

# ISMAEL MENDOZA

imendoza@umich.edu ◊ GitHub: <https://github.com/ismael-mendoza>

## EDUCATION

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| <b>University of Michigan</b><br>PhD Physics and Scientific Computing, <b>GPA: 4.00</b> | <i>Ann Arbor, MI</i><br><i>Expected June 2024</i>        |
| <b>Stanford University</b><br>MS Computer Science, <b>GPA: 3.74</b>                     | <i>Stanford, CA</i><br><i>September 2018 - June 2019</i> |

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

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| BS Physics with Honors — Minor in Statistics, <b>GPA: 3.86</b>   | <i>September 2014 - June 2018</i> |
| • <b>Honors Thesis:</b> “No escape: light waves in AdS” (Link: <a href="https://purl.stanford.edu/vf208qp2190">https://purl.stanford.edu/vf208qp2190</a> ) |                                   |

## RESEARCH EXPERIENCE

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| <b>Probabilistic Modeling with Machine Learning in Cosmology</b><br>Advisor: Jeffrey Regier (Statistics) | <i>University of Michigan, MI</i><br><i>October 2019 – Present</i> |
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- 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.

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| <b>Computational Cosmology</b><br>Advisor: Camille Avestruz (Cosmology)   | <i>University of Michigan, MI</i><br><i>September 2019 – Present</i> |
| • 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. |  |

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| <b>Observational Cosmology and Data Analysis</b><br>Advisor: Patricia Burchat (Cosmology)  | <i>Stanford, CA</i><br><i>June 2015 – Present</i> |
| • 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. |   |

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| <b>Biostatistics</b><br>Advisor: Julia Palacios (Statistics and Biomedical Data Science)   | <i>Stanford, CA</i><br><i>September 2018 – June 2019</i> |
| • 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. |  |

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| <b>Convex Optimization</b><br>Advisor: Nisheeth Vishnoi (Theoretical Computer Science)                  | <i>Lausanne, Switzerland</i><br><i>June 2018 – September 2018</i> |
| • 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 – Present*

**Physics Teaching Assistant at the University of Michigan** *Ann Arbor, MI*

- Courses:
  - Physics 136: Physics for the Life Sciences Laboratory I
  - Physics 141: Elementary Laboratory I
- Guided students through a series of physics experiments including analysis of their measurements.

*September 2019 – December 2019*

*January 2020 – April 2020*

**Physics Teaching Assistant at Stanford University** *Stanford, CA*

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

*September 2018 – December 2018*

*September 2017 – December 2017*

**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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Javier Sanchez, Ismael Mendoza, David P. Kirkby, and Patricia Burchat, *Olber's Paradox Revisited – Effects of Overlapping Sources on Cosmic Shear Estimation: Statistical Sensitivity and Pixel-Noise Bias*, in collaboration review.

## **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)

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