AGNIVA GHOSH

Physics and Astronomy Graduate Student, University of Minnesota Twin Cities, USA
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Physics PhD candidate with extensive experience in programming, statistics and mathematical modeling. Transitioning to data science after graduation. Background in statistics, object-oriented programing, parallel computation, numerical modeling, derivative-free optimization techniques, exploratory data analysis, data cleaning and machine learning.

SKILLS

Languages: Bash, C, Fortran, Git, html, Mathematica, Python, SQL
Data Analytics: Astropy, Numba, Numpy, Pandas, Regex, Scikit-learn, Scipy
Data Visualization: Mathematica, Matplotlib, Seaborn
Soft Skills: Creative Thinking, Leadership and Mentoring, Fast Learning, Attention to Details.

EXPERIENCE

University of Minnesota Twin Cities, USA

Graduate Research Student **2017 - Present**

Advisor: Prof. Liliya Williams
Thesis Title: *Free-form Reconstructions of Clusters of Galaxies Using Gravitational Lensing*

- Numerically modeled galaxy clusters using gravitational lensing using data from NASA's Hubble Space Telescope.
- Reconstructed cluster mass distributions using a non-parametric many-to-one inversion algorithm based on a derivative-free multi-objective optimization technique.
- Created a gradient-descent based solver in C for searching strongly lensed image solutions and optimized it for non-linear multi-dimensional vector functions to enhance performance.
- Using Python, developed a comparative statistical analysis of lensing data to analyze the performance of the inversion method and predicted precision of measuring cosmological parameters.
- Calculated two-point correlation functions between reconstructed lensing mass and observed gravitationally lensed images for getting insights into properties of dark matter.
- Generated large data sets of lensing parameters and uploaded to NASA domain for public use.
- Worked with multiple collaborators from various other institutions.
- Published three articles in the journal Monthly Notices of Royal Astronomical Society.

Graduate Teaching Assistant **2017 - Present**

- Guided students to solve physics problems during discussions and tutoring.
- Supervised undergraduate physics laboratory experiments with classes of ~20+ students.
- As head TA coordinated work assignments between other teaching assistants for the courses.

Indian Statistical Institute Kolkata, India

Project Linked Person **2017**

Advisor: Dr. Arindam Chatterjee
Project Title: *Quest for Dark Matter and Inflation*

- Worked on inflationary models in the context of early-universe cosmology.
- Written Mathematica scripts for analysis.

Indian Institute of Technology Kharagpur, India

Masters' Research Student **2015 - 2016**

Advisor: Prof. Tirtha Sankar Roy
Thesis Title: *Unification of Fundamental Forces: Gauge Coupling Unification in Particle Physics*

- Mathematically modeled extensions of the Standard Model of particle physics with scalar Dark Matter candidates.
- Using Mathematica, solved non-linear equations to obtain model parameters.
- Examined the possibility of the Gauge Couple Unification in the models.

EDUCATION

Doctorate of Philosophy (Ph.D.) in Physics — **2017 - Present**
University of Minnesota Twin Cities, USA

Master of Science (M.Sc.) in Physics — **2014 - 2016**
Indian Institute of Technology Kharagpur, India

Bachelor of Science (B.Sc.) in Physics — **2011 - 2014**
Serampore College, University of Calcutta, India

LEADERSHIP EXPERIENCES

- Student Representative, Graduate Education Committee, School of Physics and Astronomy, University of Minnesota Twin Cities.
- Director, Finances and Operations (F&O), Chateau Student Co-operative board, Minneapolis, MN.

AWARDS AND ACHIEVEMENTS

- *Goldman Fellowship*, School of Physics and Astronomy, University of Minnesota, 2021.
- *Certificate for Outstanding Teaching* by Center of Educational Innovation, University of Minnesota.
- *Teaching Assistant Award,* School of Physics and Astronomy, University of Minnesota, 2018.
- *Proficiency Award for Best Masters' Thesis,* Department of Physics, IIT Kharagpur, 2016.
- *Lectureship and Junior Research Fellowship,* CSIR, Government of India, 2015.
- 5-year *INSPIRE Scholarship,* Department Science and Technology, Government of India, 2011.

TALKS AND PRESENTATIONS

- Contributed talk at BUFFALO Collaboration (Online) Meeting, 2021.
- Contributed talk at European Astronomical Society (EAS) Annual Meeting, 2021.
- Invited talk at International Space Science Institute (ISSI) Workshop on Strong Gravitational Lensing in Bern, Switzerland, 2022.

PUBLICATIONS

- **Agniva Ghosh**, Liliya L. R. Williams, Jori Liesenborgs, Ana Acebron, Mathilde Jauzac, Anton M. Koekemoer, Guillaume Mahler, Anna Niemiec, Charles Steinhardt, Andreas L. Faisst, David Lagattuta and Priyamvada Natarajan, *Further support for a trio of mass-to-light deviations in Abell 370: free-form GRALE lens inversion using BUFFALO strong lensing data*, 2021, MNRAS, 506, 6144.
- Ashish K. Meena, **Agniva Ghosh**, Jasjeet S. Bagla and Liliya L. R. Williams, *Exotic Image Formation in Strong Gravitational Lensing by Clusters of Galaxies - II: Uncertainties*, 2021, MNRAS, 506, 1526.
- **Agniva Ghosh**, Liliya L.R. Williams and Jori Liesenborgs, *Free-form GRALE lens inversion of galaxy clusters with up to 1000 multiple images*, 2020, MNRAS, 494, 3998.