SRASHTI GOYAL

Curriculum Vitae

Personal Details

DoB: 6 July, 1996 Nationality: Indian
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Research Interests

Gravitational Waves Physics, Multi-messenger Astronomy, Theories of Gravity, Lensing, Data Analysis, Bayesian Inference, Machine Learning.

Statement: Gravitational waves are a new window to the universe, directly observed for the first time in 2015 by the LIGO-Virgo detectors. My present research focuses on the gravitational lensing of gravitational waves, which has applications to cosmology, the large-scale structure of the universe, and alternative theories of gravity. I work at the convergence of mathematical or computational modelling and data analysis. In the past, I have also worked on COVID-19 disease modelling and non-linear dynamics.

Academic Positions

Max Planck Institute for Gravitational Physics (Albert Einstein Institute, AEI), Potsdam, Germany

Post-doctoral Research Scientist, *October 2023 - present*

Supervisor: Dr. Miguel Zumalacarregui

Department: Astrophysical and Cosmological Relativity

Doctorate

International Center for Theoretical Sciences, Tata Institute for Fundamental Research (ICTS-TIFR), Bangalore, India

Doctor of Philosophy, Department of Physics, *2018 - 2023*

Thesis: "Strong Lensing of Gravitational Waves and Tests of General Relativity"

Supervisor: Prof. Parameswaran Ajith

Graduation

Indian Institute of Science Education and Research, Kolkata, West Bengal, India

BS-MS Dual Degree, Physical Sciences, *2013 - 2018*

Dissertation: "Nonlinear Dynamical Analysis and Modeling of Excitable Systems"

Supervisor: Prof. Soumitro Banerjee

Memberships & Achievements

- **LISA Consortium** member since **January 2024**.
- **LIGO Scientific Collaboration** member since **2020**.
- **LIGO India Scientific Collaboration** member during **2020-2023**.
- Recipient of **DST-INSPIRE** (Department of Science & Technology-Innovation in Science Pursuit for Inspired Research) Fellowship for **2013-2018**.
- Secured All India Rank (AIR) - 1510 in Graduate Aptitude Test in Engineering (**GATE-PHYSICS**) 2018.
- Secured All India Rank (AIR) - 23 (97.2 percentile) in Joint Entrance Screening Test (**JEST-PHYSICS**) 2018.
- Secured All India Rank (AIR) - 5190 in Indian Institute of Technology-Joint Entrance Examination **(IIT-JEE)** 2013. Ranked in top 0.3 % of 1.3 million students appeared in the examination.

Research Publications

1. A. Barsode, **S. Goyal**, P. Ajith, *Fast and Efficient Bayesian method to Search for Strongly Lensed Gravitational Waves*, *Astrophysical Journal*, (2025).[ArXiv]

2. H. Villarrubia-Rojo, S. Savastano, M. Zumalacrregui, L. Choi, **S. Goyal**, *GLoW: Novel Methods for Wave-Optics Phenomena in Gravitational Lensing.* (*Submitted*) [ArXiv]

3. G. Brando, **S. Goyal**, S. Savastano, H. Villarrubia-Rojo, M. Zumalacrregui *Signatures of Dark and Baryonic Structures on Weakly Lensed Gravitational Waves*, *Physical Review D*, (2025). [ArXiv]

4. **S. Goyal**, S.J. Kapadia, J.R. Cudell, A.K.Y. Li, J.C.L. Chan, *A Rapid Method for Preliminary Identification of Subthreshold Strongly Lensed Counterparts to Superthreshold Gravitational-wave Events*, *Physical Review D*, (2023). [ArXiv]

5. J. Janquart, M. Wright, **S. Goyal** et al., *Follow-up Analyses to the O3 LIGO-Virgo-KAGRA Lensing Searches*, *MNRAS,* (2023). [ArXiv]

6. LVK Collaboration, *Search for Gravitational Wave Lensing Signatures in LIGO/Virgo the Full O3 Data*, The Astrophysical Journal, (2023). [ArXiv]

7. **S. Goyal**, A. Vijaykumar, J.M. Ezquiaga, M. Zumalacarregi, A.K. Mehta, *Probing Lens-induced Gravitational Wave Birefringence as a Test of General Relativity*, Physical Review D, (2023). [ArXiv]

8. **S. Goyal**, S.J. Kapadia, P. Ajith, *Rapid Identification of Strongly Lensed Gravitational Wave Events with Machine Learning*, Physical Review D, (2021). [ArXiv]

9. **S. Goyal**, K. Haris, A.K. Mehta, P. Ajith, *Testing the Nature of Gravitational-wave Polarizations using Strongly Lensed Signals*, Physical Review D, (2020). [ArXiv]

10. M. Saleem , J. Rana, V. Gayathri, A. Vijaykumar, **S. Goyal** et al., *The Science Case for LIGO-India*, Classical and Quantum Gravity, (2022). [ArXiv]

11. A. Das, A. Dhar, **S. Goyal**, A. Kundu, S. Pandey, *Covid-19: Analysis of a Modified SEIR Model, a Somparison of Different Intervention Strategies and Projections for India*, Chaos, Solitons & Fractals, (2021). [ArXiv]

12. LIGO-Virgo Kagra Collaboration, *Tests of General Relativity with GWTC-3*, (2021). [ArXiv]

13. LIGO-Virgo Kagra Collaboration, *Search for Lensing Signatures in the Gravitational-Wave Observations from the First Half of LIGOVirgos Third Observing Run*, *The Astrophysical Journal*, (2021). [ArXiv]

Tutoring & Mentoring

- Mentored visiting undergraduate summer student at AEI Potsdam, Daryna Yushchunko, 2024.
- Tutor in compact binary coalescence course at Gravitational Waves Summer School, ICTS Bangalore, 4 -10 June, 2022.
- Hosted and mentored at local study hub for Gravitational Wave Open Data Workshop (GWODW), ICTS Bangalore, 25-26 May, 2022.

- Organised and tutored at LIGO-India Science Collaboration: Continuous Gravitational Waves Workshop, 25-27 October, 2021 held online.
- Mentored at Gravitational Wave Open Data Workshop (GWODW), 10-14 May 2021, held online.
- Tutor at undergraduate level summer course Light and Beyond, ICTS Bangalore, June 2021, held online.
- Mentored ICTS Long term visiting student, Sudhi Mathur, 2021.
- Mentored ICTS Long term visiting student, Harikrishnan D., 2020, identification of strong lensing signals with machine learning.
- Tutor at Physics-I semester course for first year undergraduate students at IISER KOLKATA, Aug-Dec 2017.

Invited Talks

- "Probing dark and baryonic structures with weakly lensed gravitational waves", invited talk at Lensing and Wave Optics in Strong Gravity meeting, Erwin Schrodinger Institute, Vienna, 14 December 2024.
- "Rapid methods to search for strongly-lensed gravitational waves", invited talk at Multi-messenger lensing meeting, Royal Astronomical Society, Manchester, UK, 11 March 2024.
- "Probing gravitational waves birefringence as a test of general relativity relativity using GWTC-3", contributed talk at Young Astronomers' Meet (YAM), ARIES, Nainital, 9-13 November 2022.
- "Strong lensing of gravitational waves", invited talk at Jain University, Bangalore, 30 April 2022
- "Rapid identification of strong lensing signals with machine learning", at University of Liege, Belgium during a visit in February 2022.
- "Search for lensing signatures in gravitational-wave observations", invited talk at CSGC, January 22-24, 2022.
- "Search for lensing signatures in gravitational-wave observations", at The Gravitational Wave Physics and Astronomy Workshop (GWPAW), 14-17 December 2021, Hannover, Germany.
- "Probing gravitational waves birefringence as a test of general relativity relativity using GWTC-3", contributed poster at Indian Association for General Relativity and Gravitation, IISER Kolkata, 19-21 December 2022.
- "Probing gravitational waves birefringence as a test of general relativity relativity using GWTC-3", contributed poster at The Gravitational Wave Physics and Astronomy Workshop (GWPAW), Melbourne, Australia, 5-9 December 2022.
- "Advent of testing general relativity and gravitational waves", invited

webinar at Researcher on Web, 7 March 2021.

- "Constraining polarisations of gravitational waves using strongly lensed signals", contributed talk at International Conference on Gravitation & Cosmology (ICGC), IISER Mohali, December 2019.
- "Numerical and experimental observation of parabolic bursting in 2D monolayer of chick cardiac cells", contributed poster at Conference on Nonlineaer Dynamics (CNSD), JNU, October 2018.

References

- **Dr. Miguel Zumalacarregui**
  Max Planck Institute for Gravitational Physics (Albert Einstien Institute, AEI), Potsdam, Germany.
  Email: mzuma@aei.mpg.de
- **Prof. Parameswaran Ajith**
  International Center for Theoretical Sciences, Tata Institute for Fundamental Research (ICTS-TIFR), Bangalore, India.
  Email: ajith@icts.res.in
- **Prof. Shasvath Kapadia**
  Inter-University Center for Astronomy and Astrophysics (IUCAA), Pune, India.
  Email: shasvath.kapadia@iucaa.in
- **Prof. Jose Maria Eziquaga Bravo**
  Neils Bohr Institute (NBI), Copenhagen, Denmark
  Email: jose.ezquiaga@nbi.ku.dk
- **Prof. Bala Iyer**
  International Center for Theoretical Sciences, Tata Institute for Fundamental Research (ICTS-TIFR), Bangalore, India.
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- **Prof. Soumitro Banerjee**
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