



VEYRA INSTITUTE FOR APPLIED SCIENCES

Research Prospectus

Divisions, groups, and ongoing programmes.

Veyra Institute for Applied Sciences (VIAS)
Calder Mesa Campus, 14 Aldermere Way, Arenfield AR-4400
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About This Prospectus

This document provides a concise overview of each of the Institute's five research divisions and their fifteen constituent research groups. Each profile includes the lead investigator, research focus, and three representative current projects. Prospective PhD students, postdoctoral applicants, and potential external collaborators are encouraged to contact group leads directly. Emails follow the convention **first.last@veyra.example**. Current vacancies: **veyra.example/positions**.



CDS — Computational & Data Systems

Machine learning, probabilistic inference, high-performance computing, and human-centred computing. The division bridges theory and deployment, from fundamental algorithm design to production-scale scientific pipelines.

Distributed Learning Systems Group

Lead: Dr. Naila Ravelo · naila.ravelo@veyra.example · Building A, Room 214

Federated and privacy-preserving machine learning, communication-efficient distributed optimisation, and robust model aggregation under non-IID data. The group develops theory and open-source tooling for real-world deployment in clinical, environmental, and industrial settings.

Selected current projects:

- FedMedNet: federated learning for multi-site clinical imaging without sharing raw data.
- Sparse gradient communication protocols for edge-to-cloud scientific instrument networks.
- Heterogeneous-client robustness benchmarks for distributed optimisation methods.

Probabilistic Inference Lab

Lead: Prof. Tomas Eberhardt · tomas.eberhardt@veyra.example · Building A, Room 118

Scalable Bayesian inference, variational methods, Gaussian process models, and their application to scientific data from sparse sensor networks, geophysical inversion, and systems biology. The lab maintains the open-source BayesSparse Python library.

Selected current projects:

- Scalable posterior inference for sparse spatiotemporal sensor fields (VX-0412).
- Hierarchical Gaussian process emulators for climate model downscaling.
- Amortised variational inference for rapid materials property screening.

Human-Centred Computing Group

Lead: Dr. Imara Solveig · imara.solveig@veyra.example · Building B, Room 305

Accessible interface design, human-AI interaction, cognitive load modelling, and participatory design. The group works with disability advocacy organisations and public-sector clients to build equitable digital tools.

Selected current projects:

- Arenfield Accessibility Observatory: longitudinal study of assistive-technology uptake.
- AI explanation interfaces for non-expert decision support in environmental management.
- Multimodal input frameworks for scientists with motor impairment.



MME — Molecular & Materials Engineering

Synthesis and characterisation of functional materials, soft matter physics, heterogeneous catalysis, and green chemistry. The division operates closely with the Spectroscopy & Analytical Core and the Cleanroom & Nanofabrication Facility.

Soft Matter & Self-Assembly Group

Lead: Prof. Davor Lindqvist · davor.lindqvist@veyra.example · Building C, Room 210

Phase behaviour, self-organisation, and stimuli-responsive properties of colloidal systems, block copolymers, and liquid crystals. Research combines theory, simulation, and small-angle X-ray scattering.

Selected current projects:

- Thermo-responsive hydrogels with tunable mesh size for controlled drug release.
- Block-copolymer directed self-assembly for sub-10 nm lithographic templates.
- Coarse-grained molecular dynamics of polyelectrolyte complexation.

Catalysis & Green Chemistry Lab

Lead: Dr. Yael Brenner · yael.brenner@veyra.example · Building C, Room 108

Heterogeneous catalysts for CO₂ valorisation, earth-abundant metal catalysis, and solvent-free reaction engineering. The lab integrates high-throughput screening with mechanistic modelling.

Selected current projects:

- Room-temperature CO₂-to-methanol over bifunctional oxide-metal interfaces.
- Earth-abundant cobalt catalysts for selective nitrile hydrogenation.
- Microwave-assisted continuous-flow synthesis of fine chemicals without organic solvents.

Functional Materials Group

Lead: Prof. Marc Auzou · marc.auzou@veyra.example · Building D, Room 220

Thermal, electrical, and optical properties of polymer nanocomposites, two-dimensional materials, and thin-film heterostructures. Collaborates extensively with industrial partners in electronics and energy storage.

Selected current projects:

- High-thermal-conductivity polymer nanocomposites for thermal interface applications.
- Wafer-scale MoS₂ growth by MOCVD for transistor applications.
- Hybrid perovskite thin films for tandem photovoltaic architectures.



QPS — Quantum & Photonic Systems

Integrated photonics, quantum sensing, and nonlinear optical phenomena. The division houses the Integrated Photonics Testbench (PH-12) and works with the Cleanroom facility for device fabrication.

Integrated Photonics Lab

Lead: Dr. Sora Veld · sora.veld@veyra.example · Building E, Room 105

On-chip squeezed light sources, silicon nitride waveguides, and photonic quantum information processing. Develops fabrication processes and characterisation methods for scalable photonic platforms.

Selected current projects:

- 15 dB on-chip squeezing at 1550 nm in SiN microring resonators.
- Low-loss Si₃N₄ waveguide design for entangled photon pair generation.
- Integrated photonic neural network inference accelerators.

Quantum Sensing Group

Lead: Prof. Elias Marchetti · elias.marchetti@veyra.example · Building E, Room 201

Nitrogen-vacancy (NV) centre magnetometry, diamond spin physics, and fieldable quantum sensors for infrastructure monitoring and biomedical applications.

Selected current projects:

- Portable NV magnetometer for sub-surface pipeline corrosion mapping.
- Dynamic decoupling sequences for extended NV coherence in geological environments.
- Widefield NV microscopy for mapping current flow in 2D materials.

Nonlinear Optics Lab

Lead: Dr. Petra Solano · petra.solano@veyra.example · Building E, Room 307

Ultrafast laser science, high-harmonic generation, and attosecond pulse characterisation. Operates a 1 kHz Ti:sapphire amplifier and an OPA system for mid-infrared pump-probe experiments.

Selected current projects:

- Attosecond transient absorption of electron dynamics in wide-gap semiconductors.
- Mid-IR driven high-harmonic spectroscopy of molecular vibrations.
- Spatio-temporal pulse shaping for volumetric laser microfabrication.



CNS — Cognitive & Neural Science

Computational neuroscience, perceptual decision-making, and neural engineering. Combines electrophysiology, neuroimaging, modelling, and device development, with clinical translation via partner hospitals.

Computational Neuroscience Group

Lead: Prof. Hana Okoro · hana.okoro@veyra.example · Building B, Room 418

Large-scale neural circuit modelling, thalamocortical dynamics, and information integration across cortical hierarchies. Uses Bayesian inference and dynamical systems theory to interpret electrophysiology and fMRI data.

Selected current projects:

- Thalamocortical binding model reconciling multi-site electrophysiology datasets.
- Hierarchical predictive coding implementation in spiking neural networks.
- Dimensionality reduction of population activity for state-space decoding.

Perception & Decision Lab

Lead: Dr. Roald Steiner · roald.steiner@veyra.example · Building B, Room 312

Psychophysics, multisensory integration, and the computational basis of perceptual decision-making under uncertainty. Combines behavioural experiments with drift-diffusion and Bayesian models.

Selected current projects:

- Decision boundary plasticity under visual-vestibular conflict.
- Optimal observer models for temporal order judgements with variable delay.
- Metacognitive monitoring in perceptual learning tasks.

Neural Engineering Group

Lead: Dr. Lior Halmstad · lior.halmstad@veyra.example · Building F, Room 104

Non-invasive brain-computer interfaces, closed-loop neurostimulation, and neural signal decoding for motor rehabilitation. Runs the BrainBridge clinical collaboration with Arenfield General Hospital.

Selected current projects:

- BrainBridge Phase II: EEG-based motor decoder for stroke rehabilitation.
- Adaptive tDCS protocols driven by real-time cortical state classification.
- Wearable dry-electrode EEG headset for ambulatory brain monitoring.



ECS — Earth & Climate Systems

Atmospheric dynamics, surface hydrology, and data-driven climate science. The division operates long-term environmental monitoring stations and develops open-access datasets and software for the wider geosciences community.

Atmospheric Dynamics Group

Lead: Prof. Aiko Romero · aiko.romero@veyra.example · Building G, Room 201

Mesoscale atmospheric modelling, boundary-layer dynamics, and urban air quality. Runs WRF and LES simulations on the Meridian cluster and maintains a network of met sensors across the Arenfield metro area.

Selected current projects:

- Arenfield Air Quality Initiative: spatiotemporal mapping of NO_x and PM_{2.5}.
- Machine learning emulators for rapid WRF boundary-layer parameterisation.
- Heat island dynamics in medium-density urban environments.

Hydrology & Earth Surface Lab

Lead: Dr. Caius Whitlock · caius.whitlock@veyra.example · Building G, Room 108

River basin hydrology, sediment dynamics, and catchment-scale water budgets. Maintains the Caldermere Basin Observatory, a 14-station streamflow and groundwater network operating since 1987.

Selected current projects:

- Caldermere streamflow dataset (1987-2024): open-access release and curation.
- Hillslope erosion modelling under projected precipitation intensification.
- Isotope tracer studies of subsurface flow pathways in karst systems.

Climate Informatics Group

Lead: Dr. Selma Underhill · selma.underhill@veyra.example · Building G, Room 315

Statistical and machine-learning methods for climate model analysis, bias correction, and regional downscaling. Develops and maintains the open-source CLIM-IX downscaling toolkit.

Selected current projects:

- CLIM-IX v2.0: GPU-accelerated bias-correction for CMIP6 ensemble outputs.
- Deep learning super-resolution for km-scale precipitation fields.
- Attribution of extreme heat events using counterfactual climate models.



How to Engage

Prospective PhD students should submit an expression of interest directly to the relevant group lead, then complete the formal application through the Graduate School portal at veyra.example/education/admissions. Admission cycles open annually on 1 October; primary deadline is 15 January.

Postdoctoral applications should be directed to group leads whose work aligns with the applicant's interests. Formal Veyra Fellows applications open biennially; the next call opens 1 March 2026. See veyra.example/education/postdoc.

Industrial collaborators and potential sponsored-project partners should contact the Office of Partnerships & Services: partnerships@veyra.example, +0 (200) 555-0188.