

# ISMAEL MENDOZA

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## EDUCATION

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### University of Michigan

PhD Physics and Scientific Computing, **GPA: 4.00**

*Ann Arbor, MI*

*Expected June 2024*

### Stanford University

MS Computer Science, **GPA: 3.74**

*Stanford, CA*

*September 2018 - June 2019*

- **Research in Statistics and Cosmology:** “Olber’s Paradox Revisited – Effects of Overlapping Sources on Cosmic Shear Estimation: Statistical Sensitivity and Pixel-Noise Bias”

BS Physics with Honors — Minor in Statistics, **GPA: 3.86**

*September 2014 - June 2018*

- **Honors Thesis:** “No escape: light waves in AdS” (Link: <https://purl.stanford.edu/vf208qp2190>)

## RESEARCH EXPERIENCE

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### Probabilistic Modeling with Machine Learning in Cosmology

*University of Michigan, MI*

Advisor: Jeffrey Regier (Statistics)

*October 2019 – Present*

- Developing a probabilistic framework to measure visually overlapping (blended) galaxies in state-of-the-art astronomical surveys like LSST.
- Building a deep generative model to characterize blended galaxies using variational autoencoders.

### Computational Cosmology

*University of Michigan, MI*

Advisor: Camille Avestruz (Cosmology)

*September 2019 – Present*

- Using dark matter halo catalogs based on N-body simulations and a variety of statistical approaches to tie together dynamical history and snapshot properties of halos.

### Observational Cosmology and Data Analysis

*Stanford, CA*

Advisor: Patricia Burchat (Cosmology)

*June 2015 – Present*

- Developed a statistical framework for weak gravitational lensing that provides a comprehensive analysis of shape measurement noise bias for blended galaxies.
- Performed large scale galaxy simulations and measurements using Stanford’s High Performance Computing cluster.
- Presented my work in poster fairs and in several of the Dark Energy Science Collaboration’s meetings.
- Currently preparing journal article for submission to the Journal of Cosmology and Astroparticle Physics that assesses the impact of blending on cosmic shear estimation for various astronomical surveys.

### Biostatistics

*Stanford, CA*

Advisor: Julia Palacios (Statistics and Biomedical Data Science)

*September 2018 – June 2019*

- Implemented efficient algorithms for calculating the likelihood of phylogenetic trees simulated from coalescent models.
- Developed Bayesian statistical framework to calculate the probability of correct classification between two different population size histories for large sample sizes and loci.

### Convex Optimization

*Lausanne, Switzerland*

Advisor: Nisheeth Vishnoi (Theoretical Computer Science)

*June 2018 – September 2018*

- Participated in Summer@EPFL CS program at the École polytechnique fédérale de Lausanne (EPFL).
- Designed and executed a project at interface of optimization, cosmology, and Riemannian geometry.
- Developed manifold optimization algorithms to measure galaxy shapes from surface brightness profiles.
- Used non-convex optimization techniques to mathematically show the high efficiency of my algorithm.

## General Relativity and Field Theory Honors Thesis

Advisor: Eva Silverstein (Cosmology)

Stanford, CA  
June 2017 – June 2018

- Developed a framework for understanding scattering processes in manifolds by combining insights from quantum scattering theory, differential geometry, and partial differential equations.
- Applied framework to successfully resolve paradox of light waves traveling in Anti-de Sitter space.
- Simulated complex wave scattering processes using Mathematica.
- Presented work as my undergraduate Honors Thesis to the Stanford Physics Undergraduate Committee and at the Stanford Symposium of Undergraduate Research (SURPS).

## TEACHING EXPERIENCE

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### Statistics Teaching Assistant at the University of Michigan

Ann Arbor, MI

- **Courses:**
  - Statistics 507: Data Science and Analytics using Python August 2020 – December 2020

### Physics Teaching Assistant at the University of Michigan

Ann Arbor, MI

- **Courses:**
  - Physics 136: Physics for the Life Sciences Laboratory I September 2019 – December 2019
  - Physics 141: Elementary Laboratory I January 2020 – April 2020
- Guided students through a series of physics experiments including analysis of their measurements.

### Physics Teaching Assistant at Stanford University

Stanford, CA

- **Courses:**
  - Physics 21: Mechanics, Fluids, and Heat September 2018 – December 2018
  - Physics 70: Foundations of Modern Physics September 2017 – December 2017
- Designed and graded weekly problem sets, quizzes, and exams.
- Lead weekly problem-solving sessions aimed at reinforcing student's understanding of lecture.

**EPASA:** Tutored middle school student in math and English.

September 2016 – June 2018

**Habla:** Tutored Stanford custodial staff in English 3 hours/week.

September 2014 – June 2018

## HONORS AND AWARDS

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**Stanford Undergraduate Advising and Research Major Grant:** Grant recipient for research 2017

**Large Synoptic Survey Telescope Corporation Enabling Science Award:** Grant recipient for research 2016

**45th International Physics Olympiad:** Bronze Medalist 2014

## PROGRAMMING SKILLS

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Python, C/C++, L<sup>A</sup>T<sub>E</sub>X, Mathematica, Unix shell, Git, R

## PUBLICATIONS

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Sanchez, J., Mendoza, I., Kirkby, D. P., & Burchat, P. R. (2021). *Effects of overlapping sources on cosmic shear estimation: Statistical sensitivity and pixel-noise bias*. arXiv preprint arXiv:2103.02078.

## SOFTWARE

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David Kirkby, Ismael Mendoza, & Javier Sanchez. (2020, August 7). *WeakLensingDeblending* (Version 1.0.0). Zenodo. <http://doi.org/10.5281/zenodo.3975230>

## PRESENTATIONS

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*Blending ToolKit Tutorial*, Ismael Mendoza, Dark Energy Science Collaboration (DESC) Summer 2020 Virtual Meeting, Chicago, IL. July 2020 (virtual)

*The Blending Problem in Cosmology*, Ismael Mendoza, Physics Graduate Student Symposium 2020, Ann Arbor, MI. July 2020 (virtual)

*BlendingToolKit: Walkthrough and Future Plans*, Ismael Mendoza, DESC Blending Working Group. July 2020 (virtual)