Alex I. Malz

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Professional Experience

Special Faculty, Carnegie Mellon University (CMU) McWilliams Center for Cosmology 2022–

Project Scientist, LSST Interdisciplinary Network for Collaborative Computing (LINCC) Frameworks 2022–

Visiting Scientist, Lawrence Livermore National Laboratory (LLNL) 2021–

Postdoctoral Research Fellow, German Centre for Cosmological Lensing (GCCL) 2019–22

Education & Academic Awards

PhD 2020, Physics, New York University (NYU) Graduate School of Arts and Sciences (GSAS)

Thesis: Probabilistic analysis methods for cosmology using uncertainty-dominated photometric data

Advisor: David Hogg DOI: dx.doi.org/10.5281/zenodo.3973536

GSAS Ted Keusseff Fellow 2018-19; GSAS MacCracken Fellow 2014-18

Department of Energy Office of Science Graduate Student Research SCGSR Fellow 2017

MS 2014, Astronomy & Astrophysics, Pennsylvania State University (PSU)

Astronomy & Astrophysics Braddock/Roberts Fellow 2012-13

BS 2011, Physics & History, California Institute of Technology (Caltech)

Caltech President's Scholar 2006-11

Leadership & Scientific Collaborations

Cosmological Advanced Survey Telescope for Optical and ultraviolet Research (CASTOR), 2022–

Vera Rubin Observatory Legacy Survey of Space and Time (LSST) Science Collaborations (SCs)

Dark Energy SC (DESC) Builder 2020–, Full Member 2016–, Member 2016–;

DESC Photometric Redshifts Working Group Convener 2019-21; Topical Team Lead 2021–;

DESC Collaboration Council 2018-20; Membership Committee 2017-19

Informatics & Statistics SC (ISSC) Member 2019–, Charter Committee 2023

Galaxies, Transients & Variable Stars, Active Galactic Nuclei SCs Member 2022–

Kilo-Degree Survey (KiDS) Member, 2019–

Cosmostatistics Initiative (COIN) Member 2018–

Grants

PI, DESC workshop 2023, Redshift Assessment Infrastructure Layers (RAIL) Topical Team

PI, CMU McWilliams/PSC Seed Grant 2022-3 for "Impossible Problems" seminar series

PI, LSST Corporation (LSSTC) Enabling Science 2022 for ISSC Ambassador student travel

LSSTC Enabling Science 2021

Organizer, ISSC Ambassadors 6 of 8 applications for interdisciplinary student research funded

PI, Stress-testing multimodal photometric redshift posteriors in the extrapolative regime

Co-I, LSSTC Enabling Science 2018 & 2019, DESC Cluster Lensing Mass Modeling Sprint Week

Co-I, NSF 2015, AST-1517237: New Probabilistic Methods for Observational Cosmology

Professional Service

Teacher, LSSTC Data Science Fellowship Program Northwestern U., Fall 2022
Hackathon Leader, From Quarks to Cosmos Carnegie Mellon U., Summer 2021
Tutorial Co-organizer, Bayesian Deep Learning for Cosmology and Gravitational Waves
Astroparticle and Cosmology Laboratory (APC) Université de Paris, Winter 2020
Tutorial Organizer, DESC Sprint Week Texas A&M University, Fall 2019
Workshop Co-organizer, Photometric LSST Astronomical Time-Series Classification Challenge (PLAsTiCC) NYU, Spring 2018
Hackathon Leader, Astro Hack Week UC Berkeley, Fall 2017
Local Organizing Committee Member, Astro Hack Week NYU, Fall 2015
Reviewer, NSF Astronomy and Astrophysics Research Grants (AAG) years redacted for confidentiality

Research Supervision & Mentoring

2023–: Alice Crafford; CMU, BS 2025
2021-22: Natalia Stylianou; U. of Leicester, BS & MS 2022; Oxford U., PhD. 2025
2021-22: Nicola Hunfeld; Ruhr-U. Bochum, MS 2022
2018: David Mykytyn, Dave Perrett, Ted Singer & Zora Tung; non-academic professionals
2018: Marin Hyatt & Lia Lubit; Hunter College High School 2020

Teaching

Instructor on Record
PSU ASTRO 011 Elementary Astronomy Laboratory (Spring 2013)
Teaching Assistant
NYU PHYS-UA 7 The Universe: Its Nature and History (Spring 2018)
NYU PHYS-UA 15 Introduction to Cosmology (Fall 2017)
PSU ASTRO 120 The Big Bang Universe (Spring 2014)
PSU ASTRO 292 Astronomy of the Distant Universe (Springs 2013, 2014)
PSU ASTRO 291 Astronomical Methods and the Solar System (Falls 2012, 2013)
PSU ASTRO 001 Astronomical Universe (Falls 2012, 2013)
Guest Lecturer
PSU ASTRO 485 Introduction to High-Energy Astronomy (Fall 2013)
PSU ASTRO 291 Astronomical Methods and the Solar System (Fall 2012)
PSU ASTRO 001 Astronomical Universe (Fall 2012)

Public Outreach

Judge, New York City Science and Engineering Fair finals event Springs 2018, –21, –22
Juror, German Young Physicists' Tournament North Rhine-Westphalia Winter 2021
Contestant, Dance Your Ph.D. youtu.be/vKs3PYqZWg8 Winter 2018-19
Produced, directed, choreographed, and danced an entertaining explanation of Malz & Hogg (2021)
Math Circle Speaker at Bridge to Enter Advanced Mathematics beammath.org Summer 2018
Designed and taught applied geometry lessons in the context of astronomy
Guest Speaker, Hunter College High School Science Club Spring 2016
Judge, Pennsylvania Junior Academy of Science finals event Spring 2013
Outreach Developer & Facilitator, PSU AstroFest Summers 2012, –13, –14
Created and implemented tie-dye-based activities teaching astronomy concepts

Invited Talks & Panels

2023
- CMU, Statistical Methods for Physical Sciences (STAMPS) Colloquium
- KITP, Building a Phys. Understanding of Galaxy Evol. with Data-driven Astro. (Tutorial)

2022
- CMU, Impossible Problems Wine-and-Cheese Seminar
- Pan-Survey SED Forum, Photometric Redshifts
- Stony Brook University, Astronomy Group Colloquium
- Lawrence Livermore National Laboratory, Lab-wide Seminar

2021
- Ludwig-Maximilians-Universität Munich, Origins Cluster Data Science Laboratory Seminar
- American Astronomical Society (AAS) #238 Meeting-in-a-Meeting, Machine Learning in Astro.
- Dark Energy Spectroscopic Instrument (DESI) Collaboration, Machine Learning Seminar
- Princeton University, Institute for Advanced Study Cosmology Lunch Talk
- Machine Learning Club, Debate Panel: Will ML Solve Photometric Redshifts?

2020
- University of Arizona, LSST-DESC Meeting, Dark Energy School Lesson

2019
- Berkeley Cen. for Cosm. Phys., Accurate Lensing in the Era of Precision Cosmo. (Workshop)
- Royal Observatory Edinburgh, Institute for Astronomy Seminar
- University of Washington, Data Intensive Research in Astronomy and Cosmology Seminar

2018
- Lawrence Livermore National Laboratory, Cosmology Seminar
- Lawrence Berkeley National Laboratory, Berkeley Center for Cosmological Physics Seminar
- Leiden University, Astronomy Seminar
- University of Leiden Lorentz Center, Colours of the Universe (Workshop)
- Carnegie Mellon University, ML + Time Domain Workshop
- Laboratoire de Physique Corpusculaire de Clermont, Seminar
- Laboratoire de Physique Subatomique et de Cosmologie de Grenoble, Colloquium

2017
- State University of New York at Stony Brook, Astronomy Colloquium
- University of Toronto, Canadian Institute for Theoretical Astrophysics Seminar
- Stanford University, Kavli Institute for Particle Astrophysics and Cosmology Tea
- Tohoku University, Photo-z Workshop for Large Surveys

2016
- University College London, Astronomy Seminar
- Imperial College London, Astronomy Seminar
- University of Pittsburgh, Photometric Redshifts for LSST (Workshop)

Selected Contributed Talks

2022: U. Illinois Urbana-Champaign, Boom! A Workshop on Explosive Transients with LSST
2021: AAS #237, DESC Special Session
2020: APC, Bayesian Deep Learning for Cosmology and Gravitational Waves
2019: AAS #233, Surveys & Large Programs (Dissertation presentation)
2019: AAS #233, Larger Efforts in Education & Public Outreach (PLAsTiCC)
2018: Oxford University, Statistical Challenges in Large-Scale Structure in the Era of LSST
2017: Northwestern University, Supernovae: The LSST Revolution
2016: Carnegie Mellon University, Statistical Challenges in Modern Astronomy
2016: Chania, Greece, Statistical Challenges in 21st Century Cosmology

Publications

AIM has been awarded Builder Status within the LSST-DESC, which grants authorship rights on all DESC publications enabled by his work on photometric redshifts, time-domain classification, and service to the collaboration; however, he has chosen to only co-author papers to which he made *a direct, scientific contribution.*

1. A. Gagliano, G. Contardo, D. Foreman-Mackey, **A.I. Malz**, P.D. Aleo. 2022. *submitted to ApJ 3 October 2022.* First Impressions: Early-Time Classification of Supernovae using Host Galaxy Information and Shallow Learning.

   Contributor: data curation, resources, software, writing

2. **A.I. Malz**, F. Lanusse, J.F. Crenshaw, M.L. Graham. 2021. *to be submitted to ApJS.* An information-based metric for observing strategy optimization, demonstrated in the context of photometric redshifts with applications to cosmology (`arXiv:2104.08229`)

   Lead author: conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, software, validation, visualization, writing

3. R. Hložek, **A.I. Malz**, K.A. Ponder, M. Dai, G. Narayan, E.E.O. Ishida,T. Allam Jr., A. Bahmanyar, R. Biswas, L. Galbany, S.W. Jha, D.O. Jones, R. Kessler, M. Lochner, A.A. Mahabal, K.S. Mandel, J.R. Martinez-Galarza, J.D. McEwen, D. Muthukrishna, H.V. Peiris, C.M. Peters, C.N. Setzer. 2020. *submitted to ApJS 22 December 2020.* Results of the Photometric LSST Astronomical Time-series Classification Challenge (PLAsTiCC) (`arXiv:2012.12392`)

   Lead author: conceptualization, formal analysis, investigation, methodology, visualization, writing

4. M. Lokken, A. Gagliano, G. Narayan, R. Hložek, R. Kessler, J.F. Crenshaw, L. Salo, C.S. Alves, D. Chatterjee, M. Vincenzi, **A.I. Malz**. 2023. MNRAS 520 2. "The Simulated Catalogue of Optical Transients and Correlated Hosts (SCOTCH)"

   Contributor: conceptualization, data curation, methodology

5. N. Stylianou, **A.I. Malz**, P. Hatfield, J.F. Crenshaw, J. Gschwend. 2021. PASP 134 1034. "The sensitivity of GPz estimates of photo-z posterior PDFs to realistically complex training set imperfections"

   Lead author: conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, software, supervision, validation, visualization, writing

6. **A.I. Malz**, D.W. Hogg. 2021. ApJ 928 127. "How to obtain the redshift distribution from probabilistic redshift estimates"

   Lead author: conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, software, validation, visualization, writing

7. M. Aguena, C. Avestruz, C. Combet, S. Fu, R. Herbonnet, **A. I. Malz**, M. Penna-Lima, M. Ricci, S. D. P. Vitenti, L. Baumont, H. Fan, M. Fong, M. Ho, M. Kirby, C. Payerne, D. Boutigny, B. Lee, B. Liu, T. McClintock, H. Miyatake, C. Sifón, A. von der Linden, H. Wu, M. Yoon. 2021. MNRAS 508 4 6092. "CLMM: a LSST-DESC Cluster weak Lensing Mass Modeling library for cosmology"

   Lead author: conceptualization, funding acquisition, methodology, project administration, software, validation, writing

8. B. Dey, J.A. Newman, B.H. Andrews, R. Izbicki, A.B. Lee, D. Zhao, M.M. Rau, **A.I. Malz**. 2021. Fourth Workshop on Machine Learning and the Physical Sciences NeurIPS. Re-calibrating Photometric Redshift Probability Distributions Using Feature-space Regression (`arXiv:2110.15209`)

   Contributor: conceptualization, methodology, supervision, writing

9. J. Zuntz, F. Lanusse, **A.I. Malz**, A.H. Wright, A. Slosar, et al. 2021. OJA 4. "The LSST-DESC 3x2pt Tomography Optimization Challenge"

   Lead author: conceptualization, formal analysis, methodology, visualization, writing

10. **A.I. Malz**. 2020. PRD 103 083502. "How NOT to obtain the redshift distribution from probabilistic redshift estimates"

    Sole author

11. B. Moews, M.S. Schmitz, A.J. Lawler, J. Zuntz, **A.I. Malz**, R.S. de Souza, R. Vilalta, A. Krone-Martins, E.E.O. Ishida. 2020. MNRAS 500 1 859. "Ridges in the Dark Energy Survey for cosmic trough identification"
    Contributor: conceptualization, methodology, writing
12. S.J. Schmidt, **A.I. Malz**, J.Y.H. Soo, I.A. Almosallam, M. Brescia, S. Cavuoti, J. Johen-Tanugi, A.J. Connolly, J. DeRose, P.E. Freeman, M.L. Graham, K.G. Iyer, M.J. Jarvis, J.B. Kalmbach, E. Kovacs, A.B. Lee, G. Longo, C.B. Morrison, J.A. Newman, E. Nourbakhsh, E. Nuss, T. Pospisil, H. Tranin, R.H. Wechsler, R. Zhou, R. Izbicki. 2020. MNRAS 499 2 1587. "Evaluation of probabilistic photometric redshift estimation approaches for LSST"
    Lead author: conceptualization, formal analysis, investigation, methodology, project administration, software, supervision, validation, visualization, writing
13. N. Kennamer, E.E.O. Ishida, S. Gonzalez-Gaitan, R.S. de Souza, A. Ihler, K. Ponder, R. Vilalta, A. Moller, D.O. Jones, M. Dai, A. Krone-Martins, B. Quint, S. Sreejitch, **A.I.Malz**, L. Galbany. 2020. IEEE Symposium Series on Computational Intelligence. Active learning with RESSPECT: Resource allocation for extragalactic astronomical transients (`arXiv:2010.05941`)
    Contributor: conceptualization, methodology
14. N. Dalmasso, T. Pospisil, A.B. Lee, R. Izbicki, P.E. Freeman, **A.I. Malz**. 2019. As. & Com. 20 100362. "Conditional Density Estimation Tools in Python and R with Applications to Photometric Redshifts and Likelihood-Free Cosmological Inference"
    Contributor: data curation, writing
15. B. Moews, R.S. de Souza, E.E.O. Ishida, **A.I. Malz**, C. Heneka, R. Vilalta, J. Zuntz. 2019. PRD 99 123529. "Stress testing the dark energy equation of state imprint on supernova data"
    Contributor: conceptualization, formal analysis, investigation, methodology, validation, writing
16. T. Cantat-Gaudin, A. Krone-Martins, N. Sedaghat, A. Farahi, R.S. de Souza, R. Skalidis, **A.I. Malz**, S. Macedo, B. Moews, C. Jordi, A. Moitinho, A. Castro-Ginard, E.E.O. Ishida, C. Heneka, A. Boucaud, A.M.M. Trindade. 2019. A&A 624 A126. "Gaia DR2 unravels incompleteness of nearby cluster population: New open clusters in the direction of Perseus"
    Contributor: conceptualization, writing
17. **A.I. Malz**, R. Hložek, T. Allam Jr., A. Bahmanyar, R. Biswas, M. Dai, L. Galbany, E.E.O. Ishida, S.W. Jha, D.O. Jones, R. Kessler, M. Lochner, A.A. Mahabal, K.S. Mandel, J.R. Martinez-Galarza, J.D. McEwen, D. Muthukrishna, G. Narayan, H.V. Peiris, C.M. Peters, K. Ponder, C.N. Setzer. 2019. AJ 158 5 171. "The Photometric LSST Astronomical Time-series Classification Challenge (PLAsTiCC): Selection of a performance metric for classification probabilities balancing diverse science goals"
    Lead author: conceptualization, data curation, formal analysis, investigation, methodology, project administration, software, supervision, validation, visualization, writing
18. C. Chang, M. Wang, S. Dodelson, T. Eifler, C. Heymans, M. Jarvis, M.J. Jee, S. Joudaki, E. Krause, **A.I. Malz**, R. Mandelbaum, I. Mohammed, M. Schneider, M. Simet, M.A. Troxel, J. Zuntz. 2018. MNRAS 482 3 3696. "A Unified Analysis of Four Cosmic Shear Surveys"
    Contributor: methodology, writing
19. **A.I. Malz**, P.J. Marshall, M.L. Graham, S.J. Schmidt, J. DeRose, R. Wechsler. 2018. AJ 156 0 35. "Approximating photo-z PDFs for large surveys"
    Lead author: conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, software, validation, visualization, writing
20. A.S. Leung, V. Acquaviva, E. Gawiser, R. Ciardullo, E. Komatsu, **A.I. Malz**, G.R. Zeimann, J.S. Bridge, N. Drory, J.J Feldmeier, S.L. Finkelstein, K. Gebhardt, C. Gronwall, A. Hagen, G.J. Hill, D.P. Schneider. 2017. ApJ 843 2 130. "Bayesian Redshift Classification of Emission-Line Galaxies with Photometric Equivalent Widths"
    Contributor: conceptualization
21. J.S. Bridge, C. Gronwall, R. Ciardullo, A. Hagen, G. Zeimann, **A.I. Malz**, V. Acquaviva, D.P. Schneider, N. Drory, K. Gebhardt, S. Jogee. 2015. ApJ 799 2 205. "Physical and Morphological

Properties of [O II] Emitting Galaxies in the HETDEX Pilot Survey"
Contributor: conceptualization, methodology

22. R. Ciardullo, G.R. Zeimann, C. Gronwall, H. Gebhardt, D.P. Schneider, A. Hagen, **A.I. Malz**, G.A. Blanc, G.J. Hill, N. Drory, E. Gawiser. 2014. ApJ 796 1 64. "HST Emission Line Galaxies at z $\tilde{2}$: The Ly-alpha Escape Fraction"
Contributor: conceptualization, methodology
23. A. Hagen, R. Ciardullo, C. Gronwall, V. Acquaviva, J. Bridge, G.R. Zeimann, G.A. Blanc, N.A. Bond, S.L. Finkelstein, M. Song, E. Gawiser, D.B. Fox, H. Gebhardt, **A.I. Malz**, D.P. Schneider, N. Drory, K. Gebhardt, G.J. Hill. 2014. ApJ 786 1 59. "Spectral Energy Distribution Fitting of HETDEX Pilot Survey Lyman-alpha Emitters in COSMOS and GOODS-N"
Contributor: conceptualization, methodology

Published Software

All of AIM's code, including work in progress, is publicly available on GitHub; these have formal releases with DOIs.

LSST-DESC RAIL Topical Team (led by **A.I. Malz**). 2022. "`qp`"
Lead author: conceptualization, methodology, project administration, software, supervision, validation, writing (documentation)

LSST-DESC RAIL Topical Team (led by **A.I. Malz**). 2022. "`RAIL`".
Lead author: conceptualization, methodology, project administration, software, supervision, validation, writing (documentation)

LSST-DESC CLMassMod Team (led by **A.I. Malz**). 2021. "`CLMM`".
Lead author: conceptualization, funding acquisition, methodology, project administration, software, supervision, writing (documentation)

A.I. Malz. 2020. "`chippr`".
Sole author

A.I. Malz, et al. 2019. "`ProClaM`".
Lead author: conceptualization, methodology, software, validation, visualization, writing (documentation)

B. Brewer, T.K. Leung & **A.I. Malz**. 2018. "`StarStudded`".
Contributor: software

A.I. Malz & P.J. Marshall. 2017. "`qp`".
Lead author: conceptualization, methodology, software, validation, visualization, writing (documentation)

Non-standard Publications

K. Breivik, et al. (incl. **A.I. Malz**) 2022. *whitepaper.* From Data to Software to Science with the Rubin Observatory LSST (`arXiv:2208.02781`)
Contributor: conceptualization, investigation, writing

LSST-DESC, et al. (incl. **A.I. Malz**) 2020. *LSST-DESC Research Note.* "The LSST-DESC Science Roadmap"
Contributor: conceptualization, project administration, writing

T. Allam Jr., A. Bahmanyar, R. Biswas, M. Dai, L. Galbany, R. Hložek, E.E.O. Ishida, S.W. Jha, D.O. Jones, R. Kessler, M. Lochner, A.A. Mahabal, **A.I. Malz**, K.S. Mandel, J.R. Martinez-Galarza, J.D. McEwen, D. Muthukrishna, G. Narayan, H.V. Peiris, C.M. Peters, K. Ponder, C.N. Setzer. *LSST-DESC Research Note.* 2018. The Photometric LSST Astronomical Time-series Classification Challenge (PLAsTiCC): Data set (`arXiv:1810.00001`)
Contributor: conceptualization, methodology, software

A.I. Malz, et al. 2018. "Dance Your Ph.D. 2018/9: Probabilistic methods for cosmological analysis with uncertainty-dominated data" (educational music video)
Lead author: conceptualization, funding acquisition, methodology (choreography), project administration (production), resources (costumes), software (video editing & web maintenance), supervision, visualization

P.J. Marshall, et al. (incl. **A.I. Malz**) 2017. *whitepaper.* Science-Driven Optimization of the LSST Observing Strategy (`arXiv:1708.04058`)

Contributor: conceptualization, methodology, writing

A.I. Malz. 2017. Cooper Square Review. "Going nowhere fast" (science communication essay) **Sole author**

Citeable Presentations

A.I. Malz & the Extended PLAsTiCC (ELAsTiCC) Team. 2023. American Astronomical Society, AAS Meeting #241, id. 117.04 "ELAsTiCC: Metrics of probabilistic classifications of the alert stream" (contributed talk)

A.I. Malz & the LSST-DESC RAIL Team. 2023. American Astronomical Society, AAS Meeting #241, Astronomy and Cloud Computing Special Session, id. 358.01. "All aboard! A LINCC Framework for extragalactic science using RAIL" (contributed poster)

A.I. Malz. 2021. American Astronomical Society, AAS Meeting #238, Machine Learning in Astronomy Meeting-in-a-Meeting, id. 103.02. "Proceed with caution: how, and how not, to use machine learning to probe cosmology" (invited talk)

A.I. Malz, F. Lanusse, J.F. Crenshaw, M.L. Graham. 2021. American Astronomical Society, AAS Meeting #238, id. 230.04. "`TheLastMetric`: an information-based observing strategy metric for photometric redshifts, cosmology, and more" (contributed poster)

J.F. Crenshaw, J.B. Kalmbach, **A.I. Malz**, A.J. Connolly. 2021. American Astronomical Society, AAS Meeting #238, id. 230.01. "`PZFlow`: normalizing flows for cosmology, with applications to forward modeling galaxy photometry" (contributed poster)

A.I. Malz. 2021. American Astronomical Society, AAS Meeting #237, LSST-DESC Special Session, id. 443.05. "The DESC Photometric Redshifts Working Group: Challenges & Opportunities" (contributed talk)

A.I. Malz. 2019. American Astronomical Society, AAS Meeting #233, Surveys & Large Programs, id. 313.05D. "Probabilistic data analysis methods for large photometric surveys" (contributed talk)

A.I. Malz. 2019. American Astronomical Society, AAS Meeting #233, Larger Efforts in Education & Public Outreach, id. 212.05. "The Photometric LSST Astronomical Time Series Classification Challenge (PLAsTiCC): challenge design and evaluation criteria" (contributed talk)

C.M. Peters, **A.I. Malz** & R. Hlozek. 2018. American Astronomical Society, AAS Meeting #231, id. 245.03. "Supernova Cosmology Inference with Probabilistic Photometric Redshifts" (contributed poster)

A.I. Malz & S. Shandera. 2014. American Astronomical Society, AAS Meeting #223, id. 456.04. "Probing Gravity in the High-Redshift Universe with HETDEX" (contributed poster)

A.I. Malz, R. Rich & S. Lepine. 2009. American Astronomical Society, AAS Meeting #213, id. 602.04. "Low-mass Binaries in the Galactic Halo Resolved by Adaptive Optics" (contributed poster)