Erise He

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Applied Mathematics & Physics (BS candidate), Emory University (Expected May 2026)
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Research Interests

Geometric Deep Learning; Symplectic / Differential Geometric Methods in ML; Topological Data Analysis (Persistent Homology) for Representation Dynamics; Neuro-/Psychoanalytic Inspired AI Architectures (symbolic misrecognition, intrinsic "desire" dynamics); Optimal Transport for Representation Alignment.

Education

ß **Emory University**, Atlanta, GA BS Applied Mathematics; BS Physics (Double Major), GPA: 4.00/4.00
Minor / Concentration: Philosophy (unofficial focus in Psychoanalysis)
Expected May 2026

- **Honors / Distinctions:** Dean's List (Fall 2024); Undergraduate Research Scholar Award (Emory College, 2025).
- **Selected Advanced Coursework:** PDE I (A); PDE in Action (A); Real Analysis II (B); Differential Geometry (in progress Fall 2025); Machine Learning (in progress Fall 2025); Mathematical Statistics I/II; Abstract Algebra; Numerical Linear Algebra; Topology (audit); Physics: Classical Mechanics II, Quantum I, Statistical Mechanics.
- **Planned Senior Thesis:** "Subjector-1: Symplectic–Topological Dynamics of Desire in Hybrid Symbolic/Latent AI Systems."

Research Experience

Undergraduate Research Assistant, Applied Math Emory University Jan 2025 – Present

- Working with Prof. <Advisor Name> on streaming persistent homology for high-velocity symbolic sequences; implementing landmark VR complexes in Python/C++.
- Proving stability bounds for loop persistence under quantised optimal transport noise; preliminary note in preparation.
- Integrating PH descriptors with low-dimensional latent dynamics driven by Hamiltonian vector fields (prototype for *Subjector-1*).

Independent Project: Subjector-1 Psychoanalytic AI Prototype Self-directed / Emory Aug 2024 – Present

- Designed a hybrid architecture coupling LLM embeddings (semantic manifold) to discrete signifier graphs; injects "desire" as residual misprojection energy.
- Formulated desire flow as a bounded Hamiltonian on an exact symplectic latent phase space; showed Liouville volume preservation in discrete integrator regime.
- Built streaming Vietoris–Rips PH to detect recurrent 1-cycles (fantasy / symbolic loops) in generated language trajectories; early results on synthetic corpora.

- Draft manuscript available: Subjector-1 preprint.

Philosophy Honors Project: Structure of Misrecognition in Lacan Emory Philosophy Dept. Jan 2024 – Dec 2024

- Mapped Lacanian registers (Symbolic / Imaginary / Real) into categorical relations; explored functorial analogues to projection / residue in representation.
- Outcome informs formal design of AI "desire loops."

Publications & Manuscripts

- E. He. *Subjector-1: A Symplectic–Topological Non-convergent Prototype for Simulating Artificial Desire.* Draft manuscript, July 2025. [preprint link].
- E. He, <Advisor>. "Streaming Persistent Homology for Symbolic Graph Walks." In preparation for submission to *SIAM Journal on Applied Algebra and Geometry*, 2026.

Talks & Posters

- "Desire as Residual: Toward a Topological Subject in AI." Emory Undergraduate Research Symposium, Apr 2025.
- (Planned) NeurIPS 2025 Workshop on Geometry and Learning – Poster submission pending.

Technical Skills

- **Programming:** Python (NumPy, PyTorch, PyTorch Geometric, JAX basics), C++17, Julia (basic), MATLAB.
- **Math / ML Libraries:** giotto-tda, Gudhi, ripser.py; geomstats; POT (Python Optimal Transport); networkx; scikit-learn.
- **ML Ops / Tools:** Jupyter, Weights&Biases, Git, Docker (basic).
- **Typesetting / Writing:** LaTeX, TikZ-cd, Overleaf.

Selected Projects

Hamiltonian Flow Integrator for Learned Latent Manifolds Python / PyTorch 2025

- Implemented symplectic Euler and leapfrog integrators over learned encoder embeddings; benchmarked energy drift vs. vanilla gradient dynamics.

Optimal Transport Codebook Quantization Python 2025

- Used entropic OT (Sinkhorn) to align LLM latent distributions with discrete symbolic vocabularies; measured distortion vs. k-means baselines.

Teaching & Academic Service

Undergraduate TA, Differential Equations Emory Math Dept. Fall 2024

- Led weekly problem sessions; authored supplementary notes on PDE numerical schemes.

Writing Fellow (Philosophy) Emory Writing Center 2023 – 2024

- Assisted students in formal argument structure; experience translating abstract theory for wider audiences.

Awards

- Emory Undergraduate Research Scholar Award (2025)
- Philosophy Department Best Essay Prize (2024)
- Dean's List (multiple terms)

Professional Development

- Summer School: Geometric Deep Learning (online intensive), 2025.
- Workshop: Topological Data Analysis in ML (SIAM AG), 2025.

References

Prof. <Math Advisor>
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Prof. <External Collaborator>
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Prof. <Philosophy Mentor>
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