

Nishwal Gora

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Research Interests

Quantum Magnetism, Neutron Diffraction, Biological Physics, Bacterial Turbulence, Statistical Physics, Computational Physics, Modelling and Visualisation of Physical Systems, Polymer assembly, Chromatin Dynamics.

Education

University of Edinburgh, MPhys in Physics

Sept 2021 – Present

- Average: 86.7 %
- Awards and Scholarships:
 - 2021/2022 Certificate of Merit for MPhys Physics (Year 1)
 - 2022/2023 Certificate of Merit for MPhys Physics (Year 2)
 - 2023/2024 Career Development Scholarship, School of Physics and Astronomy
 - 2024/2025 **Senior Honours (Bsc) Class Medal** for Best Academic Performance in Physics

Bishop Anstey and Trinity College East Sixth Form

Trinidad and Tobago

Caribbean Advanced Proficiency Examination (CAPE)

July 2018 – July 2020

- *Education:* Physics, Pure Mathematics, Chemistry, Caribbean Studies, Communication Studies. Achieved 1's in every subject.
- *Achievements:* On the Merit List (a ranking listing the highest marks achieved at the yearly diet), placed 6th (Unit 1, 2019) and 8th (Unit 2, 2020) for Pure Mathematics. Also ranked 4th (Unit 1, 2019) and 1st (Unit 2, 2020) in Physics.

Research Experience

Zeeman Split Kramers Doublets in Spin–Supersolid Candidate $\text{Na}_2\text{BaCo}(\text{PO}_4)_2$

Edinburgh, Scotland

July 2024 – August 2024

- Used high-resolution neutron spectroscopy to track magnetic excitations across a field-tuned quantum-critical region in triangular antiferromagnet $\text{Na}_2\text{BaCo}(\text{PO}_4)_2$.
- Showed overdamping of ferromagnetic fluctuations near criticality; modelled as coupled Zeeman-split Kramers doublets explaining enhanced magnetocaloric performance.

Supervisor: Prof. Chris Stock

Magnetoelastic Honeycomb Fragmentation in VI_3

Edinburgh, Scotland

April 2025 – August 2025

- Identified a single structural transition at ~ 80 K (rhombohedral $R3 \rightarrow$ triclinic $P1$), followed by ferromagnetic order at ~ 50 K, splitting the honeycomb into two distinct V^{3+} sublattices.
- Neutron spectroscopy + Green's-function modelling reveal strong SOC and dominant NNN exchange, linking magnetoelastic distortion to stabilized long-range order.

Supervisor: Prof. Chris Stock

Beamtime at the ISIS Neutron and Muon Source (MAPS Instrument)

Didcot, England

August 2024

- Participated in 3-day beamtime session on MAPS spectrometer to collect neutron scattering data on transition-metal compounds.

Supervisor: Prof. Chris Stock | **Facility:** Rutherford Appleton Laboratory, UK

Cellular Memory and Hopfield Networks

Edinburgh, Scotland

Sep. 2025 – Present

- MPhys project connecting phase-separation-driven chromatin folding and transcription factories to attractor dynamics in Hopfield networks.
- Recasts the Waddington landscape as memory basins, linking conformational states to robust cellular identity.

Supervisor: Prof. Davide Marenduzzo

Bacterial Turbulence and Finite Tumbling

Edinburgh, Scotland
Jun. 2025 – Present

- Two-population kinetic model (runners/tumblers) with finite tumbling time; coupled Smoluchowski equations + spherical-harmonic stability analysis.
- Derived eigenvalue problem quantifying how tumbling alters instability thresholds and growth rates in active flows.

Supervisor: Prof. Alexander Morozov

Understanding Bond-Dependent Exchange in CoTiO_3

Edinburgh, Scotland
Jan. 2025 – March 2025

- Green's-function/RPA + mean-field analysis of spin-wave dynamics; spin-rotation handling of non-collinear order for direct comparison with neutron data.
- Found bond-dependent interactions enhance out-of-plane coupling, likely via low-temperature symmetry reduction and directional dimer formation.

Supervisor: Prof. Chris Stock

Publications

- N. Gora and A. Morozov, "Hydrodynamic Instabilities in bacteria with finite tumbling time," in preparation.
- N. Gora, T. I. Popescu, and C. Stock, "Dimer Formation and Bond-Dependent Exchange in CoTiO_3 ," in preparation.
- E. Shen, T. I. Popescu, N. Gora, K. Guratinder, E. Chan, H. Lane, J. A. Rodriguez-Rivera, G. Xu, P. M. Gehring, A. N. Fitch, and C. Stock, "Magnetoelastic Honeycomb Fragmentation in VI_3 ," *Phys. Rev. B*, accepted (doi.org/10.1103/pkc4-vyj8).
- T. I. Popescu, N. Gora, F. Demmel, Z. Xu, R. Zhong, T. J. Williams, R. J. Cava, G. Xu, and C. Stock, "Zeeman Split Kramers Doublets in Spin-Supersolid Candidate $\text{Na}_2\text{BaCo}(\text{PO}_4)_2$," *Phys. Rev. Lett.* **134**, 136703 (2025). doi:10.1103/PhysRevLett.134.136703

References (Research Supervisors): Prof. Chris Stock (C.Stock@ed.ac.uk) | Prof. Davide Marenduzzo (Davide.Marenduzzo@ed.ac.uk) | Prof. Alexander Morozov (Alexander.Morozov@ed.ac.uk)

Extra-Curricular Activities

Edinburgh Scientific Researchers Association (ESRA)

Edinburgh, Scotland
Sep 2021 – Present

- September 2021 – September 2022: *Member of Physics Department in ESRA*. pursued project to age a Galaxy Cluster using a telescope in the Royal Observatory, Edinburgh.
- September 2022 – April 2023: *Co-Head of Department of Physics*, guiding research projects on 1) computer simulation, 2) Finding the value of the cosmological constant 3) Building an efficient Solar Panel.
- April 2023 – Present: *Treasurer of ESRA*, providing and securing funding for projects in Biology, Social Sciences, Chemistry and Physics.

Edinburgh University Science Media (EUSci)

Edinburgh, Scotland
Feb 2024 – Present

- *Contributing Editor* – Edited articles for Issue 32 of the EUSci Magazine (link).
- *Contributing Writer* – Authored science communication articles for the EUSci website on topics including "Crisis in Cosmology – The Laniakea Supercluster and What It Means for the Universe" (link) and "Fusion Energy: A Viable Alternative to Fossil Fuels?" (link).

Global Buddies

Edinburgh, Scotland
Sep 2022 – July 2023

- *Buddy Leader* – Assisted group of international students adjust to Edinburgh by organising meet ups, group activities, tours etc.

Prism Caribbean

Trinidad and Tobago
Jan 2021 – Jun 2021

- *Founder/Contributor* – Developed learning material (specifically mathematics) for Caribbean students who are economically disadvantaged.

Technological Proficiency

Languages: Python (proficient), MATLAB (proficient), R (intermediate), HTML (basic)

Modelling & Visualisation: LAMMPS (proficient), VMD (proficient), AutoCAD—Engineering Drawing (Qualified) (intermediate)