Paul Leask

☏ +447860846112
✉ paulnleask@live.co.uk
🖥 paulnleask.github.io.

Research Skills

Physics:	Theoretical Particle Physics, Nuclear Physics, General Relativity, High Energy Physics, Quantum Field Theory, Compact Stars
Mathematics:	Topological Solitons, Riemannian Geometry, Differential topology, Lie Theory, Symplectic Geometry
Computing:	C++, Python, CUDA C, Mathematica, MATLAB, SolidWorks, Fusion360, Advance Steel

Education

University	**University of Leeds**
Degree	**P.hD. Mathematical Physics**
Period	Oct 2020 – Sep 2023
Thesis	Skyrmion crystals: From compact stars to finite atomic nuclei
Description	Investigating isospin asymmetric nuclear matter within the Skyrme model, with applications to cold dense neutron stars. We also couple the skyrmions to vector mesons (ω and ρ) in a bid to reduce nuclear binding energies and address the compression modulus issue.

University	**University of Glasgow**
Degree	**M.Sci. Mathematics & Physics**
Period	2015 – 2019
Award	First Class Honours
Thesis	Ginzburg–Landau vortices on $\mathbb{H}^2$
Description	Investigated critically coupled vortices on curved Riemannian manifolds in the Ginzburg–Landau model of superconductivity. Analytic solutions were found on the hyperbolic plane $\mathbb{H}^2$. Numerical solutions on $\mathbb{R}^2$ were obtained using a custom gradient descent algorithm, coded in CUDA C for HPC.

Experience

Employer	**Instituto Galego de Física de Altas Enerxías (IGFAE)**
Position	**Visiting Researcher**
Period	May 2023 – June 2023
Description	Visiting researcher at the Galician Institute of High Energy Physics (IGFAE). Working with Prof. Christoph Adam on skyrmions coupled to ρ-mesons.

Employer	**Jagiellonian University**
Position	**Visiting Researcher**
Period	February 2023 – March 2023
Description	Visiting researcher at the Institute of Theoretical Physics. Working with Prof. Andrzej Wereszczyński on neutron stars and quantum skyrmion crystals coupled to gravity.

Employer	**University of Glasgow (Carnegie Trust Vacation Scholarship)**
Position	**Undergraduate Researcher (Integrable Systems & Mathematical Physics Group)**
Period	Jul 2018 – Sep 2018

Employer	**University of Glasgow**
Position	**Research Assistant (Nuclear Physics Group)**
Period	Jul 2017 – Sep 2017
Description	Working under the supervision of Prof. David Ireland, assessing the reliability of observables extracted from fits to angular distributions in particle scattering experiments. Using a toy Monte-Carlo technique to generate data with known components and fit these to compare to the generated model. It included effects such as resolution and detector holes as well as extending to multiple dimensions in angular observables.

Awards

Award	**Dougall Prize**
Awarded by	**University of Glasgow School of Mathematics & Statistics**
Date Awarded	Jul 2018

Award	**Undergraduate Vacation Scholarship**
Awarded by	**Carnegie Trust for the Universities of Scotland**
Date Awarded	May 2018

Publications

- P. Leask & M. Speight, *Crystals in the ω-Skyrme model* (in preparation)
- P. Leask, C. Adam, M. Huidobro, A. G. Martin–Caro, C. Naya & A. Wereszczynski, *Skyrmions coupled to ρ-mesons* (in preparation)
- P. Leask, M. Huidobro & A. Wereszczynski, *Quantized and gravitating multi-wall skyrmion crystals with applications to neutron stars* [arXiv:2306.04533] (submitted to Nucl. Phys. B)
- P. Leask, D. Harland & M. Speight, *Skyrmion crystals with massive pions* [arXiv:2305.14005] (submitted to J. Math. Phys)
- P. Leask, *Baby Skyrmion crystals* [arXiv:2111.02217], Phys. Rev. D **105**, 025010, (2022)

Talks

- (Invited) *Isospin asymmetric nuclear matter in the Skyrme model*, Solitons and (non)-integrability in Geometry, Jagiellonian University, Poland, June 2023.
- (Invited) *New Skyrmion crystals*, Geometric Models of Nuclear Matter, University of Kent, UK, July 2022.
- (Invited) *Skyrmion crystals*, Solitons and (non)-integrability in Geometry, Jagiellonian University, Poland, June 2022.
- (Invited) *Baby Skyrmion crystals*, Pure PGR Seminar, University of Leeds, UK, February 2022.
- *Numerical Solutions for Skyrme Models*, British Early Career Mathematicians' Colloquium, University of Birmingham, UK, July 2021.
- (Invited) *Planar Skyrmion crystals*, Solitons and (non)-integrability in Geometry, Jagiellonian University, Poland, June 2021.
- *The surface energy of a baby Skyrme crystal*, Young Researchers in Mathematics, University of Bristol, UK, June 2021.

References

Prof. Andrzej Wereszczyński
Professor of Theoretical Physics at the Jagiellonian University
Institute of Physics, Jagiellonian University, Lojasiewicza 11, Kraków, Poland
andrzej.wereszczynski@uj.edu.pl

Prof. Martin Speight
Professor of Mathematics at the University of Leeds
Room 9.11, School of Mathematics, University of Leeds, Woodhouse, Leeds, LS2 9JT
J.M.Speight@leeds.ac.uk

Dr. Derek Harland
Associate Professor in Geometry at the University of Leeds
Room 8.06, School of Mathematics, University of Leeds, Woodhouse, Leeds, LS2 9JT
D.G.Harland@leeds.ac.uk