Alex I. Malz

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Ruhr-Universität Bochum (RUB)
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Postdoctoral Research Fellow, German Centre for Cosmological Lensing
Visiting Scientist, Lawrence Livermore National Laboratory

Education

PhD 2020, Physics, New York University (NYU)
Thesis: Probabilistic analysis methods for cosmology using uncertainty-dominated photometric data Advisor: David W. Hogg
MS 2014, Astronomy & Astrophysics, Pennsylvania State University (PSU)
ä BS 2011, Physics & History, California Institute of Technology (Caltech)

Fellowships & Honors

Vera C. Rubin Observatory Legacy Survey of Space and Time (LSST)
Dark Energy Science Collaboration (DESC) Builder 2020-
Finalist, Dance Your Ph.D. contest, 2019
NYU Graduate School of Arts and Sciences Ted Keusseff Fellow, 2018–2019
Department of Energy Office of Science Graduate Student Research SCGSR Fellow, 2017
NYU Graduate School of Arts and Sciences MacCracken Fellow, 2014–2018
PSU Astronomy & Astrophysics Braddock/Roberts Fellow 2012–2013
Caltech President's Scholar, 2006–2011

Scientific Collaborations & Affiliations

Kilo-Degree Survey (KiDS) Member, 2019–.
LSST-DESC Full Member, 2016–
Photometric Redshifts Working Group Co-Convener, 2019–.
past: Collaboration Council, 2018–; past: Membership Committee 2017–2019
LSST Informatics & Statistics Science Collaboration (ISSC) Member, 2019–
Cosmostatistics Initiative (COIN) Member, 2018–

Grants & Proposals

LSST Corporation Enabling Science grants
Organizer, ISSC Ambassadors 2021 (six of eight applications for interdisciplinary LSST student research funded)
PI, ISSC Ambassador: Stress-testing multimodal photometric redshift posteriors in the extrapolative regime Summer 2021
Co-I, LSST-DESC CLMassMod Sprint Weeks, RUB Summer 2019; CMU Summer 2018
Co-I, NSF AST-1517237: New Probabilistic Methods for Observational Cosmology 2015

Invited talks

Origins Cluster Data Science Laboratory Seminar (Ludwig-Maximilians-Universität Munich & Technical University of Munich) Summer 2021

Machine Learning in Astronomy, id. 103.02 (American Astronomical Society #238 Meeting-in-a-Meeting) Spring 2021

Machine Learning Seminar (Dark Energy Spectroscopic Instrument (DESI) Collaboration) Spring 2021

Institute for Advanced Study Cosmology Lunch Talk (Princeton University) Spring 2021

Panelist (Machine Learning Club) Spring 2021

Dark Energy School, LSST-DESC Meeting (University of Arizona) Winter 2020

Accurate Lensing in the Era of Precision Cosmology (Berkeley Center for Cosmological Physics) Spring 2019

Institute for Astronomy Seminar (Royal Observatory Edinburgh) Spring 2019

Data Intensive Research in Astronomy and Cosmology Seminar (University of Washington) Spring 2019

Cosmology Seminar (Lawrence Livermore National Laboratory) Fall 2018

Berkeley Center for Cosmological Physics Seminar (Lawrence Berkeley National Laboratory) Fall 2018

Astronomy Seminar (Leiden University) Fall 2018

Colours of the Universe (University of Leiden Lorentz Center) Fall 2018

ML + Time Domain Workshop (Carnegie Mellon University) Summer 2018

Seminar (Laboratoire de Physique Corpusculaire de Clermont) Summer 2018

Colloquium (Laboratoire de Physique Subatomique et de Cosmologie de Grenoble) Summer 2018

Astronomy Colloquium (State University of New York at Stony Brook) Fall 2017

Canadian Institute for Theoretical Astrophysics Seminar (University of Toronto) Fall 2017

Kavli Institute for Particle Astrophysics and Cosmology Tea (Stanford University) Summer 2017

Photo-z Workshop for Large Surveys (Tohoku University) Spring 2017

Astronomy Seminar (University College London) Summer 2016

Astronomy Seminar (Imperial College London) Summer 2016

Photometric Redshifts for LSST (University of Pittsburgh) Spring 2016

Selected contributed talks

DESC Special Session, id. 443.05 (American Astronomical Society #237) Spring 2020

Bayesian Deep Learning for Cosmology and Gravitational Waves (Astroparticle and Cosmology Laboratory, Université de Paris) Winter 2020

Tutorial, DESC Sprint Week (Texas A&M University) Fall 2019

Surveys & Large Programs, id. 313.05D (American Astronomical Society #233) Winter 2019

Larger Efforts in Education & Public Outreach, id. 212.05 (American Astronomical Society #233) Winter 2019

Chalkboard talk, Statistical Challenges in Large-Scale Structure in the Era of LSST (Oxford University) Spring 2018

Supernovae: The LSST Revolution (Center for Interdisciplinary Exploration and Research in Astrophysics, Northwestern University) Spring 2017

Statistical Challenges in Modern Astronomy (Carnegie Mellon University) Spring 2016

Statistical Challenges in 21st Century Cosmology (Chania, Crete) Spring 2016

Organization & Community Service

Hackathon leader, From Quarks to Cosmos (Carnegie Mellon University) Summer 2021

Tutorial Co-organizer, Bayesian Deep Learning for Cosmology and Gravitational Waves Workshop (Astroparticle and Cosmology Laboratory Université de Paris) Winter 2020

Co-organizer, Photometric LSST Astronomical Time-Series Classification Challenge (PLAsTiCC) Workshop (NYU) Spring 2018

Local Organizing Committee member, Astro Hack Week (NYU) Fall 2015

Public outreach

Judge at the New York City Science and Engineering Fair finals event Spring 2021

Juror at the German Young Physicists' Tournament North Rhine-Westphalia regional competition Winter 2021

Finalist in the 2019 Dance Your Ph.D. contest

Produced, directed, choreographed, and danced an entertaining explanation of the CHIPPR Bayesian hierarchical model of Malz & Hogg (2021); https://youtu.be/vKs3PYqZWg8

Math Circle Speaker at Bridge to Enter Advanced Mathematics, a program to help underserved students enter advanced study in mathematics Summer 2018

Designed and taught applied geometry lessons in the context of astronomy

Judge at the New York City Science and Engineering Fair finals event Spring 2018

Guest Speaker at Hunter College High School Science Club Spring 2016

Judge at the Pennsylvania Junior Academy of Science finals event Spring 2013

Outreach Developer and Facilitator at PSU AstroFest Summers 2012, 2013, 2014

Created and implemented tie-dye-based activities teaching astronomy concepts

Research Supervision & Mentoring

2021: Nicola Hunfeld: RUB, MS (2022)

2021: Natalia Stylianou: University of Leicester, BS (2022)

2018: David Mykytyn, Dave Perrett, Ted Singer & Zora Tung: non-academic professionals

2018: Lia Lubit & Marin Hyatt: 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 (10/2013)

PSU ASTRO 291 Astronomical Methods and the Solar System (12/2012)

PSU ASTRO 001 Astronomical Universe (10/2012)

Publications

1. M. Aguena, C. Avestruz, C. Combet, S. Fu, R. Herbonnet, **A. I. Malz**, M. Penna-Lima, M. Ricci, S. D. P. Vitenti, et al. 2021. *submitted to MNRAS.* CLMM: a LSST-DESC Cluster weak Lensing Mass Modeling library for cosmology (`arXiv:2107.10857`)
   Lead author: conceptualization, funding acquisition, methodology, project administration, software, validation, writing (original draft & review/editing)
2. **A.I. Malz**, F. Lanusse, J.F. Crenshaw, M.L. Graham. 2021. *submitted to MNRAS.* 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 (original draft & review/editing)
3. **A.I. Malz**. 2020. PRD 103 083502. "How NOT to obtain the redshift distribution from probabilistic redshift estimates"
   Sole author
4. 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 (original draft & review/editing)
5. R. Hložek, K.A. Ponder, **A.I. Malz**, M. Dai, G. Narayan, E.E.O. Ishida, et al. 2020. *submitted to AJ 22 December 2020.* Results of the Photometric LSST Astronomical Time-series Classification Challenge (PLAsTiCC) (`arXiv:2012.12392`)
   Lead author: onceptualization, formal analysis, investigation, methodology, visualization, writing (original draft & review/editing)
6. S.J. Schmidt, **A.I. Malz**, J.Y.H. Soo, et al. 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 (original draft & review/editing)
7. 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. *accepted to IEEE Symposium Series on Computational Intelligence.* Active learning with RESSPECT: Resource allocation for extragalactic astronomical transients (`arXiv:2010.05941`)
   Contributor: conceptualization, methodology
8. **A.I. Malz**, D.W. Hogg. 2021. *accepted to ApJ 23 July 2020.* How to obtain the redshift distribution from probabilistic redshift estimates (`arXiv:2007.12178`)
   Lead author: conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, software, validation, visualization, writing (original draft & review/editing)
9. 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 (original draft & review/editing)
10. 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 (original draft & review/editing)
11. 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 (original draft & review/editing)

12. **A.I. Malz**, R. Hložek, et al. 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 (original draft & review/editing)

13. 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, writing (review/editing)

14. 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 (original draft & review/editing)

15. **A.I. Malz**, P.J. Marshall, et al. 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 (original draft & review/editing)

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

    Contributor: conceptualization, methodology, writing (original draft & review/editing)

17. 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, writing (review/editing)

18. 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, writing (review/editing)

19. 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 2: The Ly-alpha Escape Fraction"

    Contributor: conceptualization, methodology, writing (review/editing)

20. 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, writing (review/editing)

Published software

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

Cosmological Hierarchical Inference with Probabilistic Photometric Redshifts; **Sole author**

A.I. Malz & the PLAsTiCC team. 2019. "`ProClaM`".

Probabilistic Classification Metrics; **Lead author**: conceptualization, methodology, software, validation, visualization, writing (documentation)

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

probabilistic catalogs from crowded stellar fields; Contributor: software

A.I. Malz & P.J. Marshall. 2017. "`qp`".

handling diverse parameterizations of univariate probability density functions; **Lead author**: conceptualization, methodology, software, validation, visualization, writing (documentation)

Citeable posters & non-standard publications

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; **Lead author**: conceptualization, formal analysis, investigation, methodology, project administration, software, validation, visualization, writing (original draft & review/editing)

J.F. Crenshaw, J.B. Kalmbach, **A.I. Malz**, A. 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; Contributor: supervision, validation

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

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; **Lead author**: conceptualization, data curation, formal analysis, investigation, methodology, software, validation, visualization, writing (original draft & review/editing)

A.I. Malz. 2017. Cooper Square Review. "Going nowhere fast".

science communication; **Sole author**

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; **Lead author**; conceptualization, data curation, formal analysis, investigation, methodology, visualization, writing (original draft & review/editing)

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; **Lead author**; formal analysis, funding acquisition, investigation, writing (original draft & review/editing)