Summer Particle (Astro) Physics Workshop (2022)

Report of Contributions

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

Introductory Remarks

Tuesday 3 May 2022 12:00 (30 minutes)

Presenter: BAIOCCHI, Melissa

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

Introduction to Particle Physics

Tuesday 3 May 2022 12:30 (1 hour)

"It's a dangerous business, Frodo, going 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."

Presenter: TAM, Benjamin (Queen's University)

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

Accelerator Physics Overview

Tuesday 3 May 2022 14:00 (1 hour)

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

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

Lunch

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

Introduction to Unix Command Line Interface (CLI) and tools for scientific computing

Tuesday 3 May 2022 16:00 (2 hours)

This workshop includes a crash course in Unix filesystems, including navigation, file permissions and other useful common commands, including shell scripts. We will also discuss shell scripts and Docker containers. Time permitting, we will cover an introduction to networked computing and DevOps for scientific computing.

Presenter: GALLACHER, David

Contribution ID: **6**

Type: **not specified**

Scintillating Bubble Chambers

Wednesday 4 May 2022 12:30 (30 minutes)

The SBC Collaboration is constructing a 10-kg liquid argon bubble chamber with scintillation readouts. The goal is to achieve 100 eV nuclear recoils detection with near-complete discrimination against electron recoil events. In addition to a dark matter search, SBC targets a CEvNS measurement of MeV-scale neutrinos from nuclear reactors. A high-statistics, high signal-to-background detection would enable precision searches for physics beyond the standard model. In this talk, after giving a brief introduction to dark matter and challenges, I will present the physics reach of the SBC detectors and the advantages of using such technology.

I will also discuss the progress towards the construction at Fermilab to test the sub-keV threshold performance and at SNOLAB for the search for dark matter.

Presenter: PIRO, Marie-Cécile

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

SNO+

Wednesday 4 May 2022 13:00 (30 minutes)

Presenter: WRIGHT, Alex (IPP/Queen's University)

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

Particle Astrophysics Overview

Wednesday 4 May 2022 14:00 (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.

Presenter:　INACIO, Ana Sofia (Laboratório de Instrumentação e Física Experimental de Partícul)

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

Lunch

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

Statistics and Error Analysis

Wednesday 4 May 2022 16:00 (2 hours)

A Crash Course in Statistics: 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

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

ROOT

Thursday 5 May 2022 16:00 (2 hours)

Root is a C++-based data analysis environment that is supported by CERN. This will be a two-hour tutorial style introduction to Root, including the basic functionality, basic data structures, and how to read and write data. The available documentation and how to use it will be discussed.

The zip file contains materials that you will need in order to participate in the workshop

Presenter: JILLINGS, Chris

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

Lunch

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

Git

Thursday 5 May 2022 12:00 (2 hours)

Presenter: RHEA, Carter

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

Neutrinos: Past, Present and Future

Friday 6 May 2022 12:30 (1 hour)

This talk will give a short overview of neutrino physics, including their initial motivation and discovery, the solar neutrino problem and its resolution by the SNO experiment. The talk will end with current open questions in neutrino physics.

Presenter: MARTIN, Ryan

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

Dark Matter Overview

Friday 6 May 2022 14:00 (1 hour)

Over the past several decades physicists have made remarkable progress in understanding the fundamental building blocks of nature. Yet there remains much we still do not know. One of the biggest open questions in our Universe is the nature of dark matter. Cosmological and astrophysical observations point to the existence of a non-luminous and mysterious form of matter that is far more abundant than all the visible matter in our Universe. This substance, which we simply refer to as ""dark matter"", holds our Universe together. It is responsible for the formation of galaxies, the solar system and ultimately life as we know it.

In this one hour lecture, I will discuss how particle and astro-physicists have been trying to answer two questions, What is dark matter? and How do we find it? The lecture will focus on the current status of dark matter searches. In particular, how connections between diverse searches from the laboratory to the cosmos could help deepen our understanding of dark matter.

Presenter: MOHLABENG, Gopolang (Queen's University)

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

Lunch

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

Indirect Dark Matter Detection

Friday 6 May 2022 16:00 (30 minutes)

The session will provide a short introduction to indirect searches for dark matter, with cosmic rays, gamma rays, neutrinos and cosmology.

Presenter:　VINCENT, Aaron (Queen's University)

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

Superallowed Beta Decays

Friday 6 May 2022 16:30 (30 minutes)

Presenter:　GRINYER, Gwen (University of Regina)

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

Belle-II

Friday 6 May 2022 17:00 (30 minutes)

Belle II and it's accelerator SuperKEKB are setting world records for the amount of data produced and collected in eˆ+ eˆ- collisions. This huge data set is being used to test the standard model through incredibly precise measurements of predictions made by the standard model and beyond. This session will outline the Belle II detector, our event selection algorithms, and highlights from our new physics results.

Presenter: MILLER, Caleb

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

PICO

Friday 6 May 2022 17:30 (30 minutes)

The PICO collaboration operates freon-filled bubble chambers for the direct detection of dark matter, focused primarily on the spin dependent WIMP-proton regime. This session will describe the history and basics of bubble chambers as particle detectors, their role in dark matter direct detection, and the PICO-40L chamber. PICO-40L is the current generation of bubble chamber being assembled at SNOLAB in Sudbury, Canada, which is planned to begin re-commissioning in summer 2022.

Presenter: MOORE, Colin

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

Python

Monday 9 May 2022 13:00 (2 hours)

In this two-hour workshop we will cover python topics for beginners and also some tips and tricks that more experienced python users can implement into their coding practices. We will cover an introduction to python as a programming language, an overview of basic python objects and their built-in functions. We will also go over some of my favourite python libraries and modules for scientific programming. Time permitting, I will give a quick crash course in writing test code which is one way in which any programmer can level-up their coding game. This session will be highly interactive with coding demo's, exercises, and exploration time built into the workshop's schedule.

Presenter: SOUSA-FRONENBERG, Hannah

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

Lunch

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

Academic Presentations

Monday 9 May 2022 16:00 (1 hour)

An interactive workshop to help you develop presentation and communication skills to share your science and make it engaging. Includes information on how to create presentations, visuals, posters, and how to make your talks accessible.

Presenter: SAFFIN, Jenna

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

Lunch

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

NEWS-G

Tuesday 10 May 2022 16:00 (30 minutes)

Presenter: DURNFORD, Daniel

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

Medical Physics Overview

Tuesday 10 May 2022 16:30 (30 minutes)

An overview of the field of medical physics with an emphasis on how it is related to particle physics.

Presenter: FLETCHER, Liz (Carleton University)

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

ATLAS

Tuesday 10 May 2022 17:00 (30 minutes)

Presenter: TRIGGER, Isabel (TRIUMF (CA))

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

DarkSide

Monday 9 May 2022 17:00 (30 minutes)

Dark matter search is a high priority endeavour in our field. Building larger and more sensitive detectors underground in the next decades will provide an opportunity for new discoveries, but it will also require new technological developments to achieve that. Liquid argon has been used by many collaborations already and has proven to deliver high quality data, but one of the challenges that future experiments will need to address is a background intrinsic to atmospheric argon itself in a form of argon-39. In this class, I will go over lessons learned from past experiments, how those can be applied to future projects and what strategies are being developed to address the intrinsic argon background.

Presenter: MANECKI, Szymon (Queen's University)

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

Super-Kamiokande

Tuesday 10 May 2022 17:30 (30 minutes)

The discovery of neutrino oscillation in atmospheric neutrinos by Super-Kamiokande (Super-K) and solar neutrinos by the Sudbury Neutrino Observatory (SNO) led to their experiment's PIs sharing the 2015 Nobel Prize in Physics. Both of these are water Chernkov detectors, Super-K with light water, and SNO with heavy water. A new generation of water Cherenkov detectors 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 neutrino oscillation, and progress towards building a new Intermediate Water Cherenkov Detector in the J-PARC beamline that will be part of the next generation of CP-violation searches with neutrinos.

Presenters: Dr AJMI, Ali; JAMIESON, Blair (University of Winnipeg)

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

The Majorana Demonstrator and LEGEND experiments

Wednesday 11 May 2022 14:00 (30 minutes)

This talk will give a short overview of experiments that utilize high purity germanium detectors to search for neutrinoless double-beta decay and ultimately understand whether the neutrino is a Dirac of Majorana particle.

Presenter: MARTIN, Ryan

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

Dark Matter Modulation and the COSINUS Experiment

Wednesday 11 May 2022 14:30 (30 minutes)

Presenter:　STUKEL, Matthew

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

Lunch

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

nEXO

Wednesday 11 May 2022 16:00 (30 minutes)

Presenter:　BRUNNER, Thomas (McGill University)

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

Multi-Messenger Astronomy

Thursday 12 May 2022 14:00 (1 hour)

Presenter: CLARK, Ken (Queen's University)

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

Lunch

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

C++

This session aims to provide students with introductory working knowledge of C++. We will explore commonly used syntax with some example code. Exercises will also be provided to guide participants in further understanding of the principles. Time permitting, a brief tie-in with ROOT will also be given.

Presenter: LAM, Ian (Queen's University, Canada)

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

Watchman

Wednesday 11 May 2022 16:30 (30 minutes)

Presenter:　PICKARD, Leon

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

ANNIE

Wednesday 11 May 2022 17:00 (30 minutes)

Presenter: PICKARD, Leon

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

PMT's

Wednesday 11 May 2022 13:00 (30 minutes)

Presenter: SKENSVED, Peter

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

P-ONE

Tuesday 10 May 2022 14:30 (30 minutes)

Presenter: GAERTNER, Andreas (University of Alberta)

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

Closing Remarks

Thursday 12 May 2022 18:00 (10 minutes)

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

Mandatory Fun!

Thursday 12 May 2022 18:10 (1h 20m)

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

SuperCDMS

Tuesday 10 May 2022 14:00 (30 minutes)

The Super Cryogenic Dark Matter Search (SuperCDMS) experiment uses cryogenic semiconductor detectors instrumented with superconducting transition edge sensors to search for interactions caused by low-mass dark matter particles. In this talk I will describe the detection principle, experimental setup, and calibration and energy reconstruction techniques used by SuperCDMS that allow it to have excellent sensitivity to light dark matter.

Presenter: GERMOND, Richard