

# Benjamin Colmey

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[Personal Website](#)

Department of Materials Science, University of Cambridge  
27 Charles Babbage Rd, Cambridge CB3 0FS

## Education

### University of Cambridge, Queens' College

(2024 – May 2027)

PhD in Computational Physics and AI

Awards: Stamps Scholarship

### McGill University

(2021 – 2023)

Master of Science in Physics: Experimental Condensed Matter

*Thesis: Generating Massive Bursts of keV Electrons for Ultrafast Electron Microscopy*

### McGill University

(2015 – 2020)

Bachelor of Science in Physics

## Publications

- **Partial Differential Operators and Fourier Integral Operators in the Gevrey Setting and Applications**  
B. Colmey, R. Lascar  
*Submitted to Journal d'Analyse Mathématique*, arXiv pre-print 2503.04189, 2025
- **Sub-cycle Nanotip Field Emission of Electrons Driven by Air Plasma Generated THz Pulses**  
B. Colmey, R.T. Paulino, D.G. Cooke  
*Applied Physics Letters* 126 (3): 031108, 2025
- **Spatiotemporal walk-off and improved focusing of plasma THz sources**  
R.T. Paulino, B. Colmey, D.G. Cooke  
*Optics Express*, 32(15), 26351-26358, 2024.

## Research Experience

### Researcher in Computational Physics, Electron Microscopy Group

(2024 – Present)

University of Cambridge, Cambridge, United Kingdom

- Investigating machine learning approaches to enhance the analysis of scanning transmission electron diffraction images, identifying key microstructural and crystallographic features
- Performing quantum mechanical simulation of electron propagation for ML-assisted inverse structure reconstruction

### Researcher in Experimental Condensed Matter, Cooke Group

(2021 – 2023)

McGill University, Montreal, Canada

- Conducted research for McGill's Quantum Dynamics Lab, working on R&D for a novel electron microscope
- Designed ultra-high vacuum and sample manipulation systems using AutoCAD and Solid-Works, while simulating vacuum and pumping conditions to achieve pressures below  $10^{-12}$  Torr
- Simulated quantum electron wave packet dynamics in Python with the finite-difference time-domain (FDTD) method

#### **Research Assistant in Quantum Optics in Fraser Group**

(May – Sept 2020)

Queen's University, Kingston, Canada

- Explored the application of InAsP semiconductor quantum dots (QDs) as efficient single-photon sources for quantum computing and secure communication
- Performed Monte Carlo simulations in Python to model QDs, efficiently simulating Poissonian emission events and Hanbury Brown and Twiss (HBT) and Hong-Ou-Mandel (HOM) experiments

#### **Research Project in Optics in Cooke Group**

(Jan – May 2020)

McGill University, Montreal, Canada

- Designed and tested an achromatic optical cone to transform circularly polarized terahertz light into radially polarized beams, suitable for electron acceleration
- Employed MATLAB's Linear Algebra Package (LAPACK) algorithms for modeling of polarization state manipulations with Jones matrices

### **Additional Relevant Experience**

#### **Machine Learning Project: Using ML to Inpaint Corrupted Piano Audio**

(2023)

- Applied machine learning to restore audio in vintage piano recital recordings, enhancing their clarity and listenability
- Utilized Short-Time Fourier Transform (STFT) for signal processing, experimenting with various custom loss functions and network architectures

### **Teaching and Extra Curricular Experience**

#### **Demonstrator, University of Cambridge**

(Fall 2024 – Present)

- Facilitated undergraduate Part 1A practicals, providing hands-on guidance in laboratory techniques and ensuring adherence to safety protocols.

#### **Volunteer: National Autistic Society, Cambridge Branch**

(Fall 2024 – Present)

- Participated in regular meet-ups, fostering meaningful conversations and providing a supportive social environment for members.

**Math & Physics Tutor** (2021 – 2023)

- Provided personalized 1:1 tutoring in high school physics and math, focusing on problem-solving and conceptual understanding.

**Teaching Assistant, McGill University** (2021–2023)

- Led tutorials and conducted weekly office hours, providing individual support and clarification of complex topics to undergraduate students. Courses assisted: Optics, Electronics, Physics 101, Physics 102

**Student Mentor, McGill Physics Hackathon** (2022, 2023)

- Mentored high school and undergraduate students during programming competitions, aiding in problem solving and coding

**Volunteer: Friendship Circle Montreal** (2021–2024)

- Provided mentorship and support to students with disabilities, organizing engaging activities and sports to foster skills development and social integration.

## Skills and Courses

### Technical Skills:

- Python (including NumPy, Pandas, PyTorch, Pyspark, Keras, Scikit-learn, TensorFlow)
- Data Visualization (using Plotly, Matplotlib, Seaborn)
- Software Proficiency: Linux OS, Labview, GIT, AutoCAD, COMSOL

### Certifications:

- PyTorch for Deep Learning, Convolutional Neural Networks in Python - Computer Vision, Python for Data Science

### Languages:

- Bilingual in English and French, advanced in Spanish

## Referees

**Prof. Paul Midgley**  
*pam33@cam.ac.uk*

Dept of Materials Science, University of Cambridge

**Prof. David Cooke**  
*david.cooke2@mcgill.ca*

Dept of Physics, McGill University

**Prof. James Fraser**  
*james.fraser@queensu.ca*

Dept of Physics, Queen's University

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