WIPC 2023

Women in

Physics Canada Conference

July 4th-7th, 2023

University of Manitoba, Fort Garry Campus

Winnipeg, Manitoba, Canada

Women in Physics Canada
Femmes en Physique Canada

July 4 - 7, 2023
University of Manitoba, Winnipeg

KEYNOTE SPEAKER

Dame Jocelyn Bell Burnell

Discovered pulsars in 1967.
Awarded the Breakthrough Prize in Fundamental Physics (2018).
The First Female President of The Royal Society of Edinburgh.

PROGRAM

Invited Talks / Student talks and posters
Skill Development Workshops / EDI Panel
Speed mentorship / Grad Fair / Networking activities
Banquet at the Canadian Museum for Human Rights

For more information:

https://sci.umanitoba.ca/wipc2023/

wipc2023@physics.umanitoba.ca
wipc2023

Table of Contents

Sponsors

Big Bang! Sponsors

Extragalactic Sponsors

Galactic Sponsors

Canadian Institute for Theoretical Astrophysics
National Research Council of Canada
Perimeter Institute
University of Toronto Dunlap Institute for Astronomy & Astrophysics
Winnipeg Institute for Theoretical Physics

Stellar Sponsors

Arthur B. McDonald Canadian Astroparticle Physics Research Institute
Institut Quantique, UdS
SNOLAB
The University of British Columbia Stewart Blusson Quantum Matter Institute
The University of Winnipeg Department of Physics
Toronto Metropolitan University
Trottier Institute for Research on Exoplanets
Trottier Space Institute at McGill
University of Calgary
University of Manitoba Department of Physics & Astronomy

Planetary Sponsors

Brandon University Department of Physics and Astronomy
Canadian Astronomical Society
University of Lethbridge
University of Saskatchewan Physics and Engineering Physics
University of Victoria
University of Waterloo Centre for Astrophysics
Women in Science

Higgs Sponsor

University of Regina Faculty of Science

Leptons Sponsor

Canadian Association of Physicists

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. All WIPC 2023 participants – including, but not limited to attendees, speakers, volunteers, exhibitors, organizers, members of the media, and service providers – are expected to abide by this code of conduct. Attendance at this WIPC meeting implies consent to abide by this code of conduct. We will not tolerate harassment of participants in any form.

Explicitly, please follow these guidelines:

Expected Behaviour:

- Behave professionally. Harassment and sexist, racist, or exclusionary comments or jokes are not appropriate.
- Treat all participants with kindness, respect, and consideration, valuing a diversity of views and opinions (including those you may not share). Communicate openly, with respect for other participants, critiquing ideas rather than individuals.
- All communication should be appropriate for a professional audience including people of many different backgrounds. Sexual language and imagery is not appropriate.
- Pay attention to the power dynamics in the meeting rooms, especially during discussions and workshops, to make sure more junior members are able to have their contributions heard.
- Respect the rules and policies of the meeting venue.

Unacceptable Behaviour:

- Harassment, bullying, intimidation, or discrimination of any sort will not be tolerated. This includes the use of any offensive language or imagery in any meeting venue. Behaviour that is acceptable to one person may not be acceptable to another, so use discretion to ensure respect is communicated. Harassment intended in a joking manner still constitutes unacceptable behaviour.
- Harassment includes sustained disruption of talks or other events, inappropriate physical contact, sexual attention or innuendo, deliberate intimidation, stalking, and any inappropriate behaviour. It also includes offensive comments related to gender, sexual orientation, physical or cognitive ability, political affiliation, physical appearance, age, body size, race, or religion.
- Retaliation for reporting unacceptable behaviour will not be tolerated.

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 and without a refund of the conference fee. Any participant who wishes to report a violation of this policy is asked to speak, in confidence, to any of the members of WIPC's Organizing Committee. Please feel free to contact them directly in case any conduct concerns arise during the conference.

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 while intervening.

Based on the nature of the violation and the response, the organizing committee 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 WIPC.

Accessibility

Presenters are encouraged to make their figures colour-blind friendly to the extent possible, as well as using large, easy-to-read fonts, etc., to enable easier viewing for all participants. For any accessibility accommodations, please contact the meeting organizers with any requests.

Note

This code of conduct has been adapted from WIPC 2019 who based it on the "London Code of Conduct", as originally designed for the conference "Accurate Astrophysics. Correct Cosmology", held in London in July 2015; it also incorporates elements from Ecological Society of America's Code and The 2018 Michigan Exoplanets Workshop. 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.

Welcome Message

Dear participants:

On behalf of the Organizing Committee of the 2023 Women in Physics Canada Conference (WIPC2023) taking place at the University of Manitoba's Fort Garry Campus, I am thrilled to extend a most warm welcome to all of you joining us from across Canada and abroad!

As a University of Manitoba (UM) community, we acknowledge that this conference is taking place on the original lands of the Anishinaabeg, Cree, Oji-Cree, Dakota, and Dene peoples, and on the homeland of the Métis Nation.
We also acknowledge and recognize that there is under-representation of women and other minority groups in the fields of Physics, Astronomy and STEM; and as numerous studies show, diversity and inclusive environments promote performance, creativity, innovation, and success. This is our main motivation behind organizing this conference and at the UM which values Equity, Diversity and Inclusion (EDI) as one of its main Pillars. Originally planned for 2020, just around the time COVID-19 hit and changed the world, WIPC is finally happening! We sincerely hope that this in-person meeting will stimulate exciting and unique connections and networking opportunities, showcase the amazing work and discoveries made by many of you, and will create wonderful memories and excitement for a bright future ahead.

Thank you *all* (women, allies, and everyone who's passionate about Physics and Astronomy and EDI in STEM) for joining us! We are so thrilled to host Dame Jocelyn Bell Burnell as our conference keynote speaker. Jocelyn is not only the discoverer of pulsars, a breakthrough in Astrophysics and Science, but is also a champion of Equity, Diversity and Inclusion.
We are grateful to our invited speakers and panelists – all successful and innovative physicists and scientists - for their time and dedication to helping the next generation of trailblazers in Physics & Astronomy and Science!
Please take the time to connect with all these inspiring women. We have arranged an exciting program of talks and posters, workshops, panel discussions, and one-on-one networking opportunities. For those of you seeking graduate programs, please visit the Grad Fair happening at lunchtime on Friday.

We are grateful to our conference sponsors for their tremendous support. This meeting would not have been possible without the generous contributions we received from so many sponsors across the country (Big Bang, Extragalactic, Galactic, Stellar, Planetary, Higgs and Leptons).
Their generosity enabled us to plan an affordable meeting, and particularly provide support for students (in the form of travel awards and students prizes), support for speakers, childcare support, and food throughout the conference! Lunches, breaks, and dinners will be covered. And don't miss the banquet dinner at the Canadian Museum for Human Rights, happening Wednesday evening and which should be an amazing experience!

We look forward to everyone's participation and we hope that you will have a most memorable conference and time in Winnipeg! Please enjoy, network and connect!

Sincerely,
Samar Safi-Harb
Professor, Canada Research Chair
WIPC Organizing Committee Chair
On behalf of the WIPC2023 organizing committee and volunteers

Message from the Chief Science Advisor of Canada

Dear delegates,

I would like to extend warm greetings to all of you attending the 10th edition of the Women in Physics Canada Conference. As you gather to celebrate your passion for physics, share your ideas and create collaborative opportunities, I want to express my heartfelt support and encouragement.

Throughout history, women have overcome challenges and shattered barriers to make remarkable contributions to science — and physics is no exception. As a woman in science myself, I am all too aware of these barriers but also of the progress achieved over the past decades. Nonetheless, we still have a long way to go, and we need to accelerate the pace of change. In getting there, we can take inspiration from the enlightened and courageous leaders before us and among us who trailblazed a way forward.

From Caroline Herschel to Marie Curie, to Chien-Shiung Wu, to Vera Rubin, to Donna Strickland and so many more — women in physics and astronomy have changed the world. And of course, Dame Jocelyn Bell Burnell, whose ground-breaking work, vision, and resilience have shattered glass ceilings, revolutionized astrophysics, and inspired the next generation.

You are part of this legacy. Your ideas, insights and unique perspectives have the power to shape the future in profound ways. Physics holds the key to understanding the complex challenges we face, including climate change, renewable energy, quantum technologies and unlocking the secrets of the universe. In a world that continues to evolve, your contributions are more important than ever.
As you push the frontiers of knowledge in your labs, I encourage you to consider how we can make physics, and all fields of science, more inclusive, equitable and welcoming to all. Diversity is the key to a more creative and innovative future. I also encourage you to share your passion and the fruit of your research with your community. Whether encouraging young people to pursue science, enhancing science literacy among the public or explaining the societal impact of research to policy makers, engaging in public dialogue is rewarding and beneficial to all. Above all, take pride in being part of a community of brilliant women physicists who are changing the face of science.

I wish you an unforgettable conference filled with inspiration, collaboration, and opportunities. The world awaits your remarkable contributions, and I am excited to see the impact you will make.

Dr. Mona Nemer
Chief Science Advisor of Canada

Keynote Speaker: Dame Jocelyn Bell Burnell

Biography

Dame Jocelyn Bell Burnell discovered pulsars as a graduate student in radio astronomy in Cambridge, opening up a new branch of astrophysics – work recognised by the award of a Nobel Prize to her supervisor. She has subsequently worked in many roles in many branches of astronomy, working part-time while raising a family.

She is now an Academic Visitor in Oxford, and Chancellor of the University of Dundee, and was (the first female) President of the Royal Society of Edinburgh – Scotland's National Academy. Much in demand as a speaker and broadcaster, in her spare time she gardens, listens to choral music and is active in the Quakers. She has co-edited an anthology of poetry with an astronomical theme – "Dark Matter: Poems of Space".

Organizing Committee

Organizing Committee

Samar Safi-Harb, Chair
Janette Suherli, Deputy Chair
Brynne Blaikie
Chelsea Braun
Jayanne English
Rachel Nickel
Danielle Pahud
Jessica Rodgers
Isabel Sander
Kyla Smith

Admin Staff

Nicolle Amyotte
Robyn Beaulieu

Volunteers

Kelvin Au
Lucas Victor da Conceição
Skye Heiland
Evelyne Hluszok
Tavleen Kainth
Brock Klippenstein
Cherylea Kristalovich
Jack Lindner
Brydyn Mac Intyre
Becca Man
Cole Treyturik
Arina Tseragotin

Emergency Contacts

Emergencies:
911 for ambulance, police, or fire

UofM Security Services:

- 204-474-9341 from any phone
- 555 from any university phone
- #555 from Bell MTS or Rogers Wireless
- Use any emergency phone on campus
- emergency_response@umanitoba.ca

Winnipeg Police:
204-986-6222

Safe Walk/Ride:
204-474-9312

UofM Fort Garry Campus Info:
204-474-9312

Contacts during Conference Hours (WIPC2023 matters):
204-510-6497, Samar Safi-Harb, Conference Chair
204-930-2763, Janette Suherli, Conference Deputy Chair

Conference Services

Parking

Parking is available in the parkade across from the entrance to St. John's College. Additional information on rates and lots can be accessed here: https://umanitoba.ca/parking/visitor-parking

Registration

The registration table is located just inside the main entrance of St. John's College, in the Galleria. Registration desk will be staffed throughout the conference:

Tuesday, July 4th	6:00pm – 9:00pm
Wednesday, July 5th	starts at 8:00am
Thursday, July 6th	starts at 8:00am
Friday, July 7th	starts at 8:30am

Wifi

Two wifi networks are available: **uofm-guest** (accept the usage agreement)
eduroam (login with your university information)

Wellness Room

A quiet room for prayer, reflection, sensory breaks, or other quiet needs is available in Room 111 (Quiet Room) of St. John's College.

Washrooms

Women's, men's, and accessible (all-genders) washrooms are available on the ground floor of the conference venue.

Food and Drinks

This conference is fully catered: snacks and beverages will be provided at all health breaks; lunch is provided on all three main conference days; and dinner is provided at the Conference Banquet on Tuesday and at the Poster Session on Wednesday. Vegetarian and vegan options are available, and additional dietary needs, as specified in your registration form, have been accounted for. Additional food options are available for purchase in the University Centre building.

Social Media

Use the hashtag **#WIPC2023** to post about the conference on social media! You can also tag the conference on Twitter, **@wipc2023**. Please be respectful of other attendees and ask permission before taking or posting photos of others.

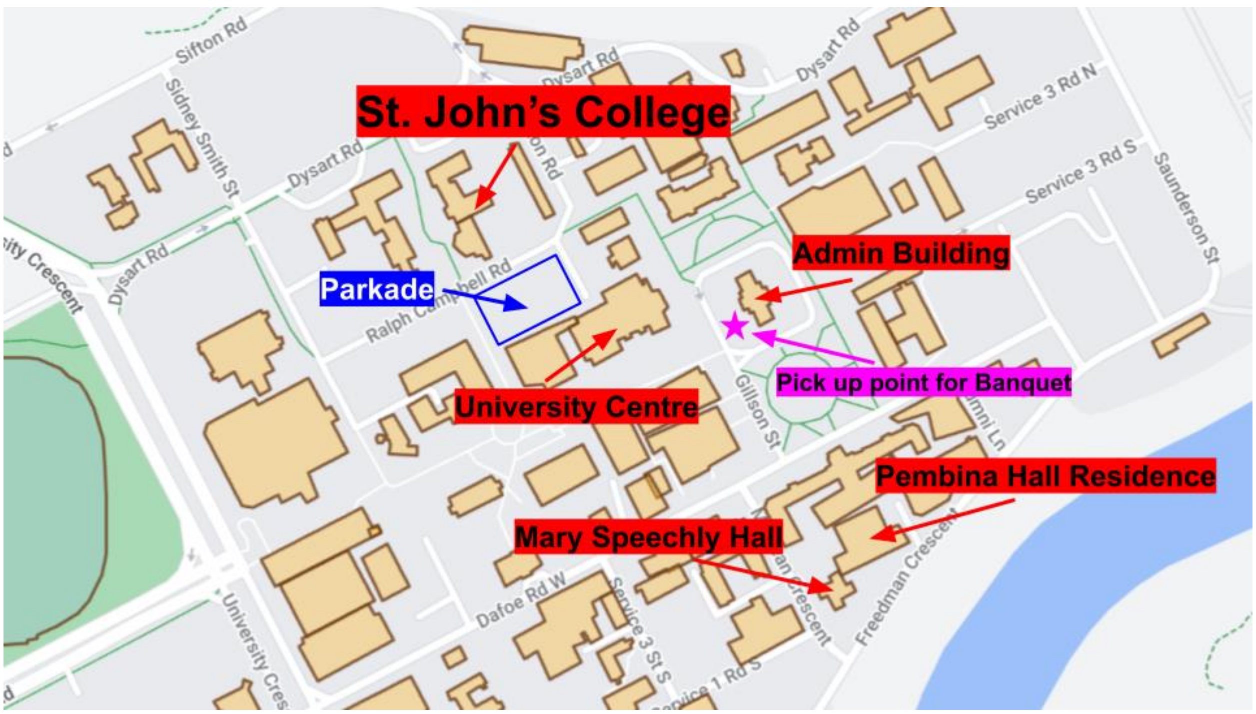
Map & Rooms

A digital, interactive map of the University of Manitoba is available here: https://umanitoba.ca/maps/

Most of the conference takes place in **St. John's College**, where we will be using the following spaces:

- Galleria
- Robert B. Schultz Theatre
- 118 Lecture Theatre (for parallel sessions)
- Daily Bread Café
- 108 Cross Common Room (posters and Grad Fair)

The Speed Mentorship session takes place in the Marshall McLuhan Hall in **University Centre** (second floor).



The Conference Banquet takes place at the **Canadian Museum for Human Rights** near the city centre. We will depart by bus from the Chancellor's Circle Loop (indicated by the magenta star on the map).

The group photo takes place in front of the **Admin Building**.

Pre-booked on-campus accommodation rooms are in the **Mary Speechly Hall** and the **Pembina Hall Residence** buildings.

Program

Program Overview

	Arrival Tue, Jul 4	First day Wed, Jul 5	Second day Thu, Jul 6	Third day Fri, Jul 7
08:30 - 09:00		Opening Remarks + Welcome *Robert B. Schultz Theatre*	Invited Talk: **Nathalie Nguyen-Quoc Ouellette** *Robert B. Schultz Theatre*	
09:00 - 09:30		Invited Talk: **Sarah Burke** *Robert B. Schultz Theatre*	Invited Talk: **Julianne Pollard-Larkin** *Robert B. Schultz Theatre*	Invited Talk: **Gabrielle Fontaine** *Robert B. Schultz Theatre*
09:30 - 10:00		Invited Talk: **Juliette Mammei** *Robert B. Schultz Theatre*	☕ Health Break *St. John's College Galleria*	Invited Talk: **Kim Venn** *Robert B. Schultz Theatre*
10:00 - 10:30		☕ Health Break *St. John's College Galleria*	EDI Panel **Julianne Pollard-Larkin, Brenda Matthews, Alexandra Pedersen, Christine Kraus** (Moderator: **Kim Venn**) *Robert B. Schultz Theatre*	Invited Talk: **Christine Kraus** *Robert B. Schultz Theatre*
10:30 - 11:00		Workshop I: **Maude Lizaire** (Artificial Intelligence) *Robert B. Schultz Theatre*		☕ Health Break *St. John's College Galleria*
11:00 - 11:30				Career Panel **Kristine Boone, Marjorie Gonzalez, Lauren Hayward, Aimee Hungerford, Harsha Blumer** (Moderator: **Alexandra Pedersen**) *Robert B. Schultz Theatre*
11:30 - 12:00		Workshop II: **Gwendolyn Eadie** (Astrostatistics) *Robert B. Schultz Theatre*	Students / Early-Career Researchers Talks: **EDI & Physics Education** *Robert B. Schultz Theatre*	
12:00 - 12:30			☕ Lunch *Daily Bread Café*	
12:30 - 13:00		☕ Lunch *Daily Bread Café*		☕ Lunch, Grad Fair *Daily Bread Café, 108 Cross Common Room*
13:00 - 13:30				
13:30 - 14:00			Students / Early-Career Researchers Talks: **Astronomy & Astrophysics** *Robert B. Schultz Theatre* Students / Early-Career Researchers Talks: **Subatomic Physics** *118 Lecture Theatre*	
14:00 - 14:30		Students / Early-Career Researchers Talks: **Condensed Matter** *Robert B. Schultz Theatre* Students / Early-Career Researchers Talks: **Medical Physics** *118 Lecture Theatre*		Student Prizes and Closing Remarks *Robert B. Schultz Theatre*
14:30 - 15:00				
15:00 - 15:30		☕ Health Break *St. John's College Galleria*		
15:30 - 16:00		Keynote Talk: **Dame Jocelyn Bell Burnell** *Robert B. Schultz Theatre*	Group Photo	
16:00 - 16:30			☕ Health Break *Marshall McLuhan Hall, University Centre*	
16:30 - 17:00			Special Event: Speed Mentorship *Marshall McLuhan Hall, University Centre*	
17:00 - 17:30		☕ Conference Banquet *Canadian Museum for Human Rights*		
17:30 - 18:00				
18:00 - 18:30	☕ Reception / Ice-breaker Event *St. John's College Galleria*			
18:30 - 19:00				
19:00 - 19:30			☕ Poster Session (with dinner) *108 Cross Common Room*	
19:30 - 20:00				
20:00 - 20:30				
20:30 - 21:00				

☕ Food and drinks are provided

Detailed Program

Arrival Day: Tuesday, July 4th

Tuesday, July 4	
18:00 - 21:00	Reception & Ice-breaker Event St. John's College Galleria

Day 1: Wednesday, July 5th

<table>
<tr><th colspan="3">Wednesday, July 5</th></tr>
<tr><td>8:30 - 9:00</td><td colspan="2">Opening Remarks and Welcome: Samar Safi-Harb (WIPC2023 Chair) and Tina Chen (University of Manitoba Executive Lead Equity, Diversity, and Inclusion)
Robert B. Schultz Theatre</td></tr>
<tr><td>9:00 - 9:30</td><td colspan="2">Invited Talk: Sarah Burke (Stewart Blusson Quantum Matter Institute)
Chair: Kyla Smith
Robert B. Schultz Theatre</td></tr>
<tr><td>9:30 - 10:00</td><td colspan="2">Invited Talk: Juliette Mammei (University of Manitoba)
Chair: Kyla Smith
Robert B. Schultz Theatre</td></tr>
<tr><td>10:00 - 10:30</td><td colspan="2">Health Break
St. John's Galleria</td></tr>
<tr><td>10:30 - 11:30</td><td colspan="2">Workshop: Artificial Intelligence, Maude Lizaire, (Quebec Artificial Intelligence Institute)
Chair: Janette Suherli
Robert B. Schultz Theatre</td></tr>
<tr><td>11:30 - 12:30</td><td colspan="2">Workshop: Astrostatistics, Gwendolyn Eadie (University of Toronto)
Chair: Janette Suherli
Robert B. Schultz Theatre</td></tr>
<tr><td>12:30 - 14:00</td><td colspan="2">Lunch Break
Daily Bread Cafe</td></tr>
<tr><td>14:00 - 15:00</td><td>Student/Early-Career Researcher Talks:
Condensed Matter & Plasma Physics
Chair: Rachel Nickel

14:00: Kaylee Biggart,
University of Waterloo
14:12: Christina Balanduk,
University of Manitoba
14:24: Tahreem Yousaf,
University of Saskatchewan
14:36: Nasrin Azari,
Simon Fraser University
14:48: Ying Yang,
University of Manitoba
Robert B. Schultz Theatre</td><td>Student/Early-Career Researchers Talks:
Medical Physics & Biophysics
Chair: Jessica Rodgers

14:00: Nisha Agarwal,
University of Ontario Institute of Technology
14:12: Melissa Anderson,
University of Manitoba
14:24: Cassandra Miller,
University of British Columbia
14:36: Emma Friesen,
University of Winnipeg
Poster Flash Talk:
Olivia Moluchi, University of Waterloo
118 Lecture Theatre</td></tr>
<tr><td>15:00 - 15:30</td><td colspan="2">Health Break
St. John's Galleria</td></tr>
<tr><td>15:30 - 16:30</td><td colspan="2">Keynote Talk: Dame Jocelyn Bell Burnell (University of Oxford)
Chair: Samar Safi-Harb
Robert B. Schultz Theatre</td></tr>
<tr><td>16:30 - 17:00</td><td colspan="2">Break</td></tr>
<tr><td>17:00 - 17:30</td><td colspan="2">Meet at 5pm to board the bus to the Conference Banquet
Chancellor’s Circle Loop</td></tr>
<tr><td>17.30 - 22:00</td><td colspan="2">Conference Banquet
Canadian Museum for Human Rights</td></tr>
</table>

Day 2: Thursday, July 6th

<table>
<tr><th colspan="3">Thursday, July 6</th></tr>
<tr><td>8:30 - 9:00</td><td colspan="2">Invited Talk: Nathalie Nguyen-Quoc Ouellette, (Trottier Institute for Research on Exoplanets)
Chair: Jessica Rodgers
Robert B. Schultz Theatre</td></tr>
<tr><td>9:00 - 9:30</td><td colspan="2">Invited Talk: Julianne Pollard-Larkin, (University of Texas, MD Anderson Cancer Center)
Chair: Jessica Rodgers
Robert B. Schultz Theatre</td></tr>
<tr><td>9:30 - 10:00</td><td colspan="2">Health Break
St. John's Galleria</td></tr>
<tr><td>10:00 - 11:30</td><td colspan="2">EDI Panel Discussion:
Julianne Pollard-Larkin (University of Texas, MD Anderson Cancer Center),
Brenda Matthews (National Research Council of Canada),
Alexandra Pedersen (McDonald Institute),
Christine Kraus (SNOLAB)
Moderator: Kim Venn (University of Victoria)
Chair: Samar Safi-Harb
Robert B. Schultz Theatre</td></tr>
<tr><td>11:30 - 12:15</td><td colspan="2">Student/Early-Career Researchers Talks: EDI & Physics Education
Chair: Juliette Mammei

11:30: Kyla Smith, University of Oxford
11:42: Samantha Lange, University of Waterloo
11:54: Solmaz Khodaeifaal, Simon Fraser University
Poster Flash Talk:
Liz Cunningham, University of Toronto
Robert B. Schultz Theatre</td></tr>
<tr><td>12:15 - 13:30</td><td colspan="2">Lunch Break
Daily Bread Cafe</td></tr>
<tr><td>13:30 - 15:30</td><td>Student/Early-Career Researchers Talks: Astronomy & Astrophysics
Chair: Chelsea Braun

13:30: Solveig Thompson, University of Calgary
13:42: Labani Mallick, California Institute of Technology
13:54: Batia Friedman-Shaw, Perimeter Institute, University of Waterloo
14:06: Rebecca Booth, University of Calgary
14:18: Xiying Zhang, University of Barcelona (withdrawn)
14:30: Anousha Greiveldinger, University of Notre Dame
14:42: Delica Leboe-McGowan, University of Manitoba
Poster Flash Talks:</td><td>Student/Early-Career Researchers Talks: Subatomic Physics
Chair: Brynne Blaikie

13:30: Portia Switzer, University of Winnipeg, University of Regina
13:42: Defne Tanger, TRIUMF
13:54: Maedeh Lavaaf, University of Manitoba
14:06: Sakshi Kakkar, University of Manitoba
14:18: Miho Wakai, University of British Columbia
14:30: Fatemeh Gorgannejad, University of Manitoba
14:42: Shefali, University of Manitoba
14:54: Akshaya Vijay, University of Manitoba
Poster Flash Talks:</td></tr>
</table>

	Kyle Wittmeier, University of Winnipeg Jiayue Yang, University of Waterloo Evelyn Macdonald, University of Toronto Tabassom Madayen, University of Toronto Yunting Wang, University of British Columbia Robert B. Schultz Theatre	Chelsea-Lea Randall, Canadian Light Source Inc. Amala Jaison, University of Manitoba Tahereh Mohammadi, University of Manitoba Samin Majidi, McGill University 118 Lecture Theatre
15:30 - 16:00	Group Photo University of Manitoba Admin Building	
16:00 - 16:30	Health Break Marshall McLuhan Hall at University Centre	
16:30 - 18.30	Speed Mentorship Marshall McLuhan Hall at University Centre	
18:30 - 19:00	Break	
19:00 - 21:00	Poster Session (with dinner) 108 Cross Common Room	

Day 3: Friday, July 7th

Friday, July 7	
9:00 - 9:30	Invited Talk: **Gabrielle Fontaine** (University of Manitoba) Chair: Jayanne English Robert B. Schultz Theatre
9:30 - 10:00	Invited Talk: **Kim Venn** (University of Victoria) Chair: Jayanne English Robert B. Schultz Theatre
10:00 - 10:30	Invited Talk: **Christine Kraus** (SNOLAB) Chair: Jayanne English Robert B. Schultz Theatre
10:30 - 11:00	Health Break St. John's Galleria
11:00 - 12:30	Career Panel Discussion: **Kristine Boone** (Photonic Inc.), **Marjorie Gonzalez** (Nuclear Medicine for Health Authorities), **Lauren Hayward** (Perimeter Institute for Theoretical Physics), **Aimee Hungerford** (Los Alamos National Lab), **Harsha Blumer** (University of Manitoba) Moderator: **Alexandra Pedersen** (McDonald Institute) Chair: Kyla Smith Robert B. Schultz Theatre
12:30 - 14:00	Lunch Break & Grad Fair Daily Bread Café & 108 Cross Common Room
14:00 - 15:00	Student Prizes and Closing Remarks: Samar Safi-Harb Robert B. Schultz Theatre

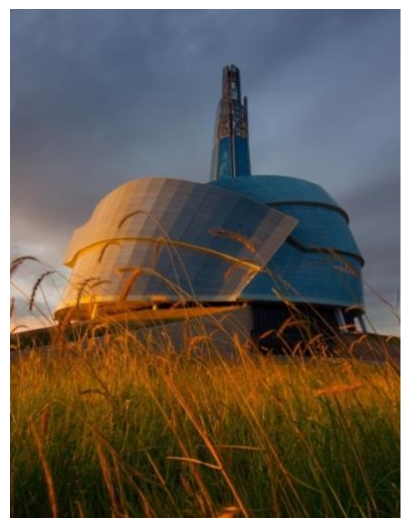
Conference Banquet at the Canadian Museum for Human Rights

Schedule

5:00pm	Bus pickup from outside the University of Manitoba Admin Building
5:30pm	Arrival at Canadian Museum for Human Rights
5:30-7:00pm	Tour of the Galleria & Reception in the Garden of Contemplation: reception drink tickets are provided in your registration package, and a cash bar is available should you wish to purchase additional drinks
7:30-9:00pm	Dinner
9:00-9:45pm	Performance by the Asham Stompers
10:00pm	Bus departure back to campus

Canadian Museum for Human Rights https://humanrights.ca

Welcome to the only museum in the world dedicated to human rights education and awareness. Canada's newest national museum is a stunning architectural icon designed by Antoine Predock. Hundreds of stories – told using the latest technologies, the oldest forms of communication and the power of art—reinforce the importance of rights for all. You can also discover the building's amazing architecture or learn the seven sacred teachings of the Anishinaabe, Cree and Dakota people on the unique Mikinak-Keya Spirit Tour.



Experience the power of human rights on a themed tour through Canada's most inspiring building. Interpretive guides at the Canadian Museum for Human Rights are ready to help you dig deeper into the stories that have shaped our world.

Image credit Gavion Orobko and text courtesy of Tourism Winnipeg

Asham Stompers www.ashamstompers.ca

The Asham Stompers are a Métis and First Nations dance group performing the Red River jig combined with traditional square dancing from First Nations communities.

Explore Winnipeg

Image credit: Esplanade Riel and The Canadian Museum for Human Rights by Zyron Paul Felix

See the page on the conference website for information about the following in and around Winnipeg:

Attractions:

- Canadian Museum for Human Rights
- The Forks
- Splash Dash River Tour
- Manitoba Legislative Building
- Manitoba Museum
- Winnipeg Art Gallery
- Assiniboine Park & Zoo
- The Leaf
- Fortwhyte Alive
- Royal Canadian Mint

Neighbourhoods:

- Fort Garry
- The Exchange District
- Saint-Boniface
- Osborne Village
- West End
- Corydon Avenue
- Chinatown

Information for Presenters

Oral Presentations

The oral presentations are on July 5th and 6th in primarily parallel sessions. Each presentation will be allocated 12 minutes: 9 minutes for the talk and 3 minutes for questions. The presentation slides will be projected from a single computer. Presenters are encouraged to make their figures colour-blind friendly to the extent possible, as well as using large, easy-to-read fonts, etc., to enable easier viewing for all participants.

Presenters are required to upload their slides a minimum of 24 hours before their session in either pdf or pptx format via this link: https://forms.gle/TsWCi3by8i4azW5j6. The file should be named "Last_First_talk.ext", for example, Janette Suherli's talk should be named Suherli_Janette_talk.pdf.

Prizes for student talks will be awarded on Friday afternoon, and the oral presentations are being judged on the following five criteria: introduction and methods; analysis, results, and next steps; flow and pace; plots and graphics; and Q&A.

Poster Presentations

The poster format is A0 size (1189 mm x 841 mm) or smaller and must be in portrait orientation. Unfortunately, the organizers do not offer poster printing options, so please ensure you bring your printed poster to the conference. Presenters are encouraged to make their figures colour-blind friendly to the extent possible, as well as using large, easy-to-read fonts, etc., to enable easier viewing for all participants.

The posters will be displayed throughout July 5th and 6th, and there will be a specific Poster Session on July 6th from 7:00-9:00pm. Participants will also have the opportunity to view the posters during the health breaks and lunch time.

Poster presenters have the option to give a “flash” talk, presenting one slide to advertise their poster in just one minute during the talk sessions.

Prizes for student posters will be awarded on Friday afternoon, and the poster presentations are being judged on the following five criteria: introduction and methods; analysis, results, and next steps; logical flows and aesthetic/legibility; plots and graphics; and overall presentation and Q&A.

Invited Speakers

Sarah Burke

A journey through the land of atoms and molecules with scanning tunnelling microscopy

Abstract

Scanning tunnelling microscopy (STM) offers a remarkable atomic-scale view of the structures of surfaces: relying on the very small and exponentially distance-dependent current of electrons tunnelling through a vacuum barrier, we can see the atoms and molecules that make up the materials of our world. Moreover, by "simply" holding a metal wire, an atom's width away from the surfaces we study, we can use this quantum mechanical trick to probe not only the surface structure, but to see how the electrons behave in these materials, providing insight into the exotic, and not-so-exotic but important things that electrons can do for us. I will share some of my own journey into the field of materials through the "lens" of STM, while sharing some of the different materials we've explored and the insights gained by this atomic-scale view. We've seen how defects serve as a powerful probe of the electronic structure of Quantum Materials, and how probing the local electronic states can help us understand and design devices and even chemical reactions.

Biography

Dr. Sarah Burke is an Associate Professor in the departments of Physics & Astronomy, and Chemistry, and a Principal Investigator in the Stewart Blusson Quantum Matter Institute at the University of British Columbia. Her research uses scanning probe microscopy techniques to investigate materials from the atomic scale up. Burke received her Bachelor's Degree from Dalhousie University in 2002 (Honours in Physics) and her Master's and Doctoral Degrees in Physics from McGill University in 2004 and 2009 respectively, where she focused on studying the growth and epitaxy of organic molecules on insulating surfaces using non-contact atomic force microscopy. She then held an NSERC Postdoctoral Fellowship at UC Berkeley with Michael Crommie where she investigated graphene nano-structures using low temperature scanning tunnelling microscopy and spectroscopy.

Since arriving at the University of British Columbia in 2010 she has built an interdisciplinary research group approaching materials questions from the atomic scale, applying these techniques to a wide range of materials from superconductors to molecular materials for future devices and controlling surface reactivity. She held the Canada Research Chair (Tier 2) in Nanoscience 2010-2020, received a Peter Wall Early Career Scholar Award for Interdisciplinary study 2011-2012, and the Killam Award for Excellence in Mentoring in 2022.

Gabrielle Fontaine

The Design and Evaluation of a Portable Microwave System for Breast Cancer Screening in Remote and Low-income Areas

Abstract

In North America, breast cancer screening is limited for women of lower socioeconomic status and those from certain racial and ethnic groups. Screening uptake is significantly lower for women in First Nation (FN) communities than non-FN populations, resulting in late-stage diagnoses. Proper access to screening is also limited in low- and middle-income countries, contributing to disproportionally high mortality rates. For my Ph.D. research, I aim to design and evaluate a portable microwave system for breast cancer screening in low-income and remote areas. To ensure this system is suitable for these communities, the device will be low in cost and size, have a user-friendly interface, and use machine learning to notify the woman of their diagnosis immediately following their scan. This system will provide accessible screening for women living in First Nation, low-income, and remote communities, thereby reducing health inequities and preventing unnecessary deaths.

Biography

Gabrielle Fontaine is a Ph.D. student in the Department of Physics and Astronomy at the University of Manitoba. Gabrielle is Anishinaabe and a proud member of Sagkeeng First Nation. Her research focuses on developing a safe, portable, and low-cost breast cancer screening system specifically for women in First Nation and Northern communities. Gabrielle has been involved with various equity, diversity, and inclusion committees within the university. Outside of academia, she is a Juno-nominated musician in the Indigenous pop-rock band, Indian City. Gabrielle primarily focuses her scientific and artistic skills to support the Indigenous Peoples of Canada.

Christine Kraus

Biography

Christine Kraus grew up in Germany and studied at Johannes Gutenberg University in Mainz, where she completed her Ph.D. on "Final Analysis of the Mainz Neutrino Mass experiment" in 2004. She moved to Canada to work on the famous SNO experiment as a Postdoc at Queen's University. The SNO collaboration was co-recipient of the 2016 Breakthrough prize. In 2010 she started a new position as Canada Research Chair at Laurentian University taking on the role of site activity coordinator on the multipurpose detector SNO+, which is located at SNOLAB – 2 km deep underground in VALE's Creigton mine. Since 2021 she works directly at SNOLAB after the financial troubles at Laurentian University that led to the cut of all physics programs.

In 2011 she received the City of Sudbury's 40 under 40 award. Looking for new exciting properties of neutrinos that might help us understand the make-up of the Universe and gain knowledge about neutrinos coming from the earth, the sun and nearby supernovas is the physics goal of SNO+. In addition, adding tellurium to the SNO+ scintillator will allow for a competitive search of neutrinoless double beta decay, which if discovered will enhance our knowledge of how the Universe came to be. SNOLAB has a broad physics and other science program, making important contributions to the field of neutrino and dark matter science while being a wonderful place to perform world-leading research.

Juliette Mammei

The role of luck in shaping my life/career

Abstract

In this talk I will talk about my personal journey from being an economically disadvantaged, female adolescent to a Canadian subatomic physicist, mother, EDI advocate and everything else that I am. My current work is focussed on parity-violating electron scattering experiments to measure nuclear and nucleon properties. Although I always knew I wanted to be a scientist, I had no idea what a nucleon, or parity, or any number of things even were. I knew I wanted to go to college, but not where, or how, or which major to have or…. I knew I wanted to have children but had no idea what would go into trying to balance a full-time career, and a family, and to develop myself as a person. I will talk about the role that luck (and taking those opportunities that were presented) had in guiding me to where I am now.

Biography

Dr. Mammei is an Associate Professor at the University of Manitoba. She received her PhD from Virginia Tech in 2010, with a thesis that described her work on the parity-violating electron scattering (PVES) experiments Qweak and G0. Recently, she completed two experiments measuring the weak charge distribution in heavy nuclei using PVES, PREX and CREX, which provide information about the neutron matter equation of state. These experiments were theoretically clean measurements of the neutron radius, which relates to neutron star radii by providing the slope of the symmetry energy in the neutron matter equation of state. The majority of her time is spent preparing for the future MOLLER experiment, which will make an ultra-precise measurement of the weak mixing angle in order to search for Physics Beyond the Standard Model. Dr. Mammei always knew she wanted to be a scientist, even before she knew what a scientist was. She has known she wanted to be a nuclear physicist since high school, and was disappointed when the top quark was discovered her junior year (she wanted to discover it!). Through hard work, and a little bit of luck, she ended up working at Thomas Jefferson National Accelerator Facility (JLAB), in Newport News, VA, where she continues to run experiments as described above. She lives in Winnipeg with her 3 kids, 2 dogs, cat and cockatiel… and her husband.

Nathalie Nguyen-Quoc Oullette

Unveiling the Cosmos with the JWST

Abstract

The James Webb Space Telescope (JWST) has finally launched and has been dazzling the entire world with its amazing images and discoveries! The Webb Telescope, a 6.5m infrared telescope, is without a doubt one of the most complex machines ever built by humanity and the largest telescope ever sent to space. Thanks to Webb, we now have the capacity to see farther than ever in our Universe, peer through the cosmic dust sprinkled throughout galaxies and discover and study new alien worlds. This project is an international collaboration between NASA, the European Space Agency and the Canadian Space Agency. In addition to contributing the FGS/NIRISS instrument, Canada and its astronomers are already some of the first to use the telescope and have already begun producing groundbreaking science thanks to its revolutionary data.

Biography

Nathalie Nguyen-Quoc Ouellette is an astrophysicist, science communicator and lifetime lover of all things space! She obtained her Ph.D. in Physics & Astronomy at Queen's University in Kingston, Ontario in 2016. Her research focuses on galaxy formation and evolution, particularly those found in clusters. Nathalie is currently the Deputy Director of the Trottier Institute for Research on Exoplanets (iREx) and the Mont-Mégantic Observatory (OMM) at the University of Montréal and is also the Outreach Scientist for the James Webb Space Telescope in Canada collaborating with the Canadian Space Agency. She is a frequent contributor and analyst in Canadian media on everything related to space. She also organises and participates in science outreach events from local to international scales to encourage the interest and participation of youth and the general public in space science and to increase scientific literacy in Canada.

Julianne Pollard-Larkin

Attitude, Aptitude and Altitude: My Journey from Physics Student to Physics Leader!

Biography

Dr. Julianne Pollard-Larkin is an Associate Professor of Medical Physics at the University of Texas, MD Anderson Cancer Center in Houston, TX. She is the Service Chief medical physicist in MD Anderson's Thoracic Radiation Oncology Clinic. Dr. Pollard-Larkin also conducts clinical research and mentors and teaches Medical Physics residents, Radiation Oncology residents and graduate students. Her primary research interests include Flash ultra-high dose radiotherapy, pacemaker radiotherapy dose measurements and improving the efficacy of motion management in thoracic treatments and radiobiology. Julianne is also the Chair of the American Association of Physicists in Medicine's (AAPM) Equity, Diversity and Inclusion committee as well as the chair of the American Institute of Physics' (AIP) Liaison Committee on Underrepresented Minorities (LCURM).

She received her PhD in Biomedical Physics at UCLA and her B.S. in Physics and Mathematics at the University of Miami in Coral Gables, Fl. After receiving her PhD at UCLA, Julianne was accepted into the Medical Physics Residency program at MD Anderson in Houston, Tx. Following her residency, Julianne was hired by MD Anderson as faculty.

Beyond her role in the clinic and classroom, Julianne is a firm believer in outreach and increasing the number of women and underrepresented populations in science. Ensuring that more underrepresented students and women follow in her footsteps is Julianne's passion.

Kim Venn

Biography

Kim Venn is a Professor in Physics & Astronomy at the University of Victoria. She is an international leader in the study of stars and galaxies, including the development of new instrumentation and research tools at astronomical observatories. Her scientific interests include the structure and evolution of dwarf galaxies and observational constraints on the nucleosynthesis of the elements. She held a Canada Research Chair at UVic (2005-2015), the Clare Boothe Luce Professorship at Macalester College in St. Paul, MN (1995-2005) and was recipient of the Presidential Early Career Award in Science and Engineering (2000). She is the Director of the UVic Astronomy Research Centre, the PI for an NSERC CREATE training program on New Technologies for Canadian Observatories (2017-2023), and currently is Board Chair for the Association of Canadian Universities for Research in Astronomy (ACURA). Venn has been a prolific researcher, supervisor, and collaborator, with over 300 publications in the astronomical literature.

Workshops

Maude Lizaire

AI 101 for physicists

Abstract

Artificial intelligence (AI) broadly refers to the use of machines and computers to solve problems and achieve tasks associated with human intelligence. It encompasses a broad number of technologies, but the recent widespread use of the term AI mainly refers to advances made in the field of deep learning. As such, the goal of this workshop is to provide physicists with a clear picture of core concepts and tools of deep learning. We first cover the basic principles of machine learning, such as the bias-variance trade off and gradient-based methods. Then, we will focus on developing a concrete understanding of neural network architectures, their motivations, limitations and applications.

Biography

Maude Lizaire is a Ph.D candidate at Mila – Quebec Artificial Intelligence Institute, a Vanier scholar, and a former co-organizer of the WIPC 2019. Her research lies at the intersection of machine learning, formal languages, and tensor network methods. Before her journey in AI began, Maude completed a B.Sc. in Mathematics and Physics at Université de Montréal. She then pursued experimental physics for her master's degree, focusing on high temperature superconductors, at the Institut quantique of Université de Sherbrooke. After a brief period working in the startup world, Maude participated in the AI4Good Lab,a bootcamp designed to introduce women across Canada with a STEM background to the field of AI. The inclusive and multidisciplinary nature of this experience inspired her to return to academia for her doctoral studies in computer science where she continues to advocate for underrepresented groups in STEM as a member of Mila's Equity, Diversity, and Inclusion committee.

Gwendolyn Eadie

An introduction to Bayesian inference using m&m's candy

Abstract

In this workshop, you will learn the fundamentals and basics of Bayesian statistics in a fun and interactive tutorial. No previous experience with Bayesian analysis is required, and a Jupyter notebook will be supplied to help you learn and explore how Bayesian inference works with real data. The workshop will start with a short introduction about Bayes Theorem, followed by the example using m&m's chocolates. Everyone will be given real data (yes, chocolates!), and will use the Jupyter notebook to perform Bayesian inference on this data given the model provided. You will have time to compare and discuss the results of your Bayesian inference with your peers, and then we will discuss our results as a group.

Biography

Dr. Gwendolyn Eadie is an Assistant Professor of astrostatistics at the University of Toronto (U of T), jointly-appointed in the David A. Dunlap Department of Astronomy & Astrophysics and the Department of Statistical Sciences. Before joining the U of T in 2019, Dr. Eadie was a Moore/Sloan and Washington Research Foundation eScience Postdoctoral Fellow and a DIRAC Institute Postdoctoral Fellow at the University of Washington in Seattle, WA. She completed her PhD at McMaster University in 2017, with a focus on hierarchical Bayesian models of the Milky Way's mass, and was awarded the 2018 J.S. Plaskett Medal by the Canadian Astronomical Society (CASCA) for the most outstanding PhD thesis in the preceding two calendar years. At the U of T, Gwen has established an interdisciplinary Astrostatistics Research Team composed of astronomers and statisticians; their research includes hierarchical Bayesian modeling, time series analysis, and multivariate analysis applied to objects ranging from the Milky Way to globular clusters and individual stars. Outside of work, she enjoys figure skating, travelling, and spending time with friends and family.

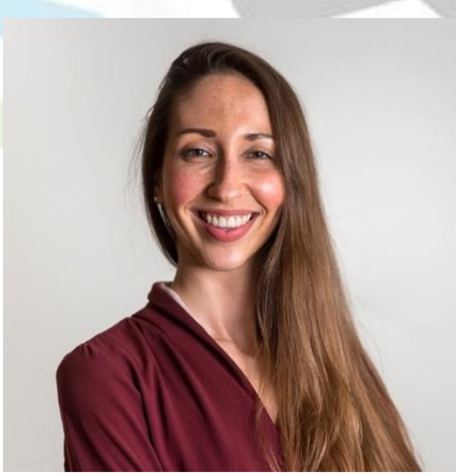
EDI Panel

Moderator Kim Venn is joined by

Christine Kraus

Julianne Pollard-Larkin

Alexandra Pedersen



Brenda Matthews

Kim Venn

Biography

Kim Venn is a Professor in Physics & Astronomy at the University of Victoria. She is an international leader in the study of stars and galaxies, including the development of new instrumentation and research tools at astronomical observatories. Her scientific interests include the structure and evolution of dwarf galaxies and observational constraints on the nucleosynthesis of the elements. She held a Canada Research Chair at UVic (2005-2015), the Clare Boothe Luce Professorship at Macalester College in St. Paul, MN (1995-2005) and was recipient of the Presidential Early Career Award in Science and Engineering (2000). She is the Director of the UVic Astronomy Research Centre, the PI for an NSERC CREATE training program on New Technologies for Canadian Observatories (2017-2023), and currently is Board Chair for the Association of Canadian Universities for Research in Astronomy (ACURA). Venn has been a prolific researcher, supervisor, and collaborator, with over 300 publications in the astronomical literature.

Christine Kraus

Biography

Christine Kraus grew up in Germany and studied at Johannes Gutenberg University in Mainz, where she completed her Ph.D. on "Final Analysis of the Mainz Neutrino Mass experiment" in 2004. She moved to Canada to work on the famous SNO experiment as a Postdoc at Queen's University. The SNO collaboration was co-recipient of the 2016 Breakthrough prize. In 2010 she started a new position as Canada Research Chair at Laurentian University taking on the role of site activity coordinator on the multipurpose detector SNO+, which is located at SNOLAB – 2 km deep underground in VALE's Creigton mine. Since 2021 she works directly at SNOLAB after the financial troubles at Laurentian University that led to the cut of all physics programs.

In 2011 she received the City of Sudbury's 40 under 40 award. Looking for new exciting properties of neutrinos that might help us understand the make-up of the Universe and gain knowledge about neutrinos coming from the earth, the sun and nearby supernovas is the physics goal of SNO+. In addition, adding tellurium to the SNO+ scintillator will allow for a competitive search of neutrinoless double beta decay, which if discovered will enhance our knowledge of how the Universe came to be. SNOLAB has a broad physics and other science program, making important contributions to the field of neutrino and dark matter science while being a wonderful place to perform world-leading research.

Brenda Matthews

Biography

Dr. Brenda Matthews is an astronomer with the National Research Council of Canada, located at the Herzberg Astronomy & Astrophysics Research Centre in Victoria, BC. Her research is focused on exoplanetary systems, particularly the cold belts of comets called debris disks because of the dust and gas that are rendered detectable through cometary collisions. Dr. Matthews has led extensive observing campaigns to detect and characterize debris disk over the last decade, including key programs on the Herschel Space Observatory and the James Clerk Maxwell Telescope, and she subsequently authored or co-authored two substantive reviews on debris disks. Dr. Matthews is an expert on observations from the infrared to centimetre regime, particularly interferometry and polarimetry. She acted as past Chair of the Equity and Inclusivity Committee for the Canadian Astronomical Society and served on Canada's Astronomy and Astrophysics Long Range Plan 2020. She currently serves on the Science Advisory Committee for the ngVLA, a next generation Very Large Array.

Alexandra Pederson

Biography

Alexandra Pedersen (she/her) joined the **McDonald Institute** in 2019 as a Business Development Officer and is transitioning to a Manager, EDII Capacity Building role in 2023. Alex, as she prefers, earned a PhD in Human Geography (Queen's University) and holds a Master's in International Studies (University of Northern British Columbia). Her graduate research focused on Indigenous Peoples and non-Indigenous communities' experiences with, and resistance to, imposed development. At the McDonald Institute, as part of the external relations teams, Alex builds new partnerships and nurtures existing collaborations. She co-developed a Diversity and Equity Assessment Planning Tool with the Human Rights and Equity Office (Queen's) for Individual Researchers; a self-assessment guide and yearly planning activity for faculty in physics to increase their EDII skills and action in the labs and research spaces. Alex contributes to several EDII Committees at Queen's University, in addition to acting as the co-treasurer for the Queen's University Association for Queer Employees. Outside of her work roles, Alex is the President of the Limestone Beekeepers' Guild, and can be found in her apiary buzzing with the bees.

Julianne Pollard-Larkin

Biography

Dr. Julianne Pollard-Larkin is an Associate Professor of Medical Physics at the University of Texas, MD Anderson Cancer Center in Houston, TX. She is the Service Chief medical physicist in MD Anderson's Thoracic Radiation Oncology Clinic. Dr. Pollard-Larkin also conducts clinical research and mentors and teaches Medical Physics residents, Radiation Oncology residents and graduate students. Her primary research interests include Flash ultra-high dose radiotherapy, pacemaker radiotherapy dose measurements and improving the efficacy of motion management in thoracic treatments and radiobiology. Julianne is also the Chair of the American Association of Physicists in Medicine's (AAPM) Equity, Diversity and Inclusion committee as well as the chair of the American Institute of Physics' (AIP) Liaison Committee on Underrepresented Minorities (LCURM).

She received her PhD in Biomedical Physics at UCLA and her B.S. in Physics and Mathematics at the University of Miami in Coral Gables, Fl. After receiving her PhD at UCLA, Julianne was accepted into the Medical Physics Residency program at MD Anderson in Houston, Tx. Following her residency, Julianne was hired by MD Anderson as faculty.

Beyond her role in the clinic and classroom, Julianne is a firm believer in outreach and increasing the number of women and underrepresented populations in science. Ensuring that more underrepresented students and women follow in her footsteps is Julianne's passion.

Career Panel

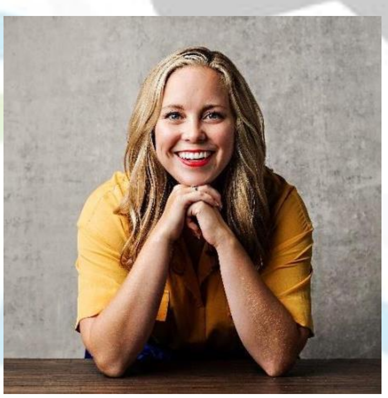
Moderator Alexandra Pedersen is joined by

Harsha Blumer

Lauren Hayward

Marjorie Gonzalez

Kristine Boone



Aimee Hungerford

Alexandra Pederson

Biography

Alexandra Pedersen (she/her) joined the **McDonald Institute** in 2019 as a Business Development Officer and is transitioning to a Manager, EDII Capacity Building role in 2023. Alex, as she prefers, earned a PhD in Human Geography (Queen's University) and holds a Master's in International Studies (University of Northern British Columbia). Her graduate research focused on Indigenous Peoples and non-Indigenous communities' experiences with, and resistance to, imposed development. At the McDonald Institute, as part of the external relations teams, Alex builds new partnerships and nurtures existing collaborations. She co-developed a Diversity and Equity Assessment Planning Tool with the Human Rights and Equity Office (Queen's) for Individual Researchers; a self-assessment guide and yearly planning activity for faculty in physics to increase their EDII skills and action in the labs and research spaces. Alex contributes to several EDII Committees at Queen's University, in addition to acting as the co-treasurer for the Queen's University Association for Queer Employees. Outside of her work roles, Alex is the President of the Limestone Beekeepers' Guild, and can be found in her apiary buzzing with the bees.

Kristine Boone

Biography

Kristine Boone, PhD, works with the outreach and technical teams at Photonic Inc. Prior to the recent move, she was a Business Development Representative for Quantum Engineering Solutions at Keysight Technologies. Dr. Boone started her industry career as a researcher at the quantum computing start-up Quantum Benchmark Inc. (acquired in 2021 by Keysight) and obtained her PhD from the University of Waterloo's Institute for Quantum Computing (IQC). Her research focused on the characterization of quantum computers, in particular on developing protocols to diagnose error ubiquitously present in quantum computations.

Harsha Blumer

Biography

Dr. Harsha Blumer is a Technology Transfer Manager at the Partnerships, Knowledge Mobilization and Innovation Office of the University of Manitoba. In this role, she supports the university's knowledge exchange, manages intellectual property and technology transfer activities. She also holds an Adjunct Professor position at the Dept. of Physics & Astronomy of West Virginia University and her research focuses on the radio and high-energy astrophysics of pulsars and magnetars.

Harsha obtained an M.Sc. in Physics, an M.Tech. in Space and Atmospheric Sciences, and a Ph.D. in Astrophysics from the University of Manitoba, where she received the prestigious Governor General's Academic Gold Medal. She completed her postdoctoral research at West Virginia University, where she also served as a Research Scientist and Project Director for Pulsar Search Collaboratory, an astronomy education program for high school students and teachers. She has a deep passion for empowering young minds, women, and minorities to pursue STEM careers, and strongly advocates for equity, diversity and inclusion in the realms of science and technology.

Marjorie Gonzalez

Biography

Marjorie Gonzalez started in Astrophysics and graduated with a Masters degree from the University of Manitoba and a PhD degree from McGill University. She then worked as a Postdoc in Astrophysics at UBC, before switching fields and graduating with a Masters degree in Medical Physics from UBC. For the past 11 years, she has worked as a Medical Physicist and Radiation Safety Officer in Nuclear Medicine for Health Authorities in BC. She is currently working with Interior Health and is based in Kelowna, BC. In 2022, she started a consulting business helping other clinics and hospitals with their medical physics and radiation safety needs. Outside of work, she is an amateur birder and volunteers for a local conservation group in Kelowna.

Lauren Hayward

Biography

Lauren Hayward is a Teaching Faculty member at the Perimeter Institute for Theoretical Physics, and an Adjunct Assistant Professor in the Department of Physics and Astronomy at the University of Waterloo. Lauren works within the field of computational quantum matter physics, and her research interests involve using numerical methods to study phases of quantum many-body systems. She develops academic programs and teaches courses in statistical mechanics, condensed matter theory and machine learning. She is the co-host of the podcast "Conversations at the Perimeter", where she interviews scientists working to unravel the mysteries of the universe.

Aimee Hungerford

Biography

Aimee Hungerford received her PhD from the University of Arizona in Astrophysics and was awarded a Director's Postdoctoral Fellow at Los Alamos National Lab (LANL) in 2004. In 2005 she was hired into a staff scientist position in LANL's Computer and Computational Sciences (CCS) Division. She has remained at LANL since that time and has served in a variety of technical leadership roles across CCS, X-Theoretical Design and X-Computational Physics divisions. Her technical expertise includes astrophysics (computational modeling of supernovae), weapons assessment, and multiphysics code development. She has served as project lead for projects in Defense Program's Office of Experimental Sciences (OES), and Advanced Simulation and Computing (ASC). She is currently LANL's Deputy Director for the ASC Program.

Oral Abstracts

Condensed Matter & Plasma Physics

Kaylee Biggart
University of Waterloo

A quest to build high precision and durable capacitive thermometers for use in low temperature thermal Hall measurements

In a society ever dependent on technology, the search for materials to revolutionize technological advancements is increasingly urgent and important. Researchers embark on a cyclical global strategy of discovery, fabrication, and further discovery. As part of this global strategy, the study of quantum materials plays a crucial role in revolutionizing technology as we know it today.

One important area of quantum materials research is utilizing a phenomenon called the thermal Hall effect, wherein a temperature gradient is applied in one direction, a magnetic field is applied perpendicular to the temperature gradient, and as a result, a temperature gradient transverse to both the applied field and applied temperature gradient may be observed. By invoking and measuring this phenomenon, exotic and novel charge neutral excitations can be studied, providing valuable knowledge of the quantum properties of a material.

To perform thermal Hall measurements, the temperature of various points of the sample must be measured precisely and accurately in high magnetic fields. To satisfy this requirement, our research group fabricates SrTiO3 capacitive thermometers that are sensitive enough to detect temperature changes of 1 part in 10,000 while being insensitive to applied magnetic fields. We present a novel fabrication method to ensure the thermometers perform reliably upon many iterations of thermal cycling. By increasing the lifetime of the thermometers, experimental efficiency increases, and our research group can contribute more essential knowledge and findings to the study of quantum materials, and perhaps even spark a revolution of technology.

Christina Balanduk
University of Manitoba

Design and development of a 3D printed mini terahertz spectrometer

Time domain terahertz (THz) spectroscopy is a powerful tool for the characterization of a wide variety of materials. However, THz based measurement techniques can be expensive due to the required specialty optics. Additionally, THz light is challenging to detect even using specialized detectors, making the alignment challenging. This work aims to develop a 3D printed mini THz spectrometer which addresses these issues. This project demonstrates the ability to cheaply develop THz based experiments with a small footprint which may be easily mounted to an optics table. The spectrometer is designed to allow for simple installation of the apparatus with minimal alignment requirements. The presented apparatus is inspired by a broadband GaP transmission THz spectrometer[1] and will apply electro-optic sampling along side pump probe techniques to obtain time resolved measurements.

[1] J. Gibbs, "Broadband TeraHertz time domain spectroscopy for rapid material characterization," Master's thesis, 2022

Tahreem Yousaf
University of Saskatchewan

Helium Ion Implantation Studies of Tungsten and Tungsten Alloys for Fusion Plasma-Facing Components

Plasma fusion devices will require plasma-facing components (PFCs) that can endure the harsh environment at the hot plasma's edge [1]. Studies of materials suitability for fusion PFCs require experiments that can simulate the ion bombardment associated with fusion edge plasmas [2-3]. Currently, tungsten is considered the best candidate for PFCs due to its high melting point, strong mechanical properties, and low erosion rate. However, studies have shown tungsten to go under extreme morphology change when it is bombarded by a high fluence of low-energy ions from helium and deuterium plasmas (i.e., primarily low-energy He+ ions, and deuterons). The impact of helium ion bombardment on pure tungsten, and tungsten heavy alloy (W-HA) NAECOMET 1000, (90%W-6%Ni-4%Cu) is investigated. For this study, pure tungsten and NAECOMET 1000 samples were implanted with 3 keV helium ions with fluences ranging from $1.15 \times 10^{21} m^{-2}$ to $2.21 \times 10^{21} m^{-2}$, using Plasma Immersion Ion Implantation (PIII). After PIII treatment, samples were analyzed using field emission scanning electron microscopy (Fe-SEM) and atomic force microscopy (AFM), which revealed differences in surface morphology and topography of implanted samples. X-ray diffraction (XRD) studies showed peak shifts increasing with helium ion fluence for both the pure W and NAECOMET 1000 samples, as well as an increase in mean crystallite size, confirming the distortion of the lattice. XPS compositional analysis showed a strong oxidation (> 97 %) near the metal surface, after helium PIII treatment, for both pure W and NAECOMET 1000 W-HA samples. Some conclusions about the potential suitability of W-HA materials for fusion plasma PFCs are drawn.

[1] T. Hirai et al., "Use of tungsten material for the ITER divertor", Nuclear Materials and Energy 9, pp. 616-622 (2016).
[2] M. J. Baldwin and R. P. Doerner, "Formation of helium induced nanostructure 'fuzz' on various tungsten grades," J. Nucl. Mater. 404, no. 3, pp. 165–173 (2010).
[3] K. Tokunaga et al., "Blister formation and deuterium retention on tungsten exposed to low energy and high flux deuterium plasma," J. Nucl. Mater., 337–339, pp. 887–891 (2005).

Nasrin Azari
Simon Fraser University

μ+ Knight Shift Measurements of UTe2: Evidence for Kondo Liquid Emergence and Relocalization

N. Azari[1], M. R. Goeks[1], M. Yakovlev[1], M. Abedi[1], S. R. Dunsiger[1,2], S. M. Thomas[3], J. D. Thompson[3], P. F. S. Rosa[3], and J. E. Sonier[1]

1 Department of Physics, Simon Fraser University, Burnaby, British Columbia V5A 1S6, Canada
2 Centre for Molecular and Materials Science, TRIUMF, Vancouver, British Columbia V6T 2A3, Canada
3 Los Alamos National Laboratory, Los Alamos, New Mexico 87545, USA
*Presenting author: Nasrin_azari@sfu.ca

Following the discovery of superconductivity in the heavy fermion compound UTe_2 in 2019 [1], our research group has focused on exploring its magnetic properties using muon spin relaxation/rotation (μSR) techniques [2, 3]. UTe_2 is considered a rare candidate for spin-triplet superconductivity, with the possibility of spin-triplet pairs being formed through either ferromagnetic or antiferromagnetic fluctuations. The magnetic fluctuations in UTe_2 have been a subject of debate, as it is uncertain whether they are ferromagnetic or antiferromagnetic in nature. For example, the first μSR study in our group provided evidence for ferromagnetic fluctuations coexisting with superconductivity [2], while inelastic neutron scattering measurements detected antiferromagnetic fluctuations. The results of our second μSR measurements on UTe_2 have indicated the presence of magnetically phase separated regions within the samples. We demonstrated that there are magnetic clusters in the sample that gradually freeze below ~0.2K. In our third study we have investigated the local magnetic susceptibility of UTe_2 in the normal state by transverse field muon spin rotation (TF- μ SR) via positive muon (μ+) Knight shift measurements. According to our results UTe_2 can be described by the two-fluid model of Kondo lattice systems [4] in which the collective hybridization between conduction and heavy electrons forms an itinerant heavy-electron fluid as well as a Kondo impurity fluid. Our findings indicate that prior to the onset of superconductivity, the itinerant heavy-electron fluid is partially arrested by competing magnetic correlations between localized U 5*f*-moments, which may be fundamental to the interactions responsible for spin-triplet superconductivity in UTe_2.

[1]. S. Ran et al., Science 365, 684 (2019).
[2]. S. Sundar et al., Phys. Rev. B 100, 140502 (2019).
[3]. S. Sundar et al., Commun Phys 6, 24 (2023).
[4]. S. Nakatsuji, et al., Phys. Rev. Lett. 92, 016401 (2004).

Ying Yang
University of Manitoba

Creating BIC via long-distance coherently coupled cavity magnonics

Ying Yang[1], Yihui Zhang[1], Jiguang Yao[1], Yang Xiao[2], Jun Li[1,3], Can-Ming Hu[1]

1 Department of Physics and Astronomy, University of Manitoba, Winnipeg R3T 2N2, Canada
2 Department of Physics, Nanjing University of Aeronautics and Astronautics, Nanjing 210016, China
3 MOE Key Laboratory of Advanced Micro-Structured Materials, School of Physics Science and Engineering, Tongji University, Shanghai 200092, China

We couple the dielectric resonator supporting the cavity-BIC and the negative damping to the YIG sphere remotely and indirectly, to access the coherent coupling between the cavity and magnon modes mediated by the waveguide over 1 meter. In the transmission response, the polariton-BIC is put forward in the long-distance coherent coupling system of the negative-damping cavity mode and the positive-damping magnon mode, with extremely sharp dips and 0 group velocities. Multi-dimensional tunability help us to realize the transfer and evolution from the cavity-BIC to the polariton-BIC, which illustrates a wishbone shape in the cavity-like eigenmode or a waterdrop shape in the magnon-like eigenmode. A model of indirect coupling involving the negative damping and the back action is proposed and explains our results well. In our work, the magnon-polariton damping is engineered arbitrarily close to 0 or even negative. It's of paramount importance for polaritonic devices that the BICs with localized electromagnetic energy could be transferred and exchanged to different system in macroscopic distance with high efficiency due to energy exchange. This high-level remote control gives access for BIC transfer links help us to build strategies that are related to cloaking, nonlinear optics, sensing and monitoring, as well as optical neural networks.

Medical Physics & Biophysics

Nisha Agarwal
University of Ontario Institute of Technology

Spectral recognition of complex biomolecules by studying their interaction with noble metal nanoparticles

Nano-imaging and Spectroscopy Laboratory, Faculty of Science, University of Ontario Institute of Technology, 2000 Simcoe Street North, Oshawa ON L1G0C5, Canada

All molecules can be identified through their signature fingerprint that is the vibrations without the need for labeling or tagging the molecule to a fluorophore. Although the process of vibration detection using Raman spectroscopy seems trivial, there are several nuances to consider. For instance, the excitation wavelength used to excite the molecule, detection of molecules with different conformations, identification of molecules in trace concentrations and scaling the process from simple to complex biomolecules. Some of these challenges can be overcome by employing tailored nanoparticles that interact with these molecules to enhance the weak Raman signals, otherwise known as Surface Enhanced Raman Spectroscopy (SERS).

In my talk, I will introduce the pulsed laser ablation technique to create rigid nanostructured substrates that give specific, sensitive, reproducible and repeatable signals of the analyte. These substrates provide significant advantage over traditional colloidal solutions for SERS applications. I will highlight the spectral detection of these nanostructured substrates from simple molecules such as Rhodamine 6G and apomorphine to complex biomolecules such as proteins. This will include strategies to increase the performance of the SERS substrates with good reliability.

Melissa Anderson
University of Manitoba

Mousebed and Anaesthetic Delivery System for In Vivo MRI

A 3D printed mousebed and anaesthetic device were designed and tested for use in a 7 T MRI machine. Images were obtained with samples in a radiofrequency (RF) coil inside the mousebed and with samples in the RF coil with makeshift holders to determine if the 3D printed mousebed could provide similar quality images and easier setup. Spin echo images were acquired of a 15 mL water phantom with the following parameters: field of view of 2cmx2cm, 64x64 matrix size, and slice thickness of 2mm. The full width at half maximum (FWHM) of the distribution gives an indication of the image quality. With arbitrary values for signal intensities, comparisons of FWHM between images can be fairly made comparing the ratio of the FWHM and mean of the signal intensity. Oscillating gradient spin echo (OGSE) measurements were made of an unpreserved mouse head and the apparent diffusion coefficient (ADC) of the mouse brain was calculated to assess image quality of the type of image needed to infer axon diameters. The ADC of the mouse brain was found to be $0.2\pm0.1\mu m^2/ms$. The mousebed had a ratio of 0.11 ± 0.02 and the plastic holder produced images with a ratio of 0.069 ± 0.003. The mousebed and anaesthetic device satisfactorily centered the sample in the magnet without causing noticeable artifacts in the images. The anaesthetic device fit around the nose of the unpreserved mouse. We are now ready to test the device on a live mouse and proceed with measurements of axon diameters.

Cassandra Miller
University of British Columbia

The impact of tumour size and phenotype on dose rates of Lu-17 and Ac-225 in tumour cells using computational modelling of tumour growth

Cassandra Miller[1,2], Ivan Klyuzhin[1], Guillaume Chaussé[3], Julia Brosch-Lenz[1], Gabriele Birindelli[4], Kuangyu Shi[5], Babak Saboury[6], Arman Rahmim[1,2,3,4], and Carlos Uribe[3,4]

1 Department of Integrative Oncology, BC Cancer Research Institute, Vancouver, BC, Canada
2 Department of Physics, University of British Columbia, Vancouver, BC, Canada
3 Functional Imaging, BC Cancer, Vancouver, BC, Canada 4Department of Nuclear Medicine, Inselspital, University of Bern, Bern, Switzerland
5 Department of Radiology, University of British Columbia, Vancouver, BC, Canada
6 Department of Radiology, Hospital of the University of Pennsylvania, Philadelphia, PA, United States of America

Introduction: Radiopharmaceutical therapies (RPTs) with alpha-emitting radioisotopes have shown promising results for cancer treatment. However, there are large variations in tumour phenotypes among and within patients, which may make standardized treatments less effective for some. We use tumour growth simulations to compare ^{225}Ac dose rates (DRs) to tumours of varying sizes and phenotypes in a prostate cancer model.

Methods: We used a mathematical tumour growth model to generate 2D tumour cross-sections. Three tumour phenotypes were generated: mostly necrotic (type 1), hypoxic (type 2), or normoxic (type 3) tumours. 96.5%, 3%, and 0.5% of the radioactivity went to the normoxic, hypoxic, and necrotic cells (based on the percentage of oxygen present in those cells) and 0% went to normal cells/blood vessels. Cellular dose kernels were created using GATE Monte Carlo software. To determine the pharmaceutical uptake in the cell cytoplasm and membrane to scale the dose kernels, a standardized internalization assay was performed to determine the activity in each cell region at multiple time points. The kernels were convolved with the tumour images to yield DR maps and the mean DR per injected activity (DR/A) was determined.

Results and Conclusion: We observed that healthy tissues may be spared more in normoxic tumours, and higher DR/A was seen in smaller tumours, which is expected considering the short range of alpha particles. Overall, we observed that DR/A varied significantly with tumour phenotype, suggesting that standardized treatment may impact all patients differently and personalized treatment is ideal.

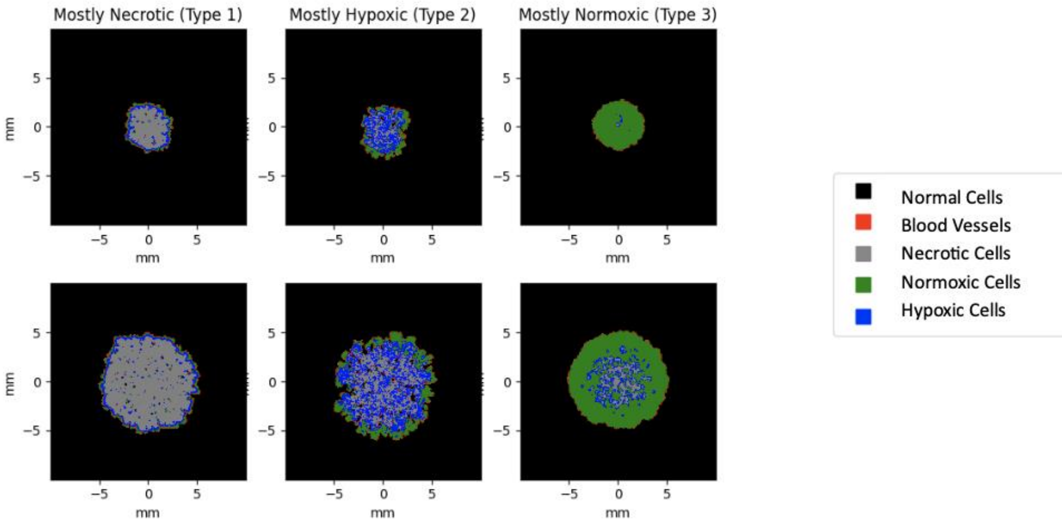


Figure 1: Images of the different tumour phenotypes generated in this study. The top row shows small tumours (5.5 mm diameter) and the bottom large tumours (10 mm diameter).

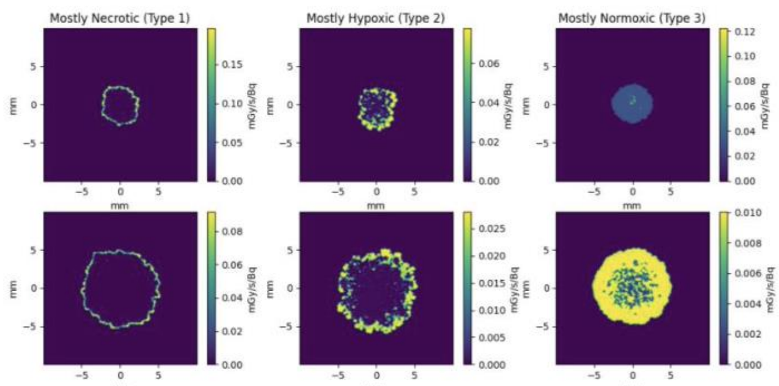


Figure 2: Dose rate maps in units of mGy/s/Bq corresponding to the different tumour phenotypes shown in Figure 1.

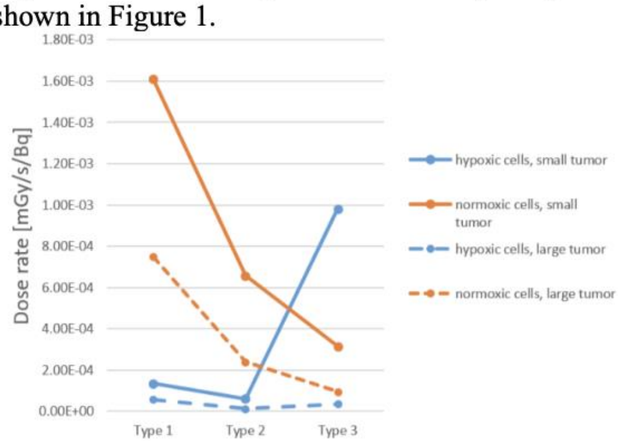


Figure 3: Mean DR/A per cell type for the different phenotypes and tumour sizes.

Emma Friesen
University of Winnipeg

Measuring Axon Diameters within the Mouse Corpus Callosum using Oscillating Gradient Spin Echo MRI Sequences

Emma Friesen[1], Jiaqi Cui[2], Madison Chisholm[3], & Dr. Melanie Martin[4]

1 Department of Biochemistry, University of Winnipeg
2 School of Computer Science, Sichuan University
3 Department of Neuroscience, University of Winnipeg
4 Department of Physics, University of Winnipeg

The brain is made of billions of cells called neurons, which are responsible for conducting electrical signals between the central nervous system and the rest of the body. The axon is the thread-like projection of the neuronal cell body and is usually insulated by the myelin sheath. The two hemispheres of the brain are connected by a white matter tract called the corpus callosum and the degeneration and dysfunction of axons within this brain region is indicative of many disorders, including Multiple Sclerosis. Such degeneration can be seen in the decreasing diameters of axons within the corpus callosum.

Current methods for measuring axon diameters require ex vivo tissue samples and electron microscopy analysis. Recently, Magnetic Resonance Imaging (MRI) is proving to be a useful tool for measuring axon diameters. Oscillating Gradient Spin Echo (OGSE) MRI pulse sequences can be used to probe micron-sized structures within the sample. This project investigated the use of OGSE sequences to measure axon diameters in the mouse corpus callosum. A CDI (Clostridioides difficile Infection) male mouse was anesthetized using isoflurane and perfused according to University of Winnipeg and Manitoba CACC protocol. Following sacrifice, the mouse brain in skull was isolated then soaked in paraformaldehyde for 48 hours, followed by phosphate buffered saline for another 48 hours prior to imaging. The mouse brain was then transferred to a holding tube filled with Fomblin and the tube was placed inside the 21 cm horizontal bore 7 Tesla Bruker Magnet. Images were registered, ROIs were drawn in the corpus callosum, and axon diameters within the corpus callosum were inferred using custom-built Matlab code.

Axon diameters in various regions of the corpus collosum were inferred to be $5.4\pm0.8\mu m$, $5.3\pm0.7\mu m$ and 6 ± 1 μm. MRI using OGSE pulse sequences can probe micron-sized axons in fixed biological tissues. The next step is to reduce the uncertainty in the measurements. The authors would like to acknowledge funding from NSERC and Mitacs, as well as assistance with animal care from Rhonda Kelly.

EDI & Physics Education

Kyla Smith
University of Oxford

What is out-of-field teaching and why does it matter for physics?

Out-of-field teaching occurs when there is a mis-match between a teacher's expertise and what they are teaching. Within the science disciplines, each of biology, chemistry, and physics have their own specialised knowledge, solution methods, experimental techniques, jargon, and symbols, yet the assignment of high school science teachers often does not reflect these differences in knowledge and training. Therefore, teachers trained in biology or chemistry may feel out-of-field when teaching physics.

Teacher self-efficacy is a teacher's belief in their capability to organize and execute particular teaching tasks. This study investigates teachers' self-efficacy in the different science disciplines and compares the teacher self-efficacy of in- versus out-of-field teachers. The study adopts social cognitive theory as a theoretical framework in an effort to centre and value the voices, experiences, and knowledge of teachers. This presentation will discuss some of the issues faced by those teaching out-of-field in physics, as well as the implications of this for physics students.

Samantha Lange
University of Waterloo

Exploring the Equity, Diversity and Inclusion (EDI) Climate in the University of Waterloo's Department of Physics and Astronomy and its Impact on Student Retention

Equity, Diversity, and Inclusion (EDI) in the physics community has become an increasingly important topic in recent years. However, limited research has been done in Canada to investigate the general EDI climate in physics, particularly at the university level. Recently, the Department of Physics and Astronomy (UW DPA) at the University of Waterloo has actively promoted EDI efforts, as more physicists recognize the value of having people with diverse backgrounds and experiences in the field. This study investigates the EDI climate at the UW DPA and its impact on student experiences, enrollment and retention.

The study highlights the male to female ratio of first-year and graduating students, emphasizing the recent increase in female student enrollment. From 2010 to 2021, the male to female ratio in physics undergraduate students has decreased, while the number of women in the department has increased. This shift can be attributed to various equity in STEM initiatives implemented by the University of Waterloo.

First-year students generally perceive the EDI climate in the UW DPA to be positive. However, more research is needed to understand the experiences of marginalized first-year students, particularly 2SLGBTQ+ students and students with disabilities. It is imperative to provide better support for these students over their academic careers, ensuring that they have a safe and inclusive learning environment. By prioritizing EDI, we can ensure equal opportunities for academic success and enhance innovation and excellence in physics.

Solmaz Khodaeifaal
Simon Fraser University

Students' Video Recordings: A Means to Assess Physics Learning and Improve Girls' Self-confidence and Willingness to Participate in This Subject

By transforming and updating curricula and pedagogical approaches in teaching and learning physics, students' assessments cannot remain unchanged. I explore a science program in BC, Canada, that has revolutionized students' assessment using video recording assignments. In this approach, students' assessment comprises specific steps, from submitting homework on an online platform to creating video recordings for individual assignments and a collaborative project. Why do I propose assessing young students' physics learning in this way? Our education, work, and lives in the 21st century have become deeply intertwined with technology. In addition to achieving the learning goals, students must also develop skills such as active learning, problem-solving, critical thinking, creativity, analysis, reasoning, technology use, technology design, innovation, and collaboration. These skills enable them to make real progress not only in their education but also in their future careers and lives. During this pandemic and the shift towards online learning, having students create a video is a way to motivate them, especially girls, in the field, to explore interesting possibilities with technology and the resources provided in the lessons. Their video reflects their understanding, learning, reasoning, innovating, creativity, and ability to analyze and solve problems while using technology, demonstrating autonomy and improving their self-confidence. In addition to engagement and participation in class activities, each student is assessed not only according to group work and the collaborative project but also independently, based on their chosen topic and interest, and the video they create, a performance-based assessment, as emphasized by the National Science Foundation (2020).

Astronomy & Astrophysics

Solveig Thompson
University of Calgary

Searching for Intermediate Mass black holes using the James Webb Space Telescope

Black holes are categorised into two classes based on their mass: stellar-mass black holes that have masses up to a few 10s M⊙ (solar masses), and supermassive black holes which range from 10^6-10^{10} M⊙ and are found in the cores of all giant galaxies when searched. There is a proposed third size of black hole, the intermediate mass black hole, that bridges the mass gap between the stellar and supermassive black holes, and if they exist can provide important constraints on competing theories of supermassive black hole formation. Intermediate mass black holes are challenging to detect, so to date there are none compellingly confirmed to exist; however, compact stellar systems (CSSs) are likely locations for these intermediate mass black holes to reside in due to their high stellar densities and small sizes (as compared to larger galaxies). In this talk, I will discuss current efforts using the James Webb Space Telescope (JWST) to detect the precent of massive black holes in a collection of CSSs in the nearby Virgo Galaxy Cluster. Over 40 hours of time on JWST were awarded for this program and I will present early results including kinematic maps of the CSSs and early constraints on the presence of black holes in these systems. The frequency with which we find massive black holes in CSSs can provide important constraints on how the supermassive black holes form and evolve over time, as well as the origin of the CSSs they reside in.

Labani Mallick
California Institute of Technology

Detection Advancement and Variability Modeling of Ultra-Fast Outflows (UFOs) to Constrain AGN Feedback Mechanisms

Dr. Labani Mallick[1,2]
1 California Institute of Technology, Pasadena, USA
2 Incoming CITA National Fellow at the University of Manitoba, Winnipeg, Canada

Energetic ultra-fast outflows (UFOs), discovered in luminous active galactic nuclei (AGN) via the detection of highly blueshifted absorption lines in the X-ray count spectra, are considered to provide the 'feedback' mechanism linking the central supermassive black holes with their host galaxies. However, the detection significance of UFO features strongly depends on the continuum model. To overcome that, we developed a variability technique for advancing UFO detection and created physical models to fit variability spectra. By fitting a spline to the variability spectra of a sample of AGN, we detected UFO spikes of velocity ~0.1-0.3c, unlike the flux spectra, which did not always show UFO absorption lines. The physical modeling of their variability spectra confirmed the presence of wind absorption (e.g. FeXXV or FeXXVI) outflowing with velocities ~0.1-0.3c. The net outflow power surpasses 5 percent of the bolometric luminosity, which confirms that UFOs can effectively drive the AGN feedback and influence star formation in their host galaxies. One of the most important applications of such methods/models would be on X-ray micro-calorimeter data from *XRISM*, *Athena*, and *Colibrì*, where we can separate different layers of absorption in the wind with distinct variability properties.

Batia Friedman-Shaw
Perimeter Institute, University of Waterloo

Impact of Peculiar Velocities on the Relativistic Dipole Moment

Cosmology and galaxy surveys aim to uncover the Large Scale Structure of the universe. Assuming that the universe is statistically homogeneous and isotropic, galaxies should exhibit parity (mirror) symmetry in terms of position and velocity. Interestingly, however, that mirror symmetry between galaxies in a sample can be broken to the observer along the line of sight due to the redshifting of galaxies. This broken symmetry translates mathematically into the dipole moment of the power spectrum, the Fourier transform of the correlation function between galaxies, with the existence of such a term giving insight into the structure of the apparent preferred directions of galaxy velocities. This term is potentially impacted by peculiar velocities – the movement of galaxies due to gravitational pull – which have a slight redshifting effect on our observations. Here, we present our analysis of the impact of peculiar velocities, known as the velocity bias, on emission line galaxies (ELGs), as measured by redshifting actual spectral data from the Dark Energy Spectroscopic Survey (DESI). We used ELGs specifically because the characteristically strong emission lines of their spectra make them particularly sensitive to the changes that small redshifts can have on said spectra. The impact of this velocity bias term on multipole moments such as the dipole moment can be propagated to its effects on the power spectrum, giving us greater insight into the Large Scale Structure of the universe.

Rebecca Booth
University of Calgary

Revealing the three-dimensional structure of the Galactic magnetic field with the GMIMS Low-Band North survey

Rebecca Booth[1], Anna Ordog[2,3], Tom Landecker[3], Jo-Anne Brown[1], Alex Hill[2]

1 University of Calgary
2 University of British Columbia Okanagan
3 Dominion Radio Astrophysical Observatory, Herzberg Astronomy and Astrophysics Research Centre, National Research Council Canada

The Galactic magnetic field (GMF) plays an important role in the dynamics of the Galaxy. Modelling the GMF is challenging as magnetic fields are not emission sources that can be observed directly with a telescope. Instead, we must rely on indirect observations of Faraday rotation, the change in the polarisation angle that occurs when a linearly polarised wave passes through a region containing a magnetic field and free electrons. My research uses the new rotation measure (RM) synthesis technique, which reveals the complex Faraday rotation patterns imprinted by the GMF on polarised synchrotron emissions in three dimensions. Unfortunately, observing polarisation across a wide, densely sampled frequency band is necessary for RM synthesis and previous polarisation surveys were limited to a few discrete frequencies. To address this, the Global Magneto-Ionic Medium Survey (GMIMS) has set out to map the polarised radio emission from the entire sky. The northern component of GMIMS will consist of three surveys in different frequency ranges, all observed at Canada's Dominion Radio Astrophysical Observatory. In my presentation, I will share the early results from the Low-Band North (LBN) survey, covering the 350 to 1030 MHz range. In the RM synthesis technique, lower frequencies significantly increase the resolution of the Faraday rotation information, allowing us to discern more details about the GMF along the line of sight. Therefore, the LBN survey will launch an exploratory science of the polarisation properties of the Galaxy, contributing a valuable puzzle piece in the quest to model the GMF in three dimensions.

Xiying Zhang (withdrawn)
University of Barcelona

Particles escaping from the pulsar wind nebula?

Pulsars are highly magnetized fast-spinning neutron stars that lose their rotational energy through relativistic magnetized winds which are mainly composed of electron-positron pairs. At the termination shock where pulsar winds meet the confining ambient medium, the kinetic energy of the flow gets converted as particles get thermalized and accelerated to relativistic energies. These high energy electrons (also positrons) traveling in the magnetic field emit synchrotron and inverse Compton radiation from radio to gamma-rays forming the pulsar wind nebula (PWN). When a pulsar moves supersonically, its nebula is supposed to present a cometary tail bow shock head morphology as in the case of Mouse Nebula. Recent X-ray observations suggest this kind of PWNe tends to acquire puzzling jet-like structure that cannot be explained by pulsar jet theories developed for torus-jet morphology seen around subsonically moving pulsars. A comprehensive X-ray analysis was performed for the PWN associated with PSR 1853+01 using data from Chandra, XMM-Newton and NuSTAR observations. The pulsar is located well inside the radio shell of the supernova remnant W44. Previous 45 ks Chandra observations unveiled the presence of the fast-moving pulsar together with its trailing elongated nebula on the southern edge of the W44 X-ray emission region. Our analysis reveals, in addition, the existence of an antennae-like feature ahead of the pulsar. This reminds us of the Snail Nebula where two prong structures were seen near the pulsar. We argue that large-scale outflow misaligned with the pulsar motion direction are energetic particles escaping the PWN's bow shock.

Anousha Greiveldinger
University of Notre Dame

A Surprising Periodicity Detected During a Superoutburst of V844 Herculis by TESS

Anousha Greiveldinger[1], Peter Garnavich[1], Colin Littlefield[1,2], Mark Kennedy[3], Jules P. Halpern[4], John R. Thorstensen[5], Paula Szkody[6], and Rebecca S. Boyle[1]

1 Department of Physics and Astronomy, University of Notre Dame, Notre Dame, IN 46556, USA 2 Bay Area Environmental Research Institute, Moffett Field, CA 94035 USA
3 University College Cork, Cork, Ireland
4 Department of Astronomy and Astrophysics, Columbia University, New York, NY 10027 USA
5 Department of Physics and Astronomy, Dartmouth College, Hanover, NH 03755 USA
6 Department of Astronomy, University of Washington, Seattle, WA 98195, USA

We identify a previously undetected periodicity at a frequency of 49.08±0.01 d_{-1} (period of 29.34±0.01 minutes) during a superoutburst of V844 Her observed by TESS. V844 Her is an SU UMa type cataclysmic variable with an orbital period of 78.69 minutes, near the period minimum. The frequency of this new signal is constant in contrast to the superhump oscillations commonly seen in SU UMa outbursts. We searched without success for oscillations during quiescence using MDM, TESS, and XMM-Newton data. Tests applied to the TESS data suggest that the new signal does not originate from a nearby source and is not an instrumental artifact of the TESS photometry. We compare the X-ray properties of V844 Her with short orbital period intermediate polars (IP), V1025 Cen, 84.6 minutes, and DW Cnc, 86.1 minutes. The lack of a periodic signal in the XMM light curve and the relatively low X-ray luminosity of V844 Her suggests that it is not a typical IP. We consider the possibility that the 49 d_{-1} signal is the result of super-Nyquist sampling of a Dwarf Nova Oscillation (DNO or lpDNO) with a period near the 2-minute cadence of the TESS data. However, archival AAVSO photometry from a 2006 superoutburst supports the presence of a 49 d_{-1} signal. We conclude that the new signal is a real photometric oscillation coming from the V844 Her system and that it is unlikely to be an aliased high-frequency oscillation. The steady frequency of the new signal suggests that its origin is related to an asynchronously rotating white dwarf in V844 Her. This research was supported in part by a College of Science Summer Undergraduate Research Fellowship (COSSURF) from the University of Notre Dame.

Delica Leboe-McGowan
University of Manitoba

PythonMHD: A New Code for High-Speed Astrophysical MHD Simulations in Python

PythonMHD is a new software package for astrophysical magnetohydrodynamic (MHD) simulations. It is the first comprehensive, research-oriented MHD simulation code to be written in Python. By using an accessible, widely understood programming language, PythonMHD minimizes its learning curve for new users, allowing more individuals to explore astrophysical MHD phenomena. In order to further improve the user's experience, PythonMHD provides built-in visualization and analysis tools that the user can access while they are still running their simulation. Other MHD simulation codes, such as Athena and FLASH, require the user to transfer simulation data into separate software packages for visualization and analysis. The inclusion of built-in visualization and analysis tools is particularly important for preventing users from wasting time and computational resources on unusable simulation data, because they can terminate a simulation as soon as they see unexpected results in the visualization or analysis outputs. Although Python is ideally suited for creating a readable, user-friendly MHD code, its speed compared to low-level languages, such as C, has prevented it from being considered as a serious candidate for computationally intensive MHD algorithms. The runtime of a Python MHD simulation is approximately ten times the runtime that one would obtain if they ran the same simulation in C. In order to address this critical problem, PythonMHD gives the option of running its MHD solver in C, enabling users to efficiently run large simulations while benefitting from the visualization and analysis functions that a Python-based tool can more easily provide.

Subatomic Physics

Portia Switzer
University of Winnipeg, University of Regina

Probing Quantum Chromodynamics through Beam Spin Asymmetry

It is well-understood that Quantum Chromodynamics (QCD) explains the interactions of quarks and gluons inside a hadron. While perturbative QCD (pQCD) describes QCD at high energies (high momentum transfer) and non-perturbative QCD (non-pQCD) is QCD at low energies, theories predict a transition region between pQCD and non-pQCD at moderate energies. Existing experimental data, however, do not give adequate information to the interactions of quarks and gluons in the transition region. Different theories provide multiple predictions to these interactions in the transition region, but the data for each are limited. Experimental Hall C at Jefferson lab is one of the advanced facilities to study the transition region. We use high energy electron beam to study the internal structure of hadrons through deep exclusive meson production (DEMP). Through this, an important observable to study is beam spin asymmetry (BSA). The BSA is computed for the equation: $e + p \longrightarrow e' + \pi + \Delta$. In this talk I will discuss the experiment and give an update on my contribution to the data analysis.

Defne Tanyer
TRIUMF

ML-Driven Tuning of OLIS Beamline

D. Tanyer, W. Fedorko, C. Charles, P. Jung, O. Shelbaya, R. Baartman, T. Planche, D. Wang

The Off-Line Ion Sources (OLIS) facility is part of TRIUMF's world-class Isotope Separator and Accelerator (ISAC) complex, specializing in nuclear and particle physics research. Delivery of stable beams from OLIS and rare isotope beams from ISAC and eventually ARIEL (the Advanced Rare Isotope Laboratory) to various experiments with desired intensity and quality requires a complex tune of many independent parameters, over a lengthy, manual procedure.

Here we present first results of tuning the OLIS beamline using Bayesian optimization, a state-of-the-art machine learning algorithm to maximize black-box functions. It takes advantage of probabilistic modeling using Gaussian processes with an iterative method (an acquisition function) of selecting sample points to search for the best solution. We have shown that the working model outperforms the human operators in minimizing beam loss over a section of beamline.

Our AI-driven method has far-reaching implications for automated tuning of the entire ISAC-I/II and ARIEL beamline complexes for rare and stable isotope beam transport.

Keywords: Bayesian optimization, Machine Learning, accelerator tuning

Maedeh Lavaaf
University of Manitoba

Magnetically Shielded Room for the Neutron Electric Dipole Moment Experiment at TRIUMF

Discovering a nonzero neutron electric dipole moment (nEDM) provides some of the tightest constraints on extensions to the Standard Model that attempt to explain the mechanisms underlying *CP*-violation. The objective of the TUCAN (TRIUMF UltraCold Advanced Neutron) collaboration is to search for a permanent EDM of the free neutron, d_n, with a sensitivity of $\sigma(d_n) \leq 10^{-27} e\text{cm}$. The typical experimental method to measure the nEDM uses polarized ultracold neutrons (UCN) and employs the Ramsey method of separated oscillatory fields. Because of their slow movement, measurement of the spin precession frequency of UCNs requires very homogeneous electric and magnetic fields in space and time over the experimental area. A large multi-layer room called a Magnetically Shielded Room (MSR) shields the main precession magnetic field produced by an internal coil from the environment magnetic fields. However, it is possible to magnetize the MSR due to its finite remanence. Degaussing is necessary to reach the lowest possible residual field inside the MSR. Moreover, in the nEDM measurement, many possible sources of systematic error can manifest as a false EDM signal. Historically, the dominant systematic errors have come from magnetic field inhomogeneities, reducing the precision of the experiment. Providing a picture of the magnetic field environment within the experiment would help control the system's homogeneity. This presentation will discuss the optimized degaussing system for reproducible and complete degaussing to low residual field values, and also, the simulation of mapping the magnetic field inside the MSR to extract quantities relevant to the compensation of systematic effects in the experiment.

Sakshi Kakkar
University of Manitoba

High-precision experimental nuclear physics with the upgraded TITAN Penning trap

Sakshi Kakkar[1,2*], I. Belosevic[2], E.M. Lykiardopoulou[2,3], A. Weaver[2,4], G. Gwinner[1], A.A. Kwiatkowski[2,5]

1 Department of Physics and Astronomy, University of Manitoba, Winnipeg, MB, Canada
2 TRIUMF 4004, Wesbrook Mall, Vancouver, BC, Canada
3 Department of Physics and Astronomy, University of British Columbia, Vancouver, BC, Canada
4 Department of Physics, University of Brighton, Brighton, UK
5 Department of Physics and Astronomy, University of Victoria, Victoria, BC

Nuclear-physics experiments probe nuclear structure, nucleosynthesis and fundamental interactions, for which high precision and accurate mass measurements are critical inputs. TRIUMF's Ion Trap for Atomic and Nuclear science (TITAN) facility employs the Measurement Penning Trap (MPET) to measure masses of exotic nuclei to high precision and accuracy up to $\sim 10^{-10}$. To improve the resolving power and to reduce the statistical uncertainty in the mass measurement, a higher charge state of the ions can be used. This and other benefits of charge breeding radionuclides like improved beam purification can be realized only at TITAN as it alone combines radioactive ions, charge breeding, and a Penning trap. To fully leverage these advantages, MPET is undergoing an upgrade to a new cryogenic vacuum system compatible with ions in charge states over 20+. The status of MPET will be presented.

Miho Wakai
University of British Columbia

Dark matter searches at Belle II

Belle II is a particle physics experiment located in Tsukuba, Japan. The collaboration consists of a diverse range of countries and institutes, with over 1,000 collaborators. The Canadian team involves 6 different institutes, making a crucial contribution to the experiment.

The experiment is designed to produce precise measurements of known features in particle physics, as well as explore new hypothetical particles. The particle collisions are provided by the SuperKEKB collider, which has achieved the world record of most particle collisions per unit time in June 2020.

One of the highest priorities of the experiment is to understand dark matter, which is one of the biggest unsolved mysteries of the universe. Dark matter is a hypothetical type of matter that does not interact with electromagnetic radiation, which makes it difficult to detect. It is estimated to constitute 26% of the total matter-energy in the universe. Many astronomical observations can be explained with the presence of dark matter due to its interaction with gravity. However, the nature of dark matter and what it comprises is still unknown. Belle II seeks to be the first experiment to produce dark matter through particle collisions. This is done through a collaborative effort with theorists to try and search for different types of dark matter production. With its state-of-the-art detector and its large data-set, Belle II is optimal for dark matter searches with unprecedented precision.

This talk will discuss the Belle II experiment, as well as the exciting on-going analyses involving dark matter.

Fatemeh Gorgannejad
University of Manitoba

Optimizing the Pion Detector System to Improve Background Correction in the MOLLER Experiment

Parity-violating electron scattering techniques have emerged as powerful tools for exploring New Physics beyond the Standard Model (SM) of particle physics. The Measurement of a Lepton Lepton Electroweak Reaction (MOLLER) Experiment at Jefferson Lab is focused on investigating new dynamics through accurate measurements of the parity-violating asymmetry (A_PV) in electron-electron scattering. To achieve the expected precision, the experiment requires corrections for background processes that are characterized by background asymmetries and fractional dilution factors. Pion asymmetries and pion dilution factors have significant contributions to the experimental corrections and will be measured in a dedicated pion detector system. The University of Manitoba has been designing, developing, and constructing the pion detector system for the MOLLER experiment. To confirm the effectiveness of the detector system, the outcomes from simulations, cosmic testing, and beam tests carried out at MAMI-B microtron in Mainz, Germany, will be compared.

Furthermore, a novel approach to improve the understanding of uncertainties introduced by experimental corrections is introduced. Bayesian analysis, a complementary method to the commonly used frequentist methods, will be explored to provide a more robust assessment of the uncertainties in the corrections. The potential benefits of employing Bayesian analysis in parity-violating electron scattering experiments will be discussed.

In the end, in order to highlight the importance of diversity and inclusion in physics research, the challenges and obstacles I faced while working on this project as an Iranian woman in North America will be addressed.

Shefali
University of Manitoba

Cooling analysis of HVMAPS detector in MOLLER experiment and opportunities for women in physics

All the High Energy Physics (HEP) experiments strive for the initiatives to promote gender equality in the field of Physics in Canada. Likewise, to participate in scientific progress, MOLLER collaboration provides a platform for the female physicists to contribute their skills and expertise leading to more vigorous and impactful outcomes. The Measurement of Lepton Lepton Electroweak Reaction (MOLLER) experiment plans to take a longitudinally polarized beam of electrons, provided by Jefferson Lab's CEBAF (Continuous Electron Beam Accelerator Facility), and scatter them off unpolarized electrons of the target. The measurements are obtained by using a set of detectors in Hall A at Thomas Jefferson National Accelerator Facility (JLab) before entering the liquid hydrogen target. My research work focuses on investigating the ability of High Voltage Monolithic Active Pixel Sensors (HVMAPS) in Hall A's Compton polarimeter to monitor the electrons scattered via Compton scattering. Monolithic active pixel sensors require an in-vacuum operation to allow low-momentum particles at high rates. To prevent damage, the electronics necessitate dissipating the heat and require a cooling system. The temperature measurement of the HVMAPS in vacuum is essential to understand the thermal properties of the pixel detector and cooling needs. This talk will review the continuous efforts towards the cooling strategies, structure modification to achieve in-vacuum operation, improved research opportunities, challenges, and the importance of promoting a supportive environment for women in research institutions.

Akshaya Vijay
University of Manitoba

The Future Electron-Ion Collider

The US-based future Electron-Ion Collider (EIC) is a novel tool to address some of the unexplained physics of nucleons by colliding highly polarized electron beams with polarized beams of protons or ions. EIC expects the first beam in 2030. The high-energy interactions between the electrons and protons help in understanding the internal structure of the nucleons. The unique and powerful tools of EIC are needed to look deep into the nucleons and nuclei and to unlock the secrets of the "glue" that binds the building blocks of visible matter in the universe. The world's first and largest collider with controllable polarised beams will uniquely address three profound questions about nucleons:

- How does the mass of the nucleon arise?
- How does the spin of the nucleon arise?
- What are the emergent properties of dense systems of gluons?

Answers to these questions are essential for our understanding of the nature of matter around us. My research at the University of Manitoba involves the simulation of transverse and longitudinal polarization of the electron beam with more focus on the effect of transverse beam smearing on transverse polarization measurement. I will also address the challenges I came across being a woman in physics and the motivation that holds me in this field of science, especially in a large international collaboration like EIC.

Poster Abstracts (listed alphabetically)

Arij Alameh (#A6)
University of Manitoba

On the Levi-civita field and applications

Arij Alameh and Khodr Shamseddine

Department of Physics and Astronomy, University of Manitoba

The non-Archimedean Levi-Civita field R is an interesting mathematical structure that extends the real numbers to include infinitesimal and infinite elements. It is the smallest totally ordered non-Archimedean field extension of the field of real numbers R that is real closed (all positive elements of R have nth roots and every polynomial of odd degree over R has at least one root in the field) and Cauchy complete in the topology induced by the order (every sequence of R-numbers whose elements get arbitrarily closer together converges to an element of the field). In fact, R is small enough so that its elements can be implemented on a computer, thus allowing for computational applications. In this poster, we highlight key properties and applications of the Levi-Civita field, thus providing insights into the world of non-Archimedean analysis. In particular, we summarize the similarities and differences between R and R, with the differences being the results of the non-Archimedean property of R.

Jennifer Besner (#E5)
University of Ottawa

Femtosecond Laser Machined Waveguides for Quantum Logic-Gate Manufacturing

Quantum computing, whose implementations are relatively immature, shows great promise as a means to improve computational abilities. A major challenge to building quantum computers is their increased susceptibility to errors. For example, the tolerances of fabricated quantum logic gates are currently too low. This research focuses on addressing this issue in the context of quantum computing, in particular by using waveguides networks. Ultrafast femtosecond lasers are known to induce isotropic refractive index modifications in glass, which have previously been used to create high-quality single-mode waveguides. This technique also allows for greater spatial control of the waveguide's form upon creation, which is the property that we hope to leverage with this project. By creating pairs of waveguides which curve towards and then away from one another, we aim to create a novel form of a single-photon quantum logic gate. The regions where the waveguides are close to one another see the evanescent fields of light passing through them overlapping, and the photons within them acting as our qubits. When these fields overlap, optical power can be exchanged between the waveguides, creating the coupled system required to form a quantum logic gate. This design has fewer inconsistencies from one logic-gate to the next, and thus better tolerances, due to the gradual transformations allowed by curved waveguides that enable completely new types of optical processes.

Madison Chisholm (#B3)
The University of Winnipeg

Axon Diameter Inferences in Substructures of the Mouse Corpus Callosum

Approximately 1 in 6 people globally are affected by a Neurological disorder. Previous research has linked numerous Neurological disorders post-mortem to abnormalities in axon distribution and integrity within neural white matter tracts. Therefore, it is of high interest to investigate methods that will eventually be able to measure axon diameters in white matters tracts in live brains. This would allow for the development of new clinical applications such as earlier diagnosis and allow for the development of new treatments. Diffusion MRI is a method with the potential to infer microstructure in live brains using temporal diffusion spectroscopy (TDS). TDS, when used with certain pulse sequences, such as Oscillating Gradient Spin Echo (OGSE), can be used to infer micron-scale axon diameters. To calibrate TDS with OGSE, an ex vivo mouse brain was imaged and analyzed in this project and many substructures were studied to assess the differences within a mouse. The images were collected using a 7T Bruker AvanceIII NMR system with Paravision 5.0 and were processed and analyzed using MATLAB. The mean diameter inferred of axons in the corpus callosum ranged from 2.6 ± 3.4 μm to 5.6 ± 1.0 μm, with an average of 5.3 ± 0.2 μm. The next step is to increase the precision of the measurements with the goal of being able to measure axon diameters in in vivo mouse brains.

Liz Cunningham (#C1)
University of Toronto

Towards More Inclusive Scientific Meetings and Conferences: An Implementation Guide

Scientific meetings and conferences are the backbone of science. They are a place to share ideas, meet other scientists, and grow your career. They are especially important for people who are traditionally underrepresented in science and those who are early in their career. They, however, can often be places where those very people feel unwelcome. Because of this, scientific meetings are a great place to focus Diversity, Equity, and Inclusivity (DEI) efforts. In early 2023, 500 Women Scientists published a second version of their Inclusive Scientific Meetings Guide. This is a great document, with a lot of theory, helpful suggestions, and best practices. I think that this guide is important and necessary. I also think that there is room for more hands-on guidance for meeting organizers who are just venturing into the world of DEI. Because of this, my work is focused on building on the existing guide to make a complementary Implementation Guide. The Implementation Guide will provide a summary of some of the most important points of the Inclusive Scientific Meetings Guide, some new information, direct guidance for what accessible and inclusive meetings should look like, and specific examples of things like wording questions about pronouns and codes of conduct that can be used by meeting organizers.

Marzieh Esmaeilzadeh (#A5)
University of Manitoba

Absorption properties of Neodymium-doped laser crystals for low quantum defect pumping

M. Esmaeilzadeh, N. Roy, A. Major

Faculty of Electrical and Computer Engineering, University of Manitoba, Winnipeg, Canada

We report on the absorption coefficients of some popular Neodymium-doped laser crystals at wavelengths longer than the more traditional ones around 808 and 880 nm. In this study, high- resolution absorption spectra of Nd:YVO_4, Nd:$GdVO_4$, Nd:YAG, Nd:YLF, and the combination of Nd:YVO_4 + Nd:$GdVO_4$ crystals were measured to identify the wavelengths at which the lowest amount of heat can be produced during the excitation. Such wavelengths correspond to the lowest quantum defects in these crystals. According to the obtained absorption spectra, the most appropriate pumping wavelengths of the individual Nd:YVO_4 and Nd:$GdVO_4$ crystals are 914 nm and 912 nm, respectively. At the same time the combination of Nd:YVO_4 + Nd:$GdVO_4$ crystals provides a broad absorption spectrum approximately between 910 nm and 916 nm. Moreover, the absorption spectra of Nd:YAG and Nd:YLF crystals reveal that laser diodes at 946 nm and 908 nm can be the best choices to excite these two widely used gain media.

Charlotte Ferworn (#B4)
Toronto Metropolitan University

Investigation of the Role of Microbubble Shell on the Efficacy of Doxorubicin Uptake into Breast Cancer Cells

Charlotte Ferworn[1], Agata Exner[2], Michael Kolios[1], Raffi Karshafian[1]

1 Department of Physics, Toronto Metropolitan University, Toronto, Ontario M5B 2K3, Canada.
Institute for Biomedical Engineering, Science and Technology (iBEST), A Partnership Between Toronto Metropolitan University and St. Michael's Hospital, 209 Victoria Street, Toronto, Ontario M5B 1T8, Canada
Keenan Research Centre for Biomedical Science, Unity Health Toronto, 209 Victoria Street, Toronto, Ontario M5B 1W8, Canada
2 Case Western Reserve University, Department of Biomedical Engineering, Cleveland, United States
Case Western Reserve University, Department of Radiology, Cleveland, United States

The application of ultrasound and microbubbles (USMB), shell-encapsulated gas core agents, are used in targeted delivery applications of various chemotherapeutic drugs. When exposed to ultrasound (US) microbubbles (MBs) can undergo two kinds of cavitation: at lower pressures, non-inertial (or stable) cavitation, and at higher pressures, inertial cavitation, which is characterized by the MB implosion. [1] The optimization of USMB depends on various factors including the acoustic response of MBs which partly depends on their shell characteristics. Here, we investigate the effect of MB shell composition in USMB mediated delivery of doxorubicin chemotherapy (3μM) in breast cancer cells. Cells were exposed to three types of MBs: Definity (clinically approved), and two manufactured in our laboratory; Propylene Glycol and Glycerol (PGG), and Propylene Glycol (PG) shelled MBs at 1MHz ultrasound and three pressures (360kPa, 700kPa, 900kPa). The results indicate that MB shell composition affects USMB mediated drug delivery. USMB performed with PGG and Definity MBs resulted in higher uptake of Dox in comparison to PG. The difference between MB of these two shell types was more pronounced at the 700kPa pressure – the pressure closest to the inertial cavitation threshold of Definity.[2] This could indicate a relationship between MB shell characteristics and cavitation type. There was no significant difference between cells treated with PGG and Definity and cells treated with Dox alone.

[1] Roovers, S. et al. The Role of Ultrasound-Driven Microbubble Dynamics in Drug Delivery: From Microbubble Fundamentals to Clinical Translation. Langmuir (2019). doi:10.1021/acs.langmuir.8b03779
[2] Momin, S. (2016). On the Acoustic Response of Ultrasonically-Stimulated Microbubbles and Enhanced Intracellular Uptake of a Fluorescent Molecule. Toronto Metropolitan University.

Sakina Hussain (#D6)
Western University

Weather on Other Worlds: High Dispersion Spectra and Physical Characteristics of 16 Ultracool Dwarfs

Ultracool dwarfs comprise the lowest mass stars and brown dwarfs, those celestial objects that inhabit a category between planets and stars, massive enough to initiate nuclear fusion, but not to sustain it. Cooler than stars and roughly Jupiter-sized, they display gas giant planet-like weather patterns and surface features, manifested by changes to spectral features over time. The study of these objects furthers understanding of much of the exoplanet population and situates them as excellent candidates for the search for terrestrial exoplanets in the habitable zone.

In this research we present the high-dispersion spectra of 16 brown dwarfs. Through comparison to models we shed light on their physical characteristics, including surface gravity, effective temperature, metallicity, radial velocity, and projected rotation velocity, further characterizing the ultracool dwarf parameter space. Such work outlines extremes and limits such as the lower limit to rotation period previously established by our group, a growing collection to which we now add three new objects.

Amala Jaison (#E2)
University of Manitoba

Magnetic resonance requirements and shim coil design for the TUCAN EDM experiment

The TUCAN EDM experiment aims to measure the neutron electric dipole moment (EDM) to a precision of 1×10^{-27}ecm. The experiment is a precise relative measurement of the spin precession frequency of ultra-cold neutrons stored in a bottle, placed in homogenous magnetic and electric fields. The magnetic field is shielded from external influences by conducting the experiment in a magnetically shielded room (MSR). A main precession field of B0=1 μT is produced by an internal coil. Magnetic field inhomogeneity in the coil/MSR system will cause the neutron spins to dephase as they precess, reducing the statistical precision of the experiment. Controlling the homogeneity is also important for false EDM signals. A system of square shim coils, mounted on the surface of a cube surrounding the experiment, is being developed to make adjustments to the field. This presentation will discuss quantitatively the magnetic homogeneity requirements, and demonstrate the ability of the shim coil design to meet them.

Lovepreet Kaur (A4)
University of Northern British Columbia

THz-TDS as a Non-Destructive Testing Tool for Industrial Manufacturing Processes

Terahertz Time-Domain Spectroscopy (THz-TDS) offers a promising solution for materials' non-destructive testing (NDT). With exceptional transparency and sub-millimeter spatial resolution, THz-TDS enables the analysis of material properties, including composition, thickness, and defects, without causing damage to the internal structure of the material. By enhancing quality control and optimizing the manufacturing process, THz-TDS has represented a valuable tool for NDT applications, ensuring the reliability and quality of materials across various industries. In this study, we utilized the Picometrix T-Ray 4000 THz time-domain spectrometer to investigate the potential of NDT applications. The primary objective of this research is to assess the accuracy and precision of a thickness measurement system. This is done by taking the thickness measurements using two distinct wedges fabricated from Ultra High Molecular Weight (UHMW) polymer, featuring a uniform density but variable thickness. By analyzing the transmission data and examining the temporal shift between the reference and sample THz waveform, an accuracy/precision of approximately 15 μm is obtained. The performance is compared to a 100 GHz point scanner operating at a frame rate of up to 50 Hz, demonstrating comparable results. Our findings indicate that THz-TDS offers a non-destructive testing solution aligned with the needs of industrial manufacturing processes and is accessible now with the less expensive single-frequency sources and cameras operating at 100 GHz.

Gabrielle Lee (#B1)
Toronto Metropolitan University

Detecting High Intensity Focused Ultrasound Thermal Lesions using T2-Weighted Fast Spin Echo Magnetic Resonance Imaging: An Ex Vivo Tissue Study

HIFU is a non-invasive thermal therapy treatment that uses heat to destroy cancer cells without damaging adjacent vital structures and cells. HIFU is used in conjunction with an imaging guidance, e.g., MRI, for precise targeting and treatment monitoring. T2W-FSE is the most commonly used MRI pulse sequence to detect HIFU thermal lesions as it provides good contrast between normal and coagulated tissue. A drawback of this pulse sequence is the manifestation of ringing artifacts and loss of resolution due to the signal modulation in *k*-space caused by the T2 decay. The IFT multiplication scheme aims to smooth out the signal modulation by multiplying an IFT multiplication filter, which is an inverse of the signal modulation trend present in *k*-space, to reduce the effects and improve image quality. In this study, four types of IFT multiplication filters were developed (regular, narrow, wide, and compound filters) and implemented on T2W-FSE MR images of *ex vivo* porcine tissue with HIFU induced thermal lesions. Corrected MR images of HIFU thermal lesions using the narrow filter yielded the largest improvement of 13.83±2.49%, 17.04±2.25%, and 14.44±1.12% for lateral and axial spatial resolutions, and lesion SNR, respectively, compared to the original images, indicating amplification of the signals in *k*-space in addition to smoothing out the exponential signal modulation caused by the T2 decay. The results obtained in this study indicate the potential of the IFT multiplication scheme being translatable to the clinics as a method to improve thermal lesion detectability in MR-guided HIFU procedures.

Leya Lopez (#A1)
Simon Fraser University

Nonlinear Photoconductivity in Pump Probe Spectroscopy

Leya Lopez, Derek G. Sahota, J. Steven Dodge

Here we revisit a procedure that is commonly used to determine the photoexcited conductivity from pump-probe spectroscopy measurements. A common practice in pump-probe spectroscopy is to derive the photoexcited conductivity from the measured changes in the reflection or transmission amplitude. This procedure requires knowledge about the depth dependence of the photoexcited conductivity in the medium. Although the photoconductivity dept profile is typically not measured directly, it is commonly assumed that it has a linear dependence on the absorbed pump energy. Recently we showed that nonlinearity can distort this depth profile a high pump fluence, and that this can introduce large systematic errors in the optical response functions derived from it [1]. In this project, we develop a mathematical framework for genera analysis procedure in pump-probe spectroscopy for such nonlinearities. We present analytical expressions for the reflection and transmission amplitude of common excitation profiles that are relevant in pump-probe spectroscopy, discuss its common features and show how nonlinearity appears in conventional analysis procedures.

1. J. Steven Dodge, Leya Lopez and Derek G. Sahota Optical Saturation Produces Spurious Evidence for Photoinduced Superconductivity in K3C60. Phys. Rev. Lett. 130, 146002 (2023).

Evelyn Macdonald (#D3)
University of Toronto

Water vapour transit ambiguities for tidally locked rocky planets

Climate simulations are a valuable tool for linking surface conditions to observables for tidally locked habitable zone rocky planets. JWST will observe several of these planets' atmospheres in the coming years using transit spectroscopy, but will not be able to observe their surfaces directly. Nonetheless, the amount and location of land on a planet can have significant climate effects, as can the mass of its atmosphere. In this work, I use a 3D climate model to systematically vary land cover and atmosphere mass on a tidally locked planet. I then use a radiative transfer model to generate synthetic water vapour transit spectra from my climate simulations. I will discuss how climates respond to variations in land cover and atmosphere mass, and show that it will be difficult to differentiate between climate regimes using transit spectroscopy when these parameters are unknown. Since both land cover and atmosphere mass will be difficult to measure for a given planet, these sources of uncertainty will need to be accounted for when interpreting observations.

Tabassom Madayen (#D5)
University of Toronto

Discovery and Classification of HD 165401Ab White Dwarf

Tabassom Madayen, Ziyyad Ali, and Lea Hirsch

We report the discovery of a white dwarf companion to the star HD 165401 with a projected separation of 24.40 ± 2.44AU from the primary star. HD 165401 was previously marked as a potential Blue Straggler (BS) star and by characterizing the companion, HD 165401Ab, as a white dwarf, the blue straggler scenario was confirmed. We analyzed observations from the Keck II / NIRC2 camera using the adaptive optics technique (AO), along with Radial Velocity (RV) data from Keck I / HIRES spectrograph from 2005 to 2022. The RV data show an acceleration of 0.151 ± 0.001$ms^{-1}yr^{-1}$ indicating the existence of a companion with an orbital period longer than the time baseline of the data. We measured the astrometry of the companion and combined it with the RV data and used the Markov Chain Monte Carlo (MCMC) approach to apply Bayesian analysis on the orbital parameters of HD 165401Ab. The mass of the companion was measured as M = $0.9^{+0.23}_{-0.19}$ M⊙. By performing photometry on HD 165401Ab, we found ΔH = 8.75±0.35 and ΔKp = 8.97 = ±0.34. We used the Python package WDPhotTools and determined the cooling age of HD 165401Ab as τ = 3 Gyrs.

Samin Majidi (#E4)
McGill University

Designing a Calibration System for the nEXO Experiment's Outer Detector

Supervised by Prof. Thomas Brunner and Dr. Erica Caden

Designing a Calibration System for the nEXO Experiment's Outer Detector nEXO is a proposed tonne-scale experiment which aims to search for neutrinoless double beta ($0\nu\beta\beta$) decay in the isotope ^{136}Xe. The observation of $0\nu\beta\beta$ decay would demonstrate lepton number violation in weak processes and the Majorana nature of neutrinos. This would be an explicit signature of physics beyond the Standard Model and also may provide insight into the observed matter-antimatter asymmetry in the Universe. nEXO is being designed to investigate this rare decay with a projected half-life sensitivity
that is greater than 10^{28} years at the 90% confidence level.

In order to reduce the impact of cosmogenic backgrounds, the experiment is anticipated to be located at SNOLAB, an underground laboratory located two kilometres underground. The xenon-filled Inner Detector (ID) is designed to be placed at the centre of a water tank. This 12.3 m in diameter and 12.8 m in height tank, filled with 1.5 kilotonnes of ultra-pure deionized water and instrumented with an array of 8-inch photomultiplier tubes (PMTs), constitutes the Outer Detector (OD). The PMTs will be used to veto background events in the ID that produced by spallation neutrons from passing
cosmic muons and other secondary particles.

A calibration system is being developed for nEXO OD. The aim of this system is to calibrate the timing properties of the PMT's readout system and monitor the optical properties of the water. I will discuss the design implemented for calibrating the OD by analyzing the result of a GPU-accelerated ray-tracing software (Chroma).

Tahereh Mohammadi (#E3)
University of Manitoba

Atomic Magnetometers in Neutron Experiments

According to the Big Bang theory, the universe possessed an equal amount of matter and antimatter at an early age. However, In the universe today, we only see matter and almost no antimatter. Why is the universe this way? There is an ongoing experimental effort to address this puzzle by measuring the neutron electric dipole moment (EDM). It turns out, the EDM is an observable that violates time-reversal symmetry which is equivalent to the matter-antimatter symmetry in particle physics theories. In the neutron EDM experiment, we put ultracold neutrons in a bottle and measured their spin precession frequencies in combined static magnetic and electric fields. Using neutrons produced at a new source at TRIUMF (Canada's particle accelerator center, Vancouver, BC), we will be able to measure the neutron EDM by a factor of 10 more precisely than the previous best experiment. A systematic error arises due to magnetic field inhomogeneity. I am preparing an array of 20 atomic cesium magnetometers to monitor the magnetic field at various positions in the experiment. The array will be used to tailor the 1 μT magnetic field to be very homogeneous at the level of 40 pT. I will present recent progress on the TRIUMF Ultra-Cold Advanced Neutron (TUCAN) EDM experiment, focusing on the role of the magnetometers.

Olivia Moluchi (#B2)
University of Waterloo

Bare spherical gel dosimeter with optical computed tomography scanning

Olivia Moluchi[1*], Kevin Jordan[1], Matt Mulligan[2]

1 London Regional Cancer Program, London Health Sciences Centre
2 Department of Medical Biophysics, Western University, London, Ontario, Canada

A hydrogel dosimeter made with radiochromic polyvinyl alcohol-iodide (PVA-I) and crosslinked by glutaraldehyde (GTA) has been reported. Due to the mechanical strength of the transparent gel, a study to cast samples in spherical shapes was initiated. The bare sample measured 47 mm in diameter and a plastic funnel was customized to keep the gel in place, alongside suction. The setup was placed in a cylindrical vessel, measured 96 mm in diameter, for 3-D optical CT scanning. Elimination of concentration gradients and equivalent refractive indices were found with a solution of same formulation without GTA used inside the vessel for scanning purposes. "In-air" irradiation was conducted while the gel sphere remained in the vessel after draining the solution. A maximum dose of 20 Gy was delivered onto the gel sphere by a single, 6 MV, x-ray beam. Indication of accurate 3D dosimetry within 1 mm of the gel surface is possible due to similar results between the central axis depth doses for the gel reconstruction and the Monte Carlo calculation. Relative to the calculation, the gel sphere recorded slightly greater dose in the build-up region and slightly less dose in the exit region.

Chelsea-Lea Randall (#A3)
Canadian Light Source

Using the Quadrupole Scan Technique to Measure the Beam Profile in the Booster-to-Storage Ring Transfer Line at the Canadian Light Source

The Canadian Light Source is a third generation 2.9 GeV synchrotron light source on the University of Saskatchewan campus in Saskatoon, Saskatchewan. It consists of three accelerators: a linear accelerator, a booster ring, and the storage ring. There are two transport lines that move the electron beam between accelerators to finally be stored in the storage ring. In the storage ring the electron beam produces synchrotron light for the 22 beamlines to use for various experiments.

The incoming beam from the booster ring is not currently well understood and by extension the beam propagating through the transfer line and reaching the storage ring is not well understood either. Using existing diagnostic cameras in the BTS and quadrupole scan techniques, we can measure the electron beam phase space distribution. With these techniques we can profile the beam extracted from the booster ring and use that to better optimize injection through the transfer line into the storage ring. This would increase the amount of charge captured by the storage ring, reducing the lost electrons and radiation caused by the loss of electrons.

Priya Sharma (#A2)
Canadian Light Source Inc.

Automation of Hall Probe Measurements of a Magnetic Landmark at the Canadian Light Source Magnet Mapping Facility

The magnet mapping lab at the Canadian Light Source Inc. (CLS) is dedicated to developing and characterizing magnet devices that cater to the organization's needs.

The lab is equipped with a Hall probe bench that features a Senis 3-D Hall probe mounted on a movable carriage, enabling precise 3D magnetic flux density measurements. This advanced system provides a complete 3D map of the magnetic field, used in applications like magnetic field shimming and the assembly of permanent magnet (PM) and insertion devices (IDs).

The magnetic landmark is a fixed device consisting of a set of permanent magnets used as a reference point for calibrating the Hall probe. The precise positioning of the probe relative to the specific magnetic landmarks provides the Hall probe magnetic field measurements that can be tied into a mechanical survey.

Python automation code is being used to read data files produced by the Hall probe scan automation software. After reading the data, the code analyzes the results and identifies significant landmarks in the magnetic field measurements. Using this information, the code determines the optimal settings for the next Hall probe scan. The outcome of these scans provides us with the locations of the magnetic landmark's points of interest.

In summary, the Magnet Mapping Lab at CLS uses Python automation code to analyze Hall probe data files, identify significant magnetic landmarks, and optimize scan settings for precise mapping of the magnetic field in three dimensions.

Galina Sherren (#D4)
Memorial University of Newfoundland Department of Physics and Physical Oceanography

A Long-Term Period Analysis of the Semi-Regular Variable Star V CVn

The semi-regular variable star V Canum Venaticorum (V CVn) has been the focal point of several studies in stellar astrophysics due to its rare pulsation and linear polarization behaviour. Based on decades of polarimetric observations, it is known that the polarization fraction of V CVn varies inversely with the brightness of the star, concluding that this behaviour is likely caused by stellar wind bow shocks as the star moves through the interstellar medium. However, despite these studies of V CVn, there continue to be questions about its long-term pulsation behaviour which could help explain its evolution and dynamic history. In this project, we use observational data spanning over a century collected through the American Association of Variable Star Observers (AAVSO) to study long-term pulsation changes of V CVn, from which we compute the pulsation frequencies and secondary periods to better explain the strange properties of V CVn.

Yunting Wang (#D7)
University of British Columbia

How to Count Clustered Galaxies

Obtaining accurate source counts of galaxy populations in astronomical images is crucial for understanding the underlying models of galaxy formation and evolution. Yet, in cases where observations are limited by angular resolution, images can be confused and sources blended, making it challenging to probe source counts deep down to the faint end of brightness. One such method for overcoming this limitation is fitting the one-point map statistics (flux histogram), known as the probability of deflection (P(D)). P(D) recovers the contribution of faint sources in the flux distribution, assuming a Poisson randomized distribution of galaxy positions. However, the presence of clustered sources can bias the estimated counts, making it difficult to obtain reliable measurements. In this study, we present a new approach to correcting clustering bias in source counts based on a combination of one-point map statistics, i.e., the flux histogram, and two-point statistics, i.e., the spatial clustering or correlation. Our method is built on the P(D) analysis of flux fluctuations and a phenomenological function form of the clustering contribution for a wide range of clustering strengths. This approach will allow us to simultaneously recover the deep source counts and their clustering strength in a map for a broad range of wavelengths from far-infrared to radio. Our study will provide a powerful tool for use on the data from future wide-field surveys, leading to better constraints on the underlying models of galaxy formation and evolution.

Kyle Wittmeier (#D1)
University of Winnipeg

Assessing Early Universe Models for Primordial Black Holes as Dark Matter

Primordial black holes (PBHs) provide an exciting prospect for accounting for the mysterious dark matter that comprises 85% of the matter in our universe. This scenario can be realized by a variety of early universe scenarios, in particular via a phase of accelerated expansion known as cosmic inflation. Many models for PBH production have been proposed, with differing number of parameters and differing ability to fit data sets such as the Cosmic Microwave Background. However, little has been done to compare these models in a robust statistical framework. In this talk I will present preliminary results in performing model comparison of candidate models for the genesis of primordial black holes.

Jiayue Yang (#D2)
University of Waterloo

Black Hole Phase Transitions Near Quadruple Points

Treating the horizon radius as an order parameter in a thermal fluctuation, the free energy landscape model sheds light on the dynamic behaviour of black hole phase transitions. Here we carry out the first investigation of the dynamics of the recently discovered multicriticality in black holes. We specifically consider black hole quadruple points in D = 4 Einstein gravity coupled to non-linear electrodynamics. We observe thermodynamic phase transitions between the four stable phases at a quadruple point as well as the weak and strong oscillatory phenomena by numerically solving the Smoluchowski equation describing the evolution of the probability distribution function. We analyze the dynamic evolution of the different phases at various ensemble temperatures and find that the probability distribution of a final stationary state is closely tied to the structure of its off-shell Gibbs free energy.

List of Participants

Naman **Agarwal**, University of Manitoba
Nisha **Agarwal**, University of Ontario Institute of Technology
Arij **Alameh**, University of Manitoba
Nicolle **Amyotte**, University of Manitoba
Melissa **Anderson**, University of Manitoba
Kelvin **Au**, University of Manitoba
Sarah **Aubert**, Toronto Metropolitan University
Nasrin **Azari**, Simon Fraser University
Christina **Balanduk**, University of Manitoba
Robyn **Beaulieu**, University of Manitoba
Susan **Beshta**, University of Manitoba
Jennifer **Besner**, University of Ottawa
Kaylee **Biggart**, University of Waterloo
Aymsley **Bishop-Mahon**, University of Manitoba
Brynne **Blaikie**, University of Manitoba
Harsha **Blumer**, University of Manitoba
Kristine **Boone**, Photonic Inc
Rebecca **Booth**, University of Calgary
Chelsea **Braun**, University of Manitoba
Phiona **Buhr**, University of Manitoba
Trang **Bui**, University of Manitoba
Jacob **Burgess**, University of Manitoba
Sarah **Burke**, University of British Columbia
Jocelyn **Bell Burnell**, University of Oxford
Erica **Caden**, SNOLAB
Ruth **Cameron**, University of Manitoba
Ria **Chakraborty**, University of Waterloo
Arka **Chatterjee**, University of Manitoba
Madison **Chisholm**, University of Winnipeg
Liz **Cunningham**, University of Toronto
Jenel **Cuya**, Winnipeg
Lucas **Victor da Conceição**, University of Manitoba
Sophia **da costa**, University of Waterloo
Jessica **de Kort**, University of Winnipeg/University of Manitoba
Chetna **Duggal**, University of Manitoba

Gwendolyn **Eadie**, University of Toronto
Jayanne **English**, University of Manitoba
Marzieh **Esmaeilzadeh**, University of Manitoba
Amna **Farooq**, Brandon University
Charlotte **Ferworn**, Toronto Metropolitan University
Gabrielle **Fontaine**, University of Manitoba
Batia **Friedman-Shaw**, Perimeter Institute/University of Waterloo
Emma **Friesen**, University of Winnipeg
Jennifer **Gale**, University of New Brunswick
Amy-Rae **Gauthier**, University of New Brunswick
Marjroie **Gonzalez**, Interior Health
Fatemeh **Gorgannejad**, University of Manitoba
Chloe **Green**, Brandon University
Anousha **Greiveldinger**, University of Notre Dame
Jasmine **Hamzeh**, Winnipeg
Alex **Hayes**, University of Manitoba
Lauren **Hayward**, Perimeter Institute for Theoretical Physics
Skye **Heiland**, University of Manitoba
Fergus **Henstridge**, Durham University
Evelyne **Hluszok**, University of Manitoba
Aimee **Hungerford**, Los Alamos National Laboratory
Sakina **Hussain**, Western University
Natasha **Jacobson**, University of Manitoba
Amala **Jaison**, University of Manitoba
Sakshi **Kakkar**, University of Manitoba
Lovepreet **Kaur**, University of Northern British Columbia
Solmaz **Khodaeifaal**, Simon Fraser University
Brock **Klippenstein**, University of Manitoba
Christine **Kraus**, SNOLAB
Cherylea **Kristalovich**, University of Manitoba
Ayush **Kumar**, University of Manitoba
Samantha **Lange**, University of Waterloo
Maedeh **Lavvaf**, University of Manitoba
Delica **Leboe-McGowan**, University of Manitoba
Gabrielle **Lee**, Toronto Metropolitan University
Jack **Lindner**, University of Manitoba
Maude **Lizaire**, Mila - Université de Montréal
Leya **Lopez Lovely**, Simon Fraser University
Brydyn **Mac Intyre**, University of Manitoba
Evelyn Jayke **Macdonald**, University of Toronto

Austin **MacMaster**, University of Manitoba
Tabassom **Madayen**, University of Toronto
Samin **Majidi**, McGill University
Labani **Mallick**, California Institute of Technology
Juliette **Mammei**, University of Manitoba
Rebecca **Man**, University of Manitoba
Brenda **Matthews**, National Research Council of Canada
Evan **McDonough**, University of Winnipeg
Cassandra **Miller**, University of British Columbia
Tahereh **Mohammadi**, University of Manitoba
Olivia **Moluchi**, University of Waterloo
Doerksen **Neil**, University of Manitoba
Nathalie **Nguyen-Quoc Ouellette**, Université de Montréal
Rachel **Nickel**, University of Manitoba
Alex **Pedersen**, McDonald Institute/Queen's University
Francene **Perehinec**, University of Manitoba
Amilia **Petryk**, University of Manitoba
Julianne **Pollard-Larkin**, MD Anderson Cancer Center
Chelsea-Lea **Randall**, Canadian Light Source Inc.
Jessica **Rodgers**, University of Manitoba
Jocelyn **Roney**, University of Manitoba
Nirankush **Roy**, Indian Institute of Technology, Kharagpur
Heather **Russell**, University of Victoria
Samar **Safi-Harb**, University of Manitoba
Isabel **Sander**, University of Manitoba
Brenna **Sawchuk**, Brandon University
Priya **Sharma**, Canadian Light Source Inc.
Shefali, University of Manitoba
Galina **Sherren**, Memorial University of Newfoundland
Kyla **Smith**, University of Oxford
Alexa **Stang**, Brandon University
Nathan **Steinle**, University of Manitoba
Janette **Suherli**, University of Manitoba
Portia **Switzer**, University of Winnipeg
Defne **Tanyer**, University of Waterloo
Solveig **Thompson**, University of Calgary
Cole **Treyturik**, University of Manitoba
Arina **Tseragotin**, University of Manitoba
Kim **Venn**, University of Victoria
Akshaya **Vijay**, University of Manitoba
Miho **Wakai**, University of British Columbia

Yunting **Wang**, University of British Columbia
Kyle **Wittmeier**, University of Winnipeg
Jiayue **Yang**, University of Waterloo
Ying **Yang**, University of Manitoba
Nazgol **Yarmand**, Sir Winston Churchill Secondary School
Tahreem **Yousaf**, University of Saskatchewan
Abeer **Zahra**, University of Manitoba
Xiying **Zhang**, Universitat de Barcelona (ICCUB)