Summer Student Research Talks
January 12, 2021

Future Job Opportunities & Awards,

Department of Physics

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Land acknowledgement

We acknowledge that we are gathered on ancestral lands, on Treaty One Territory. These lands are the heartland of the Métis people. We acknowledge that our water is sourced from Shoal Lake 40 First Nation.

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Michael Hohner 😳⚠️❤️ liked

Mayor Brian Bowman @Mayor_Bowman · 47m

Please do not:

🚫 Drink urine
🚫 Consume bleach
🚫 Ingest horse medicine

Please:

✅ Get vaccinated!
✅ Limit your contacts
✅ Wash hands
✅ Wear a mask
✅ Watch distance

More info:

➡️ gov.mb.ca/covid19/index....

➡️ canada.ca/en/public-heal...

14 38 113

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Our student presenters

- Kiera Pond-Augusto
- Michael Grehan
- Madison Chisholm
- Ashley King
- Shawn Seklton
- Tapendra BC
- Dylan Stokes

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Job Opportunities Available: Summer 2022

- Andrew Frey
- Blair Jamieson
- Chris Bidinosti
- Jeff Martin
- Melanie Martin
- Russell Mammei
- Evan McDonough

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String Theory

String theory is a leading candidate to explain the unification of all the fundamental forces, including a quantum theory of gravity. It naturally includes extra dimensions, and it is potentially capable of describing extreme environments like the interiors of black holes and the earliest stages of the universe. String theory also led to the discovery of "holography," the fact that gravitational physics in certain spacetimes is equivalent to theories of nuclear physics. I have a number of interests, including how the structure of extra dimensions affects our 4D world, black hole formation in holographic spacetimes and the role of quantum information in gravity (especially black holes, the early universe, and holography). A variety of projects are possible and will be tailored to the student.

Contact Info: Andrew Frey, e-mail: a.frey@uwinnipeg.ca; phone: 786-9215; office: 2L26

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Neutrino Physics

Neutrinos are weakly interacting particles that can pass through a light-year of lead without interacting. Experiments with neutrinos have shown that they quantum mechanically change flavor as they travel through vacuum (neutrino oscillations), which lead to the 2015 nobel prize in physics being jointly awarded to Art McDonald and Takaki Kajita as leaders of the Canadian SNO experiment, and the Japanese Super-Kamiokande (SK) experiments respectively. The SK detector, located 1 km under a mountain, remains the largest water Cherenkov detector in the world, and has set the most stringent limits on nucleon decay. A program has begun to build the Hyper-Kamiokande (HK) detector (60 m diameter and 60 m tall) that is ten times larger than SK that has the sensitivity to detect small differences in how neutrinos and anti-neutrinos interact (CP-violation). A neutrino beam produced at the Japanese Proton Accelerator Research Complex (JPARC), 295 km from SK, has been used by the Tokai to Kamioka (T2K) experiment to detect the appearance of electron flavored neutrinos in a beam of muon-neutrinos. Future measurements of this beam with HK will be limited by systematic uncertainties in the detector response, neutrino flux, and cross-section.

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Neutrino Physics Continued…

Canadian researchers are leading an effort to reduce these systematic uncertainties by carrying out measurements of hadron production at Fermilab to reduce the neutrino flux uncertainties with the EMPHATIC project and preparing for a new intermediate distance water Cherenkov detector (IWCD) that will use multi-PMT modules. Come join this effort to do analysis of SK data, design and test elements that will bring the IWCD, EMPHATIC and HK experiments from concept to reality.

Possible projects:

1) Development of pattern recognition using machine learning to enable multi-ring fitters for water Cherenkov detectors (IWCD, Super-Kamiokande and Hyper-Kamiokande)

2) A ring imaging Cherenkov detector for hadron production measurements at Fermilab, and a beam test of a water Cherenkov detector at CERN

3) Developments on bottom-up optical calibration using photogrammetry of water Cherenkov detectors, and commissioning of an underwater test facility on campus at UWinnipeg to provide detailed calibration of mPMT modules.

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Digital Agriculture – The TerraByte Project

The recent and rapid advancement of (i) miniaturized, low-cost sensors, (ii) robotics and autonomous vehicles, and (iii) machine learning techniques could soon bring a new revolution to farming and food security. Physicists, with their unique problem-solving skills, design ingenuity and computational know-how, have an important role to play in this exciting, multi-disciplinary research.

See more here https://terrabyte.acs.uwinnipeg.ca

Contact Info: Chris Bidinosti, e-mail: c.bidinosti@uwinnipeg.ca; phone: 786-9718; office: 3L17

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Development of Novel MR Imaging Methods

Imaging techniques have become an indispensable tool in every field of research as well as in industry and indeed in everyday life. We use imaging of some form or another to look at – and into – the very small (e.g., molecules and cells), the very large (e.g., geology and weather patterns), and everything in between, such as your luggage at the airport. The search for new imaging technologies, with different capabilities and areas of application, is important not only to science and scientists but to society as a whole. My present research focuses on MRI with hyperpolarized xenon as well as the development and understanding of a new method of MRI known as TRASE (TRansmit Array Spatial Encoding). This technique uses much less bulky and expensive equipment, which could result in lighter, simpler, and cheaper MRI apparatus that would be more available to the greater population.

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TRIUMF Ultracold Advanced Neutron (TUCAN) Collaboration

U of W is leading a new ultracold neutron project at TRIUMF, Canada's National Laboratory for Particle and Nuclear Physics, in Vancouver, BC. The flagship experiment will be a search for a neutron electric dipole moment (nEDM). If non-zero, the nEDM would signify a previously undetected source of CP violation, and could shed light on the mystery of the matter-antimatter asymmetry of the universe.

Possible projects this year are:

- Magnetics engineering (C. Bidinosti)
- Analysis of detector data from the fall 2018 run to study the performance of the neutron spin-flippers and spin-analysers (B. Jamieson)
- Neutron detection and data acquisition (T. Lindner)
- Design and assembly of a pulsed laser deposition facility to make neutron guides, and magnet design using finite element software (R. Mammei)
- Magnetic sensors and ultracold neutron source cryogenic engineering (J. Martin)

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TUCAN Continued…

For more information, contact:

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Thomas Lindner, e-mail: lindner@triumf.ca phone: (604)222-1047 x6181

Russell Mammei, e-mail: r.mammei@uwinnipeg.ca; phone: 788-7491; office: 2L22

Jeff Martin, e-mail: j.martin@uwinnipeg.ca; phone: 786-9443; office: 3L22/23

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Non-invasive Imaging of Mouse Models of Human Diseases

My research develops magnetic resonance imaging and positron emission tomography techniques for the study of the central nervous system. In general, student projects typically involve data processing, but can also include data collection on the 7T MRI scanner at the Health Sciences Centre.

Contact Info: Melanie Martin, e-mail: m.martin@uwinnipeg.ca; phone: 786-9442; office: 3L20/21

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Cold Neutron Beta Decay at the SNS

The Nab collaboration aims to make the world's most precise measurement of the electron neutrinoangular correlation parameter "a" and the Fierz interference term "b" in cold neutron beta decay. The experiment employs a novel 4 Pi field expansion spectrometer and is located at the Fundamental Neutron Physics Beam line (FNPB) of the Spallation Neutron Source (SNS) at Oak Ridge National Lab in the USA. The Winnipeg group has developed a 30 keV proton accelerator and large area microchannel plate (MCP) detector at the University of Manitoba to characterize the main Si detectors with protons prior to installation in the experiment. We typically hire 1 student per summer and their projects have been hardware (detector building, building a vacuum chamber) and software (detector DAQ development, CAD design) oriented. Possible projects for 2020 include:

1) Characterization of the MCP detector with the proton source at UofM.
2) Characterization of Nab silicon detectors at the University of Manitoba.

For more info, contact: Russell Mammei, e-mail: r.mammei@uwinnipeg.ca; phone: 988-7491; office: 2L28

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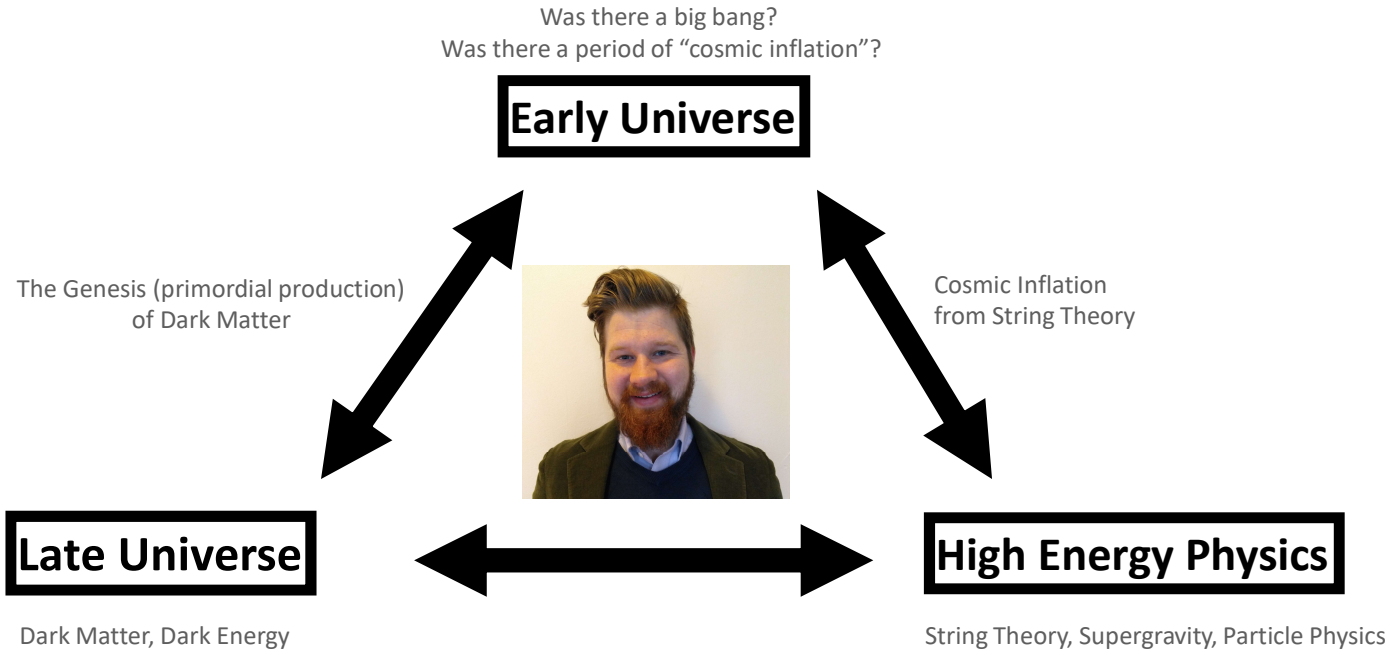
Evan McDonough

Always looking for enthusiastic students!!!

Broad set of really cool topics, connecting 3 main themes



e.mcdonough@uwinnipeg.ca

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Internal Awards (UofW)

- USRA (if apply through UW)
  - Deadline Jan 24, 2022.
- P2GS
  - Deadline around early February 2022.
- ISSP
  - Applications open soon!
- https://www.uwinnipeg.ca/research/funding/undergraduate-student-research-funding-opportunities.html

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External Awards

- USRA (if apply at another University)
- IPP (must also hold TRIUMF or USRA)
  - Deadline Jan 14, 2022.
- CINP
  - Deadline March 1, 2022.
- TRIUMF
  - Jobs usually posted ~ mid January
  - Deadline shortly thereafter.
- MITACS Globalink Research Award Thematic Call
  - Deadline passed.
- DAAD
  - Deadline December 15, 2021.
- PSI Start
  - Deadline January 17, 2022.
- McDonald Institute (have both jobs & internships for non-physics majors)
  - Deadline January 21, 2022.
- AAPM 10 week internship.
  - Deadline Feb 3, 2022.
- 2022 DREAM 10 week internship.
  - Deadline Feb 2, 2022.

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