George Stein

Postdoctoral Scholar · Berkeley Center for Cosmological Physics · University of California, Berkeley

60 St. George Street, Toronto, Ontario, M5S 3H8

(+1) 778-316-7636 | george.f.stein@gmail.com | www.cita.utoronto.ca/~gstein/ | georgestein | george-stein

Education

University of California, Berkeley — *Berkeley, USA*

Postdoctoral Scholar — *September 2019 – Current*

- Computational Cosmology & Machine Learning

University of Toronto — *Toronto, Canada*

PhD in Astronomy & Astrophysics — *September 2014 – August 2019*

- Dissertation: Computational Cosmology & Machine Learning
- Relevant Coursework: Parallel Computing, Algorithms, Neural Networks, Scientific Software Development

University of British Columbia — *Vancouver, Canada*

Honours B.Sc. in Physics & Astronomy, with Distinction — *September 2010 – May 2014*

- Relevant Coursework: Linear Algebra, Differential Equations, Multivariable Calculus, Computational Physics, Probability

Work Experience

Canadian Institute for Theoretical Astrophysics — *Toronto, Canada*

PhD Thesis. Advisor: Prof. J. Richard Bond — *September 2015 – August 2019*

- Developed high perfomance cosmological simulations utilizing MPI and OpenMP, and scaled to >5TB RAM across >2k processors
- Implemented machine learning techniques for astrophysical applications, including CNNs in Keras + TensorFlow (see publications)
- Lecturer/Teaching Assistant for 16 undergraduate level courses, including Computational Astrophysics. Co-supervised 9 students

University of Toronto — *Toronto, Canada*

Graduate Researcher — *September 2014 – August 2015*

- GPU algorithm development in OpenCL for the purpose of fast radio burst detection in TBs of microsecond cadence radio data
- Theoretical modeling, and simulating, the late-time observable effects of non-standard physics in the early universe

Swinburne University of Technology — *Melbourne, Australia*

Vacation Scholar — *June 2014 – August 2014*

- Analysis of the cosmic rest frame using peculiar velocity survey data & determining the statistical significance with Bayesian inference

University of British Columbia & Canadian Institute for Theoretical Astrophysics — *Vancouver, Canada*

Undergraduate Researcher — *May 2013 – May 2014*

- Numerous research projects centered around creating massively-parallel tools to forecast cosmological signals for future experiments

Skills & Interests

Computing:

- **Python** (7 years): Keras + TensorFlow, NumPy, Cython, MPI4Py, ...
- **Fortran** (6 years): extensive experience with MPI, OpenMP
- **C** (various projects): experience with MPI, OpenMP
- **OpenCL** (4 month graduate project): GPU implementations
- **Git**; **Unix/Linux**

Organizations:

- **Head of Graduate Astronomy Students Association (GASA) Social Committee** (2016–2018)
- **UofT AstroTours monthly telescope operator** (2016–2018)
- **Organizer:** graduate soccer team *Hubble United* (2016–2019)
- **Co-organizer:** department softball team *the Iguanas* (2017)

Honours & Awards

2017 & 18	**Queen Elizabeth II Graduate Scholarship in Science & Technology**, University of Toronto	*$15,000/yr*
2016	**Compute Canada International HPC Summer School Grant**, Ljubljana, Slovenia	*$3,000*
2014 & 15	**Dunlap Scholarship**, Dunlap Institute for Astronomy & Astrophysics	*$5,000/yr*
2014	**Vacation Scholarship**, Swinburne University of Technology	*$10,500*
2013	**Summer Undergraduate Research Award**, Canadian Institute for Theoretical Astrophysics	*$8,000*
2010	**Dean of Science Scholarship**, University of British Columbia	*$3,000*

Publications

Journal Articles

RED ARE HYPERLINKS

The mass-Peak Patch algorithm for fast generation of deep all-sky dark matter halo catalogues and its N-body validation — *MNRAS, sty3226*

George Stein, Marcelo A. Alvarez, J. R. Bond, 2018

The WebSky Suite of Extragalactic CMB Mocks — *In Prep*

Stein, G., Alvarez, M. A., Bond, J. R., et al., 2019

Joint power spectrum and voxel intensity distribution forecast on the CO luminosity function with COMAP — *arXiv:1808.07487*

H. T. Ihle, D. Chung, **G. Stein**, and the COMAP Collaboration, 2018

Comparing approximate methods for mock catalogues and covariance matrices I: correlation function *MNRAS, 482, 2, 1786–1806*
Martha Lippich et al. (incl. **George Stein**), 2018

Comparing approximate methods for mock catalogues and covariance matrices II: Power spectrum multipoles *arXiv:1806.09497*
Linda Blot et al. (incl. **George Stein**), 2018

Comparing approximate methods for mock catalogues and covariance matrices III: Bispectrum *MNRAS, sty2964*
Manuel Colavincenzo et al. (incl. **George Stein**), 2018

A volumetric deep Convolutional Neural Network for simulation of mock dark matter halo catalogues *MNRAS, 482, 3, 2861–2871*
Philippe Berger and **George Stein**, 2018

Journal Articles as part of Collaborations

Measurement of the Splashback Feature around SZ-selected Galaxy Clusters with DES, SPT and ACT *arXiv:1811.06081*
T. Shin et al. (incl. **George Stein**), 2018

Cross-correlating Carbon Monoxide Line-intensity Maps with Spectroscopic and Photometric Galaxy Surveys *arXiv:1809.04550*
Dongwoo T. Chung et al. (incl. **George Stein**), 2018

The Simons Observatory: Science goals and forecasts *arXiv:1808.07445*
The Simons Observatory Collaboration (incl. **George Stein**), 2018

CCAT-prime: Science with an Ultra-widefield Submillimeter Observatory at Cerro Chajnantor *arXiv:1807.04354*
G. J. Stacey et al. (incl. **George Stein**), 2018

Weak-Lensing Mass Calibration of ACTPol Sunyaev-Zel'dovich Clusters with the Hyper Suprime-Cam Survey *arXiv:1804.05873*
Miyatake, H., Battaglia, N., et al. (incl. **George Stein**), 2018

Conference Proceedings

Line-Intensity Mapping: 2017 Status Report *arXiv:1709.09066*
Kovetz, E. D. et al. (incl. **George Stein**), 2017

Testing Inflation with Large Scale Structure: Connecting Hopes with Reality *arXiv:1412.4671*
Alvarez, M. A. et al. (incl. **George Stein**), 2014

Selected Academic Presentations

Talks

STARRED ARE HYPERLINKS

Machine Learning Cosmic Structure Formation* *Toronto, Canada*
Invited Talk at the Scinet User Group Meeting *September 2018*

Effects of Low Mass Galaxies on the COMAP Signal *Owens Valley Radio Observatory, California*
COMAP Collaboration Meeting *August 2018*

Simulating the Universe* *University of Toronto*
Public Lecture *May 2018*

The WebSky Suite of Extragalactic CMB Mocks *Princeton University, New Jersey*
ACT Collaboration Meeting *January 2018*

Ultra Fast Cosmological Simulations Using the Peak Patch Approach *Tata Institute of Fundamental Research, India*
Cosmology Seminar *November 2017*

Covariance Estimation & Sky Maps with the Peak Patch Approach *Universitat Autònoma de Barcelona, Spain*
Joint Euclid meeting of the Cosmological Simulations and Weak Lensing SWGs *October 2017*

Forward Modelling Large Scale Tracers of Initial Conditions *Institut D'Astrophysique De Paris, France*
Journal-club Universe *October 2017*

Modeling the CO Signal of Galaxies *University of Oslo, Norway*
COMAP Collaboration Meeting *June 2017*

Mocking the Era of Intensity Mapping *Johns Hopkins University, Baltimore*
Second Annual Intensity Mapping Workshop *June 2017*

Intensity Mapping the Epoch of Galaxy Assembly *UAlberta, Edmonton*
CASCA annual meeting *May 2017*

CITA Extragalactic Simulations *Princeton University, New Jersey*
ACT Collaboration Meeting *February 2017*

Efficient Simulations of the High Redshift CO Signal — *Owens Valley Radio Observatory, California*
COMAP Collaboration Meeting — *January 2017*

Primordial non-Gaussianity with Large Scale Structure — *McMaster University, Ontario*
Great Lakes Cosmology & Galaxies Workshop — *June 2016*

Primordial non-Gaussianity with Large Scale Structure — *University of Winnipeg, Manitoba*
CASCA annual meeting — *June 2016*

Fast Mocks in the Very Large Survey Era with the Peak Patch Approach — *Lorentz Center, Leiden*
Statistics of Extrema in Large Scale Structure — *March 2016*

Statistics of SZ Anisotropies from Full-Sky Peak Patch Simulations — *McMaster University, Ontario*
CASCA annual meeting — *May 2015*

Posters

The WebSky Suite of Extragalactic CMB Mocks — *Victoria, Canada*
CASCA 2018 — *May 2018*

The WebSky Suite of Extragalactic CMB Mocks — *Santiago, Chile*
CosmoAndes 2018 — *January 2018*

A Multi-Tracer Approach to Primordial non-Gaussianity — *Ann Arbor, Michigan*
COSMO-16 — *August 2016*

Mocking Heaven: Tracing Inflationary Perturbations with the Cosmic Web — *Ljubljana, Slovenia*
International HPC Summer School 2016 — *June 2016*

Media Coverage

Training from ARC experts fuels discovery of AI methods to map the cosmos — *Compute Ontario*
computeontario.ca/training-from-arc-experts-fuels-discovery-of-ai-methods-to-map-the-cosmos/ — *November 2018*

Teaching Experience

All courses taught at the University of Toronto

AST222 - Galaxies & Cosmology, Teaching Assistant — *Winter 2017, 2018*
CTA200 - Computational Astrophysics, Lecturer — *Summer 2017, 2018*
AST210 - Great Moments in Astronomy, Teaching Assistant — *Fall 2015, 2016, 2017, current*
AST251 - Life on Other Worlds, Teaching Assistant — *Winter 2016, Summer 2016, 2017, 2018*
AST201 - Stars and Galaxies, Teaching Assistant — *Winter 2015*
AST101 - The Sun and Its Neighbours, Teaching Assistant — *Winter 2014, Summer 2015*

References

Prof. J. Richard Bond @ ***The Canadian Institute for Theoretical Astrophysics*** — *bond@cita.utoronto.ca*
60 St. George Street, Toronto, Ontario, Canada, M5S 3H8

Prof. Renée Hložek @ ***The Dunlap Institute and Department of Astronomy & Astrophysics*** — *hlozek@dunlap.utoronto.ca*
50 St. George Street, Toronto, Ontario, Canada, M5S 3H4

Prof. Norman Murray @ ***The Canadian Institute for Theoretical Astrophysics*** — *murray@cita.utoronto.ca*
60 St. George Street, Toronto, Ontario, Canada, M5S 3H8

Other Interests

- Soccer, Golf
- Camping, hiking, and fitness
- Gardening