

Kushal Lodha

Graduate Student, KASI-UST, Daejeon

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🌐 kushalodha.github.io

RESEARCH INTERESTS

- **Dark Energy & Modified Gravity** : Falsification of Λ CDM, parametric and non-parametric constraints on dark energy and modified gravity using large-scale structure.
- **Advanced Statistical Techniques** : Non-parametric statistics, model-agnostic reconstruction and deep learning.

EDUCATION

PH.D. IN ASTRONOMY AND SPACE SCIENCE | KOREA ASTRONOMY AND SPACE SCIENCE INSTITUTE

Mar 2022 - Present

- GPA :- 4.21/4.5
- Advisor: Prof. Arman Shafieloo
- Proposed thesis title: *Reconstructing the late and early Universe using DESI data* (expected Jul 2026)

5-YEAR INTEGRATED MASTERS (PHYSICS) | INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR

Jul 2015 - Jul 2020

- GPA :- 8.97/10.0
- Micro-Specialization :- Simulation Methods and Applications (GPA : 9.67/10.0)

ACADEMIC ACHIEVEMENTS

- Awarded **Best Student Paper Award 2025** by Korea Astronomy and Space Science Institute.
- Selected for the **UST International Presentation Support Grant** to present at COMSO'24 and COSMO'25.
- Recipient of the **SHE** (Scholarship for Higher Education) under **INSPIRE** (Innovation in Science Pursuit for Inspired Research) programme, a flagship scheme of the Department of Science & Technology, Government of India.
- Secured a rank among the top **2.5%** in **Joint Entrance Examination (Advanced)** -2015 and top **0.1%** in **Joint Entrance Examination (Mains)** -2015, undertaken by 150,000 students and 1.3 million respectively.

WORK EXPERIENCE

ASSOCIATE DATA SCIENTIST | SIGMOID ANALYTICS PVT LTD, BENGALURU

Dec 2020 - Jan 2022

- Designed a campaign strategy to maximize ROI/Lift for Scotts-Miracle Gro's \$1 million media mix marketing budget using GAM and tree-based ML models.

RESEARCH EXPERIENCE

PUBLICATIONS

Lead Author

- **Lodha K . et al.**, *Extended Dark Energy analysis using DESI DR2 BAO measurements*, Phys.Rev.D 112 (2025) 083511 (DOI: 10.1103/w4c6-1r5j).
- **Lodha K . et al.**, *DESI 2024: Constraints on Physics-Focused Aspects of Dark Energy using DESI DR1 BAO Data*, Phys.Rev.D 111 (2025) 2, 023532 (DOI: 10.1103/PhysRevD.111.023532).
- **Lodha K . et al.**, *Searching for local features in primordial power spectrum using genetic algorithms*, MNRAS, Volume 530, Issue 2, May 2024. (DOI: 10.1093/mnras/stae803).
- **Lodha K ., Roy A. & Kar S.**, *Physics of a Particle on a Rotating Hoop: Experiment and Theory*, Resonance 25, 1261–1281 (2020). (DOI: 10.1007/s12045-020-1044-5).

Co-Author

- Garcia-Quintero C., Noriega H. E., de Mattia A., Aviles A., **Lodha K . et al.**, *Cosmological implications of DESI DR2 BAO measurements in light of the latest ACT DR6 CMB data*, Phys.Rev.D 112 (2025), 083529 (DOI: 10.1103/d6yc-xpqb).
- Bahr-Kalus B., Parkinson D., **Lodha K ., et al.**, *Model-Independent Measurement of the Matter-Radiation Equality Scale in DESI 2024*, Phys.Rev.D 112 (2025) (DOI: 10.1103/yqm1-ybbv).

- Ishak M., Pan J., Calderon R., **Lodha K.** et al., *Modified Gravity Constraints from the Full-shape Modeling of Clustering Measurements from DESI 2024* JCAP 09 (2025) 053 (DOI: 10.1088/1475-7516/2025/09/053).
- Calderon R., **Lodha K.** et al., *DESI 2024: Reconstructing Dark Energy using Crossing Statistics with DESI DR1 BAO data* JCAP 10 (2024) 048 (DOI: 10.1088/1475-7516/2024/10/048).

Alphabetical Papers

- Elbers W. (including **Lodha K.**) et al., *Constraints on Neutrino Physics from DESI DR2 BAO and DR1 Full Shape* Phys.Rev.D 112 (2025) 083513 (DOI: 10.1103/w9pk-xsk7).
- Abdul Karim M. (including **Lodha K.**) et al., *DESI DR2 Results II: Measurements of Baryon Acoustic Oscillations and Cosmological Constraints* Phys.Rev.D (2025) 027 (DOI: 10.1103/w9pk-xsk7).
- Abdul Karim M. (including **Lodha K.**) et al., *DESI DR2 Results I: Baryon Acoustic Oscillations from the Lyman-alpha Forest* Phys. Rev. D (2025) 027 (DOI: 10.1103/2wwn-xjm5).
- Adame A. G. (including **Lodha K.**) et al., *DESI 2024 VII: cosmological constraints from the full-shape modeling of clustering measurements* JCAP 07 (2025) 028 (DOI: 10.1088/1475-7516/2025/07/028).
- Adame A. G. (including **Lodha K.**) et al., *DESI 2024 VI: Cosmological Constraints from the Measurements of Baryon Acoustic Oscillations* JCAP 02 (2025) 021 (DOI: 10.1088/1475-7516/2025/02/021).
- Adame A. G. (including **Lodha K.**) et al., *DESI 2024 V: Full-Shape Galaxy Clustering from Galaxies and Quasars* JCAP 09 (2025) 008 (DOI: 10.1088/1475-7516/2025/09/008).
- Adame A. G. (including **Lodha K.**) et al., *DESI 2024 IV: Baryon Acoustic Oscillations from the Lyman Alpha Forest* JCAP 01 (2025) 124 (DOI: 10.1088/1475-7516/2025/01/124).
- Adame A. G. (including **Lodha K.**) et al., *DESI 2024 III: Baryon Acoustic Oscillations from Galaxies and Quasars* JCAP 04 (2025) 012 (DOI: 10.1088/1475-7516/2025/04/012).
- Adame A. G. (including **Lodha K.**) et al., *DESI 2024 II: sample definitions, characteristics, and two-point clustering statistics* JCAP 07 (2025) 017 (DOI: 10.1088/1475-7516/2025/07/017).
- Bag S. (including **Lodha K.**) et al., *Detecting unresolved lensed SNe Ia in LSST using blended light curves* A&A, 691 (2024) A100 (DOI: 10.1051/0004-6361/202450485).

PRE-PRINTS

- Abdul Karim M. (including **Lodha K.**) et al., *Data Release 1 of the Dark Energy Spectroscopic Instrument*, (2025, Submitted to The Astronomical Journal) (DOI: arXiv:2503.14745).
- **Lodha K.**, Linder E., Caldwell R. Valentino E. D., *Vacuum Metamorphosis in light of DESI DR2 BAO*, (in prep, to appear on arXiv by Dec 2025) (DOI: arXiv:2512.XXXX).
- **Lodha K.**, Alam S., Shafieloo A., *Robustness of BAO measurements to z_{eff} approximation and its role in breaking CMB imposed dark energy degeneracies*, (in prep, to appear on arXiv by Dec 2025) (DOI: arXiv:2512.XXXX)
- **Lodha K.**, Parkinson D. Shafieloo A. et al., *Application of Multi-objective Optimization in Cosmology*, (in prep, to appear on arXiv by Jan 2026) (DOI: arXiv:2601.XXXX).

ROLES AND SERVICE

CO-CHAIR, DESI DESILIKE TOPICAL GROUP

Sep 2024 - present

- Co-leading the development of desilike, DESI's cosmological inference framework. Organized biweekly coordination meetings to integrate new analysis features, write comprehensive documentation and robust unit testing.

STUDENT HEAD, PHY SOCIETY, IIT KHARAGPUR

May 2017 - May 2019

- Organized **Departmental Monthly Lecture** series and **Departmental Lab Visit** program for first-year students for two consecutive years.
- Organized and taught at supplementary **tutorial sessions** for Physics-II (Elementary Quantum Mechanics and Solid State Physics) course.

TALKS & CONFERENCES

- COSMO'25 Pittsburgh - Oct 2025
- The End of Lambda? CosKASI Daejeon - Sept 2025
- DESI Summer Collaboration Meeting Berkeley - Jul 2025
- DESI Winter Collaboration Meeting Cancun - Dec 2024
- COSMO'24 Kyoto - Oct 2024
- Korea Astronomy Society Fall Meeting Gyeongpo - Sept 2024
- DESI Winter Collaboration Meeting Hawaii - Dec 2023
- Korea Astronomy Society Fall Meeting Jeju - Oct 2023
- Korea Japan Workshop on DE Seoul - Nov 2022
- KIAS Cosmology Meeting Seoul - Oct 2022

- IAU General Assembly Busan - Aug 2022

MISC

SCHOOL/WORKSHOP

- Physics of the Early Universe - An Online Precursor (ICTS Bangalore, 2020)
- KIAS Workshop on Cosmology and Structure Formation, (KIAS Seoul, 2020)
- Indo-Japan Accelerator School cum Workshop (VECC Kolkata, 2020)
- Summer School on Astronomy, Cosmology and Gravitation (IIT-Bombay, 2018)

SKILLS

Proficient Languages :

C/C++ • Python • Fortran • \LaTeX

Utility Software/Libraries :

CAMB • CLASS • Cobaya • desilike • JAX • OpenMP/MPI

Platforms :

Linux • Windows

COLLABORATIONS & SOCIETIES

- DESI
- LSST-DESC
- Korea Astronomical Society

REFEREED JOURNALS

- Astrophysical Journal Letters
- Physical Review D
- MNRAS
- JCAP
- Astrophysics and Space Science
- DESI Internal Reviewer