

Positions

Computational Scientist, Perimeter Institute for Theoretical Physics, 2018–present

Research Associate, Department of Astronomy & Astrophysics and Dunlap Institute,
University of Toronto, 2015–2018

McWilliams Postdoctoral Fellow, McWilliams Center for Cosmology,
Carnegie Mellon University, 2012–2015

Postdoctoral Research Associate, Astrophysical Sciences
Princeton University, 2009–2012
Supervisor: Robert Lupton

Education

Doctor of Philosophy, Computer Science
University of Toronto, 2009
Thesis: *Astrometry.net: Automatic recognition and calibration of astronomical images*
Supervisors: Sam Roweis and David Hogg

Master of Science, Computer Science
University of British Columbia, 2004
Thesis: *Fast methods for inference in graphical models*
Supervisor: Nando de Freitas

Bachelor of Science, Physics and Computer Science (Combined Honors)
University of British Columbia, 2002
Honors thesis: *Commissioning the DRAGON nuclear astrophysics facility*
Supervisors: John D’Auria and Phil Gregory

Research Roles

Imaging Survey Scientist, Dark Energy Spectroscopic Instrument

Architect, Sloan Digital Sky Survey IV

Teaching and Work Experience

Module Instructor, Computational Physics (PHYS 776, University of Waterloo), 2018.

Certified Instructor, Software Carpentry, 2017.

Lecturer, Canary Islands Winter School of Astrophysics, *Bayesian inference in Astronomy & Astrophysics*, 2014.

Mentor, Google Summer of Code, 2011.

Assistant Lecturer, International Max Planck Research School, Heidelberg Summer School, *Statistical Inferences from Astrophysical Data*, 2009.

Head Teaching Assistant, Computer Science, University of Toronto, 2008.

Teaching Assistant, Computer Science, University of Toronto, 2007.

Software Designer, Ego Communications, 2004–2007.

Teaching Assistant, Computer Science, University of British Columbia, 2001–2003.

NSERC Undergraduate Summer Research Assistant, Laboratory for Computational Intelligence, University of British Columbia, Summer 2002.

TRIUMF Summer Student, Tri-University Meson Facility, Summer 2001.

Intern, IBM Almaden Research Center, Summer 1999.

Research Assistant, Electronic Games for Education in Mathematics and Science, 1998.

Publications

* *Indicates refereed publications; (*) indicates papers under review*

- * Ross, N. P. *et al.* (2018) A new physical interpretation of optical and infrared variability in quasars *Monthly Notice of the Royal Astronomical Society*, 480, 4468–4479. arXiv:1805.06921.
- * Zou, H. *et al.* (2018) The Second Data Release of the Beijing-Arizona Sky Survey *The Astrophysical Journal Supplements*, 237, 37. arXiv:1712.09165.
- (*) Dey, A., Schlegel, D. J., **Lang, D.** *et al.* (2018) Overview of the DESI Legacy Imaging Surveys *The Astronomical Journal*, submitted. arXiv:1804.08657.
- * Amiri, M. *et al.* (2018) The CHIME Fast Radio Burst Project: System Overview. *The Astrophysical Journal*, 863, 48. arXiv:1803.11235.
- * Schlafly, E. F. *et al.* (2018) The DECam Plane Survey: Optical photometry of two billion objects in the southern Galactic plane. *The Astrophysical Journal Supplements*, 234, 39. arXiv:1710.01309.

- * Meisner, A. M., **Lang, D.**, and Schlegel, D. J. (2017) Time-resolved WISE/NEOWISE Coadds. *The Astronomical Journal*, 156, 69. arXiv:1710.02526.
Meisner, A. M., **Lang, D.**, and Schlegel, D. J. (2017) Deep Full-sky Coadds from Three Years of WISE and NEOWISE Observations. arXiv:1705.06746.
- * Bosch, J. *et al.* (2017) The Hyper Suprime-Cam Software Pipeline. *Publications of the Astronomical Society of Japan*, 70, S5. arXiv:1705.06766.
- * Aihara, H. *et al.* (2018) First data release of the Hyper Suprime-Cam Subaru Strategic Program. *Publications of the Astronomical Society of Japan*, 70, S8. arXiv:1702.08449.
- * Abolfathi, B. *et al.* (2018) The Fourteenth Data Release of the Sloan Digital Sky Survey: First Spectroscopic Data from the extended Baryon Oscillation Spectroscopic Survey and from the second phase of the Apache Point Observatory Galactic Evolution Experiment. *The Astrophysical Journal Supplements*, 235, 42. arXiv:1707.09322.
- * Blanton, M. *et al.* (2017) Sloan Digital Sky Survey IV: Mapping the Milky Way, Nearby Galaxies, and the Distant Universe. *The Astronomical Journal*, 154, 28. arXiv:1703.00052.
- * Raichoor, A. *et al.* (2017) The SDSS-IV Extended Baryon Oscillation Spectroscopic Survey: final Emission Line Galaxy Target Selection. *Monthly Notices of the Royal Astronomical Society*, 471, 3955. arXiv:1704.00338.
- * Wang, F. *et al.* (2017) First Discoveries of $z > 6$ Quasars with the DECam Legacy Survey and UKIRT Hemisphere Survey. *The Astrophysical Journal*, 839, 27. arXiv:1703.07490.
- * Zou, H. *et al.* (2017) Project Overview of the Beijing-Arizona Sky Survey. *Publications of the Astronomical Society of the Pacific*, 129, 064101. arXiv:1702.03653.
- * Zou, H. *et al.* (2017) The First Data Release of the Beijing-Arizona Sky Survey. *The Astronomical Journal*, 153, 276. arXiv:1702.03854.
- DESI Collaboration: Aghamousa, A. *et al.* (2016) The DESI Experiment Part I: Science, Targeting, and Survey Design. arXiv:1611.00036.
- DESI Collaboration: Aghamousa, A. *et al.* (2016) The DESI Experiment Part II: Instrument Design. arXiv:1611.00037.
- * Ness, M. and **Lang, D.** (2016) The X-shaped Bulge of the Milky Way revealed by WISE. *The Astronomical Journal*, 152, 14. arXiv:1603.00026.
- * Meisner, A. M., **Lang, D.**, and Schlegel, D. J. (2016) Full-depth Coadds of the WISE and First-year NEOWISE-Reactivation Images. *The Astronomical Journal*, 153, 38. arXiv:1603.05664.
- * Albareti, F. D. *et al.* (2017) The Thirteenth Data Release of the Sloan Digital Sky Survey: First Spectroscopic Data from the SDSS-IV Survey MApping Nearby Galaxies at Apache Point Observatory. *The Astrophysical Journal Supplements*, 233, 25. arXiv:1608.02013.
- * Myers, A. *et al.* (2015) The SDSS-IV Extended Baryon Oscillation Spectroscopic Survey: Quasar Target Selection. *The Astrophysical Journal Supplements*, 221, 27. arXiv:1508.04472.

- * Raichoor, A. *et al.* (2016) The SDSS-IV extended Baryon Oscillation Spectroscopic Survey: selecting emission line galaxies using the Fisher discriminant. *Astronomy & Astrophysics*, 585A, 50. arXiv:1505.01797.
- Juric, M. *et al.* (2015) The LSST Data Management System. *Astronomical Data Analysis Software and Systems XXV*. arXiv:1512.07914.
- * Gregersen, D. *et al.* (2015) Panchromatic Hubble Andromeda Treasury XII. Mapping Stellar Metallicity Distributions in M31. *The Astronomical Journal*, 150, 189. arXiv:1511.00006.
- * Dalcanton, J. D. *et al.* (2015) The Panchromatic Hubble Andromeda Treasury VIII: A Wide-Area, High-Resolution Map of Dust Extinction in M31. *The Astrophysical Journal*, 814, 3. arXiv:1509.06988.
- * Prakash, A. *et al.* (2016) The SDSS-IV extended Baryonic Oscillation Spectroscopic Survey: Luminous Red Galaxy Target Selection. *The Astrophysical Journal Supplements*, 224, 34. arXiv:1508.04478.
- * **Lang, D.**, Hogg, D. W., and Schlegel, D. J. (2014) WISE photometry for 400 million SDSS sources. *The Astronomical Journal*, 151, 36. arXiv:1410.7397.
- * Regier, J. *et al.* (2015) Celeste: Variational inference for a generative model of astronomical images. *Proceedings of The 32nd International Conference on Machine Learning*, 2095–2103. arXiv:1506.01351.
- * DiPompeo, M., Bovy, J., Myers, A. and **Lang, D.** (2015) Quasar Probabilities and Redshifts from WISE mid-IR through GALEX UV photometry. *Monthly Notices of the Royal Astronomical Society*, 452, 3124–3138. arXiv:1507.02884.
- * Williams, B. F., *et al.* (2015) A Global Star Forming Episode in M31 2–4 Gyr Ago. *The Astrophysical Journal*, 806, 48. arXiv:1504.02120.
- * Alam, S. *et al.* (2015) The Eleventh and Twelfth Data Releases of the Sloan Digital Sky Survey: Final Data from SDSS-III. *The Astrophysical Journal Supplements*, 219, 12. arXiv:1501.00963.
- * Mandelbaum, R. *et al.* (2015) GREAT3 results I: systematic errors in shear estimation and the impact of real galaxy morphology. *Monthly Notices of the Royal Astronomical Society*, 450, 3. arXiv:1412.1825.
- * Schneider, M. D. *et al.* (2014) Hierarchical probabilistic inference of cosmic shear. *The Astrophysical Journal*, 807, 87. arXiv:1411.2608.
- Regier, J. *et al.* (2014) Celeste: Scalable variational inference for a generative model of astronomical images. *Neural Information Processing Systems: Workshop on Variational Inference*.
- * Williams, B. F., **Lang, D.**, *et al.* (2014) The Panchromatic Hubble Andromeda Treasury X. Ultraviolet to Infrared Photometry of 117 Million Equidistant Stars. *The Astrophysical Journal Supplements*, 215, 9. arXiv:1409.0899.

- * Greene, J. *et al.* (2014) Near Infrared Spectra and Intrinsic Luminosities of Candidate Type II Quasars at $2 < z < 3.4$. *The Astrophysical Journal*, 788, 91. arXiv:1404.3760.
- * **Lang, D.** (2014) unWISE: unblurred coadds of the WISE imaging. *The Astronomical Journal*, 147, 108. arXiv:1405.0308.
- * **Lang, D.**, Hogg, D. W., and Schölkopf, B. (2014) Towards Building a Crowd-Sourced Sky Map. *JMLR Workshop and Conference Proceedings*, 33 (AI & Statistics 2014), 549. arXiv:1406.1528.
- Montet, B. T. *et al.* (2013) Maximizing Kepler science return per telemetered pixel: Searching the habitable zones of the brightest stars. Whitepaper. arXiv:1309.0654.
- Hogg, D. W. *et al.* (2013) Maximizing Kepler science return per telemetered pixel: Detailed models of the focal plane in the two-wheel era. Whitepaper. arXiv:1309.0653.
- * Ahn, C. P. *et al.* (2013) The Tenth Data Release of the Sloan Digital Sky Survey: First Spectroscopic Data from the SDSS-III Apache Point Observatory Galactic Evolution Experiment. *The Astrophysical Journal Supplements*, 211, 17. arXiv:1307.7735.
- * Hogg, D. W. and **Lang, D.** (2012) Replacing standard galaxy profiles with mixtures of Gaussians. *Publications of the Astronomical Society of the Pacific* 125, 719. arXiv:1210.6563.
- * Foreman–Mackey, D., Hogg, D. W., **Lang, D.**, and Goodman, J. (2012) emcee: The MCMC Hammer. *Publications of the Astronomical Society of the Pacific*, 125, 306. arXiv:1202.3665.
- * Bundy, K. *et al.* (2012) SynMag Photometry: A Fast Tool for Catalog-Level Matched Colors of Extended Sources. *The Astronomical Journal* 144, 188. arXiv:1301.3164.
- * Weisz, D. R. *et al.* (2012) The Panchromatic Hubble Andromeda Treasury IV: A Probabilistic Approach to Inferring the High Mass Stellar Initial Mass Function and Other Power-law Functions. *The Astrophysical Journal* 762, 123. arXiv:1211.6105.
- * Johnson, L. C. *et al.* (2012) PHAT Stellar Cluster Survey I: Year 1 Catalog and Integrated Photometry. *The Astrophysical Journal*, 752, 95. arXiv:1204.3091.
- * Dalcanton, J. J., Williams, B. F., **Lang, D.**, *et al.* (2012) The Panchromatic Hubble Andromeda Treasury. *The Astrophysical Journal Supplements* 200, 18. arXiv:1204.0010.
- * Dorman, C. E. *et al.* (2012) The Splash Survey: Kinematics of Andromeda’s Inner Spheroid. *The Astrophysical Journal*, 752, 147. arXiv:1204.4455.
- * **Lang, D.** and Hogg, D. W. (2011) Searching for comets on the World Wide Web: The orbit of 17P/Holmes from the behavior of photographers. *The Astronomical Journal*, 144, 46. arXiv:1103.6038.
- * Rosenfield, P. *et al.* (2011) The Panchromatic Hubble Andromeda Treasury I: Bright UV stars in the bulge of M31. *The Astrophysical Journal*, 755, 131. arXiv:1206.4045.

- * Eisenstein, D. J. *et al.* (2011) SDSS-III: Massive Spectroscopic Surveys of the Distant Universe, the Milky Way Galaxy, and Extra-Solar Planetary Systems. *The Astronomical Journal* 142 (3), article 72. arXiv:1101.1529.
- * Aihara, H. *et al.* (2011) The Eighth Data Release of the Sloan Digital Sky Survey: First Data From SDSS-III *The Astrophysical Journal Supplement* 193 (2), article 29. arXiv:1101.1559.
- Lang, D.** and Hogg, D. W. (2010) Telescopes don't make catalogues! In *GAIA: At the Frontiers of Astrometry, EAS Publications Series* 45, 351. arXiv:1008.0738.
- Hogg, D. W., Bovy, J., and **Lang, D.** (2010) Data analysis recipes: Fitting a model to data. arXiv:1008.4686.
- * **Lang, D.**, Hogg, D. W., Mierle, K., Blanton, M., and Roweis, S. (2010) *Astrometry.net*: Blind astrometric calibration of arbitrary astronomical images. *The Astronomical Journal* 139, 1782. arXiv:0910.2233.
- * **Lang, D.**, Hogg, D. W., Jester, S., and Rix, H.-W. (2009) Measuring the undetectable: Proper motions and parallaxes of very faint sources. *The Astronomical Journal* 137, 4400. arXiv:0808.4004.
- Hogg, D. W. and **Lang, D.** (2008) Astronomical imaging: The theory of everything. *Classification and Discovery in Large Astronomical Surveys*, C. A. L. Bailer-Jones (ed.), AIP Conference Proceedings 1082, 331. arXiv:0810.3851.
- Hogg, D. W., Blanton, M., **Lang, D.**, Mierle, K., and Roweis, S. (2008) Automated Astrometry. *Astronomical Data Analysis Software and Systems XVII*, R. W. Argyle, P. S. Bunclark, and J. R. Lewis, eds., ASP Conference Series 394, 27.
- * Barron, J. T., Hogg, D. W., **Lang, D.**, and Roweis, S. (2008) Blind Date: Using proper motions to determine the ages of historical images. *The Astronomical Journal* 136, 1490. arXiv:0805.0759.
- * Barron, J. T., Stumm, C., Hogg, D. W., **Lang, D.**, and Roweis, S. (2008) Cleaning the USNO-B Catalog through automatic detection of optical artifacts. *The Astronomical Journal* 135, 414. arXiv:0709.2358.
- * Klaas, M., Briers, M., de Freitas, N., Doucet, A., Maskell, S. and **Lang, D.** (2006) Fast Particle Smoothing: If I Had A Million Particles. *Proceedings of the 23rd International Conference on Machine Learning (ICML)* 481.
- * de Freitas, N., Wang, Y., Mahdaviani, M. and **Lang, D.** (2005) Fast Krylov Methods for N-Body Learning. *Advances in Neural Information Processing Systems (NIPS)* 18, 251.
- * Klaas, M., **Lang, D.** and de Freitas, N. (2005) Fast maximum a posteriori inference in Monte Carlo state spaces. *Proceedings of the Tenth International Workshop on Artificial Intelligence and Statistics (AI-STATS)*, 158.
- * **Lang, D.** and de Freitas, N. (2004) Beat Tracking the Graphical Model Way. *Advances in Neural Information Processing Systems (NIPS)* 17, 745.