*

Galactic-3 : **Enhancing the Advanced MOST Science Archive : MK Spectral Classification of MOST Targets**
David Bohlender *(NRC Herzberg)*

Galactic-4 : **Peering deeper into the plerionic supernova remnant G21.5-0.9**
Benson Guest *(Department of Physics and Astronomy, University of Manitoba), Benson Guest and Samar Safi-Harb*

Galactic-5 : **How Do Protostars Assemble Mass ? A Sub-Millimetre (JCMT) Variability Survey of Deeply Embedded Protostars**
Doug Johnstone *(NRC Herzberg), Steve Mairs (UVic), James Lane (UVic), Greg Herczeg (China), Yuri Aikawa (Japan), Geoff Bower (Taiwan), Vivien Chen (Taiwan), Jennifer Hatchell (UK), Jeong-Eun Lee (Korea), and the EAO JCMT Transient Survey Team*

Galactic-6 : **2D rotating evolution and pulsation models of gamma Doradus and Delta Scuti stars observed by Kepler**
Catherine Lovekin *(Physics Department, Mount Allison University), Joyce Guzik, Los Alamos National Laboratory*

Galactic-7 : **A binary shortcut towards the evolution of Type II Cepheids**
Hilding Neilson *(University of Toronto), Robert G. Izzard, Nancy R. Evans, Edward Guinan, Scott G. Engle & Douglas L. Welch*

Galactic-8 : **The Search for Long-Period Pulsars in the PALFA Survey**
Emilie Parent *(McGill University), Victoria Kaspi, Scott Ransom, Maura McLaughlin, Patrick Lazarus, Paul Scholz, Erik Madsen, Chitrang Patel, Weiwei Zhu, Adam Brazier and the PALFA collaboration*

Galactic-9 : **ON THE SHAPES OF RADIAL VELOCITY CURVES OF ROTATIONALLY AND TIDALLY DISTORTED POLYTROPIC MODELS OF STARS**
Tarun Sachdeva *(Thapar University, Patalia)*

Galactic-10 : **3D simulations of young core-collapse supernova remnants**
Samar Safi-Harb *(University of Manitoba), Gilles Ferrand*

Galactic-11 : **Not the magnetic field**
Jeroen Stil *(University of Calgary), A. Hryhoriw*

Galactic-12 : **Gas Content and Kinematics in Clumpy, Turbulent Star-forming Disks**
Heidi White *(Dunlap Institute / University of Toronto), Heidi A. White, David Fisher, Norman Murray, Karl Glazebrook, Roberto Abraham, Alberto Bolatto*

Galactic-13 : **NLTE Effects in Globular Cluster Integrated Light Spectra**
Mitchell Young *(St. Mary's University), C. Ian Short*

Galactic-14 : **The University of Manitoba's High-Energy Catalogue of Supernova Remnants and Pulsar Wind Nebulae**
Yichen Zhan *(University of Manitoba), Samar Safi-Harb, Gilles Ferrand, and Jennifer West*

Extragalactic-1 : **Disappearing and Redshifted Broad Absorption Line Quasars**
Nabeel Ahmed *(York University), Patrick Hall (York), Niel Brandt (PSU), Nur Filiz Ak (Erciyes)*

Extragalactic-2 : **Identifying X-ray Binaries in the Sculptor Dwarf Spheroidal Galaxy**
Robin Arnason *(University of Western Ontario), Pauline Barmby (UWO), Tom Maccarone (Texas Tech), Stephen Zepf (Michigan State)*

Extragalactic-3 : **Investigating central galaxy kinematics using cold gas.**
Keagan Blanchette *(University of Manitoba), Jayanne English, Jason Fiege*

Extragalactic-4 : **An ALMA Archival Study of the Core Mass Function in the LMC**
Nathan Brunetti *(McMaster University Physics & Astronomy), Christine D. Wilson*

Extragalactic-5 : **Energy truncation of NFW profiles as a possible explanation for tidally stripped halo density profiles**
Nicole Drakos *(University of Waterloo), James E. Taylor*

Extragalactic-6 : **Identifying Halo White Dwarfs within the NGVS Field**
Nicholas Fantin *(Queen's University), Patrick Cote, David Hanes*

Extragalactic-7 : **Mapping the Quasar Inner Parsec with the Maunakea Spectroscopic Explorer**
Sarah Gallagher *(Western University), Sarah Gallagher (Western University), Patrick Hall (York University), Kelly Denney (Ohio State), Chris Willott (NRC Herzberg), Anna Pancoast (Harvard-Smithsonian CfA), Yue Shen (University of Illinois), and Keith Horne (University of St. Andrews)*

Extragalactic-8 : **Solo Dwarf Galaxy Survey : Dwarf Irregulars in the Local Group**
Clare Higgs *(Department of Physics and Astronomy, University of Victoria), Alan McConnachie*

Extragalactic-9 : **Stellar Populations in the Interacting System Arp94 with SITELLE**
Carmelle Robert *(Université Laval), L. Drissen, L. Rousseau-Nepton, I. Moumen, T. Martin, M. Bureau, S. Courteau, L. Ho, J. Iglesia Paramo, S. Lavoie, R.P. Martin, N. Ouellette, I. Perez, H. Plana, T. Ruiz Lara, L. Sanchez*

Extragalactic-10 : **Polarization of faint radio sources from stacking the ATLAS survey**
Steven Rogowski *(University of Calgary), J. M. Stil, J. K. Banfield, T. Franzen, R. Norris*

Education-1 : **Observational Astronomy at the University of Manitoba : Phys 2070**
Christina Balanduk *(University of Manitoba), Sayeema Sultana and Jennifer West*

Education-2 : **Education and Outreach from AstroMcGill**
Emilie Parent *(McGill University), Kelly Lepo Gabrielle Simard Erik Madsen*

Education-3 : **Atchakosuk : Ininew Stories of the Stars**
Jennifer West *(University of Manitoba), Ian Cameron, University of Manitoba Wilfred Buck, Manitoba First Nations Education Resource Centre*

Education-4 : **A Brief History of Chronobiology and Light**
Jim Hesser *(NRC Herzberg), Dorothy Paul (first author), Department of Biology, University of Victoria and Royal Astronomical Society of Canada, Light Pollution Abatement Committee*

Planets-1 : **The Outer Solar System Origins Survey : I. Design and First-Quarter Discoveries**
JJ Kavelaars *(NRC), Michele T. Bannister, J. J. Kavelaars, Jean-Marc Petit, Brett J. Gladman, Stephen D. J. Gwyn, Ying-Tung Chen, Kathryn Volk, Mike Alexandersen, Susan Benecchi, Audrey Delsanti, Wesley Fraser, Mikael Granvik, Will M. Grundy, Aur´elie Guilbert-Lepoutre, Daniel Hestroffer, Wing-Huen Ip, Marian Jakubik, Lynne Jones, Nathan Kaib, Pedro Lacerda, Samantha Lawler2, Matthew J. Lehner, Hsing Wen Lin, Tim Lister, Patryk Sofia Lykawka, Stephanie Monty, Michael Marsset8, Ruth Murray-Clay, Keith Noll, Alex Parker, Rosemary E. Pike, Philippe Rousselot, David Rusk, Megan E. Schwamb, Cory Shankman, Bruno Sicardy, Pierre Vernazza, Shiang-Yu Wang*

Planets-2 : **Super-Earth atmospheric models based on planet formation history**
Sarah McKenzie-Picot *(McMaster University), Ralph Pudritz*

Instruments-1 : **POMM : a new high precision Polarimeter for the "Observatoire du Mont-Mégantic"**
Pierre Bastien *(CRAQ & dép. de physique, Université de Montréal), Mike Tommy Duchesne & Laurent Drissen (U. Laval)*

Instruments-2 : **Canadian Gemini News**
Stephanie Cote *(NRC Herzberg)*

Instruments-3 : **Potpourri of Metrics, Bibliometrics, Scientometrics and Curiosities**
Dennis Crabtree *(NRC Herzberg)*

Instruments-4 : **Update on the Next Generation Very Large Array**
James Di Francesco *(NRC Herzberg), Members of the NGVLA science working groups.*

Instruments-5 : **Searching for Fast Radio Bursts with CHIME**
Alex Josephy *(McGill University), Paul Demorest, Matt Dobbs, Mark Halpern, Vicky Kaspi, Tom Landecker, Erik Madsen, Cherry Ng, Ue-Li Pen, Scott Ransom, Ingrid Stairs, Shriharsh Tendulkar, Keith Vanderlinde and the CHIME/FRB collaboration.*

Instruments-6 : **System Performance Testing of the DVA1 Radio Telescope**
Lewis Knee *(NRC Herzberg), L.A. Baker, G.J. Hovey, M. Kesteven, G. Lacy, T. Robishaw*

Instruments-7 : **Development of a Novel MEMS Based Low Current Lorentz Actuator Array for Adaptive Optics**
Byoungyoul Park *(University of Manitoba), Dwayne Church and Cyrus Shafa*

Instruments-8 : **Tools for Slitless Spectroscopy of Extrasolar Planets with NIRISS aboard JWST**
Jason Rowe *(Institut de recherche sur les exoplanètes, iREx, Université de Montréal), René Doyon Loïc Albert*

Instruments-9 : **A Large Area MEMS Low Voltage Electrostatic Actuator for a Deformable Mirror System**
Yu Zhou *(University of Manitoba), Cyrus Shafai*

Techniques-1 : **Neutrino masses from Gravitational wakes.**
Chiamaka Okoli *(Department of Physics, University of Waterloo), Morag Scrimgeour Niayesh Afshordi Mike Hudson*

Techniques-2 : **Bayesian unfolding to measure the anti-electron neutrino cross section on carbon**
Fady Shaker *(University of Manitoba), Blair Jamieson*

COMPLETE LIST OF ABSTRACTS

Disappearing and Redshifted Broad Absorption Line Quasars (Session : Posters : Extragalactic-1) ; ***Nabeel Ahmed*** *(York University), Patrick Hall (York), Niel Brandt (PSU), Nur Filiz Ak (Erciyes)*

We have identified, using the Sloan Digital Sky Survey, a sample of disappearing (BAL) quasars where the BALs were seen to disappear between different spectroscopic epochs. One proposed model for this variability is a significant increase in ionizing radiation reaching the BAL outflow. The extra ionizing radiation will ionize C IV to C V, for example, resulting in a decrease in observed C IV absorption. We have obtained Gemini spectroscopy to observe the UV-emitting regions of these BAL quasars simultaneous with Chandra observations that can tell us how much X-ray absorbing gas is along our line of sight. We will search for a correlation between BAL disappearance, BAL variability, and X-ray absorbing gas along our line of sight. We have also found a sample of BALs that are redshifted in the quasar rest frame. This sample can give new insight on our understanding of BAL Quasars and winds as they are very rare, with only 1 in 1000 BALs being redshifted. Although not very well understood yet, some possible explanations are rotationally dominated outflows or gas infalling to small radii. We have ongoing Chandra observations that are testing these models by assessing if heavy X-ray absorption lies along our line of sight. We will present Gemini spectroscopy of these two samples of quasars and preliminary results on any rest-frame UV spectral changes accompanying the X-ray observations.

NFIRAOS : First Light Adaptive Optics System for TMT (Session : Instruments) ; ***David Andersen*** *(NRC Herzberg Astronomy & Astrophysics), G. Herriot, J. Atwood, P. Byrnes, K. Caputa, A. Densmore, J. Fitzsimmons, T. Hardy, A. Hill, D. Kerley, O. Lardiere, J. Stocks, J.-P. Veran*

NFIRAOS is the facility Adaptive Optics system for the Thirty Meter Telescope, is being designed and integrated at NRC Herzberg in Victoria Canada. NFIRAOS is an MCAO system that will feed three client instruments. It is cooled to -30°C to minimize thermal backgrounds and has two deformable mirrors, six laser wavefront sensors, and uses up to three low-order (tip/tilt and/or focus) IR wavefront sensors (OIWFS) in each instrument and up to four guide windows on the science detectors (ODGW) to correct atmospheric turbulence, telescope windshake and quasi-static optical errors. In April 2015 the federal government announced funding for full membership in TMT, and consequently design and construction activity has ramped up. Approximately ten major subsystems in NFIRAOS are being designed with Canadian industrial support. We present recent engineering work and design revisions to NFIRAOS, such as the addition of a pyramid WFS operating as a truth wavefront sensor and a NGS WFS when lasers are unavailable, and NFIRAOS' CPU-based real time computer.

Improved modeling of molecular cloud cores : modeling in the visibility plane and with tensor stability calculations (Session : Posters : Galactic-1) ; ***Victor Arendt*** *(University of Manitoba), Suraj Srinivasan, University of Manitoba Erica Franzmann, University of Manitoba Dr. Jason Fiege, University of Manitoba*

PolCat is a recently developed program for modeling submillimetre polarization maps of magnetized molecular cloud cores developed by our research group at the University of Manitoba. PolCat uses sequences of parametrized coordinate transformations to model the density structure and magnetic fields threading a cloud core, allowing for complex field geometries. Two improvements have been made to this software. Submillimetre arrays, such as ALMA,

measure the interference pattern produced by electromagnetic waves. The first improvement to PolCat was to allow PolCat models to be directly compared to interferometer data on the Fourier UV plane, without the need for image reconstruction, and thus avoiding reconstruction artifacts. This was accomplished through Fourier transforming the intensity and polarization maps, interpolating onto measured spatial frequencies, and computing chi-squared for the Stokes vectors in the UV plane. Testing was done on synthetic data to demonstrate the feasibility of this method. The second improvement was to the quality of models produced by PolCat. PolCat has successfully been applied to astronomical data from a number of molecular cloud cores, but some models generated by PolCat may be unphysical, since they represent highly unstable cores. We have developed modifications to PolCat that allow us to constrain models to being reasonably close to equilibrium, using the tensor virial theorem. These modifications have been tested on data from the cloud core DR21-Main in Cygnus. It has been found that the modifications successfully eliminate models that are greatly out of equilibrium, while leaving a set of models that agree well with the data and are reasonably close to equilibrium.

Identifying X-ray Binaries in the Sculptor Dwarf Spheroidal Galaxy (Session : Posters : Extragalactic-2) ; ***Robin Arnason*** *(University of Western Ontario), Pauline Barmby (UWO), Tom Maccarone (Texas Tech), Stephen Zepf (Michigan State)*
Many of the details about the formation and details of mass-accreting binaries in the field of the Milky Way are still uncertain. Globular clusters, traditionally used for studying populations of single stars at the same age, metallicity, and distance, are difficult to apply to field binaries because the high density of these clusters permits formation by dynamical methods. Dwarf galaxies allow the opportunity to study mass-accreting binaries in a typical field environment but with the usual advantages of globular clusters. We present preliminary results of a study of the Sculptor Dwarf Spheroidal Galaxy, where followup Gemini GMOS spectroscopy is used in combination with existing Chandra X-ray Telescope surveys.

Magnetohydrodynamic Models of Molecular Tornadoes (Session : Posters : Galactic-2) ; ***Kelvin Au*** *(University of Manitoba), Jason Fiege*
Molecular filaments are precursors to star formation and their understanding is a vital step in the stellar formation process. Magnetic fields, rotation, and external pressure characterize the stability and dynamics of these filaments. Observations near the Galactic Centre have revealed several helically-wound molecular filaments collectively known as, "molecular tornadoes." The tornado structure is atypical of the traditional molecular filament and warrants further investigation into the cause and any arising implications on the filament stability. Our goal is to formulate analytical and numerical magnetohydrodynamic (MHD) models of these molecular tornadoes in order to investigate the dynamics and stability, and to predict the submillimetre polarization maps associated with the magnetic structure. Beginning with the standard, cylindrical filament, we adjust parameters such as magnetic fields, rotation, and external pressure. We will then model the tornado structure as a torsional Alfvén wave propagating along the filament. Currently, we have explored various scenarios of the standard cylindrical molecular filament including rotational effects (with various rotation laws), poloidal, and toroidal magnetic fields. From this exploration, we have developed constraints in the parameter space corresponding to observations. We have already produced some analytical solutions for certain molecular tornado scenarios and have performed a virial analysis that resulted in a prediction of conditions for kink instabilities. In the near future, we plan to investigate perturbations in the MHD model.

47 Tuc X9 : the first ultra-compact X-ray binary identified in quiescence and its twisted accretion (Session : High Energy) ; ***Arash Bahramian*** *(University of Alberta), C. O. Heinke, J.A.C. Miller-Jones, T.J. Maccarone, V. Tudor, T. Kallman, S. Bogdanov, J. Garcia-Martinez, G.R. Sivakoff, J. Strader, L. Chomiuk*

X9 is a low-luminosity (1e33-1e34 erg/s) X-ray source in the globular cluster 47 Tuc, identified with a blue optical/UV counterpart, and showing strong emission lines from carbon (in the UV) and oxygen (in the X-ray) that suggest accretion from a C/O white dwarf. Recently we have measured strong radio emission from this object, suggesting that the accretor is a black hole. I present result of our deep simultaneous study of this source in X-rays (with Chandra and NuSTAR) and in Radio (ATCA). We show evidence for clear signs of photo-ionized emission from oxygen VII and VIII in the system, providing additional evidence that the system is an ultra-compact X-ray binary (orbital period < 80 mins). However, we find a 6.8 day periodic modulation in the X-ray light curve, which indicates the presence of a warped accretion disk. Finally, we present evidence for the presence of reflected X-ray emission from the disk.

Observational Astronomy at the University of Manitoba : Phys 2070 (Session : Posters : Education-1) ; ***Christina Balanduk*** *(University of Manitoba), Sayeema Sultana and Jennifer West*

We present an overview of the University of Manitoba's observational astronomy course, in which students gain the skills to operate the University's Evans' and Ewen telescopes along with processing and analyzing images. Students in this course also gain a knowledge of various topics in astronomy, including an understanding of various types of telescopes, variable stars and the motion of the night sky. Students then choose an object to observe with the Evans' telescope, prepare an observing proposal, collect the data, and finally process their images for their final project, which is presented both orally and in the form a website.

Pieces of Andromeda : machine-learning and big data techniques applied to M31 (Session : Techniques) ; ***Pauline Barmby*** *(Western University), S. Rahmani, M. Rafiei Ravandi, J.L.A. Nandez, N. Vulic, R. Arnason*

As the nearest large galaxy, Andromeda has been the target of many observational studies. Putting the pieces from some of these studies together has the potential to answer old questions, and generate new ones, about everyone's favorite large non-Milky Way Local Group galaxy. Our work includes analyzing mid-infrared spectra with self-organizing maps, determining the properties of a massive number of mid-infrared point sources, and cross-identifying M31 X-ray sources.

POMM : a new high precision Polarimeter for the "Observatoire du Mont-Mégantic" (Session : Posters : Instruments-1) ; ***Pierre Bastien*** *(CRAQ & dép. de physique, Université de Montréal), Mike Tommy Duchesne & Laurent Drissen (U. Laval)*

A new Polarimeter has been built for the Observatoire du Mont-Mégantic, POMM, and is currently undergoing commissioning. It is optimized to reach a precision of one part per million, a factor of 100 better than its predecessor. The characteristics that make this goal possible and the observational projects envisioned will be presented. The instrument is particularly well-suited to study low-level polarization variations in bright stars. Hot Jupiters are expected to produce orbital variations at the level of a few x 10-6. The polarization is produced by Rayleigh and dust scattering of stellar photons in the atmosphere of the planet. There is a controversy about the detection of exoplanet HD 189733b, claimed and refuted by various observers. Additional data

should help understand this system. Orbital variations in stellar binaries, such as Wolf-Rayet stars, will also be studied.

Investigating Dense Gas and Star Formation in the Antennae Galaxies (NGC 4038/39) using ALMA (Session : Extragalactic I) ; ***Ashley Bemis*** *(McMaster University), Christine Wilson, Maximillien Schirm*
The Antennae is the nearest (22 Mpc) pair of interacting galaxies and shows evidence of recent, wide-spread star formation. We are studying the relationship between dense gas and star formation in the Antennae by comparing high-resolution ALMA observations of dense gas tracers (HCN, HCO+, and HNC) to the 70 micron image from the Herschel Space Observatory. A recent study of the Antennae by Bigiel et al. (2015) using CARMA has compared the emission of these dense gas tracers in the brightest regions of the overlap region and two nuclei. With the higher sensitivity of ALMA, we are able to probe additional fainter regions in the dense gas tracers and compare the total recovered flux of these two studies. We combine the ALMA data with OVRO CO data to derive the star formation efficiencies and compare with dense gas fractions and dense gas star formation efficiencies.

Investigating central galaxy kinematics using cold gas. (Session : Posters : Extragalactic-3) ; ***Keagan Blanchette*** *(University of Manitoba), Jayanne English, Jason Fiege*
Using hydrogen gas spectral line radio data of spiral galaxy NGC 3198, we investigate the validity of using the optically thin limit as an approximation within the radiative transfer equation of the galaxy modelling software currently called GalAPAGOS/MantaH. This is a first step in a larger project aimed at incorporating carbon monoxide (CO) data into the GalAPAGOS environment, with the goal being to constrain the very inner rise of galaxy rotation curves. The addition of CO data will allow us to investigate different galactic properties including its dark matter content, possible active galactic nuclei, and whether the HI region has over-densities that may be sites of star formation. If HI models of NGC 3198 at this optically thin limit are comparable to those without this approximation, this will allow us to decrease the computational time required to produce valid models. Additionally, this approximation can be used to efficiently model the kinematics and rotation curve of CO spectral line data of early-type galaxy NGC 5379 even though the absolute intensities of the CO emission are not modelled.

Enhancing the Advanced MOST Science Archive : MK Spectral Classification of MOST Targets (Session : Posters : Galactic-3) ; ***David Bohlender*** *(NRC Herzberg)*
Since its launch in 2003 the MOST (Microvariability and Oscillation of Stars) Space Telescope has conducted more than 260 lengthy observing campaigns. While these campaigns often concentrate on a single primary target observed in Fabry (if bright) or Direct Imaging observing modes, there are typically many secondary targets for which simultaneous direct imaging is obtained as well as many guide stars for which precise photometry is recorded. As a result excellent photometry has now been obtained by MOST for almost 4000 objects ! Approximately 25% of these MOST targets are stars with unknown MK spectral types. To enhance the content of the Advanced MOST Science Archive (AMSA), soon to be released by the CADC after a collaborative development effort with the CSA, we are obtaining low-resolution (45Ä/mm) spectra of northern objects with the DAO Plaskett telescope and Cassegrain spectrograph. These spectra will be made available through the AMSA. We will present samples in this poster as well as a brief description of the AMSA.

Update on Discover the Universe (Session : Education) ; ***Julie Bolduc-Duval*** *(Discover the Universe)*
Discover the Universe, CASCA's main outreach program, offers astronomy training to teachers and informal educators across Canada and even around the world. This talk will give you an update on the latest projects and many new initiatives which are on the way.

Polarization at Low Multipoles from the Planck HFI Instrument and the Reionization Epoch of the Universe (Session : Cosmology I) ; ***J. Richard Bond*** *(CITA, University of Toronto), for the Planck Collaboration*
One of the hardest quantities to determine well in cosmology is the Compton depth tau_C to electron scattering of CMB photons, which is directly related to the redshift z_reion when light from the first stars in primeval galaxies reionized the post-recombination neutral atoms. tau_C and z_reion rely on accuracy in the first dozen E polarization multipoles cleaned of systematics and foregrounds. I will report on our Planck 2016 use of the High Frequency Instrument channels to considerably refine (and lower) the prior WMAP9 and Planck 2015 estimates, and its implications for z_reion and galaxy formation.

An ALMA Archival Study of the Core Mass Function in the LMC (Session : Posters : Extragalactic-4) ; ***Nathan Brunetti*** *(McMaster University Physics & Astronomy), Christine D. Wilson*
I present preliminary results of an ALMA archival study that combines data from two separate projects to build a large sample of clouds and cores in the Large Magellanic Cloud (LMC). These projects contain continuum and spectral line data of 30 Doradus, N159E and N159W over a combined area of ~10.1 square arcminutes in Bands 3 and 6 (~95 and ~228 GHz respectively). I focus on using the continuum data to estimate dust masses for these sources as well as an analysis of the cloud/clump properties to construct a clump mass function (CMF). The lower metallicity in the LMC will be used in comparison with galactic studies to explore the effects of metallicity on the CMF. I will also discuss the wider continuum and eventually spectral line archival studies that will be enabled by this data gathering approach. I plan to include N166, GMC 225, PCC 11546, N113 and potentially several Small Magellanic Cloud and Magellanic Bridge objects to build a data set with substantially improved statistics compared to any single ALMA project.

Achakosuk (The Stars) (Session : Banquet) ; ***Wilfred Buck*** *(Manitoba First Nations Education Resource Centre Inc.)*
This presentation will focus on the Ininew (Cree) perspective of Kisic Aski (Sky World). Thirteen Ininew constellations and mythologies will be identified and discussed as well as touching on the sun, moon and some of the planets. The listener will get a glimpse of the night sky from a totally different perspective than the main stream Roman & Greek mythology.

Numerical Relativity Simulations of Binary Black Hole Mergers (Session : Cosmology II) ; ***Manuela Campanelli*** *(Rochester Institute of Technology)*
On September 14, 2015, the advanced LIGO observatories detected gravitational waves (GW150914) coming from the coalescence of two black holes, occurred 1.3 billions year ago, with 29 and 36 solar masses merging into a final black hole with 62 solar masses. Numerical relativity simulations of binary black holes played a crucial role in the calculations of the expected gravitational wave signal that was just observed. I will review briefly the history of numerical

relativity simulation efforts to model these systems, with an emphasis on the role that it currently plays in the new field of gravitational wave astronomy. I will also present some exciting new results in the context of magnetohydrodynamical simulation indicating that massive binary black hole sources might be also detectable in the EM spectrum, in some not too distant future.

Measuring the C18O column density in hot cores (Session : Galactic II) ; ***James Campbell*** *(University of Calgary), Rene Plume, Emmanuel Caux, Ted Bergin, Dariusz Lis, Jose Cernicharo, Karl Menten, Peter Schilke, Juergen Stutzki, Shiya Wang*
High-mass stars are formed embedded within hot, dense, molecular gas reservoirs known as hot cores. Hot cores exist within cooler, larger scale structures known as molecular clumps. The column density of a species is a fundamental observable quantity. Observations of low-J CO lines at (sub)millimetre wavelengths are commonly employed to measure the column density of astronomical objects. This traditional technique is complicated by the high densities and temperatures found towards hot cores. Observations of C18O, a rare isotopologue, surmount optical depth issues, while high temperatures, atypical of the cool cores associated with low-mass star formation, excite the C18O molecule into higher energy states with transitions lying in the far-infrared. We utilize observations of both the low and high-J lines (up to J=15-14) in order to accurately constrain the C18O column density. The high-J lines, which are blocked by the Earth's atmosphere, have been observed using the Herschel/HIFI instrument. The low-J lines have been obtained via ground-based observations using the IRAM 30m telescope and the James Clerk Maxwell Telescope. We measure the C18O column density of the hot core, as well as the surrounding molecular clump, towards a sample of 13 objects. Canonical abundance ratios scale the C18O column density to the total molecular gas column density, a quantity of key theoretical importance.

Searching for the closest habitable worlds : cool stars with even cooler planets (Session : Planets II) ; ***Ryan Cloutier*** *(University of Toronto), Mr. Ryan Cloutier, Prof. Kristen Menou, Prof. René Doyon*
Some of the biggest outstanding questions in exoplanetary science revolve around the search for habitable Earth-like planets. How frequent are habitable exoEarths ? What are their properties ? Where is the closest habitable world ? Although the detection of potentially habitable exoEarths around Sun-like stars is hindered by the long required time baselines and the small planetary signals in both transit and radial velocity observations, detecting such planets around M-dwarfs is much more tractable. Furthermore, the empirical M-dwarf distribution of rotation periods appears to be bi-modal with a significant population of slow rotators with corresponding levels of radial velocity jitter at the sub-m/s level. Such stars are the most attractive targets for the radial velocity surveys to be conducted with up-coming instrumentation optimized for operation at near-IR wavelengths where most M-dwarf flux is emitted. I'll present calculations of the planet detection completeness around this common class of star and discuss how we plan to reach these detection levels with SPIRou : a next generation spectro-polarimeter with first-light scheduled on CFHT in 2017. I'll also touch on what this means for the characterization of transiting planetary systems, a la TESS, with SPIRou in the northern sky and eventually with its cousin instrument NIRPS in the south.

Constraints on cosmic birefringence from Planck 2015 polarization data (Session : Cosmology I) ; ***Dagoberto Contreras*** *(University of British Columbia), On behalf of the Planck Collaboration*
Parity violating extensions of the standard electromagnetic theory cause a rotation in the plane of polarization of propagating photons. This effect in particular impacts the anisotropies of the cosmic microwave background (CMB), producing non-vanishing T--B and E--B correlations that are otherwise null when parity is conserved. Here we present new constraints on this rotation derived from Planck 2015 CMB data. We focus on a technique that uses images of polarization stacked on temperature or E-mode hot and cold spots. The former being sensitive to T--B correlations while the latter is sensitive to E--B correlations. We find this technique to be close to optimal, reporting the smallest statistical uncertainties to date, while our systematic uncertainties are similar to other CMB experiments. Our constraints are compatible with no parity violation and are dominated by the systematic errors given by the uncertainty in the orientation of the polarimeters.

Canadian Gemini News (Session : Posters : Instruments-2) ; ***Stephanie Cote*** *(NRC Herzberg)*
The Canadian Gemini Office will provide updates on Gemini operations over the last year, and provide some statistics of semesters 2016A and 2016B and instrument usage from the Canadian community. The status of Gemini upcoming instruments and upgrades will be reviewed. Please stop by the poster to meet CGO staff who will be available to answer your questions about Phase I, Phase II, data reductions, etc.

POL-2 : The SCUBA-2 polarimeter and the study of magnetism in star-forming regions (Session : Instruments) ; ***Simon Coudé*** *(Université de Montréal), S. Coudé, P. Bastien & the POL-2 commissioning team*
POL-2 is the next generation submillimetre polarimeter installed on the James Clerk Maxwell Telescope (JCMT). This new instrument will take advantage of the unique capabilities of the SCUBA-2 bolometer camera to help us understand the role of magnetism in the interstellar medium. The POL-2 commissioning team has made significant advances in the last months, and POL-2 observing was offered for the first time in the call for proposals of the 16B semester at the JCMT. The encouraging results obtained during commissioning suggest science observing for individual projects and large programs is indeed going to begin as planned this coming fall. The BISTRO survey in particular will map with unprecedented sensitivity the polarization toward dense star-forming regions of the Gould Belt. This will allow us to study the role of magnetism in the fragmentation of dense filaments in giant molecular clouds, and thus its effect on star formation.

Potpourri of Metrics, Bibliometrics, Scientometrics and Curiosities (Session : Posters : Instruments-3) ; ***Dennis Crabtree*** *(NRC Herzberg)*
I will present a selection of informational graphics on the performance of large telescopes, measures of the Canadian and Australian astronomical communities and other curiosities.

The Actively Disintegrating Minor Planet(s) Orbiting the White Dwarf WD 1145+017 (Session : Planets II) ; ***Bryce Croll*** *(Boston University)*
Recently the first planet (or sub-planet) mass objects were announced to be transiting a white dwarf (WD 1145+017). We have observed evidence for multiple planetesimals in short period (~4.5 hour) orbits around this white dwarf ; these planetesimals appear to be disintegrating and

display the variable transit depths and asymmetric transit profiles that we have come to associate with disintegrating planets/planetesimals. I will report a wealth of multiwavelength observations of this system with telescopes big and small : from Keck and HST, to 11-inch amateur telescopes. These extensive observing resources have led us to conclude that these multiple disintegrating planetesimals may be from one main minor planet that is being tidally ripped apart before our eyes. Also, our multiwavelength photometry allows us to place a limit on the particle size in the cometary tails trailing these planetesimals, helping to determine the mechanism (collisions, tidal disruption, a Parker wind, etc.) that has led to the cometary tails. Ultimately, our observations may even inform us about the ultimate fate of planets in our own Solar System, including the Earth -- once the Sun becomes a white dwarf.

Update on the Next Generation Very Large Array (Session : Posters : Instruments-4) ; ***James Di Francesco*** *(NRC Herzberg), Members of the NGVLA science working groups.*
The Next Generation Very Large Array (NGVLA) is an ambitious project to build a successor to the present Karl G. Jansky Very Large Array. The project is in the early phases of design and scope, but the vision currently consists of hundreds of antennas spread across the state of New Mexico with receivers that can observe 1-50 GHz and ~70-115 GHz. Such a facility will enable transformational science beyond the abilities of ALMA and SKA-1, including high-resolution probes of terrestrial planet formation zones and low-excitation molecular gas in galaxies at high redshifts. In this presentation, I will describe recent progress and future plans for defining and constructing the NGVLA.

Status of the James Webb Space Telescope (Session : Big Projects/Missions) ; ***Rene Doyon*** *(Université de Montréal - iREx), NIRISS science team*
JWST's development is progressing steadily, on schedule, since the last four years, for a launch date in October 2018. All four science instruments have been successfully tested through three comprehensive cryogenic test campaigns and the telescope is rapidly taking shape. After a brief presentation on the status development of JWST, I will describe its unique and powerful capabilities and presents highlights of the Canadian-led NIRISS Guaranteed Time Observation program (450 hours) largely dedicated to a deep spectroscopic survey of the early universe and atmospheric characterization of nearby Hot Jupiters and super-Earths. As the first call for proposals (November 2017) is rapidly approaching, the Canadian community should get ready to use JWST.

The Nature of the Super-Earth 55 Cancri e (Session : Planets II) ; ***Diana Dragomir*** *(University of Chicago)*
Recent surveys have revealed an extraordinary and unexplained diversity of low-mass exoplanets. The main frontier for constraining the nature and origins of these planets is atmospheric characterization to reveal their detailed physical properties. The transiting super-Earth 55 Cnc e orbits its bright, G type host star with an extremely short period of just under 18 hours. These characteristics make 55 Cnc e a good candidate for transmission spectroscopy, and an even better target for dayside emission spectroscopy. So far, phase and eclipse observations of this extreme super-Earth present an intriguing picture. The MOST transit discovery data for 55 Cnc e exhibits a low-amplitude variation at the orbital period of the planet, which cannot be solely explained by scattered light. We present continuing evidence of this effect in subsequent MOST photometry of 55 Cnc, and find that its amplitude and phase change between observing seasons. Further, there have also been claims of variable eclipse depth for this planet at Warm Spitzer wavelengths. We will show results from newly acquired Spitzer and HST WFC3 transits and eclipses of this planet. These new data will shed (even) more light on this exciting super-Earth in

an effort to constrain its composition and the dynamics of its atmosphere. We will also discuss our results in light of the recently announced variable eclipse depth and phase variations of this planet as observed with the Spitzer telescope. This multi-pronged data set for 55 Cnc e will guide JWST spectroscopy of a much larger sample of close-in low-mass transiting exoplanets.

Energy truncation of NFW profiles as a possible explanation for tidally stripped halo density profiles (Session : Posters : Extragalactic-5) ; ***Nicole Drakos*** *(University of Waterloo), James E. Taylor*
To study the dynamics of halo mergers, it is necessary to simulate stable isolated halos ; however, the commonly used Navarro-Frenk-White (NFW) profile cannot be fully simulated due to its infinite mass. One solution to this problem is to exponentially truncate the density profile outside some cut-off radius (e.g. Kazantzidis et al, 2004). However, we suggest an alternate, physically motivated truncation based on energy. Our truncation yields a profile that looks similar to tidally stripped halos (Hayashi et al., 2003). Thus, we also provide a possible physical explanation for the density profile of tidally stripped halos.

SITELLE : Commissioning and Science Verification (Session : Instruments) ; ***Laurent Drissen*** *(Université Laval), The SITELLE Team*
SITELLE, CFHT's new Wide-Field Imaging Fourier transform spectrometer, was successfuly commissioned in August 2015. After a brief introduction to the instrument itself, I will present some highlights from the commissioning and science verification observing runs, from nearby supernova remnants to distant galaxies.

Inferring the mass of the Dark Matter Halo from Globular Cluster 3D Kinematics (Session : Cosmology I) ; ***Gwendolyn Eadie*** *(Physics & Astronomy, McMaster University), William Harris, McMaster University*
The Milky Way's (MW's) composition, structure, dynamical properties, and formation history are heavily influenced by one important property : the Galaxy's mass. However, inferring the mass profile of the MW is very difficult, and estimates in the literature differ by more than a factor of two. We must rely on kinematic information of tracer objects such as globular clusters and halo stars, which are under the influence of the Galaxy's gravitational potential, to constrain the mass profile of the Galaxy's dark matter halo. However, attempts to use the kinematics is made more difficult by the lack of complete 3-dimensional space velocity observations for many tracers. A second problem is that the spatial distributions of the dark matter and the tracers are undoubtedly different. Eadie et al. (2015) addressed the first problem ; they developed a Bayesian technique which takes full advantage of the available data (both incomplete and complete data). Here, we address the second problem. We present new mass and mass profile estimates for the MW using the Bayesian analysis developed by Eadie et al (2015), assuming the power-law model profiles and distribution functions from Evans et al. (1997), Deason et al. (2011), and Deason et al. (2012). Under this model, the globular clusters are assumed to follow a different spatial distribution than the dark matter.

Red Misfit Galaxies in the Sloan Digital Sky Survey (Session : Extragalactic II) ; ***Fraser Evans*** *(McMaster University), Laura Parker*
It has long been known that many properties of galaxies depend strongly on their host environment ; red passively-evolving galaxies dominate dense environments and blue star-forming galaxies dominate low density environments. ~90 percent of the galaxies in the universe can be described this way, as either blue and active or red and passive. In a large sample of galaxies from

the Sloan Digital Sky Survey we study the remaining ~10 percent of galaxies which defy this trend, galaxies which exhibit red colours but are actively star-forming. These 'red misfit' galaxies are a population physically distinct from blue active and red passive galaxies. They have intermediate morphologies, they are the preferred hosts of AGN and their abundance does not seem to depend on environment in any obvious way. I will discuss the peculiar properties of red misfits as well as their implications for both environmental and secular galaxy evolution in the low-redshift universe.

Identifying Halo White Dwarfs within the NGVS Field (Session : Posters : Extragalactic-6) ; ***Nicholas Fantin*** *(Queen's University), Patrick Cote, David Hanes*
White dwarfs represent the end of the evolutionary sequence of intermediate mass stars (initial mass less than ~8 solar masses). Most of our knowledge of white dwarfs comes from a local sample owing to their small size and faint optical luminosity. We use colours derived from a combination of deep optical data from the Next Generation Virgo Cluster Survey (NGVS) and UV data from a targeted GALEX survey (GUViCS) to select white dwarf candidates. The resulting catalog contains 903 white dwarf candidates with g' magnitudes between 18.5 and 24.0, which is a factor of 4 more than previous work. Model cooling curves to derive photometric distances for a subset of candidates. Proper motions are estimated using positional data from NGVS and SDSS for objects which appear in both catalogs. Using the photometric distances, proper motions, and colours, we show that a sizable population of halo white dwarfs can be studied using the combination of deep optical and UV data. Future studies, including spectroscopic followups and extensions using the future Luau large u-band survey are discussed.

3D visualization of astronomical data using immersive displays (Session : Techniques) ; ***Gilles Ferrand*** *(University of Manitoba), Jayanne English (U. of Manitoba, Physics & Astronomy), Pourang Irani (U. of Manitoba, Computer Science, Human-Computer Interaction lab)*
We will report on an exploratory project aimed at performing immersive 3D visualization of astronomical data sets, starting with spectral-line emission data cubes from galaxies. This work is done as a collaboration between the Department of Physics and Astronomy and the Department of Computer Science at the University of Manitoba. We are building our prototype using the 3D engine Unity, because of its ease of use for integration with advanced displays. First we will discuss general issues regarding 3D visualization, such as : load and convert astronomy data, perform fast volume rendering allowing for interaction, and produce physically meaningful visualizations using the principles of visual literacy. We will then explore how the visualization can be enhanced inside systems that provide immersive 3D, such as a CAVE environment, a zSpace tabletop, or virtual reality headsets. We will show how a desktop visualization can be ported to such systems, and introduce the challenges to be met when designing a user interface that allows us to take advantage of this new way of exploring data. We hope to lay the foundations for an innovative framework useful for all radio astronomers, and encourage interested parties to join our efforts. This pilot project addresses the challenges presented by frontier astronomy experiments, such as the Square Kilometre Array and its precursors.

A Detailed BLASTPol Study of Magnetic Fields in Vela C : Modeling Polarization Fraction and Local Field Dispersion (Session : Galactic II) ; ***Laura Fissel*** *(CIERA - Northwestern University), The BLASTPol Collaboration*
Maps of polarized thermal dust emission can be used to create extremely detailed "portraits" of magnetic field morphology, which can in turn be used to study the role of magnetic fields in star formation. The BLASTPol collaboration has recently released the most detailed magnetic field map ever made for a giant molecular cloud forming high mass stars. Our 500 micron polarization

map of Vela C has 0.5 pc resolution and covers almost all of the extent of this 10 by 30 pc cloud. The intermediate and large-scale magnetic field in Vela C shows considerable order, however we also observe regions of large change in magnetic field orientation over small (~0.5 pc) scales. These regions of high local dispersion in field orientation do not in general correlate with column density, as might be expected if the field were affected by large-scale gas motions near self gravitating cloud substructures. We will show that modeling changes in polarization fraction across Vela C shows considerable promise for probing the orientation of the magnetic field along the line of sight and characterizing the degree of disorder in the field. The same methods can then be applied to synthetic polarization maps derived from 3-D numerical simulations of star formation in order to constrain cloud magnetic field properties, though careful modeling of the dust temperature structure and grain alignment efficiency will be needed to fully understand the origin of variations in polarization fraction with column density.

Astrophysical implications of the gravitational wave observation by Advanced LIGO (Session : Cosmology II) ; ***Heather Fong*** *(Canadian Institute for Theoretical Astrophysics/University of Toronto), On behalf of the LIGO and Virgo Scientific Collaboration*
On September 14, 2015, the two LIGO detectors observed a transient gravitational-wave signal. Detailed analyses reveal the signal to have originated from the coalescence of a pair of astrophysical black holes. It is the first direct detection of gravitational waves, and we now have observational evidence that binary black holes exist in nature and merge with one another. This allows us to make statements about various theoretical predictions that have been proposed over the past forty years. In this talk, I will discuss the key astrophysical implications based on the gravitational-wave discovery of coalescing binary black holes.

Submillimetre Polarization Modelling with PolCat : Refinements and New Developments (Session : Galactic I) ; ***Erica Franzmann*** *(University of Manitoba),Erica Franzmann,Jason Fiege*
"PolCat" is a software package for modelling the magnetic field and density structures of molecular cloud cores from submillimetre polarization maps. PolCat builds a three-dimensional core model via the use of consecutive parametrized coordinate transformations, and generates polarization maps of the model to fit to observational datasets. We utilize the Ferret genetic algorithm to search out the space defined by the transformation and dust parameters to simultaneously minimize χ^2 for the intensity and polarization position angle maps separately. The code automatically discovers the trade-offs between these two objectives to find the families of models that balance both. Extensive testing has demonstrated that PolCat reliably finds models that are in good agreement with polarization maps, although classes of mathematically degenerate models are often discovered. Recent work uses the tensor virial theorem to reduce this degeneracy, by providing the option to restrict models to those that are near virial equilibrium, to within some threshold, along all three principal axes. A second recent addition adds the functionality to model cores directly from interferometry data on the Fourier UV plane without the need for image reconstruction.

The search for brown dwarfs and low-mass stars in young associations of the solar neighborhood (Session : Prize Lecture) ; ***Jonathan Gagné*** *(Carnegie Institution of Science, DTM), Jonathan Gagné, David Lafrenière, René Doyon, Lison Malo, Étienne Artigau, Jacqueline Faherty, Loïc Albert, Adam Burgasser*
I will present the BANYAN II statistical tool that our team developed to identify new candidate members of young moving groups in the solar neighborhood. This will be followed with a presentation of the BANYAN All-Sky Survey (BASS) in which the all-sky near-infrared catalogs 2MASS

and AllWISE were cross-matched in conjunction with BANYAN II to identify new young brown dwarfs. This survey has allowed us to discover a large number of new young brown dwarfs in isolation, several of which have physical properties such as mass, age and temperature that make them similar to exoplanets that were recently discovered using the method of direct imaging. Such isolated analogs of the giant, gaseous exoplanets are precious benchmarks that will allow a deep characterization of their atmospheres using high-resolution and high signal-to-noise spectroscopy, which is made possible due to the absence of a nearby and bright host star. I will end by describing the most recent developments in the search for young, planetary-mass objects in the solar neighborhood. This includes the discovery of SDSS J1110+0116, a new young ~10 Jupiter-mass object in isolation that displays signatures of methane in its atmosphere.

Mapping the Quasar Inner Parsec with the Maunakea Spectroscopic Explorer (Session : Posters : Extragalactic-7) ; ***Sarah Gallagher*** *(Western University), Sarah Gallagher (Western University), Patrick Hall (York University), Kelly Denney (Ohio State), Chris Willott (NRC Herzberg), Anna Pancoast (Harvard-Smithsonian CfA), Yue Shen (University of Illinois), and Keith Horne (University of St. Andrews)*

The centre of every massive galaxy in the local Universe hosts a supermassive black hole that likely grew between a redshift of 1 to 3 through active accretion as a luminous quasar. Despite decades of study, the details of the structure and kinematics of the inner parsec of quasars remain elusive. Because of its small angular size, this region is only accessible through time-domain astrophysics. The powerful technique of reverberation mapping takes advantage of the changing emission-line properties of gas near the black hole in response to variations in the luminosity of the black hole's accretion disk to measure the sizes and velocities of the line-emitting regions ; with this information, we can map the quasar inner parsec and accurately measure black hole masses. This information is essential for understanding accretion physics and tracing black hole growth over cosmic time ; reverberation mapping is the only distance-independent method of measuring black hole masses applicable at cosmological distances. We describe a ground-breaking MSE campaign of ~100 observations of ~5000 quasars over a period of several years (totaling ~600 hours on-sky) to map the inner parsec of these quasars from the innermost broad-line region to the dust-sublimation radius. With high quality spectrophotometry and spectral coverage from 360 nm to 1.8 microns, this unprecedented reverberation-mapping survey will map the structure and kinematics of the inner parsec around a large sample of supermassive black holes actively accreting during the peak quasar era. In addition, a well-calibrated reverberation relation for quasars offers promise for constructing a high-z Hubble diagram to constrain the expansion history of the Universe.

Peering deeper into the plerionic supernova remnant G21.5-0.9 (Session : Posters : Galactic-4) ; ***Benson Guest*** *(Department of Physics and Astronomy, University of Manitoba), Benson Guest and Samar Safi-Harb*

When a massive star explodes in a core-collapse supernova, what remains is a rapidly rotating neutron star, powering a cloud of highly energetic charged particles known as a Pulsar Wind Nebula (PWN). This expands into the low density region cleared out by the rapidly moving blast wave of ejecta. As this shell accumulates matter from the ISM, it is shock heated and is expected to be visible in the form of thermal X-ray emission. The Supernova Remnant (SNR) G21.5-0.9 has become the textbook example of this young SNR evolution, hosting a bright PWN powered by 61.8 ms pulsar (PSR J1833-1034), and a faint limb-brightened shell revealed in X-rays with the Chandra X-ray observatory. The nature of the X-ray emission from the shell (thermal versus non-thermal) and knots within the nebula (ejecta ?) remain a puzzle. We present a follow-up

Chandra X-ray analysis of G21.5-0.9 utilizing the deepest (> 1 Msec total) exposure to date, including ~780 ks with the Advanced CCD Imaging Spectrometer (ACIS) and ~310 ks with the High Resolution Camera (HRC). These observations spanning ~15 years allow for the study of variability and tracking the motion of small-scale structures within the PWN.

Catastrophic Collisions in the Solar System (Session : Planets I) ; ***Heidi Hammel*** *(AURA)*
Catastrophic collisions have shaped the destiny of the Solar System, and perhaps humankind. In 1994, a series of massive explosions on Jupiter occurred after the remnants of a fractured comet plunged into that planet's atmosphere. Hubble Space Telescope tracked these explosions (Hammel et al. 1995, Science 267, 1288), as did telescopes around the world. In 2009 amateur astronomer Anthony Wesley shocked the astronomical community with the discovery of a fresh impact site on Jupiter. Hubble again observed a massive black impact site (Hammel et al. 2010, Ap. J. Let. 715, L150). Three more giant explosions have since been seen on Jupiter, and such collisions are not limited to the giant planets. Just two years ago, residents of Chelyabinsk, Russia, were startled by a low-altitude airburst ; thousands were injured when its shockwave shattered windows across the city. This talk will focus on these cosmic catastrophes, and the implications of such events for us here on Earth.

The rise of the elements in the early universe : from nuclear astrophysics to near-field cosmology (Session : Cosmology I) ; ***Falk Herwig*** *(University of Victoria), Christian Ritter, Benoit Cote, Robert Andrassy, Austin Davis, Brian O'Shea, Paul Woodward and the NuGrid collaboration*
In order to understand the observed abundances in our and nearby galaxies we are developing an integrated modelling approach. We combine simulations of fundamental stellar physics processes, such as stellar hydrodynamics, with integrated model libraries of element formation processes in stars and stellar explosions. In order to project our comprehensive stellar yield libraries to near-field cosmology observables we have developed a series of modelling applications. These range from descriptions of simple stellar populations to merger-tree post-processing of cosmological simulations. We will present new results from the various components of this integrated nuclear astrophysics to cosmology simulation pipeline, including a comparison of the merger-tree chemical evolution results with all elements in the APOGEE data set.

Public Engagement at NRC's Dominion Astrophysical Observatory (Session : Education) ; ***James Hesser*** *(NRC - Herzberg Astronomy and Astrophysics), Dennis R. Crabtree, David Bohlender*
Since NRC's 2013 decision to cease operations of its purpose-built astronomy interpretative centre, The Centre of the Universe, leadership from community groups working in partnership with the observatory has partially restored public programs previously conducted by NRC staff. We describe the evolving approaches underway since 2013 to ensuring continued public access. These developments are led by members of the Victoria Centre, Royal Astronomical Society of Canada and the new, not-for-profit Friends of the DAO Society. Thanks to their efforts, public Saturday night viewing--which dates to the DAO's opening in 1918--was offered in summer 2014 and 2015, and is being offered in spring/summer 2016. We summarize activities to date and describe how FDAO members are positioning their organization to become the coordinating body for community groups interested in promoting science education based upon access to the DAO facilities, including performing the necessary fundraising. The DAO's 2018 centenary of initial science observations provides a near-term motivational goal.

A Brief History of Chronobiology and Light (Session : Posters : Education-4) ; ***Jim Hesser*** *(NRC Herzberg), Dorothy Paul (first author), Department of Biology, University of Victoria and Royal Astronomical Society of Canada, Light Pollution Abatement Committee*
This poster chronicles the history of the rapidly increasing understanding of Chronobiology : the study of biological rhythms and their adaptation to solar, lunar and seasonal cycles. Growing awareness of human and animal health issues originating in contemporary lighting practices give some hope that light pollution abatement of interest to astronomers will result. Members of the Royal Astronomical Society of Canada are active in efforts to improve urban lighting through local municipal authorities.
Poster presented by Jim Hesser on behalf of Dr. Paul

Extending and Measuring the Orphan Star Stream (Session : Galactic II) ; ***Lauren Hetherington*** *(Department of Astronomy and Astrophysics, University of Toronto), Lauren Hetherington, Raymond Carlberg, Carl Grillmair, Beth Willman*
The Orphan stream is a tidal stream over 30 kpc in length, extending across over 70 degrees of the sky. Observations of the Orphan stream, as well as other streams, can help constrain the overall shape of the galactic halo, as well as act as a probe to detect missing satellites. The Orphan increases in strength until extending beyond the footprint of the Sloan Digital Sky Survey (SDSS), implying that there is likely much more to discover. Additionally, the Orphans progenitor is not known, and it may be in this undiscovered region. Using the wide field of view and high photometric efficiency of the Dark Energy Camera (DECam), we extend the Orphan stream well beyond its currently known length, and potentially also discover its progenitor. Measurements of the Orphan's linear density will also be discussed.

The Transport of Energetic Charged Particles in Different Astrophysical Scenarios (Session : Techniques) ; ***Martin Heusen*** *(The University of Manitoba), Andreas Shalchi*
A fundamental problem in astrophysics is the interaction between space plasmas and energetic charged particles. While those particles propagate through the interplanetary or interstellar space, they experience scattering due to magnetic turbulence. Describing those scattering effects is important to understand different processes in space and astrophysics. We have developed a test-particle code to simulate the interaction of charged particles with turbulent magnetic fields. Diffusion coefficients along and across the mean magnetic field are calculated and compared to different analytical theories. Different turbulence models were considered such as models with reduced dimensionality and full three-dimensional models. We have also included wave propagation and dynamical effects. A number of conclusions were reached. Some are related to the influence of turbulence properties on diffusion parameters were it is shown that such influence is not strong as originally thought, and others concern the applicability of certain analytical theories. In addition, we were able to reproduce solar wind observations by employing a more realistic turbulence approach.

Solo Dwarf Galaxy Survey : Dwarf Irregulars in the Local Group (Session : Posters : Extragalactic-8) ; ***Clare Higgs*** *(Department of Physics and Astronomy, University of Victoria), Alan McConnachie*
The Solo (Solitary Local) Dwarf Galaxy survey is a volume limited sample of all nearby (< 3 Mpc) and isolated (> 300 kpc from the Milky Way or M31) dwarfs, with wide-field (u) g and i band images. This unique survey provides insight into the secular evolution of galaxies on small scales, and uses resolved stellar populations to examine structures in very low surface brightness regimes. The first dwarf, the Sagittarius Dwarf Irregular Galaxy (Sag DIG), has been analyzed in

detail while establishing the methods necessary. Currently, the analysis of the dwarfs within the virial radius of the Local Group is underway. Within this sample, the extended stellar structure and morphology will be characterized. We then will provide comparisons with the HI gas content, star formation history, separation from large host galaxies, and contrast with the satellite dwarfs of both M31 and the Milky Way. In addition, we are identifying globular clusters within the Solo Dwarfs using the deep, wide field imaging. Dwarf galaxies are often cited as the source of some of the Milky Way's globular clusters, yet our understanding of the globular clusters in nearby, isolated dwarfs is incomplete. The Solo Survey provides detailed look at the extended structure of dwarfs and characterizes the evolution of galaxies in the faint limit.

Current and future constraints on ultra-light axions (Session : Cosmology II) ; ***Renee Hlozek*** *(Dunlap Institute for Astronomy and Astrophysics, Department of Astronomy and Astrophysics, University of Toronto), David Marsh, Daniel Grin, Pedro Ferreira, Rupert Allison, Erminia Calabrese, Joanna Dunkley*

Constraining the nature of dark matter remains one of the foremost challenges in contemporary cosmology. Ultra-light axions (with masses between 10^(-22) and 10^(-33) eV) are a form of dark matter well-motivated by particle physics. Axions cause novel changes to observables like the weak gravitational lensing of the Cosmic Microwave Background and provide a new window into the dark sector. I will present current constraints on the allowed masses and densities of axions relative to Cold Dark Matter, and highlight interesting forecasts for next-generation efforts like the Stage 4 CMB Experiment.

Using Molecular Dynamics to Study the Material Properties of Exoplanet Interiors (Session : Planets II) ; ***Kelsey Hoffman*** *(NASA-Ames/SETI)*

The number of exoplanets has vastly increased over the last decade and observations are indicating a large diversity of basic properties amongst the population. The discovery that Super-Earth and sub-Neptune planets are very common yet have no Solar System analogue questions traditional core-accreation formation models. There is strong evidence of a large diversity of bulk density revealed through mass and radius measurements which allows us to begin to place constraints on the interior structure of exoplanets. In order to interpret exoplanet compositions, equations of state of various materials have been calculated or estimated, but most of these calculations assume no temperature dependence under conditions likely present in the rocky inner cores and mantles of extrasolar planets. We have begun to use molecular dynamics simulations to examine the temperature dependence of pressure-density relationships for possible compositions of exoplanet interiors. The inclusion of temperature dependence allows for estimates of important effects such as phase transitions to be included in exoplanet structure models which could have serious implications on the potential habitability of distance worlds. Here we present of initial results of simulations of iron at high densities, pressures and temperatures using classical molecular dynamics simulations.

Dark Energy : how much can we go beyond w. (Session : Cosmology II) ; ***Zhiqi Huang*** *(Canadian Institute for Theoretical Astrophysics), Jason Leung*

Many current and future dark energy surveys have focused on measuring the dark energy equation of state w. In the most general Hondeski gravity theory, where dark energy is assumed to be a scalar degree of freedom with equation of motion containing at most second-order time derivatives, it is possible to have dark-energy-induced perturbations that affect the structure formation of the Universe. We use effective field theory formalism to forecast the constraint on Hondeski class of dark energy models with future supernova and galaxy surveys and find that (i)

the constraint on w is not sensitive to the choice of model. (ii) the next generation of large scale structure surveys will allow us to go beyond the measurement of w and distinguish between wCDM and modified gravity models.

Early results from the Astrosat observatory (Session : Big Projects/Missions) ; ***John Hutchings*** *(NRC Herzberg)*
Canada is a partner in the ISRO Astrosat multi-wavelength observatory, launched in September 2015, providing the detector systems for the UVIT telescopes. I will present the results of commissioning and early science observations, and describe the opportunities for Canadian use of the facility.

A New Look at Disk-Halo Dynamics with 'CHANG-ES' (Session : Big Projects/Missions) ; ***Judith Irwin*** *(Queen's University), The CHANG-ES team*
The Continuum Halos in Nearby Galaxies -- an EVLA Survey (CHANG-ES) has exploited the new broad-band capabilities of the Expanded VLA in order to search 35 nearby edge-on galaxies for the presence of radio halos. With multiple array configurations, single-dish supplementary data, and uniquely, full polarization information, CHANG-ES has been probing the details of disk-halo dynamics with unprecedented sensitivity, including the structure of the magnetic field. This talk will provide an update on the project and present new results, including the sometimes surprising AGNs in the survey sample. The first CHANG-ES data release can be found at www.queensu.ca/changes.

SPICA Key Science (Session : Big Projects/Missions) ; ***Doug Johnstone*** *(NRC Herzberg), David Naylor - Lethbridge*
SPICA is a proposed joint ESA-JAXA cryogenically cooled (~6 K) space infrared astronomy observatory, with a large aperture (~2.5m), and a suite of instruments, contributed by Europe/Canada and Japan, working from the mid- to far-IR (see contribution from David Naylor). In this presentation I will discuss the key science cases for SPICA, namely : (1) Galaxy Evolution, through spectroscopic mid- to far-IR observations of redshifted atomic lines and PAH emission in distant dust enshrouded galaxies ; and (2) Planetary Formation, through spectroscopic mid- to far-IR observations of molecular lines and solid-state features in disks around nearby stars. Understanding the growth and assembly of galaxies in the redshift range z=1-3 is severely complicated by the presence of large amounts of dust obscuring the physics. Observations in the rest-frame infrared are much less affected by this dust and provide access to important diagnostic features such atomic lines associated with hard radiation fields from AGN [Ne V], [O IV] and tracers of gas density and temperature [Ne II], [S III], [O III], [N III], allowing simple and reliable excitation physics calculations. As well, the relative strength in various PAH bands correlates will with star formation activity and reveals organic material through the evolving Universe. Much closer to the Solar System, nearby stars surrounded by circumstellar disks will be probed using water ice as well as solid-state features due to Olivine, Pyroxene, Calcite, etc. to uncover the changing disk mineralogy with environment and age.

How Do Protostars Assemble Mass ? A Sub-Millimetre (JCMT) Variability Survey of Deeply Embedded Protostars (Session : Posters : Galactic-5) ; ***Doug Johnstone*** *(NRC Herzberg), Steve Mairs (UVic), James Lane (UVic), Greg Herczeg (China), Yuri Aikawa (Japan), Geoff Bower (Taiwan), Vivien Chen (Taiwan), Jennifer Hatchell (UK), Jeong-Eun Lee (Korea), and the EAO JCMT Transient Survey Team*

Low mass stars form via gravitational collapse in the coldest and densest regions of molecular clouds. Most embedded protostars found in these regions, however, are observed to have accretion luminosities which are an order of magnitude too faint to be explained by steady state accretion. One solution to this problem is by introducing episodic accretion phases wherein the protostar undergoes long, quiescent periods interspersed by bursts of rapid growth. The amplitudes of these accretion bursts are constrained on thousand year and longer timescales and are usually assumed to be driven by gravitational instability in the outer disk. Currently, shorter timescale variations are unconstrained by the models and observations. These timescales, however, should probe accretion processes within the inner disk. We present results from the first five months of the JCMT Transient Survey, an observational program designed to constrain the variability in young deeply embedded protostars detected in eight fields within the Gould Belt. Observations of each of these regions are taken monthly and will continue for three years, yielding a data set for both variability studies and, in the end, the deepest sub-millimetre observations of each of these regions to date. For now, within each individual observation we are able to achieve better than 5% relative uncertainty in source brightness and we expect to get better with improved analysis.

Searching for Fast Radio Bursts with CHIME (Session : Posters : Instruments-5) ; ***Alex Josephy*** *(McGill University), Paul Demorest, Matt Dobbs, Mark Halpern, Vicky Kaspi, Tom Landecker, Erik Madsen, Cherry Ng, Ue-Li Pen, Scott Ransom, Ingrid Stairs, Shriharsh Tendulkar, Keith Vanderlinde and the CHIME/FRB collaboration.*

Fast Radio Bursts (FRBs) are a class of astrophysical objects with uncertain origins. The tiny population of FRBs stands to be expanded tremendously with a dedicated search pipeline at the upcoming CHIME telescope. With a data-rate of ~17 TB/s, and a desire to alert the community immediately upon detection, it is necessary to search the data in realtime. A broad overview of the pipeline is given here with a focus on the central challenges : dedispersion, radio frequency interference (RFI) excision, and candidate classification.

Hidden in plain sight : Mass segregation using galaxy analogues in simulations (Session : Cosmology I) ; ***Gandhali Joshi*** *(McMaster University)*

We use high resolution DM-only simulations to explore the mass functions and radial distributions of subhalos in group and cluster halos with two popular halo finders -- the Amiga Halo Finder (AHF) and ROCKSTAR. There are significant differences in the subhalo radial distributions, due in large part to differing subhalo hierarchies. Instead of looking strictly at subhalo populations, we identify a sample of ‘galaxy analogues’ and show the radial distribution of these analogues agree well at large halo-centric radii, but still show significant differences at small separations from the host halo centre where phase-space information becomes important for disentangling the analogues from the dense host mass distribution. The extent to which galaxies are segregated by mass within their parent halos is a currently unresolved topic that could shed light on environmentally-driven mechanisms of galaxy evolution. We explore mass segregation in our parent halo population using the identified galaxy analogues. Like some previous work, we see evidence for mild mass segregation at small radii (within 0.5Rvir) with average galaxy analogue mass decreasing with radius. We also see evidence that beyond a

virial radius, the average galaxy analogue mass tends to increase with radius. These mass segregation trends show a further dependence on halo mass with the trends becoming weaker in more massive halos. Our findings suggest that the observed mass segregation trends are likely dominated by the accretion history of the subhalos rather than dynamical friction, particularly in massive clusters. We are currently extending this study with SPH group and cluster simulations.

The Outer Solar System Origins Survey : I. Design and First-Quarter Discoveries (Session : Posters : Planets-1) ; ***JJ Kavelaars*** *(NRC), Michele T. Bannister, J. J. Kavelaars, Jean-Marc Petit, Brett J. Gladman, Stephen D. J. Gwyn, Ying-Tung Chen, Kathryn Volk, Mike Alexandersen, Susan Benecchi, Audrey Delsanti, Wesley Fraser, Mikael Granvik, Will M. Grundy, Aur ́elie Guilbert-Lepoutre, Daniel Hestroffer, Wing-Huen Ip, Marian Jakubik, Lynne Jones, Nathan Kaib, Pedro Lacerda, Samantha Lawler2, Matthew J. Lehner, Hsing Wen Lin, Tim Lister, Patryk Sofia Lykawka, Stephanie Monty, Michael Marsset8, Ruth Murray-Clay, Keith Noll, Alex Parker, Rosemary E. Pike, Philippe Rousselot, David Rusk, Megan E. Schwamb, Cory Shankman, Bruno Sicardy, Pierre Vernazza, Shiang-Yu Wang*

We report the discovery, tracking and detection circumstances for 85 trans- Neptunian objects (tnos) from the first 42 deg2 of the Outer Solar System Origins Survey (ossos). This ongoing r-band Solar System survey uses the 0.9 deg2 field- of-view MegaPrime camera on the 3.6 m Canada-France-Hawaii Telescope. Our orbital elements for these tnos are precise to a fractional semi-major axis uncer- tainty $< 0.1\%$. We achieve this precision in just two oppositions, as compared to the normal 3--5 oppositions, via a dense observing cadence and innovative astrometric technique. These discoveries are free of ephemeris bias, a first for large trans-Neptunian surveys. We also provide the necessary information to enable models of tno orbital distributions to be tested against our tno sample. We confirm the existence of a cold “kernel” of objects within the main cold classical Kuiper belt, and infer the existence of an extension of the “stirred” cold classical Kuiper belt to at least several au beyond the 2 :1 mean motion resonance with Neptune. We find that the population model of Petit et al. (2011) remains a plausible representation of the Kuiper belt. The full survey, to be completed in 2017, will provide an exquisitely characterized sample of important resonant tno populations, ideal for testing models of giant planet migration during the early history of the Solar System.

The Trans-neptunian Automated Occultation Survey - II : an opportunity for Canadian participation. (Session : Planets II) ; ***JJ Kavelaars*** *(NRC), JJ Kavelaars, Matthew J. Lehner, Shiang-Yu Wang, Mauricio Reyes-Ruiz*

The Transneptunian Automated Occultation Survey (TAOS II) will aim to detect occultations of stars by small ($\sim$1 km diameter) objects in the Kuiper Belt and beyond. Such events are very rare $< 10^{-3}$ events per star per year) and short in duration !200 ms), so many stars must be monitored at a high readout cadence. TAOS II will operate three 1.3 meter telescopes at the Observatorio Astronomico Nacional at San Pedro Martir in Baja California, Mexico. With a 2.3 square degree field of view and a high speed camera comprising CMOS imagers, the survey will monitor 10,000 stars simultaneously with all three telescopes at a readout cadence of 20 Hz. Construction of the site began in the fall of 2013, and the survey will begin in the summer of 2017. I will describe the current status of the project construction and explain how CANFAR is providing an opportunity for Canadian astronomers to join this project and make use of the TAOS-II dataset.

Characterizing Starless Cores, Protostars, and Filaments in Cepheus (Session : Galactic I) ; ***Jared Keown*** *(University of Victoria), James Di Francesco, Cassandra Fallscheer, Bilal Ladjelate, Herschel Gould Belt Survey team*

We present a census of starless dense cores and protostars in the Cepheus molecular clouds identified in five, ~1 square degree fields observed by the Herschel Gould Belt Survey. We found a total of 900 starless cores, ~35-55% of which are gravitationally bound prestellar cores that are likely to form stars in the future. The prestellar core mass function (CMF) of this sample has a lognormal distribution similar in shape to the Chabrier initial mass function, but shifted to slightly higher masses with a peak occurring at 0.5 M_solar. The peaks of the CMFs derived individually from each observed field show variations of up to 0.2 M_solar, likely due to environmental variations between each star-forming region. Green Bank Telescope observations of dense gas from the L1251 cloud, as traced by NH3(1,1) emission observed by the GBT Ammonia Survey, reveal a strong correspondence with the Herschel-derived H2 column density map. We also detect 60 protostellar cores within the Cepheus clouds. While most of the protostellar core population in L1251 are found to overlap with NH3(1,1) integrated intensity peaks, several protostellar cores do show offsets with the dense gas, likely a result of protostellar feedback and heating.

Dense Cores Under Pressure : Early Results from GAS (Session : Galactic II) ; ***Helen Kirk*** *(Herzberg Astrophysics, NRC), Rachel Friesen, Jaime Pineda, James Lane, and the GAS and GBS teams*

The Green Bank Ammonia Survey (GAS) is a 200+ hour survey on the Green Bank Telescope to map ammonia in nearby molecular clouds, revealing the temperature and kinematics of the dense gas in these star-forming environments. I present the first results of an analysis of the stability of dense star-forming cores in the Orion A molecular cloud, using a combination of GAS data and information from the JCMT Gould Belt Survey. A comparison of the thermal pressure, non-thermal motions, self-gravity, and ambient (external cloud) pressure shows that most of the dense cores are bound. Intriguingly, the majority of this binding is due to pressure from the ambient molecular cloud material, rather than an individual core's self gravity. These results are consistent with less direct estimates made earlier in the Ophiuchus and Perseus molecular clouds. If a similar result is found in a larger range of nearby molecular cloud environments, this will point to pressure, a factor often ignored in energetic analyses of cores, being a key element in the formation of stars.

Gemini Observatory - news and perspectives (Session : Instruments) ; ***Markus Kissler-Patig*** *(Gemini Observatory)*

Markus Kissler-Patig, Gemini Director, will present news and perspectives for the Gemini Observatory, operating two of the finest 8m-class telescopes in the world. For the period of the current international agreement (2016-2021), the partnership includes Canada, the United States, Brazil, Argentina and Chile, with Korea and Australia as limited-term partners. Gemini's objective for the next 5 years is to "strive to be the best observatory in the world for the execution of flexible, innovative, and efficient science programs that exploit superior image quality and broad spectroscopic capabilities on arcminute-scale fields." The Observatory offers now four paths to request observing time (yearly large and long programs, semesterly regular programs, monthly fast turnaround programs, and director's discretionary time). Both telescopes are currently equipped with four state-of-the-art instruments and an adaptive optics system each. Furthermore, visitor instruments are welcome and four of them will be hosted at Gemini in 2016. Two more facility-class instruments are currently being developed. This presentation will provide an overview of the observatory, its operations and instrumentation, and advance a perspective for the observatory in the 2025+ era.

System Performance Testing of the DVA1 Radio Telescope (Session : Posters : Instruments-6) ; ***Lewis Knee*** *(NRC Herzberg), L.A. Baker, G.J. Hovey, M. Kesteven, G. Lacy, T. Robishaw*
DVA1 (Dish Verification Antenna 1) is an innovative rim-supported single-piece composite-material dish radio telescope developed by the National Research Council of Canada and the US SKA Technology Development Program. It has a feed-high offset Gregorian optical arrangement with a primary surface effective diameter of 15 metres and has been designed for efficient operation to a frequency of at least 10 GHz. DVA1 has been undergoing mechanical and astronomical system tests since 2014 at the Dominion Radio Astrophysical Observatory (DRAO), with a focus on single-dish performance measurements. Ku band holography measurements of commercial broadcast satellites have been used to measure the effective surface accuracy of the dual-reflector antenna system and to characterize surface stability against thermal, insolation, and wind variations. The measured Ruze efficiency is ~0.8 at 10 GHz, indicating good efficiency up to about 20 GHz. The surface is very stable (~10% variation in surface RMS) over the range of environmental conditions able to be tested at the DRAO site. Astronomical measurements using DVA1 were made in L band using a prototype front end developed for the MeerKAT array by EMSS Antennas in South Africa. Key performance metrics measured in L band include the aperture efficiency, sensitivity (Aeff/Tsys), and tipping curves. The clean shaped optics of the offset Gregorian design, careful attention to feed design, and the high sensitivity of the L band receiver yield a system with high aperture efficiency (~0.8), excellent sensitivity (~9 m^2/K), and very low spillover contribution to the system temperature. Observations of the 21 cm atomic hydrogen lines towards a number of sources demonstrate the low stray radiation pickup of the antenna. Testing is ongoing, with a current focus on measuring the polarimetric performance of the antenna on polarized continuum sources and Zeeman observations of 21 cm line sources.

Gravitational Wave observation from a Binary Black Hole Merger by Advanced LIGO (Session : Cosmology II) ; ***Prayush Kumar*** *(CITA, University of Toronto), LIGO-Virgo Collaboration*
Advanced LIGO began observing in September 2015 with over 3 times the distance reach (and ~30 times the sensitive volume) of its first generation counterparts. On September 14th, 2015, a transient gravitational-wave signal was observed by both LIGO detectors concurrently. The signal matches the waveform predicted by General Relativity for the inspiral and merger of a pair of black holes and the ringdown of the resulting post-merger black hole. This detection provides a unique opportunity to study the two-body motion in the large velocity, highly nonlinear regime, as well as to probe the final merger state of the binary. In this talk, we summarize the first results of gravitational-wave searches with Advanced LIGO, and the tests of strong-field nonlinear General Relativity performed using the observed signal from coalescing binary black holes.

Outreach Beyond Limits -- How CFHT reaches its diverse constituents (Session : Education) ; ***Mary Beth Laychak*** *(CFHT)*
The Canada-France-Hawaii Telescope serves a diverse audience of astronomers and the general public in five countries : Canada, France, Hawaii (US), Taiwan and China. The recent hiring of a full time public outreach manager gives CFHT the opportunity to expand its outreach presence in each of these nations while simultaneously reaching our local Big Island community. These goals are ambitious ; unlike other multi-national institutions pursuing a dynamic outreach presence, CFHT is a smaller facility with fewer staff fully devoted to public outreach. CFHT aims to maximize its outreach impact through a combination of online engagement and partnerships with users and stakeholders in its constituent communities. In this talk we will

discuss our success, challenges, and lessons learned from our experiences coordinating activities and events in three diverse locations : Hawaii and France, with a special emphasis on Canada.

2D rotating evolution and pulsation models of gamma Doradus and Delta Scuti stars observed by Kepler (Session : Posters : Galactic-6) ; ***Catherine Lovekin*** *(Physics Department, Mount Allison University), Joyce Guzik, Los Alamos National Laboratory*
Roughly half of the stars located within the delta Scuti instability strip are observed to be pulsating. Exactly why not all stars in this region show pulsations is unknown, but interaction between convection and pulsation is thought to play a role. In this work, we present initial results as part of a larger investigation into the connection between rotation, convection, and pulsation in delta Scuti and gamma Doradus stars. We have calculated a grid of 2D rotating stellar models and the associated pulsation frequencies. We then compared this grid with observed frequencies for four gamma Doradus and delta Scuti stars observed with Kepler. This comparison will place constraints on the age, mass, rotation rate, and convective core overshoot of each star. The results of the model fitting procedure will be used to inform 3D convection simulation of these stars, in order to better understand the interplay between convection, rotation, and pulsation.

The SPIRou RV surveys (Session : Instruments) ; ***Lison Malo*** *(CFHT), Etienne Artigau (UdeM-iREx), Claire Moutou (CFHT), René Doyon (UdeM-iREx), Jean-François Donati (IRAP)*
SPIRou is a near-infrared spectropolarimeter and a high-precision velocimeter optimized for both the detection and characterization of terrestrial planets orbiting nearby low-mass stars, and the study of the impact of magnetic field on the star-planet formation. The spectrograph is designed to record the whole near-infrared spectrum simultaneously in either circular or linear polarization and to reach a RV precision of 1 m/s at a resolving power of 75,000. It will be use to carry out the "SPIRou Legacy Survey" targeting two science objectives (habitable terrestrial planet detection & magnetic field impact on star-planet formation) and is intended to provide the community with an extensive, homogenous, well characterized and high-quality data. SPIRou is expected to make a major breakthrough in the field of telluric planets in the habitable zone of cool stars. Once implemented at CFHT in 2017, SPIRou is expected to be used extensively by the astronomical community - supporting in particular space missions such as TESS, JWST and PLATO. In this presentation, I will focus on the impact of the SPIRou future observing programs in the field of exoplanets : 1) the radial-velocity survey, its target selection of cool dwarfs, strategy and expectations ; 2) the follow-up characterization of transiting candidates ; 3) the search for giant planets around very young stars ; 4) the importance of spectropolarimetry to filter out the intrinsic jitter of target stars at the sub m/s level ; 5) the anticipated role in preparing further exoplanet characterization missions.

Imaging Exoplanets : from young gas giants with GPI to habitable planets with ELTs (Session : Planets II) ; ***Christian Marois*** *(NRC Herzberg)*
The Gemini Planet Imager Campaign has now been ongoing for more than a year and a new exoplanet, 51 Eri b, has been discovered. I will review the current state of the GPI campaign and try to predict what we might expect from it in the next 2-3 years. I will then look ahead and show the enormous potential of 30m class telescopes, given their smaller inner working angle and D^4 advantage, opening a vast array of new science capabilities. I will discuss work-in-progress to develop a high-contrast imaging module for NFIRAOS and IRIS to allow first-light detailed characterization of known young gas giant planets. In addition, I will also review the TMT 10 microns rocky planet science case, and the remarkable potential of an ExAO would have operating at that wavelength. Finally, I will discuss shorter term 10 microns science that can be

done to develop this technology, especially using current 8m telescopes on the Alpha Centauri system.

The Ejecta-Nickel Mass Relation of Type Ia Supernovae (Session : Extragalactic II) ; ***Epson Masikiv Heringer*** *(University of Toronto - department of Astronomy and Astrophysics), Charles Zhu Marten van Kerkwijk*
The progenitor channel and explosion mechanism of Type Ia supernovae (SNe Ia) are yet to be constrained by observations. Among the observables that can help to solve this conundrum, the relationship between the mass of ^{56}Ni synthesized in the explosion and the total mass ejected have been recently revisited in the literature. However, no single explosion mechanism is able to explain this relation, which has been interpreted as evidence for at least two types of progenitors of SNe Ia. Here we address the question of whether the detonation of hydrostatic carbon-oxygen white dwarfs with off-center temperature peaks and a wide range of total masses can reproduce the observations. We find that progenitors with peak temperatures of the order of $T \sim (1.3 \pm 0.2) \times 10^9$ K, as might be expected at the end of a simmering phase, provide a good match for events with ejecta masses larger than $\sim$1.15 $M_\odot$. Our results thus indicate that the observed range of ejecta and ^{56}Ni masses can be effectively described by white dwarfs that become hot in a preceding simmering phase.

N-body Kama Sutra : When galaxies, puppets and Ashton Kutcher collide (Session : Prize Lecture) ; ***Jaymie Matthews*** *(University of British Columbia)*
Astronomers read the stories told by the Universe. They don't always understand the languages, so astronomers are like ESL students -- or USL (Universe as a Second Language) students -- looking for patterns that can translate nature's stories into terms they understand. Then translating those into terms others can understand. Readers become tellers, helping others to recognise the patterns, to see hidden connections, and to make connections to their lives. Those others share and extend the stories, and in doing so, become scientists in the most fundamental sense of the job description. My Qilak Lecture is a story about telling stories, and making connections among the seemingly disconnected. How discovering the first exoplanet was like discovering your first dance partner. How Godzilla and hockey are a match made in physics education heaven. How an X-rated version of an N-body simulation can mean an A in a test on SB galaxies. With puppets and Ashton Kutcher as teaching assistants. Viewer discretion is advised.

Super-Earth atmospheric models based on planet formation history (Session : Posters : Planets-2) ; ***Sarah McKenzie-Picot*** *(McMaster University), Ralph Pudritz*
The majority of detailed modelling of exoplanetary atmospheres has focussed on Hot Jupiters because these are gas giants that are both simpler to model and to observe. Only a small number of Super-Earth atmospheres have been observed and they are more difficult to model because of the heating from the planetary surfaces and more complex atmospheric chemistry. Current models simply determine overall chemical composition of the atmosphere, without determining the variation of temperature, pressure and chemistry with altitude. We are developing a new self-consistent model of Super-Earth atmospheres that iteratively determines their temperature and pressure structure and chemical composition as a function of altitude. This model is a 1D plane-parallel model of a radiatively heated atmosphere that considers radiative flux from both the host star and the surface of the planet. Radiation is binned by frequency, and atmospheric absorption is considered for each frequency range. A major new step taken in our models is that their initial atmospheric composition (important for absorption processes) is determined by the

accretion history of migrating Super-Earth cores which is computed by our group (Alessi, Pudritz, & Cridland, 2016, submitted). I will present preliminary results of Super-Earth atmospheres, showing the variation in temperature, pressure and chemical composition with altitude for a number of Super-Earths of varying compositions and orbits.

The BRITE-Constellation Nanosatellite Mission : a First for Canada (Session : Galactic I) ; ***Tony Moffat*** *(Université de Montréal), BRITE Executive and International Advisory Science Teams*
Launched in 2013-2014, the five independently functioning BRITE (BRIght Target Explorer) nanosats are now producing excellent science data on the variable properties of a significant fraction of the brighter visible stars in the sky. (The sixth BRITE satellite is still attached to the orbiting 3rd stage launcher and unusable.) Equipped with a 30 mm telescope and an uncooled CCD detector along with either a blue or red optical filter, each satellite is producing high-precision light curves over 5-6 months non-stop and with a cadence of typically one data point every 20 seconds, leading to a typical precision of 1 part in 1000 during about 15 minutes of each 100-minute satellite orbit. With a field 24 degrees across, up to 30 stars brighter than about 4th magnitude can be observed simultaneously. The science mainly involves determining asteroseismic properties and spot rotations of stars to probe their interior and surface structure, as well as the study of binary stars. Sample results will be presented. Although faced with many challenges on the way, from first light to final validation, virtually all technical problems have been mitigated, leading to a precision as expected for unavoidable photon statistics, along with readout noise and flat-field detector errors. BRITE-Constellation involves astronomers from Canada (where the idea originated), and from Austria and Poland, plus guest observers and complementary (mainly spectroscopic) ground-based support worldwide. The latter involves both professional and amateur astronomers.

Comparing the ISM and Star Formation Properties of Nearby Spiral Galaxies in Different Environments (Session : Extragalactic II) ; ***Angus Mok*** *(McMaster University), Christine Wilson*
Using a sample of gas-rich spiral galaxies from the Nearby Galaxies Legacy Survey (NGLS), we explore the effects of environment on their distribution of atomic gas, molecular gas, and star formation. Integrated results show that molecular gas is enhanced for the galaxies in the Virgo Cluster, along with a reduction in the star formation efficiency. We use CO(3-2) data from the JCMT and VLA 21 cm observations to determine radial trends in both their molecular and atomic gas surface densities. We find no signs of a significant truncation in their molecular gas disks, in contrast to their atomic gas distributions. We also combine the CO(3-2) data with Hα-derived star formation rate maps to constrain gas depletion times.

SITELLE at the CFHT : A 3D Spectroscopic Study of the Nearby Spiral Galaxy NGC 3344 (Session : Extragalactic I) ; ***Ismael Moumen*** *(Université Laval), Robert, C., Martin, R. P., Rousseau-Nepton, L., Martin, T., Drissen, L., and the SIGNALS Team*
We present preliminary results for the study of the nearby spiral galaxy NGC 3344 observed with CFHT's imaging Fourier transform spectrograph SITELLE. SITELLE, with its large FoV (11'x11'), produced 4 million spectra with a high spatial sampling of 0.32''/pixel (seeing limited) for each datacube obtained with filters SN1 (365-385 nm), SN2 (480-520 nm), and SN3 (651-685 nm). Emission lines of [OII]3727, Hb, [OIII]4959,5007, Ha, [NII]6549,6584 and [SII]6717,6731 have been measured to study the ionized gas properties and kinematics. NGC 3344 is part of the Large Program SIGNALS (Star formation, Ionized Gas, and Nebular Abundances Legacy Survey with SITELLE) proposed for the CFHT.

Collapse in Self-gravitating Turbulent Fluids (Session : Galactic II) ; ***Norman Murray*** *(CITA, University of Toronto), Daniel Murray Phil Chang John Pittman*
We perform simulations of star formation in self-gravitating turbulently driven gas. The character of the flow changes at two radii, the disk radius r_d, and the radius r_* where the enclosed gas mass exceeds the stellar mass. Accretion starts at large scales and works inwards. We see large infall velocities $|u_r(r)| \approx (1/3)\sqrt{GM(r)/r}$ for $r \lesssim 1pc$ well before a star forms. The density evolves to a fixed attractor, $\rho(r,t) \rightarrow \rho(r)$, for $r_d < r < r_*$; mass flows through this structure onto a sporadically gravitationally unstable disk, and from thence onto the star. In the bulk of the molecular cloud, we find that the turbulent velocity $v_T \sim r^p$ with $p \sim 0.5$, in agreement with Larson's size-linewidth relation. In the vicinity of massive star forming regions we find $p \sim 0.2 - 0.3$, as seen in observations. For $r < r_*$, v_T increases inward, with $p = -1/2$. The acceleration due to the turbulent pressure gradient is comparable to that due to gravity at all $r > r_d$. As a result, the infall velocity is substantially smaller than the free fall velocity ; for $r_d < r < r_*$, we find $|u_r| \approx (1/3)vff$. The total stellar mass $M_*(t) \sim t^2$. Individual massive stars also have $M_*(t) \sim t^2$; solar mass stars show more nearly linear growth with time.

SPICA : the SPace Infrared telescope for Cosmology and Astrophysics v2.0 (Session : Big Projects/Missions) ; ***David Naylor*** *(University of Lethbridge), on behalf of the SPICA team.*
SPICA -- the SPace Infrared telescope for Cosmology and Astrophysics, is a proposed joint ESA-JAXA mission with instrument contributions from European/Canadian and Japanese consortia. SPICA, features a cryogenically cooled (~6 K) large aperture (~2.5 m) telescope that will provide astronomers with the extremely low background necessary to explore the far-infrared universe. Canada is contributing to the development of SAFARI (the SpicA FAR-infrared Instrument), one of the two core instruments. The sensitivity of SAFARI, which is two orders of magnitude better than the PACS instrument on the Herschel Space Observatory, will enable spectroscopic surveys of large numbers of distant galaxies, allowing the study of star formation to be characterized over cosmic time. Nearer to home SAFARI will map young planetary systems, providing astronomers with key information to better understand the formation history of our own solar system. In the last two years the SPICA mission has been restructured so that ESA will assume the lead role. The current status of the SPICA mission and the SAFARI instrument, emphasizing Canadian contributions, will be reviewed.

A binary shortcut towards the evolution of Type II Cepheids (Session : Posters : Galactic-7) ; ***Hilding Neilson*** *(University of Toronto), Robert G. Izzard, Nancy R. Evans, Edward Guinan, Scott G. Engle & Douglas L. Welch*
Type II Cepheids are pulsating variable stars, typically associated with older stellar populations, such as the Galactic halo and globular clusters. They are believed to evolve up the asymptotic giant branch, undergo thermal pulses and cross into the Cepheid instability strip. However, there is a second population of Type II Cepheids with close binary companions that cannot be easily explained by that scenario, including the metal-rich Type II Cepheids, and peculiar W Vir and BL Her stars. We propose that these stars instead evolve onto the Cepheid instability strip when the primary star, as a red giant star, donates mass onto its companion. We compute new stellar evolution models of low-mass stars with enhanced mass loss on the red giant branch to test this hypothesis. The models are found to evolve blueward in the Cepheid instability strip that is consistent with our hypothesis. As such, this subclass of Type II Cepheids follows an independent evolutionary shortcut, one that can be studied to understand Type IIb supernova progenitors and red straggler stars, which appear to evolve in a similar manner.

Evolution of Cataclysmic Variables and Related Binaries Containing Accreting White Dwarfs (Session : High Energy) ; ***Lorne Nelson*** *(Bishop's University), Saul Rappaport (MIT) Belinda Kalomeni (MIT)*
Cataclysmic Variables (CVs) are a very heterogeneous class of interacting binaries consisting of a white dwarf (WD) that is accreting matter from a companion star. They play an important role in chemical enrichment (Classical Novae) and could even be significant contributors to the observed frequency of Type Ia supernovae. By computing more than 50,000 evolutionary tracks of possible CV-like evolution, we identify the ranges of initial conditions that lead to the formation of : (i) generic CVs ; (ii) ultracompact ones (AM CVns) ; (iii) Supersoft X-ray Sources ; and, (iv) double degenerates. We comment on what conditions might allow these latter two channels to produce substantial numbers of Type Ia SNe (e.g., sub-Chandrasekhar events). We also make robust predictions as to how the ratio of observable isotopes such as C/O and N/O would have to evolve in order for us to be able to conclude that CVs actually descended from high-mass primordial donors. We discuss the implications that observational evidence is beginning to show that significant carbon deficiencies do exist in some CVs.

Friends of Hot Jupiters : Properties of the Directly Imaged Stellar Companion Population (Session : Planets II) ; ***Henry Ngo*** *(Planetary Sciences, Caltech), Heather A. Knutson, Sasha Hinkley, Justin R. Crepp, Konstantin Batygin, Marta Bryan, Ian Crossfield, Brad Hansen, Andrew W. Howard, John A. Johnson, Dimitri Mawet, Timothy D. Morton, Philip S. Muirhead, and Ji Wang*
Stellar companions can have a dramatic influence the formation and evolution of planetary systems. However, there are few known observational constraints on the properties of planet-hosting multiple star systems. Hot Jupiters are gas giant planets orbiting around other stars at very small semi-major axes (~0.05 AU). We investigate whether stellar companions could be responsible for these extreme orbits. Here, we use high contrast imaging to search for stellar companions around a sample of 77 hot Jupiter host stars and examine the statistical properties of these companions as compared to those of field star binaries. We find that 51% +/- 8% of hot Jupiter host stars have stellar companions between 50-2000 AU, approximately twice as large as the field star multiplicity rate. Interestingly, the mass ratio distribution for hot Jupiter hosting binaries rises towards smaller mass ratios, unlike the uniform distribution observed for field star binaries. We find that stellar companions around both hot Jupiter hosts and field stars have a uniform distribution in log semi-major axis space between 50-2000 AU. The increased binary fraction for hot Jupiter host stars suggests that either multi-stellar systems are more favorable sites for gas giant planet formation at all separations, or that the presence of a stellar companion preferentially causes the inward migration of gas giant planets via dynamical processes such as Kozai-Lidov oscillations. Using our survey data and averaging over initial semi-major axes between 1-5 AU, we constrain the maximum fraction of hot Jupiters that could have migrated inward via Kozai-Lidov oscillations to be 16% +/- 5%.

ALMA observations of Molecular Gas in the Parsec-scale Torus of NGC1068 (Session : Extragalactic II) ; ***Christopher O'Dea*** *(University of Manitoba), Jack Gallimore, Moshe Elitzer, Roberto Maiolino, Stefi Baum, Ric Davies, Amy Kimball, Dieter Lutz, Alessandro Marconi, Robert Nikutta, Eleonora Sani, Linda Tacconi*
We report new, long-baseline ALMA observations of the nucleus of NGC 1068. Continuum and lines in the 350 GHz band (Band 7 ; 0.14 x 0.11 arcsec beam) and 680 GHz band (Band 9 ; 0.084 x 0.063 arcsec beam) were observed. The nuclear radio continuum source S1 is detected in continuum at both bands. The flux density between 5 GHz (from MERLIN) and 350 GHz (Band

7) is roughly flat at 15 mJy. However, the continuum grows to 30 mJy at 680 GHz, which we interpret as an increasing contribution of thermal emission from dust grains. We can place an upper limit of 50 mas (3.5 pc) on the size of the continuum source at 680 GHz. We also detect compact, marginally resolved molecular line emission at the position of S1, including CO (6-5), CS(7-6), HCN(4-3), and methanol. We interpret these molecular detections as arising from the pc-scale torus surrounding the active nucleus.

Neutrino masses from Gravitational wakes. (Session : Posters : Techniques-1) ; ***Chiamaka Okoli*** *(Department of Physics, University of Waterloo), Morag Scrimgeour Niayesh Afshordi Mike Hudson*
We investigate a method for measuring neutrino masses using their velocity relative to dark matter. This dynamical effects make an imprint in the correlation between galaxies which may be measurable and may also distinguish the various neutrino hierarchies, if measured. We also estimate the expected signal from the dipole in the cross-correlation of galaxies and clusters due to the of wake of neutrinos over a Hubble time, which depends on the neutrino mass. In addition, the non-linear effects of structure formation were studied in simulations to prevent a biased signal.

The Search for Long-Period Pulsars in the PALFA Survey (Session : Posters : Galactic-8) ; ***Emilie Parent*** *(McGill University), Victoria Kaspi, Scott Ransom, Maura McLaughlin, Patrick Lazarus, Paul Scholz, Erik Madsen, Chitrang Patel, Weiwei Zhu, Adam Brazier and the PALFA collaboration*
The PALFA survey, the most sensitive radio search for pulsars ever done, is being conducted at the Arecibo Telescope in Puerto Rico. The survey has now discovered more than 160 pulsars in the Galactic Plane. The vast majority of these spinning neutron stars have periods shorter than 2 seconds. One reason that pulsar surveys may miss long-period radio pulsars is the strong effect of red noise at low modulation frequencies which reduces sensitivity in this part of the spectrum, notably for frequencies smaller than 0.1 Hz.It is possible to address the reduced sensitivity by using an algorithm performing better in presence of red noise : the Fast-Folding Algorithm (FFA). The FFA, first introduced by Staelin (1969), has been implemented by scientists at Berkeley to look for transits in Kepler's data. We have adapted this algorithm for pulsars searching and applied it to PALFA observations in the hope of recovering the sensitivity at small frequencies. A basic description of the FFA and specific aspects of applying such a folding algorithm on pulsar searches will be discussed in this presentation, along with preliminary results from its use in the PALFA survey.

Education and Outreach from AstroMcGill (Session : Posters : Education-2) ; ***Emilie Parent*** *(McGill University), Kelly Lepo Gabrielle Simard Erik Madsen*
AstroMcGill was founded in 2011 by an enthusiastic group of undergraduate students, graduate students and post-doctoral fellows. It serves as the education and public outreach (EPO) branch of the astronomy group within the Physics Department at McGill University in Montreal, Quebec. Over the last five years, AstroMcGill has grown from organizing sporadic visits in a couple primary schools to running a successful inquiry-based programme for grade 4-6 students, the McGill Space Explorers. During the same time span, attendance at public AstroNight lectures ramped up from a few dozen people to over 500 people each month. We will highlight the recent successes of the programme and our best guesses for the reasons behind this success. We will also discuss the challenges of working in a bilingual city as we juggle our majority anglophone volunteers, a mandatory french science curriculum for primary school children and the (somewhat) overlapping English- and French-speaking communities in the city.

Development of a Novel MEMS Based Low Current Lorentz Actuator Array for Adaptive Optics (Session : Posters : Instruments-7) ; ***Byoungyoul Park*** *(University of Manitoba), Dwayne Church and Cyrus Shafa*
This paper presents the design and testing a Lorentz actuator array for adaptive optics, that was successfully fabricated using a bulk micromachining process. The actuation mechanism is Lorentz force enabling low current (1-10 mA) and low voltage (less than 1 V) operation with bi-directional motion. Actuator design, motion and inter-element crosstalk between mirror elements between actuators were examined by simulations using COMSOL Multiphysics software. Following this, experimental testing of the actuators was undertaken, with demonstrated actuator motion up to 50 μm agreeing with the simulated performance. This MEMS based Lorentz actuator array promises a low power consumption and low voltage system for adaptive optics micro-mirror applications, with demonstrated potential for high fabrication yield.

Expanding the Horizons of X-ray Astronomy (Session : High Energy) ; ***Robert Petre*** *(NASA / GSFC)*
X-ray astronomy is experiencing a golden age as Chandra and XMM-Newton continue to enrich our knowledge of high-energy cosmic phenomena. Over the next two decades, a new generation of X-ray observatories, large and small, will deepen and broaden our observational capabilities, allowing more thorough study of known phenomena and revealing entirely new ones. In addition to the higher flux sensitivity and improved spectral resolution offered by future large missions such as ESA's Athena and NASA's X-ray Surveyor, new, smaller missions, developed on a much faster time scale, will open windows into previously unexplored domains. These domains include X-ray polarimetry, high-resolution spectroscopy with imaging, and ultra-high resolution X-ray timing. This talk will summarize new (Hitomi), upcoming (NICER), and potential future (PRAXyS, IXPE, X-ray Surveyor) capabilities provided by X-ray missions either led by NASA or with NASA involvement, and present examples of potential discoveries these missions will enable.

Observations of Turbulence Dissipating in Low and High Mass Star Forming Regions (Session : Galactic II) ; ***Andy Pon*** *(Physics and Astronomy, University of Western Ontario), M. J. Kaufman, D. Johnstone, P. Caselli, F. Fontani, M. J. Butler, I. Jiménez-Serra, A. Palau, J. C. Tan, R. Plume*
Giant molecular clouds contain supersonic turbulence that is expected to decay rapidly. The dissipation of this turbulence in low velocity shocks should produce a small volume filling factor (0.1%) hot gas component, which should be detectable in mid-J CO transitions. We present observations of both low mass (Perseus B1-E5) and high mass (IRDCs C, F, and G) star forming regions obtained with the Herschel Space Observatory. We compare these observations to phododissociation region (PDR) and shock models and argue for the presence of a secondary hot gas component, consistent with predictions for turbulent shock heating.

The Progenitors of Type Ia Supernovae (Session : Prize Lecture) ; ***Chris Pritchet*** *(Dept. of Physics and Astronomy, U. Victoria)*
Type Ia supernovae (SNe Ia) are among the most luminous explosions in the Universe ; yet we know little about the nature of SN Ia progenitors beyond the basic fact that a white dwarf is somehow involved. In this talk I will review the basic properties of SNe Ia, and their (past and future) importance in establishing the acceleration of the Universe. I will then discuss two recent research directions that shed light on the progenitors. The first involves the colours of host galaxies - a somewhat prosaic tool that turns out to provide a surprisingly direct measure of the

delay time distribution of SNe Ia, with little dependence on star formation history over a wide range of galaxy types. The second involves the spatial distribution of supernovae in their host galaxies, measured relative to the predictions of bulge/disk decomposition of the host galaxy light. Both of these methods provide support for the so-called “double degenerate” model of SN Ia explosions.

Mining in nearby galaxies (Session : Techniques) ; ***Sahar Rahmani*** *(Western University), Hossein Teimoorinia, Pauline Barmby*
Galaxies are very complex systems ; therefore, a complete understanding of them cannot be achieved only from studying linear or logarithmic correlations between their properties and various waveband data. In the past few decades, a number of statistical methods have been developed and advanced to study and visualize complex big data. We used one of these methods to study properties of nearby galaxies and create a more clear picture of them. The vast availability of data for nearby galaxies makes them suitable targets for exploratory data analysis. Spatially resolved maps provide us with a unique view of the inside of galaxies and help better understand their properties. In this project, we utilized the Kohonen Self Organizing Map (SOM) method to study data from M31 and M101. SOM is an unsupervised neural network for mapping and visualizing a complex and nonlinear high dimension data while preserving topological features of the original data. We studied 10 regions in M31 from the bulge of the galaxy to the star forming rings, as well as 8 regions in M101. These regions were chosen based on the availability of mid-infrared spectroscopy data. For each region in M31, we had 46 data obtained through photometry, spectroscopy, and derived quantities (i.e., star formation rate, stellar mass, gas mass, etc.). Using results from a correlation coefficient matrix, we reduced the dimension of this dataset and then trained the SOM using the new subset of data. We created SOMs of various sizes and used them to extract information about the galaxies. Using smaller-sized SOMs (i.e., 2 by 2) the data were clustered in 2 major groups ; and for each group, we found correlations that could not have otherwise been found without clustering. In the maps with larger sizes, we created networks to illustrate the relative relations of regions with one another. We then validated the SOMs that were generated from the M31 data by using data from M101 that have similar structure to that of M31. We found regions with similar properties in both galaxies placed in close regions in the SOMs. These results confirm that the generated SOMs can separate regions based on their physical properties, and can be used to make predictions for other regions in nearby galaxies or other targets.

Stellar Populations in the Interacting System Arp94 with SITELLE (Session : Posters : Extragalactic-9) ; ***Carmelle Robert*** *(Université Laval), L. Drissen, L. Rousseau-Nepton, I. Moumen, T. Martin, M. Bureau, S. Courteau, L. Ho, J. Iglesia Paramo, S. Lavoie, R.P. Martin, N. Ouellette, I. Perez, H. Plana, T. Ruiz Lara, L. Sanchez*
Stellar populations can reveal crucial clues about galaxy evolution scenarios and the key associated mechanisms : interactions, secular processes, gas accretion, feedback from stellar winds and supernovae or AGNs, etc. SITELLE, the CFHT imaging Fourier transform spectrometer, is exceptional with its large 11'x11' field-of-view, complete spatial coverage with a resolution of 0.32'', and vast adjustable spectroscopic capabilities. The nearby interacting system Arp94 is composed of a prominent SAB(s)a galaxy with a massive bulge, a Sy1.5 active nucleus, and an extended diffuse disk with many HII regions, and a gas-poor companion E2 galaxy with a LINER nucleus. The interaction is well signed by a 20' HI plume, multiple stellar arcs and ripples, and a possible tidal dwarf galaxy. Arp94 is certainly an ideal prototype system to trace the impact of galaxy interactions on stellar formation through time and an ideal test-bed for SITELLE’s

performance with pure absorption lines and varying mixtures of emission and absorption lines over a large range of surface brightnesses and stellar populations properties. Arp94 was observed during SITELLE's science verification run last January using the filters C1 (389-484 nm), SN2 (482-513 nm), andSN3 (647-685 nm). Preliminary results for the stellar absorption line indicators will be presented.

A Product of their Halo Environment : How galaxy properties depend on group X-ray luminosity and dynamical state (Session : Extragalactic II) ; ***Ian Roberts*** *(McMaster University), Laura Parker Ananthan Karunakaran*
Star formation rates and morphologies of galaxies, particularly low-mass galaxies, are strongly linked to the properties of their environment. Using a large sample of galaxies in SDSS groups, we investigate the dependence of star formation and morphology on host properties such as the X-ray luminosity and dynamical state, while controlling for stellar and halo mass. We find that galaxy populations in groups with strong X-ray emission have preferentially low star-forming and disc fractions, both within and beyond the radius associated with the X-ray emission. Additionally, we consider the effect of group dynamics on the properties of member galaxies and the infalling galaxy population separately. We show that the fraction of both star-forming and disc galaxies are independent of dynamical state for infalling galaxies, while galaxies within the virial radius are sensitive to the dynamical state of their host group. Specifically, low-mass galaxies in unrelaxed groups show somewhat higher star-forming and disc fractions. Together these findings help constrain the mechanisms at play in environmentally driven galaxy evolution.

Probing Extragalactic Magnetic Fields via Zeeman Splitting of OH Megamasers (Session : Extragalactic I) ; ***Tim Robishaw*** *(Dominion Radio Astrophysical Observatory, NRC-Herzberg)*
We provide an overview of a large Arecibo survey to measure magnetic fields in starburst galaxies via Zeeman splitting of hydroxyl (OH) megamaser emission. The first VLBI map of Zeeman splitting in an external galaxy will be presented. We discuss plans to further utilize OH megamasers as extragalactic magnetometers via observations with the new Five-hundred meter Aperture Spherical Telescope (FAST) and, eventually, the Square Kilometer Array (SKA).

A Newfound Behaviour in the Red Sequence Towards Low Galaxy Masses (Session : Extragalactic I) ; ***Joel Roediger*** *(HIA), Laura Ferrarese (HIA), Pat Cote (HIA)*
Star-forming galaxies are known to be quenched by their environments once they are accreted into galaxy clusters. A number of processes have been proposed to effect this transformation [e.g. ram pressure stripping, strangulation] but their efficiencies as a function of infall time, galaxy mass, and orbital parameters remain poorly known. Constraining the predominant quenching mechanism(s) at early epochs and over an extensive range of mass may be achieved by surveying the cores of nearby galaxy clusters. Deep optical imaging from the Next Generation Virgo Cluster Survey [NGVS] has unveiled the galaxy population within the innermost ~300 kpc of this benchmark cluster down to a limiting mass of M_* ~10^6 M_sol, reaching the scale of classical satellites in the Local Group. Using isophotal photometry from the NGVS, we have studied the red sequence in this region, spanning an unprecedented ~13 mags in luminosity. While the red sequence is known to flatten at its bright end, our analysis reveals that a similar behaviour occurs at its faint end too, in all colors, beginning at M_g ~-14. This newfound flattening is especially pronounced in u-band colors, suggesting that it is largely driven by a constant mean age amongst low-mass dwarfs. The implication of these results may be that the early environments of today's rich clusters were very efficient in quenching dwarf galaxies across a wide mass range. Whatever the case, current models of galaxy formation do not reproduce the shape of the red sequence

in Virgo in many respects, pointing to deficiencies in their treatment of environmental effects, as well as chemical evolution. Our results should assist in improving future generations of these models and spur new insights into galaxy transformations at the intersection of low galaxy mass and dense environment.

Modeling X-ray Spectra Using Global Optimization Methods (Session : Techniques) ; ***Adam Rogers*** *(University of Manitoba), Samar Safi-Harb & Jason D. Fiege*
Fitting models to X-ray spectral data is usually performed using local optimization methods. Local optimizers typically produce a single solution from a specified initial condition in a short amount of time, but in practice these methods suffer from a number of significant pathologies. For example, the procedure is prone to becoming trapped in local minima and often requires an involved process of user intervention to navigate through the optimization process. In contrast to local methods, global optimization routines avoid these issues and provide a fully automated approach to model fitting. Moreover, global optimizers can discover entire families of solutions and reveal parameter degeneracies. In this talk I will discuss a GUI-based X-ray spectral fitting code that I have developed in MATLAB based on the Ferret genetic algorithm and Locust particle swarm optimizer, which are included in the Qubist Global Optimization Toolbox. The code is a general utility that can be used to fit spectral models to a variety of astrophysical sources.

Polarization of faint radio sources from stacking the ATLAS survey (Session : Posters : Extragalactic-10) ; ***Steven Rogowski*** *(University of Calgary), J. M. Stil, J. K. Banfield, T. Franzen, R. Norris*
We have stacked polarized intensity of a flux-density limited sample of radio sources in the ATLAS DR3 survey of ELAIS S1 and the Chandra Deep Field South. The median fractional polarization is 3.0% $\pm$ 0.3% at flux density 2.0 mJy and 3.0% $\pm$ 0.4% at flux density 4.6 mJy. We present stacking at the 65-percentile instead of the 50-percentile (median) as a strategy to optimize the signal-to-noise ratio in stacked polarized intensity. In order to test for a significant resolved polarized component, we derived aperture-integrated Stokes I, Q, and U flux densities in increasing circular apertures with radius r = 15, 21, and 30 arcseconds. The median total flux density of the sample increases by 10% between radius 15" and radius 21" (180 kpc at z=1), with no significant increase extending the aperture to r = 30". Fractional polarization does not change significantly with aperture size. Stacking aperture-integrated polarized intensity allows us to constrain the polarization of low-surface-brightness emission associated with faint radio sources.

Remixing the Greatest Hits of the 80s (in Molecular Clouds) (Session : Galactic II) ; ***Erik Rosolowsky*** *(University of Alberta), Dario Colombo (MPIfR), Jessica Dempsey (JAC), Malcolm Currie (JAC)*
With the advent of wide-area CO surveys of the Galactic plane, the 1980s was a definitive era in our understanding of the molecular interstellar medium (ISM). By separating the emission in the plane into clouds and characterizing these objects, several landmark studies established the Giant Molecular Cloud paradigm for interpreting the star-forming ISM. This view relies on (1) primitive data, (2) by-eye separation of structures, (3) loose distance assignments, and (4) simple abstractions to define cloud properties. In this contribution, I will describe how we can improve on all four of these shortcomings, leading to a more sophisticated, if not clearer, view of the molecular ISM. Using data from the JCMT CO High-Resolution Survey (COHRS), we have have separated the emission into well-resolved structures using SCIMES, a new algorithm that partitions the data using spectral clustering applied to the dendrogram of emission. Using a

Bayesian distance estimation scheme developed for the Bolocam Galactic Plane Survey, we can assign distances to each object. The resulting catalogue yields well-resolved data on 10^4 molecular clouds. The clouds broadly follow the Larson scaling relations but with real scatter. The cloud mass distributions change with galactic radius suggesting cluster formation will vary across the galaxy.

Photometric Observations of Neptune and Uranus with K2 : Weather, Solar activity and seismology. (Session : Planets I) ; ***Jason Rowe*** *(Institut de recherche sur les exoplanètes, iREx, Université de Montréal), The K2 Solar-System Giants Science Team*
The solar system hosts two classes of giant planets : gas giants and ice giants. The ice giants are smaller (Uranus and Neptune masses are less than 18 Earth masses) with smaller hydrogen-helium envelopes, and exhibit strong enrichments in heavier elements due to the high proportion of ices delivered to the planets during their formation. The Kepler Mission has ably demonstrated that such Neptune and Uranus sized planets are common -- much more common than gas giants in fact -- outside of the solar system . Thus, knowledge of the interior structure of such worlds enables better models of their formation and evolution. K2 presents an opportunity to obtain ultra-high precision, high duty-cycle, integrated disc photometry of the Solar System's ice giants to search for oscillations in their reflected light. Such seismology is by far the most promising technique for constraining the core mass of a giant planet, independent of the uncertainties that plague interior model inversion. We present 49 days of nearly continuous broadband photometry of the planet Neptune obtained by the K2 mission and an update on planned observations of Uranus. With an observed cadence of 1-minute and point-to-point scatter better than 0.01% the photometry signal is dominated by reflected light from the Sun which is modulated by atmospheric variability from Neptune at the 2% level, a decrease in flux due to the increasing distance between Neptune and the K2 spacecraft and Solar variability from both granulation and convection driven p-modes. The time series photometry has been used to study weather patterns of Solar System giants relative to brown dwarfs, study the Sun as a distant star and to search for excess power that may be due to intrinsic oscillations of the planet Neptune.

Tools for Slitless Spectroscopy of Extrasolar Planets with NIRISS aboard JWST (Session : Posters : Instruments-8) ; ***Jason Rowe*** *(Institut de recherche sur les exoplanètes, iREx, Université de Montréal), René Doyon Loïc Albert*
We present an overview of exoplanetary science and tools being developed for the community that support the Single Object Slitless Spectroscopy (SOSS) mode of the Near-Infrared Imager and Slitless Spectrograph (NIRISS) aboard JWST. Publicly available code will enable the community to generate synthetic data, generate spectral traces, produce difference images and extract spectra.

Improved Performance of the JWST Fine Guidance Sensor (Session : Instruments) ; ***Neil Rowlands*** *(Honeywell Aerospace), Pierre Chayer, Calvin Midwinter, Gerry Warner, Julia Zhou*
The James Webb Space Telescope completed two major milestones earlier this year with the completion of the build of the Optical Telescope Element (OTE) and the third and final cryogenic test of the Integrated Science Instrument Module (ISIM) completed its third cryogenic test. Fine Guidance Sensor performance highlights from the ISIM cryogenic test campaign are described. Both the FGS/NIRISS and NIRSpec instruments received new detectors for this test and we report on the performance improvements obtained. In particular we describe the noise equivalent angle (NEA) performance as a function of guide star magnitude for the tracking and fine guidance modes. Tracking mode must be able to follow a guide star moving across the field of view of either guider, primarily to allow the Observatory line of sight to settle in advance of the fine

guidance mode. FGS tracking mode will also be used for JWST's moving target observing mode and for commissioning of the Observatory. The NEA performance vs guide star magnitude in fine guidance mode is presented ; demonstrating that the FGS-Guiders will provide the Observatory with the pointing precision required to achieve the ultimate image quality of the JWST Observatory.

Radially Magnetized Protoplanetary Disks : Evolution and Planetary Migration (Session : Planets I) ; ***Matthew Russo*** *(CITA University of Toronto), Christopher Thompson*
We present a novel model of the structure and evolution of protoplanetary disks that are exposed to their host star's magnetized T Tauri wind. In late stages, the wind's radial field is mixed into a thin surface layer, is sheared into a strong toroidal field, and is pushed downward by a combination of turbulent mixing and ambipolar and Ohmic drift. The resulting MRI turbulence and large-scale laminar stress drive mass accretion with a well-constrained radial profile. We find that the more highly magnetized inner regions support a greater mass flux leading to the secular depletion of the inner disk mass on a timescale that is short compared to the disk lifetime. We identify a feedback mechanism where turbulence stirs up settled particles to higher altitudes where they collide, fragment and suppress magnetic stresses by reducing the ionization fraction. This process maintains a low column density in the inner disk for long periods while remaining optically thick to stellar light and provides a new environment in which to study the migration of young planets.

ON THE SHAPES OF RADIAL VELOCITY CURVES OF ROTATIONALLY AND TIDALLY DISTORTED POLYTROPIC MODELS OF STARS (Session : Posters : Galactic-9) ; ***Tarun Sachdeva*** *(Thapar University, Patalia)*
A method of solving the equation of anharmonic pulsation is propose to investigate the shapes of radial velocity curves of radial oscillations of Polytropic models of stars which is distorted by rotational and Tidal force. This work uses the concept of average technique of Kippenhahn and Thomas (Proceeding of IAU Colloq 4, Ohio State Univ, Columbus, ed. Slettebak, A.,D., Gordan and Breach Science Publishers, 1970) and utilizes the results of Roche equipotential obtained by Kopal (Astronomy and Astrophysics,9,1-65,1972) for rotationally and tidally distorted stellar models. Anharmonic pulsation equation of rotationally and tidally Polytropic models of stars has been developed by following Rosseland (Oxford : Clarendon Press, 1949) . This equation is next solved numerically using the results of various modes of radial oscillations of rotationally and tidally polytropic model. The result thus obtained has been analyzed to study the effect of higher modes of radial oscillations on the shapes of radial velocity cures of rotationally and tidally distorted Polytropic models of stars. Certain conclusion based on the present study has finally been drawn. Keywords : Radial Velocity Curves, Polytropic Stars, Anharmonic, Rotationally and Tidally Distortion.

3D simulations of young core-collapse supernova remnants (Session : Posters : Galactic-10) ; ***Samar Safi-Harb*** *(University of Manitoba), Gilles Ferrand*
Within our Galaxy, supernova remnants are believed to be the major sources of cosmic rays up to the "knee" of the cosmic rays spectrum. However important questions remain regarding the share of the hadronic and leptonic components, and the fraction of the supernova energy channelled into these components. We address these questions by performing numerical simulations that combine a hydrodynamic treatment of the shock wave with a kinetic treatment of particle acceleration. Performing 3D simulations allows us to produce synthetic projected maps and spectra of the thermal and non-thermal emission, that can be compared with multi-wavelength observations (in radio, X-rays, and gamma-rays). Supernovae come in different types, and

although their energy budget is of the same order, their remnants have different properties, and so may contribute in different ways to the pool of Galactic cosmic-rays. Our first simulations were focused on thermonuclear supernovae that usually occur in a mostly undisturbed medium, like Tycho's SNR. Here we present our 3D simulations of core-collapse supernovae, like the Cas A SNR, that occur in a more complex medium bearing the imprint of the wind of the progenitor star.

Developing a new vision for astronomy computing (Session : Big Projects/Missions) ; ***David Schade*** *(Canadian Astronomy Data Centre, National Research Council Canada)*
Research Data Management ("Big Data", "Open Data", "Cyberinfrastructure") has gained the attention of high levels of government and of funding organizations. This interest has already produced changes in both funding and delivery models for scientific computing. Compute Canada will operate the bulk of the infrastructure that supports researchers. The funding provided by CFI will greatly influence the direction of development of new computing capabilities. The relationships between Compute Canada and CADC and CANFAR are being redefined and this will change the services available to users. It would be to the advantage of the astronomy community to develop a coherent response to this developing situation. This talk will focus on Data-Intensive computing for astronomy. The goal is start a conversion that will lead to a clear and coherent vision of where the community needs to go and to develop a way of working with Compute Canada to make that vision a reality.

The Spectrum of the Universe (Session : Cosmology I) ; ***Douglas Scott*** *(UBC)*
The energy density of extragalactic background radiation, from radio waves to gamma-rays, carries information about the source of that energy. I describe this spectral energy distribution of the entire Universe using a compilation of current data and explain what it tells us about the origin of these photons. Although most of this spectrum is "continuum", I will also show what the global line spectrum might look like. Considering this cosmic SED as the monopole mode of the sky distribution, it is clear how we could generalise to the the spectrum of variations on different angular scales - a data-cube statistically escribing the entire history of photon emission.

Bayesian unfolding to measure the anti-electron neutrino cross section on carbon (Session : Posters : Techniques-2) ; ***Fady Shaker*** *(University of Manitoba), Blair Jamieson*
A high intensity proton beam at the Japan Proton Research Accelerator Complex (J-PARC) is being used to produce a beam of neutrinos or anti-neutrinos that are used for the Tokai to Kamioka (T2K) neutrino oscillation experiment. About one percent of particles in the anti-neutrino beam mode are electron anti-neutrinos. A magnetized detector 280 m from the production of this beam is used to detect neutrino interactions and has particle identification capabilities that allow a selection of electron anti-neutrino events. This selection is not perfect, as a background due to protons and gamma rays from pi0s produced by muon anti-neutrino interactions remains. A Bayesian algorithm is being developed that simultaneously unfolds the physics causes from the observed effects. The causes are the electron anti-neutrino cross section as a function of neutrino energy, and backgrounds due to the protons and gamma rays. The effects are the observed electron anti-neutrino selection, gamma ray backgrounds, and proton background.

Astrophysical r-process sensitivity studies (Session : High Energy) ; ***Zachary Shand*** *(University of Calgary), Nico Koning, Rachid Ouyed*
The r-process (rapid neutron capture process) is believed to be the production mechanism for the most of the heavy elements in the galaxy. Uncertainties in both nuclear and astrophysical theory ; however, has prevented reproduction of observed elemental abundances through

simulations. As a result, the site of heavy element production has remained an open question. Observational data implies that the r-process occurs robustly in the early galaxy (at least for mass number A>130) ; however, there has been little work done to study and quantify the effect of variations in the astrophysical parameters (i.e. temperature and density evolutions). If the r-process is in fact a robust process, normal variations in site parameters should lead to variations in elemental abundances consistent with observational error and variability. Using simulation data from our r-process code SiRop (i.e. r-Java 3.0), we will show to what extent variations in the thermodynamic trajectories of different r-process sites (supernovae, neutron star mergers and quark novae) affect the predicted r-process abundances. This variability can be compared to the uncertainty introduced by the nuclear theory required to predict nuclear properties far from stability. Ideally, this will provide additional constraints on r-process astrophysical models.

Current Status and Future Plans at CFHT (Session : Instruments) ; ***Doug Simons*** *(CFHT)*
After an update of progress made on many fronts over the past few years is provided, future plans based upon evolving operations and instrumentation, as well as MSE, will be summarized. Some on-going challenges to Hawaii astronomy will be presented, and thoughts about how the Maunakea Observatories may operate in the 21st century to meet these challenges and provide world-class research opportunities for our international community will be offered.

Rapid evolution of the relativistic jet in the black hole X-ray binary V404 Cygni (Session : High Energy) ; ***Gregory Sivakoff*** *(University of Alberta), Alexandra Tetarenko (University of Alberta), James Miller-Jones ICRAR - Curtin University) on behalf of a larger collaboration*
After 26 years in quiescence, the black hole X-ray binary V404 Cygni went into outburst in June 2015, rapidly becoming the brightest X-ray binary outburst in over a decade. The exceptionally bright fluxes across the electromagnetic spectrum provided an unparalleled opportunity to study the accretion and ejection processes around an accreting stellar-mass black hole. Since V404 Cygni is one of the few X-ray binaries with a known (geometric parallax) distance, we can directly convert measured properties into accurate physical parameters. Intensive observing campaigns at all wavelengths, from the radio to the gamma-ray regime, have already produced a number of exciting results, from the signatures of positron annihilation to the cause of accretion disc instabilities. Here I present results from coordinated high-cadence radio through sub-mm observations, which probe the evolution of the relativistic jet on seconds to hours timescales and indicate 13 energy injection events in about 4 hours. We can compare the properties of these events to detailed changes in the jet morphology using simultaneous high resolution imaging with the Very Long Baseline Array, providing a unique view into the properties of relativistic jets.

New Insights Into Dust Formation in Wolf-Rayet Winds from Spectroscopic Observations of 8 WC9 Stars (Session : Galactic I) ; ***Nicole St-Louis*** *(Département de physique, Université de Montréal), André-Nicolas Chené Sébastien Desforges Antoine de la Chevrotière Vincent Hénault-Brunet*
Massive stars contribute to the ecology of galaxies in many ways. They impart a considerable amount of energy and momentum to the interstellar medium (ISM) in all phases of their evolution and inject chemically enriched material in their surrounding environment. Wolf-Rayet (WR) stars, the He-burning descendant of massive O stars, are no different but there is one particular type of WR star that contributes in an additional way. Indeed, WC9 stars (and some WC8 stars) are know to produce carbon-based dust in their winds, which eventually will be transferred to the ISM. How exactly the dust can be produced and preserved in such a harsh environment is still not completely clear. Some WC9 stars are found in binaries and in that case zones of compressed gas are

created as a consequence of colliding stellar winds, which provides a favorable environment for dust formation. However, not all WC9 stars are known to have a companion and in those cases it is unclear how the dust can form and be shielded from the strong ultraviolet flux. We have carried out a spectroscopic monitoring campaign of 8 presumably single WC9 stars to search for clues of the dust formation mechanism in these stars. In particular, many of the stars in our sample had been shown to present short timescale variability and we explore the possibility that they are yet unidentified close binaries. We confirm that the stars in our sample are indeed variable but only one shows changes with a clear periodicity. Nevertheless, we suggest that the short timescale variability we detect could arise in a non-adiabatic shock cone from colliding stellar winds in long-period binaries. This shock cone could potentially provide zones of compressed gas of sufficiently high density for dust to form and survive in the wind.

Primordial non-Gaussianity with Large Scale Structure (Session : Cosmology I) ; ***George Stein*** *(CITA), J.R. Bond, M. Alvarez, P. Berger*
We explore the detectability of different types of primordial non-Gaussianity in future 3D large scale structure surveys. For both the intermittent (spatially sporadic) and the conventional perturbative variety of non-Gaussianity we find characteristic signatures not only in the scale dependent bias on large scales, as is usually discussed, but that intermittent non-Gaussian models may have a much more unique signal which is strongest in cluster abundances and even single cluster statistics. These forecasts are promising for near-future surveys such as CHIME and SPHEREx if systematics are well controlled.

Photometry - Old and New (Session : Prize Lecture) ; ***Peter Stetson*** *(National Research Council Herzberg Astronomy and Astrophysics)*
I will probably just blather on about photometry for a while.

Not the magnetic field (Session : Posters : Galactic-11) ; ***Jeroen Stil*** *(University of Calgary), A. Hryhoriw*
Faraday rotation of polarized background sources by the Galactic interstellar medium at high Galactic latitude shows structure on angular scales of tens of degrees down to less than a degree. We present an analysis of Faraday rotation of a 35 degree long intermediate-velocity ionized filament that may be a part of the mostly-neutral Perseus-Pisces intermediate-velocity complex. Derivation of the magnetic field in this filament from rotation measures is challenging, because of a paucity of pulsar dispersion measures at high latitude. If we use a published empirical conversion of emission measure to dispersion measure, we find that the mean line-of-sight component of the magnetic field is 2.8 microgauss. Is this the best we can derive from the available data ? The answer to this riddle is not the magnetic field.

Mass media comms : experiences and techniques (Session : Education) ; ***Robert Thacker*** *(Saint Mary's University)*
I'll give a fun and light overview of my experiences with mass media, both TV and radio, over the past five years in Halifax. In 2016 I became a part-time broadcaster - although I'm not quitting my day job at SMU - as the weekly co-host, and some time host, of the Saturday "Science Files" on News 95.7. Science Files is classic talk radio, we take call-in questions on pretty much any science topic. That can be simultaneously fun and intimidating. I'll also outline some techniques for handling difficult questions and give a few interview tips.

"Cold, Galaxy-scale fountains with Black Hole Pumps" (Session : Extragalactic II) ; ***Grant Tremblay*** *(Yale University), Chris O'Dea, Stefi Baum, Raymond Oonk, Francoise Combes, Philippe Salome, Mark Voit, Megan Donahue, Brian McNamara, Timothy Davis, Michael McDonald, Alastair Edge, Tracy Clarke, Roberto Galvan-Madrid, Malcolm Bremer, Louise Edwards, Andy Fabian, Stephen Hamer, Yuan Li, Helen Russell, Alice Quillen, Meg Urry, Jeremy Sanders, Michael Wise*
A new ALMA observation of the cool core brightest cluster galaxy in Abell 2597 reveals that a supermassive black hole can act much like a mechanical pump in a water fountain, driving a convective flow of molecular gas that drains into the black hole accretion reservoir, only to be pushed outward again in a jet-driven outflow that then rains back toward the galaxy center from which it came. The ALMA data reveal "shadows" cast by giant molecular clouds falling on ballistic trajectories towards the black hole in the innermost hundred parsecs of the galaxy, manifesting as deep redshifted continuum absorption features. The black hole accretion reservoir, fueled by these infalling cold clouds, powers an AGN that drives a jet-driven molecular outflow in the form of a 10 kpc-scale, billion solar mass expanding molecular bubble. HST reveals that the molecular shell is permeated with young stars, perhaps triggered in situ by the jet. Buoyant X-ray cavities excavated by the propagating radio source may further uplift the molecular filaments, which are observed to fall inward toward the center of the galaxy from which they came, presumably keeping the fountain long-lived. I will discuss this specific result in the larger context of galaxies as a whole, as the results show that cold molecular gas can couple to black hole growth via both feedback and feeding, in alignment with "cold chaotic accretion" models for the regulation of star formation in galaxies.

Star formation with smoothed particle magnetohydrodynamics (Session : Galactic II) ; ***Terrence Tricco*** *(CITA), Daniel Price*
Magnetic fields are an integral component in the formation of protostars, responsible for producing majestic jets and outflows and tempering the rate and efficiency of star formation. Numerical simulations of star formation are difficult to perform, owing to their multi-physics nature and due to the wide range of dynamical length and time scales. Simulating magnetic fields add their own numerical challenge, that of maintaining a solenoidal field (DivB=0). I will present developments to improve the representation of magnetic fields in the smoothed particle hydrodynamics framework, along with results from simulations of jets & outflows during isolated protostar formation and of the star formation environment of molecular clouds.

Faraday Tomography with LOFAR (Session : Techniques) ; ***Cameron Van Eck*** *(Radboud University), Marijke Haverkorn*
The new generation of low-frequency radio telescopes, including the Low Frequency Array (LOFAR), have opened up a whole new range of observing capabilities and scientific possibilities. These capabilities include high-resolution Faraday tomography (the decomposition of polarized emission by the degree of Faraday rotation), which allows us to probe magnetic fields in our Galaxy. The unique properties of low-frequency polarization give us a new method to probe the local interstellar medium and its magnetic field. In my talk, I will show my results from applying Faraday tomography to LOFAR observations and demonstrate what this can tell us about the structure of magnetic fields in the local interstellar medium.

Packing Planets Together : When Neighbors Turn Against Each Other (Session : Planets I) ; ***Christa Van Laerhoven*** *(Canadian Institute for Theoretical Astrophysics), Alysa Obertas, University of Toronto Daniel Tamayo, Center for Planetary Sciences, University of Toronto*
Many of the multi-planet systems discovered to date have planets packed much closer together than the planets in our solar system. Notably, these systems are generally not young, indicating that some fraction of very closely packed systems can survive for an extended period of time. We have used numerical simulations to investigate how quickly closely packed planetary systems go unstable. Thus far we have concentrated on hypothetical planetary systems comprised of a number of Earth-mass planets on equally spaced orbits (in mutual Hill Radii) around a Sun-like star. Generally, the farther apart the planets are, the longer it takes for them to go unstable. In agreement with previous authors who have worked on this problem, we find that for separations between 3 and 8 Hill Radii, log(t_unstable) scales approximately linearly with spacing in mutual Hill Radii. However, we have enough simulations to resolve further structure superimposed on this relation. We will discuss this structure and the implications for stability of closely packed planetary systems.

Bilateral symmetry in supernova remnants and the connection to the Galactic magnetic field (Session : Galactic I) ; ***Jennifer West*** *(University of Manitoba), Samar Safi-Harb, Tess Jaffe, Gilles Ferrand, Roland Kothes, Tom Landecker, Tyler Foster*
The study of Supernova Remnants (SNRs) is fundamental to understanding the chemical enrichment and magnetism in galaxies, including our own Milky Way. In an effort to understand the connection between the morphology of SNRs and the Galactic Magnetic Field (GMF), we have examined the radio images of all known SNRs in our Galaxy and compiled a large sample that have an axisymmetric morphology, which we define to mean SNRs with a bilateral or barrel-shaped morphology, in addition to one-sided shells. We will present models of the radio synchrotron emission from Galactic SNRs that use current models of Galactic magnetic field to simulate SNR emission as a function of their position in the Galaxy. This work reveals a connection between SNRs and their environment and a relationship between the angle of the symmetry axis of bilateral SNRs and the Galactic magnetic field. Results from studying the impact of the so-called quasi-parallel and quasi-perpendicular cosmic ray electron acceleration scenarios will also be presented. This relationship has implications for understanding the magnetic field geometry and cosmic ray electron distribution in SNRs, and possibly even a new method for determining distances to features of the Galactic magnetic field as well as distances to some SNRs.

Atchakosuk : Ininew Stories of the Stars (Session : Posters : Education-3) ; ***Jennifer West*** *(University of Manitoba), Ian Cameron, University of Manitoba Wilfred Buck, Manitoba First Nations Education Resource Centre*
The Ininew (Cree) people of Manitoba, Saskatchewan and Alberta have unique perspectives of the constellations and stars that are prominent in the northern skies. The stars are believed to be spirit lights up above that are called atchakosuk. In an effort to help preserve this traditional knowledge and raise awareness in the wider astronomical community, we present some of the Ininew mythology that Wilfred Buck has gathered from the Knowledge Keepers, Medicine People and honoured Elders by travelling to their communities.

Gas Content and Kinematics in Clumpy, Turbulent Star-forming Disks (Session : Posters : Galactic-12) ; ***Heidi White*** *(Dunlap Institute / University of Toronto), Heidi A. White, David Fisher, Norman Murray, Karl Glazebrook, Roberto Abraham, Alberto Bolatto*

We present gas mass estimates for a unique sample of 16 local galaxies whose kinematic and star forming properties closely resemble that observed in high-z star forming disks. Plateau de Bure observations (targeting the CO[1-0] transition line) have been performed for six galaxies (of which five are well-detected at >8σ) yielding CO fluxes and line luminosities consistent with gas mass fractions up to ~30%, assuming alpha_CO=3.1 Msun(K km s^-1 pc^2)^-1. Fitting a modified blackbody function to existing Herschel IR observations (from PACS+SPIRE) for ten additional galaxies, we find substantial dust masses (1-3x10^9 Msun) and Tdust<30K, suggesting that the dust within these systems is dynamically cold. Application of the locally-derived dust-to-gas ratio (D :G~0.005) to fitted Mdust values suggests fgas ~10-40%. Together, the gas mass estimates reported for this sample argue that not only do z~0.1 DYNAMO galaxies share similar kinematic properties with high-z disks but they are also gas rich. Pairing the gas mass fractions with existing high-resolution kinematics reveals a linear relationship between fgas and σ/Vcirc. This provides observational evidence (long predicted from Toomre instability theory) of the role that velocity dispersion plays in the formation of these star forming massive clumps. Moreover, there exists an inverse relationship between σ/Vcirc and the depletion timescale of the gas, arguing that the substantial gas reservoirs rotating within these turbulent systems are more efficient at forming stars.

ALMA Observations of HD141569's Circumstellar Disk (Session : Planets II) ; ***Jacob White*** *(University of British Columbia), A.C. Boley, A.M. Hughes, K.M. Flaherty,E. Ford, D. Wilner, S. Corder, M. Payne*

HD 141569 is a unique ~5 Myr transition disk that can give powerful insight into the planet formation process and early debris disk evolution. This B9.5 Ve pre-MS star (99 pc) is surrounded by an extensive disk with spiral-like structure at large stellar separations, as observed in scattered light images. We use ALMA Band 7 observations to explore the possibility that HD141569 cold be a second generation debris disk. We spatially and kinematically resolve substantial CO (3-2) gas that extends from close to the star to past 100 AU. In addition we have 870 um continuum emission that we identify as an inner debris disk with a radius of ~50 AU. The mm grains of this inner region are associated with a tenuous gas component, potentially making the inner system akin to older gas-rich debris disks. In contrast, the gas in the outer disk is likely from the disk's formation. HD141569 may be observed during a short-lived but common phase of evolution, during which the gas from the protoplanetary disk is being cleared by, e.g., photoevaporation, while the nascent debris disk provides a new source of low-density gas. Based on our observations, we present mass estimates for the inner debris disk, as well as a dynamical mass measurement for the star. HD141569 may be a glimpse at the youngest known debris system giving, allowing us to study the clearing stages of planet formation.

ALMA Observations of Nearby Galaxies (Session : President talk) ; ***Chris Wilson*** *(McMaster University)*

ALMA is revolutionizing our view of the universe, including our nearest neighbour galaxies. My students and I have been using ALMA to probe the properties of the dense, star forming interstellar medium in several nearby galaxies, including the prototypical ultraluminous infrared galaxy Arp 220. I will present some of our recent results, including measurements of very high surface densities and temperatures in Arp 220 and evidence for large changes in the 12C/13C abundance ratio in several nearby luminoous infrared galaxies.

HD simulations of internal jet-stellar wind interactions : the case of Centaurus A (Session : Extragalactic II) ; ***Sarka Wykes*** *(University of Manitoba), Manel Perucho, Tom Jones, Iain McDonald, Martin Hardcastle, Amanda Karakas, Paul Nulsen, Gilles Ferrand, Albert Zijlstra, Chris O'Dea, Samar Safi-Harb and Stefi Baum*

The dimensions of Fanaroff--Riley class I jets and the stellar densities at galactic centres imply that there will be numerous interactions between the jets and stellar winds. These may give rise to the observed structure of the jets in the X-ray, and can also mass load and decelerate the jets. We have shown that jet-stellar wind interactions of the low-mass, old stellar component alone can explain the combined knot- and diffuse X-ray emission from Centaurus A's jet produced in Fermi I-type acceleration of electrons at the bow shocks. I will present results from hydrodynamical simulations of the jet interacting with winds of its internal, 'jetburned' stars with a view to investigating, at high numerical resolution and analytically, the properties of shocks (bow shock and termination shock) generated in these interactions, and the wake structure tailing into Centaurus A's jet. The results from our modelling provide tools for estimating shock Mach number and the sizes of the obstructions in the jet which will tighten constraints on the nature of individual knots observed in Centaurus A.

Accretion in Radiative Equipartition (AiRE) Disks (Session : High Energy) ; ***Yasaman Yazdi*** *(Perimeter Institute/University of Waterloo), Niayesh Afshordi*

Standard accretion disk theory (Shakura & Sunyaev 1973) predicts that the total pressure in disks at typical (sub-)Eddington accretion rates becomes radiation pressure dominated. However, radiation pressure dominated disks are thermally unstable. Since these disks are observed in a steady state, this suggests that our disk models in the radiation pressure dominated regime (i.e. inner disk) need to be modified. In this talk I will present a modification to the SS model, where radiation pressure is in equipartition with gas pressure in the inner region. We call these disks Accretion in Radiative Equipartition (AiRE) disks. I will introduce the basic properties of AiRE disks and show how they modify disk quantities such as the Toomre parameter and radiation flux.

NLTE Effects in Globular Cluster Integrated Light Spectra (Session : Posters : Galactic-13) ; ***Mitchell Young*** *(St. Mary's University), C. Ian Short*

Our overall goal is to investigate the effect that modelling the atmospheres and spectra of the evolved stellar component of Galactic globular clusters (GGCs) in non-local thermodynamic equilibrium (NLTE) on the model integrated light (IL) spectrum has on the derivation of GGC ages and metallicities ([Fe/H] values) from IL photometric colour and spectrum fitting. We create synthetic GGC populations and associated colour-magnitude diagrams (CMDs) using the Kroupa initial mass function (Kroupa, P., 2001, MNRAS, 322, 231-246) and the Teramo isochrones (Pietrinferni, A. et al, 2004, ApJ, 612, 168-190) with ages ranging from 9 to 15 Gyr, and [Fe/H] = -1.49 to -0.66, and investigate the dependence of predicted LTE and NLTE colours on the method and resolution of CMD discretization, and on the definition of representative stellar parameters in a discretized CMD.

The University of Manitoba's High-Energy Catalogue of Supernova Remnants and Pulsar Wind Nebulae (Session : Posters : Galactic-14) ; ***Yichen Zhan*** *(University of Manitoba), Samar Safi-Harb, Gilles Ferrand, and Jennifer West*

Motivated by the wealth of past, existing, and upcoming X-ray and gamma-ray missions, we have published in 2012 the first public database of high-energy observations of all known Galactic Supernova Remnants (SNRs) and Pulsar Wind Nebulae (PWNe) : http ://www.physics.umanitoba.ca/snr/SNRcat (SNRcat, Ferrand & Safi-Harb 2012). The catalogue is regularly updated, and links to/complements other existing related catalogues, including Dave Green's radio SNRs catalogue. As well, SNRcat feeds another newly developed in-house webpage for Supernova Remnant Models and Images at Radio Frequencies (SMIRF) : http ://www.physics.umanitoba.ca/snr/smirf/ (West et al. 2016). We here highlight the unique features of our catalogue, including new developments for implementing an imaging component that will allow a multi-wavelength visualization of Galactic SNRs. The latter is part of an undergraduate project to be highlighted in this poster with focus on the radio and X-ray images.

A Large Area MEMS Low Voltage Electrostatic Actuator for a Deformable Mirror System (Session : Posters : Instruments-9) ; ***Yu Zhou*** *(University of Manitoba), Cyrus Shafai*

In this paper, we demonstrate large area micromachined actuators to control a deformable mirror for an adaptive optics system. Actuators were designed to achieve a 7 μm stroke with a resonant frequency >1 kHz and a driving voltage smaller than 30 V. A 5 x 5 actuator array was fabricated using a combination of bulk micromachining and laser micromachining, with demonstrated high fabrication yield. Performance was simulated and experimentally tested. Test results showed good agreement with simulated design. These large area actuators show promise for a low voltage adaptive optics system, which would give compatibility with many existing IC electronics.

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