Dr Linden Disney-Hogg

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I am a mathematical physicist, working at the interface with pure mathematics utilising algebro-geometric structures arising from the modern approach to integrability. In addition to analytic approaches, I use my skill in computational methods to aid proof, formulate conjectures, and make visualisations. I believe in the importance of interdisciplinary collaboration in mathematics, and this has already led me to work in the disparate areas of biostatistics, number theory, and quantum computing. My research is focused around magnetic monopoles, which are a playground to explore these ideas.

Research

Funding

- London Mathematical Society Scheme 1 'Conference Grant', 2024 (£4400, prepared joint with Derek Harland, Steffen Krusch, and Tom Winyard).
- UK Engineering and Physical Sciences Research Council Doctoral Prize Fellowship, 2023 (2.5 years), with fellowship grant (£13000) and outreach grant (£2000).
- University of Edinburgh PhD Teaching Fellowship, 2023 (6 months).
- Google Summer of Code Stipend, 2021 ($2700, 2 months).
- UK Engineering and Physical Sciences Research Council Studentship, 2019 (3.5 years).
- London Mathematical Society Undergraduate Research Bursary, 2018 (£1520, 2 months).
- Wellcome Trust Summer Student Bursary, 2017 (2 months).

Current and Previous Positions

- Postdoctoral Fellow, University of Leeds, 2023 (2.5 years, ongoing).
- PhD Student, University of Edinburgh, 2019 (4 years).
- Research Intern, Institute of Cancer Research, 2017 (2 months), 2018 (2 months).
- Summer Research Student, Fermi National Accelerator Laboratory, 2015 (1 month).

Preprints

- L. Disney-Hogg, A. Beckett, and I. Deutsch. An English translation of A. Wiman's "on the algebraic curves of genus $p = 4$, 5 and 6, which possess unambiguous transformations into themselves". https://arxiv.org/abs/2204.01656, 2022.

Publications

- J. Cork and L. Disney-Hogg. Locations of JNR skyrmions. *Mathematical Physics, Analysis and Geometry*, 28(17), 2025.
- H. W. Braden and L. Disney-Hogg. Orbits of Theta Characteristics. *Experimental Mathematics*, 2025.
- H. W. Braden and L. Disney-Hogg. Dihedrally Symmetric Monopoles and Affine Toda Equations. *Journal of Physics A: Mathematical and Theoretical*, 57(49), 2024.
- N. Bruin, L. Disney-Hogg, and W. E. Gao. Rigorous numerical integration of algebraic functions. *Journal of Software for Algebra and Geometry*, 14(1), 2024.
- H. W. Braden and L. Disney-Hogg. Bring's Curve: Old and New. *European Journal of Mathematics*, 10(3), 2024.
- H. W. Braden and L. Disney-Hogg. Towards a Classification of Charge-3 Monopoles with Symmetry. *Letters in Mathematical Physics*, 113(87), 2023.
- L. Disney-Hogg, B. Kinnersley, and R. Houlston. Algorithmic considerations when analysing capture Hi-C data. *Wellcome Open Research*, 5(289), 2020.
- H. Takahashi et al. Mendelian randomization provides support for obesity as a risk factor for meningioma. *Scientific Reports*, 9(1), 2019.
- L. Disney-Hogg et al. Influence of obesity-related risk factors in the aetiology of glioma. *British Journal of Cancer*, 118(7), 2018.
- L. Disney-Hogg et al. Impact of atopy on risk of glioma: a Mendelian randomisation study. *BMC Medicine*, 16(1), 2018.

Research Software

- Numerical implementation on JNR skyrmions method, `https://github.com/DisneyHogg/JNR_skyrmions`, 2025.
- Symmetric Nahm Data, Plotting Monopoles, and the Orbits of Theta Characteristics, `https://github.com/DisneyHogg/Riemann_Surfaces_and_Monopoles`, 2023.
- Computation of the Abel-Jacobi map and associated auxiliary functions in Sagemath, `https://doc.sagemath.org/html/en/reference/curves/sage/schemes/riemann_surfaces/riemann_surface.html`, 2021.
- Intersection and automorphism-action enhancements in abelfunctions-cyclepainter, `https://github.com/DisneyHogg/abelfunctions-cyclepainter`, 2020.

Research Visits

- Visiting Researcher, Mathematical Structures and Applications Research Group, Max Planck Institute of Molecular Cell Biology and Genetics, May 2025. Collaborator: Türkü Özlüm Çelik.

Education

- PhD in Mathematics, University of Edinburgh, September 2019 - September 2023. Title: Symmetries of Riemann Surfaces and Magnetic Monopoles.
- MMath in Mathematics, University of Cambridge, October 2018 - June 2019. Distinction - 88/100. Essay title: Kinks with long-range tails.
- BA in Mathematics, University of Cambridge, October 2015 - June 2018. First Class - 80/100. Award: Girton College Scholarship, 2016.

Programming and Markup Languages

- **Python and Sagemath** - Utilised for computational algebraic geometry, group theory, representation theory, and number theory in research. Applied in conjunction with Jupyter, used to create notebooks for educational and data availability purposes. Tutored both privately and via the University of Edinburgh.
- **Matlab** - Used in computational projects to solve a variety of problems, including solving ODEs and PDEs such as soliton scattering, simulated annealing, producing Markov chains, and Monte Carlo simulations.
- **Maple** - Working with the algcurves package, applied for constructions on algebraic curves, specifically manipulations of elliptic curves and differentials over number fields.
- **R** - Employed to perform Mendelian Randomisation analysis, produce graphical output, run MC simulations, and write R scripts for parallel computation.
- **Git** - Used for version control during paper writing, contributing to public repositories via issues or pull requests, and for remote collaboration with coauthors.
- **Bash** - Used to access high-performance computing resources, apply quality control to Genome Wide Association Study data, and streamline code execution.
- **LaTeX** - Utilised to write papers, lecture notes (including output in html format), and produce supplementary material for presentations.
- **Julia** - Produced numerical code for integration and visualisation of certain ADHM Skyrmions.
- **Additionally** - Used GAP, Magma, Macaulay, and Lean intermittently in research.

Presentations

- *Symmetry, integrability and computation of hyperbolic monopole curves*, Modern Musings on Monopoles, Simons Centre for Geometry and Physics, 2025.
- *Locations of JNR skyrmions*, Solitons at Work (S@W), 2025, and Geometry and Analysis Seminar Series, University of Leeds, 2025, and Geometry and Mathematical Physics Seminar, University of York, 2025.
- *Monopole spectral curves: integrability and computation*, Recent Advances in Classical and Quantum Integrability, CaLISTA workshop, 2025.
- *Orbits of Theta Characteristics*, AMS Special Session on Automorphisms of Riemann Surfaces and Related Topics, Spring Central Meeting, 2024, and Internal Algebra Seminar Series, University of Leeds, 2024.
- *Symmetries of Riemann Surfaces and the Construction of Monopoles*, Geometry/Topology Seminar, UIC, 2024, and Yorkshire Durham Geometry Day, 2024.
- *Integrability of Monopoles*, Integrable Systems Seminar Series, University of Leeds, 2024.
- *Symmetries of Monopole Spectral Curves*, SIAM Minisymposium on Algebraic Curves, Integrable Systems, and Computer Algebra, SIAM AG23, 2023, and 67th North British Mathematical Physics Seminar, 2023, and International Seminar-Type Online Workshop on Topological Solitons, 2023.
- *The Cobordism Conjecture*, GRIFT seminar series, 2023.
- *Bring's Curve and Theta Characteristics*, AMS Special Session on Applications of Riemann Surfaces, JMM, 2023.

- *Dijkgraaf-Witten Theory as a TFT*, GRIFT seminar series, 2022.
- *Theta characteristics, Spin Structures, and their Orbits*, Hodge Club Seminar Series, 2022.
- *The Construction of Monopoles*, STAMP seminar series, 2022.
- *Riemann Surfaces and the Abel-Jacobi map*, Sage Days 112, 2022.
- *Riemann Surfaces and Invariant Spin Structures*, Edinburgh Mathematical Physics Group Seminars, 2021.
- *Symplectic Integrators and Persistent Homology*, Edinburgh Mathematical Physics Group Seminars, 2020.
- *Integrability of the Swinging Atwood's Machine*, Cambridge University Part III seminar series, 2019, and Edinburgh Mathematical Physics Group Seminars, 2019.
- *Pioneering Women in Mathematics*, Mountford Humanities and Arts Communication presentations, 2019, and Cambridge University Part III seminar series, 2019.
- *Proof of the Arnold-Liouville Theorem*, Cambridge University Part III seminar series, 2018.
- *Shape and Geometry*, Mountford Humanities and Arts Communication presentations, 2018. Awarded 2nd place prize.

Teaching

- Mentor, *Google Summer of Code, "Poincaré normal form of Riemann matrices"*, SageMath, 2025.
- Supervisor, *Undergraduate Research Project, "Machine Learning for Pure Mathematics"*, University of Leeds, 2025.
- Module Leader, *Topics in Algebraic Geometry (Graduate level)*, University of Leeds, 2024, 2025.
- Module Leader, *Calculus in the Complex Plane*, University of Leeds, 2024. Sample feedback: "excellent teaching", "in-person feedback felt interactive and fulfilling", "strong lecturer".
- Course Content Creation, *Honours Algebra*, University of Edinburgh, 2022.
- Private Tutor, *Python Programming*, Edinburgh, 2022.
- Course Tutor, *Calculus and Applications*, *Fundamentals of Pure Mathematics*, *Honours Complex Variables*, *Honours Algebra*, *Introduction to Linear Algebra*, *Proofs and Problem Solving*, *Several Variable Calculus and Differential Equations*, University of Edinburgh, 2019-2023.
- Edinburgh Teaching Award Participant, 2019-2023.
- Teach First Insight Programme, 2018.

Reviewing

- Journal of Physics A: Mathematical and Theoretical, 2025.
- American Mathematical Society, 2024-ongoing.
- Annali della Scuola Normale Superiore di Pisa, 2024.
- zbMATH, 2022-ongoing.
- Cancer Epidemiology, Biomarkers & Prevention, 2020.

Additional Roles and Responsibilities

Ongoing, Administrative, and Outreach Positions

- Society for Industrial and Applied Mathematics member, 2023-ongoing.
- Edinburgh Mathematical Society member, 2019-ongoing.
- Honorary Appointee, Institute of Cancer Research, 2019-ongoing.
- Internal Module Exam Assessor, *Calculus in the Complex Plane*, University of Leeds, 2025.
- *Academic Careers*, Leeds PGR conference talk, 2025.
- Geometric Models of Matter conference initiator and co-organiser, University of Leeds, 2024.
- Mathematical Physics in Leeds (MaPLe) seminars initiator and organiser, University of Leeds, 2024, 2025.
- "Empowering futures in STEM" outreach event, Dame Alice Owen's School, 2024.
- Student Theoretical And Mathematical Physics (STAMP) seminars initiator and organiser, University of Edinburgh, 2022, 2023.
- "Integrability and Applied Algebraic Geometry" meeting organiser - University of Edinburgh, 2022.
- Sutton Trust mentor, University of Edinburgh, 2020, 2021.
- Scottish Mathematical Sciences Training Centre representative, University of Edinburgh, 2020.
- Postgraduate representative to College Curriculum Approval Board, University of Edinburgh, 2020.
- Piscopia initiative mock interviewer, University of Edinburgh, 2020.

Additional Relevant Employment

- Mathematics expert (contractor), Mercor, 2025 (1 month).
- Summer Intern, Clearwater Wealth Management, 2016 (1 month).

Hosted Researchers

- Josh Fogg, *Acceleration of numerical linear algebra over finite fields*, December 2024.