Summer Particle Astrophysics Workshop 2024

Report of Contributions

https://indico.global/e/539

Contribution ID: **1** Type: **not specified**

Opening Remarks

Tuesday 7 May 2024 11:00 (30 minutes)

Presenter: BAI, Minya (Queen's University)

Contribution ID: **2** Type: **not specified**

Intro to Particle Physics

Tuesday 7 May 2024 11:30 (1 hour)

It's a dangerous business, Frodo, getting out your door. You step onto the road, and if you don't keep your feet, there's no knowing where you might be swept off to.

Presenters: Dr TAM, Benjamin (University of Oxford); ADAMS, Emily (Queen's University)

Session Classification: Particle & Astroparticle Physics

Contribution ID: **3** Type: **not specified**

Intro to Astroparticle Physics

Tuesday 7 May 2024 13:30 (1 hour)

Particle astrophysics lies at the rich interface between astrophysics, cosmology and fundamental physics. It aims to find answers for the most fundamental questions about our universe, its origin and evolution, using the complementary information provided by the cosmic messengers that arrive to us: cosmic rays, neutrinos, photons and gravitational waves.
This lecture aims at telling the story of the origins of astroparticle physics, the current puzzles that need to be solved, while presenting the different cosmic messengers from a very experimental perspective.

Presenters: CARPINTEIRO INACIO, Ana Sofia (University of Oxford); ADAMS, Emily (Queen's University)

Session Classification: Particle & Astroparticle Physics

Contribution ID: **4** Type: **not specified**

Unix and Command Line

Tuesday 7 May 2024 15:00 (2 hours)

Presenters: Dr RICHARDSON, Mark (McDonald Institute); BAIOCCHI, Melissa

Session Classification: Workshops

Contribution ID: **5** Type: **not specified**

Intro to Astronomy

Wednesday 8 May 2024 11:30 (1 hour)

Presenters: Dr ARORA, Nikhil; Mr TOBIN, Shamus (Queen's University); WITHERS, Tai (Queen's University)

Session Classification: Astronomy

Contribution ID: **6** Type: **not specified**

SKA

Wednesday 8 May 2024 13:30 (30 minutes)

Title: Canada and the Square Kilometre Array

Abstract: The Square Kilometre Array (SKA) is a next-generation radio astronomy observatory being built by 16 partner countries that will enable transformational science about the history, contents, and extreme conditions in the Universe. It is one of the largest science projects in history, and Canada will soon be a full member! This talk will give an overview of the SKA that highlights the science, technology, and broader impacts aspects of the facility that are most relevant to Canada.

Presenters: Dr SPEKKENS, Kristine (Queen's University); WITHERS, Tai (Queen's University)

Session Classification: Astronomy

Contribution ID: **7** Type: **not specified**

Radio Astronomy

Wednesday 8 May 2024 14:00 (30 minutes)

A beginner's guide to Radio Telescopes and Interferometers.

In this talk I will be giving an overview of how radio telescopes operate and why we use them. I will start by giving a basic overview of single-dish telescopes and interferometers as well as their applications in radio astronomy. I will continue by introducing Very Long Baseline Interferometry (VLBI), the most extreme form of interferometry and will discuss current limitations of this technique. To wrap up I will talk about the Balloon-borne VLBI Experiment (BVEX) a 22 GHz balloon-borne VLBI station that will launch from Timmins, Ontario in the Summer of 2025, as well as technical challenges that arise when doing VLBI from the stratosphere. Finally, I will discuss how experiments like this can address current limitations of ground-based VLBI such as atmospheric noise, resolution and uv-coverage.

Presenters: THIEL, Felix (Queen's University); BAI, Minya (Queen's University)

Session Classification: Astronomy

Contribution ID: **8** Type: **not specified**

Python

Wednesday 15 May 2024 15:00 (2 hours)

Presenters: MAKOWSKI, Annabelle; COQUILLAT, Jean-Marie (Queen's University, Canada)

Session Classification: Workshops

Contribution ID: **9** Type: **not specified**

Intro to Nuclear Decays & Backgrounds

Thursday 9 May 2024 11:30 (1 hour)

Author: SWEENEY, Gary (Queen's University)

Presenters: SWEENEY, Gary (Queen's University); SWIDINSKY, Nicholas (Queen's University)

Session Classification: Nuclear

Contribution ID: **10** Type: **not specified**

Superallowed Beta Decays

Thursday 9 May 2024 13:30 (30 minutes)

Presenters: Prof. GRINYER, Gwen; SWIDINSKY, Nicholas (Queen's University)

Session Classification: Nuclear

Contribution ID: **11** Type: **not specified**

KDK+

Thursday 9 May 2024 14:00 (30 minutes)

Presenters: LEMAIRE, Arnaud; SWIDINSKY, Nicholas (Queen's University)

Session Classification: Nuclear

Contribution ID: **12** Type: **not specified**

Stats & Errors

Thursday 9 May 2024 15:00 (2 hours)

In this two-hour whirlwind session, I'll introduce basic principles of frequentist and Bayesian statistics and illustrate the most common statistical techniques used in particle physics.

Presenter: OSER, Scott

Session Classification: Workshops

Contribution ID: **13** Type: **not specified**

Intro to Neutrino Physics

Friday 10 May 2024 11:30 (1 hour)

Title: Neutrinos: past, present and future

Abstract: I will present a brief history of neutrino physics to give context to the current experimental and theoretical pursuits in the field. I will highlight the story of the solar neutrino problem and its resolution in Canada.

Author: MARTIN, Ryan

Presenters: Mr KRAR, Brian; MARTIN, Ryan

Session Classification: Neutrinos

Contribution ID: **14** Type: **not specified**

Intro to GIT

Friday 10 May 2024 13:30 (1 hour)

Managing a project is fun when it's just you. Once two or more people all need to collaborate on a project - a software package, a paper, a poster - it's very easy to begin stepping on each other's toes as you pursue ideas separately and together. Git is a collaborative project management system, designed for software developers, that allows for asynchronous collaborative development. In this short lecture, we will tour some of the major features of Git, practice some of them, and start thinking about how you could manage your next software-like project using this system

Presenters: Dr SEKULA, Stephen (SNOLAB and Queen's University); YE, Tianai (Queen's University, Canada)

Session Classification: Workshops

Contribution ID: **15** Type: **not specified**

SNO+

Friday 10 May 2024 15:00 (30 minutes)

Author: RICCETTO, Serena

Presenters: ALLEGA, Anthony (Queen's University); RICCETTO, Serena

Session Classification: Neutrinos

Contribution ID: **16** Type: **not specified**

SuperKamiokande

Friday 10 May 2024 15:30 (30 minutes)

Title: The Super-Kamiokande and the Hyper-Kamiokande Experiment

The discovery of neutrino oscillation in atmospheric neutrinos by the Super-Kamiokande (Super-K) and solar neutrinos by the Sudbury Neutrino Observatory (SNO) led to the 2015 Nobel Prize in Physics. Super-K has been a long-running neutrino experiment using Water Cherenkov Detector for more than 20 years using ultra-pure water as its neutrino target. Recently it has been upgraded to Super-K-Gd. The new generation of water Cherenkov detectors is also on its way. The Hyper-K detector, which is similar to the Super-K but larger in dimensions and a more improved version, is being built to make precision measurements of neutrino oscillation, and to search for a potentially large CP-violation of neutrinos. This talk will present a brief physics overview of the neutrino oscillation, the Super-Kamiokande Experiment, and the progress towards building the new Hyper-Kamiokande Experiment in Japan, the construction of which is currently in full-swing, and aims to start taking data from 2027, thus boosting the physics searches with neutrinos.

Author: Dr AJMI, Ali (University of Winnipeg)

Presenters: Dr AJMI, Ali (University of Winnipeg); ALLEGA, Anthony (Queen's University)

Session Classification: Neutrinos

Contribution ID: **17** Type: **not specified**

nEXO

Friday 10 May 2024 16:00 (30 minutes)

Author: BRUNNER, Thomas (McGill University)

Presenters: ALLEGA, Anthony (Queen's University); BRUNNER, Thomas (McGill University)

Session Classification: Neutrinos

Contribution ID: **18** Type: **not specified**

LEGEND

Friday 10 May 2024 16:30 (30 minutes)

Author: YE, Tianai (Queen's University, Canada)

Presenters: ALLEGA, Anthony (Queen's University); YE, Tianai (Queen's University, Canada)

Session Classification: Neutrinos

Contribution ID: **19** Type: **not specified**

Dark Matter Overview

Monday 13 May 2024 11:30 (1 hour)

Author: VINCENT, Aaron (Queen's University)

Presenters: VINCENT, Aaron (Queen's University); BLEAU, Katarina (Queen's University)

Session Classification: Dark Matter

Contribution ID: **20** Type: **not specified**

Direct/In-Direct Detection

Monday 13 May 2024 13:30 (1 hour)

Author: BLEAU, Katarina (Queen's University)

Presenters: BLEAU, Katarina (Queen's University); BOUKHTOUCHEN, Yilda (Queen's University)

Session Classification: Dark Matter

Contribution ID: **21** Type: **not specified**

PICO

Monday 13 May 2024 15:00 (30 minutes)

Authors: ADAMS, Emily (Queen's University); ROBERT, Michaela

Presenters: ADAMS, Emily (Queen's University); ROBERT, Michaela; BOUKHTOUCHEN, Yilda (Queen's University)

Session Classification: Dark Matter

Contribution ID: **22** Type: **not specified**

SBC

Monday 13 May 2024 15:30 (30 minutes)

Author: CLARK, Kenneth

Presenters: CLARK, Kenneth; BOUKHTOUCHEN, Yilda (Queen's University)

Session Classification: Dark Matter

Contribution ID: **23** Type: **not specified**

Argon Experiments

Monday 13 May 2024 16:00 (30 minutes)

Author: Dr SCHUCKMAN, Frederick

Presenters: Dr SCHUCKMAN, Frederick; BOUKHTOUCHEN, Yilda (Queen's University)

Session Classification: Dark Matter

Contribution ID: **24** Type: **not specified**

NEWS-G

Monday 13 May 2024 16:30 (30 minutes)

Author: COQUILLAT, Jean-Marie (Queen's University, Canada)

Presenters: COQUILLAT, Jean-Marie (Queen's University, Canada); BAIOCCHI, Melissa

Session Classification: Dark Matter

Contribution ID: **25** Type: **not specified**

SuperCDMS

Monday 13 May 2024 17:00 (30 minutes)

Presenter: STUKEL, Matthew

Session Classification: Dark Matter

Contribution ID: **26** Type: **not specified**

Intro to Multi-Messenger Physics

Tuesday 14 May 2024 11:30 (1 hour)

Author: PARK, Nahee

Presenters: PARK, Nahee; HATCH, Patrick

Session Classification: Multi-Messenger

Contribution ID: **27** Type: **not specified**

EDII Workshop

Tuesday 14 May 2024 13:30 (1 hour)

Presenters: BAI, Minya (Queen's University); BHARDWAJ, Avani

Session Classification: Workshops

Contribution ID: **28** Type: **not specified**

HELIX

Tuesday 14 May 2024 15:00 (30 minutes)

Author: BAIOCCHI, Melissa

Presenters: ELLINGWOOD, Emma (Queen's University); BAIOCCHI, Melissa

Session Classification: Multi-Messenger

Contribution ID: **29** Type: **not specified**

IceCube

Tuesday 14 May 2024 15:30 (30 minutes)

Author: HATCH, Patrick

Presenters: ELLINGWOOD, Emma (Queen's University); HATCH, Patrick

Session Classification: Multi-Messenger

Contribution ID: **30** Type: **not specified**

VERITAS

Tuesday 14 May 2024 16:00 (30 minutes)

The Very Energetic Radiation Imaging Telescope Array System (VERITAS) is an array of four 12 m Imaging Atmospheric Cherenkov Telescopes (IACTs), located at the Fred Lawrence Whipple Observatory in Arizona, USA, that has been in full array operation since 2007. VERITAS conducts research in a variety of areas including galactic science such as supernova remnants, pulsar wind nebulae, binary systems; extra-galactic science including jetted AGN, gamma-ray burst and fast radio burst searches; multimessenger follow-ups and astroparticle physics, including dark matter searches. In this talk I will give an overview of the methods used by IACTs to observe gamma-ray like events, the VERTIAS instrument itself and highlight some past and recent results from the experiment.

Author: Dr MCGRATH, Conor (Queen's University)

Presenters: Dr MCGRATH, Conor (Queen's University); ELLINGWOOD, Emma (Queen's University)

Session Classification: Multi-Messenger

Contribution ID: **31** Type: **not specified**

Intro to Accelerators

Wednesday 15 May 2024 11:30 (1 hour)

Through the telling of historical facts and stories, you'll learn about how particle accelerators work and some of the ways accelerators are used for fundamental research. In this talk, I'll also introduce some of the well-known particle accelerators used for discovery research around the world, and some of the future ideas!

Author: VACHON, Brigitte (McGill University, (CA))

Presenters: VACHON, Brigitte (McGill University, (CA)); PANCHAL, Neha (Postdoctoral Fellow)

Session Classification: Accelerators

Contribution ID: **32** Type: **not specified**

TUCAN

Wednesday 15 May 2024 13:30 (30 minutes)

The degree of matter-antimatter asymmetry in the universe is currently unexplained by the Standard Model. While the required forms of symmetry breaking are present in the standard model, in particular CP symmetry breaking, the observed systems are not enough to explain the current asymmetry. A particle with a permanent electric dipole moment (EDM) breaks CP symmetry, and so precision EDM measurements are underway in many systems, including the neutron. The TUCAN collaboration is seeking to provide a measurement of the neutron EDM (nEDM) with unprecedented precision, improving the current upper bound by an order of magnitude. This is made possible by the TUCAN source which will be the most intense source of ultracold neutrons (UCN) in the world, as well as the development of extremely precise magnetometry and magnetic shielding. This talk will give an introduction to the nEDM experimental method, and will discuss some of the technology being developed in order to reach the target sensitivity.

Author: KLASSEN, Wolfgang (UBC/TRIUMF)

Presenters: PANCHAL, Neha (Postdoctoral Fellow); KLASSEN, Wolfgang (UBC/TRIUMF)

Session Classification: Accelerators

Contribution ID: **33** Type: **not specified**

BELLE-II

Wednesday 15 May 2024 14:00 (30 minutes)

Author: BEAUBIEN, Alexandre

Presenters: BEAUBIEN, Alexandre; PANCHAL, Neha (Postdoctoral Fellow)

Session Classification: Accelerators

Contribution ID: **34** Type: **not specified**

Intro to C++

Wednesday 8 May 2024 15:00 (2 hours)

C++ is an object-oriented successor to the programming language C and has become one of the most common programming languages used today. It sees widespread commercial use in video games, web services, robotics, and many other areas. In physics research, it is commonly used in simulation software packages like GEANT4, or analysis packages like CERN ROOT.

In this talk, it is assumed that attendees have zero knowledge of C++. Starting with the basics of data types and manipulation, a brief survey of control sequences, structs, vectors, arrays, and classes will be explored. The objective is to give you, the student, enough exposure to these concepts so that you can interpret, modify, and use the analysis scripts or simulations you shall encounter throughout your summer work. This presentation will not discuss the more complex topics of polymorphism, exception handling, or templates. At different points through the presentation, the student will be encouraged to work on a given problem that familiarizes them with the material. To be able to participate in these activities, the student will be required to have a C++ compiler (preferably g++, or equivalent), an editor, and a positive attitude!

Presenters: MORISON, Hugh; HILL, Remington (Queen's University)

Session Classification: Workshops

Contribution ID: **35** Type: **not specified**

ATLAS Overview

Thursday 16 May 2024 11:30 (30 minutes)

Presenter: TRIGGER, Isabel (TRIUMF (CA))

Session Classification: Accelerators

Contribution ID: **36** Type: **not specified**

ATLAS ITK

Thursday 16 May 2024 12:00 (30 minutes)

Presenter: VELOCE, Laurelle Maria (University of Toronto (CA))

Session Classification: Accelerators

Contribution ID: **37** Type: **not specified**

General Lab Skills and LaTeX

Thursday 16 May 2024 13:30 (1 hour)

Author: SWIDINSKY, Nicholas (Queen's University)

Presenters: BAI, Minya (Queen's University); SWIDINSKY, Nicholas (Queen's University)

Session Classification: Workshops

Contribution ID: **38** Type: **not specified**

Intro to ROOT

Thursday 16 May 2024 15:00 (2 hours)

A tutorial on programming with ROOT!

ROOT is a c/c++ environment developed at CERN to provide tools for manipulating, analysing and displaying high energy physics data. It includes a lot of advanced systems.
This will be an introduction to basic routines to simulate some data, process it and display useful graphs. There will be a short presentation, followed by tutorial exercises. It will be very helpful if everyone has the possibility to run ROOT o their own laptop.

ROOT install instructions:

There are many ways to get ROOT. There are lots more details here https://root.cern/install/, so if the below doesn't work for you check out the info there. It will be quicker to get the pre-compiled binaries, but if that doesn't work for whatever reason you can try building from source.

The first thing to do is make sure you have all the things ROOT depends on. A list of these, with instructions for different operating systems, can be found here: https://root.cern/install/dependencies/

MacOS:

Install homebrew https://brew.sh
Install XCode from the App Store
In a terminal, type: brew install root
cd root
source /usr/local/Cellar/root/6.26.06_2/bin/thisroot.sh (maybe the version and/or location are different)

Unix:

Get the precompiled binaries for your system from here:https://root.cern/releases/release-62802/
tar xvf root_v6.28.02.Linux-centos8-x86_64-gcc8.5.tar
source root/bin/thisroot.sh
More detailed walk through https://www.youtube.com/watch?v=QItrmchEQWE (he builds from source but you can do this with the precompiled tar files)

Windows:

I think you should have access to Windows Subsystem for Linux or similar
It will probably be easiest to use the above Unix instructions within that
Then install XMing https://sourceforge.net/projects/xming/
type: export DISPLAY="localhost:0"
More detailed walk through https://www.youtube.com/watch?v=pmfM4Zq6OQU (he builds from source but you can do this with the precompiled tar files)

(Alternative) Building from Source:

Once you have the dependencies, get the source file here https://root.cern/releases/release-62802/
cd root
./configure –disable-castor –disable-rfio –disable-x11 –disable-gfal –disable-ldap (these disabled options are all things I've found problems with on various systems, and we won't need them for the simple examples/project)
make
source bin/thisroot.sh

To check it's worked, type root. The terminal prompt should now be root [0]. If so, it seems root is installed ok! Now try TCanvas c1, if a blank window pops up, the graphics are all working too and you are good to go :)

If that all sounds like gobbledigook, please do not worry‼ Just let us know, and we will try to bring extra laptops with ROOT pre-installed, and/or we will spend some tutorial time on the installation process.

If you're having problems but are keen, there are many resources you can use online. https://root.cern/install/ is the place to start but there are countless guides, videos, and forums online. Someone will have encountered your problem before, it's working out what to google which can be tricky! Hopefully this is enough to get you started and point you in the direction of where to find info for your specific setup.

Good luck! And to reiterate, if you can't get root installed, it won't completely preclude you from taking part in the tutorial

Author: GROS, Philippe

Presenters: COQUILLAT, Jean-Marie (Queen's University, Canada); GROS, Philippe

Session Classification: Workshops

Contribution ID: **39** Type: **not specified**

PMTs

Friday 17 May 2024 11:30 (30 minutes)

Author: LEMAIRE, Arnaud

Presenters: LEMAIRE, Arnaud; SKENSVED, Peter

Session Classification: Instrumentation

Contribution ID: **40** Type: **not specified**

LiquidO

Friday 17 May 2024 12:00 (30 minutes)

Author: Prof. CHEN, Mark (Queen's University)

Presenters: LEMAIRE, Arnaud; Prof. CHEN, Mark (Queen's University)

Session Classification: Instrumentation

Contribution ID: **41** Type: **not specified**

Academic Writing & Presentations

Friday 17 May 2024 13:30 (1 hour)

Presenter: BRISSON-TSAVOUSSIS, Zoe (Queen's University)

Session Classification: Workshops

Contribution ID: **42** Type: **not specified**

Closing Remarks

Friday 17 May 2024 15:00 (15 minutes)

Contribution ID: **43** Type: **not specified**

Mandatory Fun

Friday 17 May 2024 15:15 (2 hours)

Presenters: BAI, Minya (Queen's University); BHARDWAJ, Avani