T. Lucas Makinen

l.makinen21@imperial.ac.uk
https://tlmakinen.github.io/

Education

2021—present **Imperial College London, London, UK**
– Physics PhD under Imperial President's Scholarship

2020–2021 **Sorbonne University, Paris, France**
– Paris Physics Master 1, *cum laude*; Internship at Institut d'Astrophysique de Paris

2016–2020 **Princeton University, Princeton, NJ**
– Bachelor of Arts (A.B.) with Honors in Astrophysics
– Minors in Applied & Computational Mathematics and Statistics & Machine Learning

Research Experience

2021–Present **PhD Study, Imperial College London & Institut d'Astrophysique de Paris**
Supervisors: Alan Heavens & Ben Wandelt
– Constructing graph neural networks for catalogue-based inference; field-level weak lensing cosmology

2021–2022 **Predoctoral Researcher, Center for Astrophysics | Harvard & Smithsonian**
Supervisor: Rafael Martínez-Galarza
– Designed graph-based methods for X-ray timeseries anomaly detection

Summer 2021 **Postgraduate Research, Scuola Internazionale di Studi Avanzati**
Supervisor: Roberto Trotta
– Built efficient GPU-based HMC sampler and neural density estimators for supernova cosmology

2020–2021 **Master's Internship, Institut d'Astrophysique de Paris**
Supervisor: Ben Wandelt
– Constructed neural network compression schemes for 2D and 3D cosmological fields to extract optimal summary statistics for Bayesian simulation-based inference methods.

2020–2021 **Data Scientist, Center for Evolutionary Hologenomics, University of Copenhagen**
Supervisors: Shyam Gopalakrishnan & Tom Gilbert
– Remote data science work leveraging Bayesian sparse regression models to identify correlations in genome and microbiome data.

2019–2020 **Student Researcher, Flatiron Institute & Princeton University**
Supervisors: Peter Melchior, Shirley Ho & David Spergel
– Designed convolutional neural network to separate astrophysical foregrounds from 21cm line cosmological signal

Summer 2020 **Summer Researcher, DAWN Institute, University of Copenhagen**
Supervisor: Charles Steinhardt
– High-dimensional inference pipeline constraining cosmological parameters with imprecise redshift measurements.

2018–2019 **Student Researcher, Imperial College & Cambridge University**
Supervisors: Robert Trotta & Kaisey Mandel
– Developed Gibbs sampler and nested sampling algorithms for learning cosmological parameters from Type-Ia supernova data

Summer 2018 **Summer Research Intern, Institut de Génetique Moléculaire de Montpellier (CNRS)**
Supervisor: Mounia Lagha, Quantified time-dependent bursting dynamics in drosophila embryos using correlation theory

Spring 2018 **Student Researcher, Princeton University Astrophysics**
Supervisors: Andy Goulding & Jo Dunkley, Created survey of DECam data to catalog 1000s of ultra-diffuse galaxies in feature space

Summer 2017 **USRP Summer Researcher, Princeton University Astrophysics**
Supervisor: Andy Goulding, Cataloged ultra-diffuse galaxies in Chandra X-ray data

Summer 2016 **Summer Student Researcher, Optical Sciences, U.S. Naval Research Laboratory**
Supervisor: Woohong Kim, Optimized fiber lasers for defense applications

2014–2015 **Student Research Assistant, Space Science Division, U.S. Naval Research Laboratory**
Supervisor: Scott Budzien, Showcased satellite drag model and spectral regression in IDL

Publications

"The Cosmic Graph: Optimal Information Extraction from Large-Scale Structure using Catalogues"
T. L. Makinen, T. Charnock, P. Lemos, N. Porqueres, A. Heavens, B. D. Wandelt, submitted to RASTI: https://doi.org/10.48550/arXiv.2207.05202

"Lossless, Scalable, Implicit Likelihood Inference for Cosmological Fields"
T. L. Makinen, T. Charnock, J. Alsing, B. D. Wandelt, Published in JCAP: https://doi.org/10.48550/arXiv.2207.05202

"deep21: a Deep Learning Method for 21cm Foreground Removal"
T. L. Makinen, L. Lancaster, F. Villaescusa-Navarro, P. Melchior, S. Ho, L. Perreault-Levasseur, D. N. Spergel, Published in JCAP: https://doi.org/10.1088/1475-7516/2021/04/081

Awards

2021 Imperial College London 4-year President's Scholarship
2020 Sorbonne University Master's Scholarship
2019 Streicker International Fellowship for summer research
2019 APS Outstanding undergraduate presentation award
2018 Office of International Programs Fellowship

Conferences / Talks

Cosmology from Home (2022)
Likelihood-Free Inference in Paris (2022)
Institut d'Astrophysique de Paris ML (2021)
AAS HEAD Meeting (2021)
MINERVA Seminar, Observatoire de Paris (2021)
Oxford University Cosmic Microwave Background Group (2021)
AstroStatistics Interest Group (2021) https://hea-www.harvard.edu/AstroStat/CHASC_2122/index.html#lm_20210914
The Alexander Group, Brown University (2021)
ML Reading Group, Center for Astrophysics, Flatiron Institute (2021)
Machine Learning for Cosmology, London Cosmology Group (2021)
Quarks to Cosmos Conference, Carnegie Mellon University (2021)
American Astronomical Society 235th Meeting, Honolulu, HI (2020)
Interview, Statistics and Machine Learning, Princeton University (2020)
University of Copenhagen DAWN Institute (2020)
Princeton University Data Science / COMPASS Seminar (2019)
American Physical Society April Meeting, Denver, CO (2019)

Collaborations: Learning the Universe Collaboration, Aquila Consortium, Royal Astronomical Society, American Physical Society, American Astronomical Society, Imperial Centre for Inference and Cosmology, Differentiable Universe Initiative