David Gallacher

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Education

2021-Current	Doctor of Philosophy McGill University, Montréal, QC	Experimental Particle Physics
2019-2021	Master of Science Carleton University, Ottawa, ON	Particle Astrophysics
2012-2019	Bachelor of Science, Honors Carleton University, Ottawa, ON	Experimental Physics

Highlighted Publications

D. Gallacher et. al (2022). Development and characterization of a slow wavelength shifting coating for background rejection in liquid argon detectors, *Submitted to NIMA*,
DOI: arXiv:2109.06819

DEAP Collaboration (2022). First direct detection constraints on Planck-scale mass dark matter with multiple-scatter signatures using the DEAP-3600 detector, January 2022, *Phys. Rev. Lett. 128, 011801,* DOI

DEAP Collaboration (2020). Constraints on dark matter-nucleon effective couplings in the presence of kinematically distinct halo substructures using the DEAP-3600 detector, *Physical Review D 102, 082001*

D. Gallacher and M. Boulay (2020) Surface background rejection technique for liquid argon dark matter detectors using a thin scintillating layer. Proceedings for LIDINE 2019, *JINST* Vol 15 (2020)

DEAP Collaboration (2019) Electromagnetic Backgrounds and Potassium-42 Activity in the DEAP-3600 Dark Matter Detector. *Physical Review D* 100, 072009

DEAP Collaboration (2019) Search for dark matter with a 231-day exposure of liquid argon using DEAP-3600 at SNOLAB. *Physical Review D* 100, 022004

Highlighted Presentations

Conferences
LIDINE 2021
[Talk] Development and characterization of a slow wavelength shifting coating for background rejection in liquid argon detectors, *Virtual, September 2021*

Canadian Association of Physicists Congress 2021:
[Talk] Argon-1: An R&D detector for next generation LAr experiments, *Virtual Conference, June 2021*

M.I Annual Meeting of The Canadian Astroparticle Physics Community 2020
[Talk] Argon-1: A single-phase LAr detector for studies in novel detector technologies and background rejection techniques, *Virtual Conference, August 25th, 2020*

LIDINE 2019
[Talk] Surface background rejection technique for liquid argon dark matter detectors using a thin scintillating layer, *Manchester UK, August 28th, 2019*

Outreach Talks
January 2020   **Curiosity on Stage at the Canada Science and Technology Museum**
                           Public lecture: Searching for Dark Matter with the DEAP-3600 experiment

Awards and Scholarships

- 2019-2021 Carleton Faculty of Science Departmental Master's Scholarship ($7000)
- 2019 Deans' Honors List
- 2019 Let's Talk Science Carleton Volunteer of the semester (Fall 2019)
- 2020 Let's Talk Science Carleton Volunteer Dedication Award (2019-2020)

Summary of Research Experience

September 2021 – Current – *Graduate Research Assistant*   Brunner Neutrino Lab
- Run coordinator of LoLX Experiment – Planning and organizing data taking campaigns, responsible for coordination of shifters and training for data acquisition shifts
- DAQ Expert – Responsible for development and installation of data-acquisition systems in lab for various experiments using Silicon photomultipliers
- Lead software developer for MERCI analysis software package, C++ based analysis framework for experiments using photodetectors and MIDAS data acquisition framework

September 2019 – August 2021 – *Graduate Research Assistant*   COLD Lab and DEAP-3600
- Photodetector technology development for cryogenic system, specifically silicon photomultipliers (SiPMs) including readout system design and data acquisition
- Co-authored the Scientific Technical Review for Cherenkov Backgrounds in DEAP for use in dark matter search analysis paper, contributed to the dark matter search paper backgrounds chapter.
- Leading role in DEAP-3600 hardware upgrades organization including characterization of a "slow" WLS material for background rejection in LAr detectors

May – September 2019 - *Research Assistant*   COLD Lab
- Assisted in the construction and commissioning of a liquid argon test detector (Argon-1) in the COLD lab class 10,000 cleanroom
- Configured and created slow control in NI Labview for a liquid argon detector system stability and readout

- Created a GEANT4 based Monte Carlo simulation of the Argon-1 detector and performed introductory studies, including improved SiPM simulations.

Sept. 2018 – May 2019 - *Honors Research Project*   DEAP-3600 R&D
- Operated and configured DEAP-1 DAQ and vacuum system
- Calibrated detector light yield using Am-241 alpha source with argon gas
- Measured Cherenkov yield for DEAP acrylic out cuttings with Tl-208 2.6 MeV γ source
- Conducted Monte Carlo studies of Cherenkov light using GEANT4 based software

May – September 2018 - *Research Assistant*   DEAP-3600
- Updated optical model for more realistic timing of WLS TPB into main Monte Carlo
- Conducted surface alpha searches with improved optical model, created a likelihood-based test for surface-alpha tagging

Skills Summary

Software Experience:
- C++
- ROOT (CERN C++ Framework)
- GEANT4
- Python
- NI LabView
- MIDAS data acquisition systems
- Other languages and software's including: HTML, CSS, bash, Fusion 360 CAD
- Experience using high performance computing clusters

Hardware Experience:
- Light readout technologies - PMTs and SiPMs
- Data acquisition systems and techniques
- 3D Printing and CAD design
- CNC Milling
- Cryogenics for liquid noble gas systems
- Ultrahigh vacuum systems
- Thermal deposition of wavelength shifters