

## Alex I. Malz

ORCID 0000-0002-8676-1622

[aimalz@astro.ruhr-uni-bochum.de](mailto:aimalz@astro.ruhr-uni-bochum.de)

<https://aimalz.github.io/>

Astronomisches Institut  
Ruhr-Universität Bochum (RUB)  
Universitätstraße 150  
44801 Bochum, Germany

### Appointments

Postdoctoral Research Fellow, German Centre for Cosmological Lensing 2019–  
Visiting Scientist, Lawrence Livermore National Laboratory 2021–

### Education & Academic Fellowships

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 W. Hogg

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

MS 2014, Astronomy & Astrophysics, Pennsylvania State University (PSU) Braddock/Roberts Fellow 2012-13

BS 2011, Physics & History, California Institute of Technology (Caltech) President's Scholar, 2006-11

### Awards & 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

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

### Leadership & Scientific Collaborations

Kilo-Degree Survey (KiDS) Member, 2019–

LSST Informatics & Statistics Science Collaboration (ISSC) Member, 2019–

Cosmostatistics Initiative (COIN) Member, 2018–

DESC Full Member, 2016–; Photometric Redshifts Working Group Convener, 2019-21  
Collaboration Council, 2018-20; Membership Committee 2017-19

### Grants

LSST Corporation (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 2019, DESC Cluster Lensing Mass Modeling Sprint Week at RUB

Co-I, LSSTC Enabling Science 2018, DESC Cluster Lensing Mass Modeling Sprint Week at CMU

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

### Professional Service

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

Tutorial Co-organizer, Bayesian Deep Learning for Cosmology and Gravitational Waves

(Astroparticle and Cosmology Laboratory Université de Paris, Winter 2020)

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

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

**Publications** 21 total; 9 as lead author

1. J. Zuntz, F. Lanusse, **A.I. Malz**, A.H. Wright, A. Slosar, et al. 2021. *submitted to MNRAS*. The LSST-DESC 3x2pt Tomography Optimization Challenge ([arXiv:2108.13418](#))  
Lead author: conceptualization, formal analysis, methodology, visualization, writing (original draft)
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)
3. M. Agüena, C. Avestruz, C. Combet, S. Fu, R. Herbonnet, **A. I. Malz**, M. Penna-Lima, M. Ricci, S. D. P. Vitenti, et al. 2021. *accepted 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)
4. **A.I. Malz**, D.W. Hogg. 2021. *accepted to ApJ 23 July 2021*. 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)
5. **A.I. Malz**. 2020. PRD 103 083502. “How NOT to obtain the redshift distribution from probabilistic redshift estimates”  
Sole author
6. 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)
7. 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: conceptualization, formal analysis, investigation, methodology, visualization, writing (original draft)
8. 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)
9. 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. Sreejith, **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
10. N. Dalmaso, 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)
11. 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)
12. T. Cantat-Gaudin, A. Krone-Martins, N. Sedaghat, A. Farahi, R.S. de Souza, R. Skolidis, **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)

13. **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)
14. 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)
15. 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)
16. **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)
17. P.J. Marshall, et al. 2017. *whitepaper*. Science-Driven Optimization of the LSST Observing Strategy ([arXiv:1708.04058](#))  
Contributor: conceptualization, methodology, writing (original draft)
18. A.S. Leung, V. Acquaviva, E. Gawiser, R. Ciardullo, E. Komatsu, **A.I. Malz**, G.R. Zeimann, et.al. 2017. ApJ 843 2 130. “Bayesian Redshift Classification of Emission-Line Galaxies with Photometric Equivalent Widths”  
Contributor: conceptualization, writing (review/editing)
19. 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)
20. 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  $z \sim 2$ : The Ly-alpha Escape Fraction”  
Contributor: conceptualization, methodology, writing (review/editing)
21. 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 Presentations & 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**. 2021. American Astronomical Society, AAS Meeting #238 Meeting-in-a-Meeting: Machine Learning in Astronomy, id. 103.02. “Proceed with caution: how, and how not, to use machine learning to probe cosmology”  
invited talk; **Sole author**
- A.I. Malz**. 2021. American Astronomical Society, AAS Meeting #237, id. 443.05. “The DESC Photometric Redshifts Working Group: Challenges & Opportunities”  
contributed talk; **Sole author**
- 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; **Sole author**
- 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; **Sole author**
- 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)

## Invited Talks

2021

Ludwig-Maximilians-Universität Munich, Origins Cluster Data Science Laboratory Seminar  
 American Astronomical Society #238 Meeting-in-a-Meeting, Machine Learning in Astronomy  
 Dark Energy Spectroscopic Instrument (DESI) Collaboration, Machine Learning Seminar  
 Princeton University, Institute for Advanced Study Cosmology Lunch Talk  
 Machine Learning Club, Panelist

2020

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

2019

Berkeley Center for Cosmological Physics, Accurate Lensing in the Era of Precision Cosmology  
 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  
 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

## 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

## Public outreach

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

Juror, German Young Physicists' Tournament North Rhine-Westphalia Winter 2021

Contestant, Dance Your Ph.D. [youtu.be/vKs3PYqZWg8](https://youtu.be/vKs3PYqZWg8), Winter 2019

Produced, directed, choreographed, and danced an entertaining explanation of Malz & Hogg (2021)

Math Circle Speaker at Bridge to Enter Advanced Mathematics [beammath.org](https://beammath.org), Summer 2018

Designed and taught applied geometry lessons in the context of astronomy

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

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, 2013, 2014

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