Ben McKeon

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Research Interests

Numerical analysis: Geometric numerical integration, Runge-Kutta methods
Scientific computing: Finite element analysis, symplectic integrators
Computational physics: Particle-in-cell algorithms, ray tracing

Education

Aug 2023 – present
PhD. Applied Mathematics — **University of Limerick, Ireland**
Thesis: Geometric particle-in-cell methods for relativistic electrodynamics
Supervisor: Dr. Alan Hegarty
Funding: Research Ireland (grant no. SFI 18/CRT/6049)

Sep 2021 – Aug 2023
MSc. Experimental Physics — **University of Galway, Ireland**
Thesis: Gradient-index lenses: Symplectic ray tracing and optical testing
Supervisor: Dr. Alexander Goncharov
Funding: University of Galway (College of Science and Engineering Scholarship)

Aug 2017 – Aug 2021
BSc. Mathematics and Physics — **University of Limerick, Ireland**
Thesis: Numerical analysis of symplectic integrators with applications in astrodynamics
Supervisor: Dr. Alan Hegarty
Final grade: First class honours

Experience

Analog Devices International, Inc. — **Limerick, Ireland**

Jun 2024 – Aug 2024
Wrote and tested a Python package to identify and remove systematic errors in the device fabrication process, keeping unit performance in line with an established statistical model.
Supervisor: Mr. Dennis Dempsey

Jan 2020 – Aug 2020
Automated acquisition and analysis of experiment data in the New Technology Quality Lab, eliminating the requirement for multiple on-site engineers during the COVID-19 pandemic.
Supervisor: Dr. Mary McSherry

Sep 2021 – Dec 2022
CSIRO Parkes Observatory — **NSW, Australia (online)**
Coordinated with colleagues in Australia and the USA to conduct remote observations of nearby stars and the galactic centre on behalf of the Breakthrough Listen initiative.
Supervisor: Dr. Howard Isaacson

Jun 2021 – Aug 2021
I-LOFAR Radio Telescope — **Birr, Ireland**
Developed Python tools to detect anomalous signals in data collected by LOFAR stations in Birr, Ireland and Onsala, Sweden, paving the way for future dual-site astrophysical surveys.
Supervisor: Dr. Evan Keane

Publications

- **McKeon, B.** and Goncharov, A.V., 2023. Symplectic numerical methods in optics and imaging: ray tracing in spherical gradient-index lenses and computer-generated image rendering. Applied Optics, 62(32), pp.8621-8631
- **McKeon, B.** and Goncharov, A.V., 2023. Performance Considerations for Ray Tracing in Gradient-index Optics with Symplectic Numerical Methods. In London Imaging Meeting (Vol. 4, pp. 35-39). Society for Imaging Science and Technology
- Johnson, O.A., Gajjar, V., Keane, E.F., McKenna, D.J., Giese, C., **McKeon, B.,** Carozzi, T.D., Alcaria, C., Brennan, A., Brzycki, B. and Croft, S., 2023. A Simultaneous Dual-site Technosignature Search Using International LOFAR Stations. The Astronomical Journal, 166(5), p.193

Awards

PhysiGIST Graduate Research Communication Competition 2021: 3rd prize
Irish National Astronomy Meeting 2021: Peter Curran Award (shared with Owen Johnson)

Skills

General computing: Linux CLI, SSH, Vim, Git
Parallelism & virtualisation: OpenMP, MPI, Docker
Programming: C++, Python, Julia, Mathematica, MATLAB

Professional Associations & Memberships

Irish Mathematical Society (IMS): Student Member
Society for Industrial and Applied Mathematics (SIAM): Student Member
Institute of Physics (IOP): Member
Optica: Certified Reviewer

Undergraduate Teaching

Sep 2023 – present | **Engineering Mathematics 3**
Jan 2024 – present | **Science Mathematics 2**

- Facilitate tutorial sessions for students (40-50 students, 4-6 contact hours/week)
- Create step-by-step solutions for all practice problems (11 sheets, 5-7 problems/sheet)
- Responsible for marking 150-200 scripts and submitting grades at the end of each semester

Jan 2022 – Apr 2022 | **Introduction to Physics**
Sep 2022 – Apr 2023 | **Experimental and Computational Physics**

- Supervised laboratory sessions (25-30 students, 4 contact hours/week)
- Assessed and graded all students during end-of-semester examinations

Conferences Organised

May 2025 | **IMS & Irish SIAM Student Chapter Conference 2025** — **University of Limerick, Ireland**
Annual meeting of IMS student members and Irish SIAM student chapters

Conferences Attended

Jun 2025 | **30th Biennial Numerical Analysis Conference** — **University of Strathclyde, UK**
Pauli Matrices: A Better Basis for Relativistic Electrodynamics?

Aug 2024 | **Penn State SETI Center Symposium** — **Green Bank Observatory, USA**
Comparing Numerical Ray Tracing Methods in the Presence of Strong Gravitational Lensing

Jun 2023 | **London Imaging Meeting** — **Institute of Physics, UK**
Performance Considerations for Ray Tracing in Gradient-index Optics with Symplectic Numerical Methods

Sep 2021 | **Irish National Astronomy Meeting** — **Online**
Are We Alone? A LOFAR SETI Survey of TESS-Selected Exoplanets

Jun 2021 | **Conference of Astronomy and Physics Students** — **Online**
Modelling Altitude and Energy of the International Space Station in Python

Mar 2021 | **All-Ireland Conference of Undergraduate Research** — **University of Limerick, Ireland**
Orbit Modelling of the International Space Station Using Symplectic Integrators in Python

Public Engagement & Outreach

Nov 2024	**Open Science Lunch Seminar**	**University of Limerick, Ireland**
	Public lecture: *Code for Collaboration: Bridging Open Science and FOSS*	
Oct 2024	**Maths Week**	**Villiers School, Limerick Ireland**
	Secondary school outreach event: *Careers in Maths & Stats* and *Maths in Courses You Might Not Expect!*	
Mar 2024	**Irish Astronomy Week**	**Dooradoyle Library, Limerick, Ireland**
	Primary school outreach event: *The Search for Extraterrestrial Intelligence*	
Jan 2024	**Galway Astrofest**	**Menlo Park Hotel, Galway, Ireland**
	Invited talk: *Super Resolution of Galaxy Survey Data*	
Feb 2023	**Python Ireland**	**Workday, Dublin, Ireland**
	Monthly meetup: *Ready, SETI, Go! Python and the Search for E.T.*	
Feb 2022	**Irish Astronomical Association**	**Online**
	Monthly lecture: *SETI and Adaptive Optics: A Match Made in the Heavens*	