Abel Lawrence Peirson

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Education

Stanford University — *Ph.D in Physics* *2017 - Jan 2023*
Thesis: High Energy Polarization Statistics and Geometry.
GPA: 4.0 (in required coursework).

University of Oxford — *MPhys in Physics* *2017*
First Class Honours with Distinction – top 10% of graduating class.
College: Christ Church

Fellowships, Honors & Awards

Stanford Data Science Scholar ($100k+) — Stanford, USA *2021*
Future Investigator in NASA Earth and Space Science and Technology ($160k+) — Stanford, USA *2019*
Roach Prize for the most outstanding undergraduate across the sciences — Oxford, UK *2017*
Hooke Prize for the most outstanding member of Christ Church in the sciences — Oxford, UK *2017*
Oxford International Strategy Scholarship — Oxford, UK *2016*
Christ Church Academic Scholarship — Oxford, UK *2014-2017*
Gold, British Physics Olympiad — London, UK *2013*

Research

Kavli Institute for Particle Astrophysics and Cosmology — Stanford University, CA *July 2018 - Present*
with ***Prof. Roger Romani***

- Set current state of the art in X-ray polarization recovery by developing novel computer vision techniques.
- Improved NASA IXPE polarization sensitivity by $> 30\%$ (Code adopted as official data analysis pipeline).
- Created fast quadratic program + nested sampling approach to fit gravitational microlenses.
- Designed testable (and fittable) emission models to explain observed polarization phenomena in relativistic jets.

Wu Tsai Neurosciences Institute — Stanford University, CA *Mar 2018 - Jun 2018*
with ***Prof. Shaul Druckmann***

- Developed biologically inspired recurrent neural network to reproduce path integration in the drosophilia fly brain.

NeuroAI Lab — Stanford University, CA *Dec 2017 - Mar 2018*
with ***Prof. Dan Yamins***

- Found transfer-learning certain affine transformations of images does not improve accuracies in object classification, using RotNet and ImageNet datasets.

Department of Physics — University of Oxford, UK *Sep 2016 - May 2017*
with ***Prof. Garret Cotter***

- Modelled blazar spectra and investigated how they change travelling across different intergalactic media.
- Placed limits on whether the Cherenkov Telescope Array will constrain the existence of axion-like particles.

CLIC Test Facility — CERN, Switzerland *June - Aug 2016*
with ***Prof. Philip Burrows***

- Used beam dispersion to improve CTF3's Quadrupole scan and reduce uncertainty in the beam energy spread.
- Designed and implemented new fitting program to enhance beam analysis pipeline.

Plasma and Fusion Laboratory — University of Science and Technology of China, Hefei *June - Aug 2015*
with ***Prof. Xuan Sun***

- Improved plasma confinement in the KMAX axisymmetric tandem mirror machine by applying a bias voltage.

Selected Experience & Outreach

G-Research — London, UK *June - Sep 2021*
Quantitative Researcher
- Quantitative research intern working on forecasting capital markets.

Peirson & Freedman — Stanford, CA *Aug 2018 - Present*
Co-founder
- Conceived and designed iOS app ***Dank Learning*** that uses neural networks to generate memes.

Wonderfest — Bay Area, CA *June 2019 - June 2020*
Science Envoy
- Selected as one of 10 graduate students from Stanford and Berkeley.
- Communicated science to public audiences as part of the Bay Area-wide Wonderfest program

Stanford Judo Club — Stanford, CA *June 2019 - June 2020*
President
- Led the club as captain in competitions.
- Set the annual budget and ran all financial matters for both the adults' and children's club.

Stanford Diversity and First Generation Office — Stanford, CA *Oct 2018 - Oct 2020*
First Generation and Low Income Student Mentor
- Mentoring undergraduates from underprivileged backgrounds in all matters of student life.

Selected Invited Talks

Optimal Signal Extraction for IXPE and an Application to Blazars, *Naval Research Laboratory Colloquium*, 2021

Towards Optimal Signal Extraction for IXPE, *Third Science Collaboration Meeting (SCM03)*, 2021

The Polarization Behavior of Synchrotron Self-Compton Emission in Blazars, *Understanding the Multiwavelength Blazar Variability - Workshop, Stanford*, 2019

AI in Design, **Used Future: Symposium by Current Obsession**, Pratt Institute NY, 2018

Episode 68, **The NVIDIA AI Podcast**, 2018

Telescope & Computing Allocations

NuStar — *Multi-Energy X-ray observations of IXPE blazar targets*, 140ks (Co-I) *2021*
Swift — *Monitoring IXPE blazar targets with Swift*, 240ks (Co-I) *2020*
Google Cloud Platform — *Parametric Density Estimation with Uncertainty using Deep Ensembles*, $1000 *2020*
XMM-Newton — *Exploring the Synchro-Compton transition in CGRaBS J0211+1051*, 57ks (Co-I) *2019*

Skills

Languages: Spanish (native) — English (native).
Software (extensive): Python — C/C++ — Scala — PyTorch — Tensorflow — Git — LaTeX.
Software (basic): R — Julia — MPI — Mathematica — Swift.

Graduate Coursework

- ***APPHYS293*** (Theoretical Neuroscience)
- ***CS379C*** (Computational Models of the Neocortex)
- ***CS238*** (Decision Making Under Uncertainty)
- ***STATS207*** (Time Series)
- ***CS224N*** (Natural Language Processing)
- ***CS230*** (Deep Learning)
- ***EE364a*** (Convex Optimization)
- ***EE364b*** (Convex Optimization II)
- ***PHYS266*** (Statistical Methods in Physics)
- ***CS106b*** (Programming Abstractions)
- ***CS361*** (Engineering Design Optimization)
- ***EE263*** (Linear Dynamical Systems)

Teaching

Stanford PHYS113 — *Computational Physics* (Teaching Assistant) *Winter 2021*
Stanford PHYS100 — *Introduction to Observational Astrophysics* (Teaching Assistant) *Spring 2019*

Peer-Reviewed Publications

[9] ***A Deep Ensemble Approach to X-ray Polarimetry***
A.L.Peirson, R.W.Romani *Neurips ML4PS workshop*, 2021

[8] ***New Tests of Millilensing in the Blazar PKS 1413+135***
A.L.Peirson, I.Liodakis, A.C.S.Readhead et al. *ApJ*, 2021 (under review)

[7] ***Towards Optimal Signal Extraction for Imaging X-ray Polarimetry***
A.L.Peirson, R.W.Romani. *ApJ*, 920, 40, 2021

[6] ***The Relativistic Jet Orientation and Host Galaxy of the Peculiar Blazar PKS 1413+135***
A.C.S.Readhead et al. *ApJ*, 907, 61, 2020

[5] ***Deep Ensemble Analysis for Imaging X-ray Polarimetry***
A.L.Peirson, R.W.Romani, H.L.Marshall, J.F.Steiner, L.Baldini. *NIMA*, 986, 2020

[4] ***The Polarization Behavior of Relativistic Synchrotron Self-Compton Jets*** [Code]
A.L.Peirson, R.W.Romani. *ApJ*, 885, 1, 2019

[3] ***Prospects for Detecting X-ray Polarization in Blazar Jets***
I.Liodakis, **A.L.Peirson**, R.W.Romani. *ApJ*, 880, 1, 2019

[2] ***The Polarization Behavior of Relativistic Synchrotron Jets***
A.L.Peirson, R.W.Romani. *ApJ*, 864, 2, 2018

[1] ***Transverse Beam Phase-Space Measurement Experience at CTF3***
D.Gamba, L.Martin, **A.L.Peirson Serratosa** et al. *IPAC2017*, 2017

Whitepapers & Other Publications

[3] ***Neural Network Analysis of X-ray Polarimeter Data***
A.L.Peirson, *The Handbook of X-ray and Gamma Ray Astrophysics*, *Springer Nature*, 2022

[2] ***The X-ray Polarization Probe Mission Concept***
K.Jahoda et al. *Decadal Survey on Astronomy and Astrophysics*, 1907.10190, 2020

[1] ***Dank Learning: Generating Memes Using Deep Neural Networks*** [Code]
A.L.Peirson, E.M.Tolunay, 1806.04510, 2018

- Techcrunch – Dank learning system autogenerates memes
- The Next Web – Stanford researchers taught AI to make dank memes