Christopher Ewasiuk

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RESEARCH SUMMARY

PhD researcher in applied signal processing and data-driven modeling, with expertise in phase-coherent analysis, matched filtering, and robust PSD estimation for resonant microwave systems. Published first-author work in *JHEP* and *Physical Review D*, combining high-performance numerical pipelines, statistical inference, and machine-learning techniques to extract weak signals from noisy experimental data. Experienced in translating theoretical models into scalable, reproducible software workflows suitable for real-world detector and instrumentation environments.

EDUCATION

University of California Santa Cruz | PhD, Physics   **Sep. 2022 – Present**
- Fourth-year doctoral researcher specializing in gravitational-wave physics, black-hole dynamics, and advanced signal processing.
- Coursework and research emphasize theoretical modeling, numerical simulation, and data analysis of complex physical systems.

University of California Santa Barbara | BS, Physics   **Sep. 2017– Mar. 2021**
- GPA: 3.77/4.0
- Graduated Magna Cum Laude
- Highest Academic Honors within Physics

University of Edinburgh | Physics Exchange Program   **Semester**
- Completed upper-division physics coursework through an international exchange program

RESEARCH EXPERIENCE

UC Santa Cruz| Santa Cruz, CA   **Sept. 2022 – Present**
PhD Researcher — Gravitational Waves & Black Hole Physics

- Develop theoretical and numerical models of black hole evolution, superradiance, and gravitational wave emission from exotic sources
- Study constraints on dark sectors and light bosonic fields using black hole evaporation and stochastic GW backgrounds
- Research collaboration with ADMX scientists at LBNL, focusing on adapting resonant microwave cavity detectors for MHz–GHz gravitational wave searches
- Lead development of reproducible phase-coherent signal processing, matched-filtering, and Welch-based PSD estimation pipelines for high-resolution ADMX microwave cavity data, enabling sensitivity to MHz–GHz gravitational-wave signals

UCSB Experimental Cosmology Group | Goleta, CA   **Sept. 2020 – Sept. 2021**
Undergraduate Researcher

- Contributed to the design and validation of laser-based lunar dust mitigation systems in collaboration with faculty and graduate researchers
- Performed thermal and optical simulations to assess system performance and experimental feasibility
- Developed modeling and control software for an integrated laser prototype
- Presented project results at the NASA Big Idea Challenge and the COSPAR Scientific Assembly

SELECTED PROJECTS

MRI Tumor Segmentation and Severity Classifying Neural Net
Erdős Institute — Data Science Capstone | Columbus, OH   **Sept. 2022 – Present**

- Designed and trained a deep neural network to segment brain tumors from MRI scans and predict tumor grade and severity
- Built a full end-to-end pipeline including preprocessing, model training, evaluation, and uncertainty quantification
- Awarded **Top Project of the Quarter** among cohort projects

    Tools & Skills: Deep Learning, CNN/U-Net Models, Medical Image Segmentation, MRI Preprocessing, Model Evaluation (Dice, IoU), Uncertainty Quantification, Python (PyTorch), NumPy, SciPy, MatLab, Statistical Analysis

PROFESSIONAL EXPERIENCE

Stanford Linear Accelerator | Menlo Park, CA   **Dec. 2021 – July 2022**
Accelerator Operator
- Monitor and tune the accelerator systems to maintain and improve the performance of the electron and photon beams they produce
- Diagnose accelerator hardware and control system software problems
- Operating the safety systems that allow access to the accelerator tunnels, including clearing the tunnels of personnel during beam activity
  Tools & Skills: Critical Thinking, MatLab, Statistics, Python, Communication, Research

Disco Hi-Tec America | San Jose, CA   **Aug. 2021 – Dec. 2021**
Application Engineer
- Applications of high intensity laser technology for high-precision cutting of semiconductor material and integrated circuit production
- Refined development methods regarding fabrication of semiconductor wafers for commercial use
- Research into optical and material properties of semiconductor metals for improving laser application technology
- Communication between clients regarding the requirements and specifications of various projects
  Tools & Skills: Materials Processing, Laser Applications, MatLab, Statistics, Python, Research and Development, Fabrication

TEACHING EXPERIENCE

UCSC Teaching Assistaint| Santa Cruz, CA   **Sept. 2022 – Present**
- Supported instruction for multiple undergraduate physics courses and laboratory sections
- Led discussion sections and labs, graded assignments and exams, and held weekly office hours
- Provided one-on-one academic support to students across a range of physics topics

Graduate Pedagogy Fellow| Santa Cruz, CA   **May. 2025 – Sept. 2025**
- Led restructuring of lower-division physics laboratory curriculum, focusing on pedagogical clarity, learning outcomes, and experimental design.
- Developed revised lab modules, assessments, and instructional materials to improve student engagement and conceptual understanding

SELECTED PUBLICATIONS (4 / 4)

- **Christopher Ewasiuk**, Stefano Profumo, Precision gravity constraints on large dark sectors, **JHEP 10** (2025) 0925, arXiv:2509.02801 [hep-ph].
- **Christopher Ewasiuk**, Stefano Profumo, Dark-sector modifications to Kerr and Reissner–Nordström black hole evaporation, **Phys. Rev. D 111** (2025) 015008, arXiv:2505.04812 [gr-qc]. [**Phys. Rev. D -** *Accepted]*
- **Christopher Ewasiuk**, Stefano Profumo, Constraints on the maximal number of dark degrees of freedom from black hole evaporation, cosmic rays, colliders, and supernovae, **Phys. Rev. D 111** (2025) 015008, arXiv:2409.11359 [hep-ph].
- Stefano Profumo, Lucas Brown, **Christopher Ewasiuk**, Sean Ricarte, Henry Su, Maximal gravitational wave signal from asteroid-mass primordial black hole mergers at resonant microwave cavities, **Phys. Rev. D 111** (2025) 063072, arXiv:2410.15400 [astro-ph.HE].

SKILLS

Physics & Theory: Quantum Field Theory, General Relativity, Black Hole Physics, Gravitational Waves, Cosmology, Superradiance, Dark Sectors, Effective Field Theories

Signal Processing & Data Analysis: Phase-coherent signal processing, matched filtering, power spectral density estimation (Welch, median stacking), Fourier analysis (FFT/rFFT), time–frequency analysis, noise modeling, statistical inference

Computational & Numerical Methods: High-performance numerical modeling, Monte Carlo methods, numerical integration, simulation pipelines, interpolation and resampling, parameter estimation

Machine Learning & Data Science: Deep learning (CNNs, U-Net), medical image segmentation, model evaluation (Dice, IoU, ROC), uncertainty quantification, feature engineering, end-to-end ML pipelines

Programming & Scientific Software: Python (NumPy, SciPy, PyTorch, Matplotlib), MatLab, C/C++, PyCBC, HDF5, YAML/JSON

Research & Professional: Experimental data analysis, reproducible research, cross-disciplinary collaboration, scientific writing and peer review, curriculum development, technical communication