Dr. Akshay Rana

Curriculum vitae

✍ Assistant Professor, Department of Physics, St. Stephen's College, University of Delhi

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Education

2009-2012 **B.Sc (University's Gold Medal)**
C.C.S. University, Meerut

2012-2014 **M.Sc (Physics)**
St. Stephen College, University of Delhi

2014-2020 **Ph.D (Physics)**
Area of Research- Cosmology
Department of Physics and Astrophysics, University of Delhi, Delhi, 110007

Awards & Fellowships

2012
University Gold medal *(For maximum marks in B.Sc. Physics)*

2012
Vice Chancellor Gold medal *(For maximum marks in all B.Sc. courses)*

2012
Delhi University M.Sc. entrance exam AIR 5^{th} rank

2012
IIT JAM (Geophysics) AIR 22^{th} rank

2012-2014
Post-Graduate Merit Scholarship *for University Rank Holders (By UGC)*

2013-2014
Delhi University Post Graduate Scholarship *(By University of Delhi)*

Dec 2013
Junior Research Fellowship *exam qualified (AIR 75^{th} rank CSIR)*

2014
GATE 2014 *qualified AIR 204*

Dec 2014
Junior Research Fellowship *exam qualified (AIR 108^{th} rank UGC)*

2016-2019
Senior Research Fellow *(CSIR)*

Teaching Experience

July 2018- June 2019 **Hindu College, University of Delhi**

Aug 2019-Till date **St. Stephen's College, University of Delhi**

Theory Subjects taught

1) Thermal Physics and Statistical Physics (Core) (B.Sc. Program III Semester)

2) Electromagnetic theory (Core) (B.Sc Hons. VI Semester)

3) Astronomy and Astrophysics (DSE) (B.Sc Hons. V Semester)

4) Computational Physics (SEC) (B.Sc Hons. IV Semester)

5) Elements of Modern Physics (Core) (B.Sc. Hons. III Semester)

6) Quantum mechanics (Core) (B.Sc Hons. VI Semester)

Experimental Labs conducted

1) Thermal Physics Lab (Core) (B.Sc Hons III Semester)

2) Mathematical Physics Lab (Core) (B.Sc. Hons III Semester)

3) Advance Mathematics Physics Lab (DSE) (B.Sc. Hons VI Semester)

4) Statistical Mechanics Lab (Core) (B.Sc. Hons VI Semester)

5) Wave and Optics Lab (Core) (B.Sc. Hons III Semester)

6) Electromagnetic Theory Lab (Core) (B.Sc. Hons VI Semester)

7) Solid State Physics Lab (Core) (B.Sc. Hons V Semester)

Programming Languages taught/known: Python, C, C++, Fortran, Mathematica, Scilab, R

Book Published Click for link

Title: Introduction to Special Relativity: An Indian Adaptation

Author: Robert Resnick
Contributing Author: Prof. Amitabha Mukherjee & Dr. Akshay Rana

Publication House: Wiley India
Print ISBN: 9789354244919
eISBN: 9789354245176

Area of research (Google scholar profile)

I Dark energy and alternative models of cosmology.

II SNe Ia, CMB, BAO, Strong gravitational lensing, Galaxy clusters as observational probes of cosmology

III Astro-statistics: Bayesian statistics, Gaussian Processes, MCMC processes

IV Fundamental Constants

Research Papers Click here

1) A Model-Independent Test of Variability of Type Ia Supernova Luminosity and CDDR

Authors: Darshan Kumar, **Akshay Rana**, Deepak Jain, Shobhit Mahajan, Amitabha Mukherjee
Journal: JCAP 01 (2022) 053
Impact Factor: 7.280 link
arXiv:2107.04784

2) Strong lensing systems and galaxy cluster observations as probe to the cosmic distance duality relation

Authors: R. F. L. Holanda, F. S. Lima, **Akshay Rana**, Deepak Jain
Journal: The European Physical Journal C, 82 (2022) 115.
Impact Factor: 4.991 link
arxiv:2104.01614

3) Probing Graviton mass using weak lensing and SZ effect in Galaxy Clusters.

Authors: **Akshay Rana**, Deepak Jain, Shobhit Mahajan, Amitabha Mukherjee
Journal: Physics Letter B (PLB) 781 (2018) 220.
Impact Factor: 4.771
arXiv:1801.03309
Special mention: Mass bound on graviton, obtained here, has been cited and included into Particle Data Group (PDG) 2019 booklet. click here

4) Probing the cosmic distance duality relation using time delay lenses.

Authors: **Akshay Rana**, Deepak Jain, Shobhit Mahajan, Amitabha Mukherjee,R.F.L. Holanda
Journal: JCAP 07 (2017) 010
Impact Factor: 7.280 link
arXiv:1705.04549

5) Constraining cosmic curvature by using age of galaxies and gravitational lenses

Authors: **Akshay Rana**, Deepak Jain, Shobhit Mahajan, Amitabha Mukherjee
Journal: JCAP 03 (2017) 028
Impact Factor: 7.280 link
arXiv:1611.07196

6) Revisiting the distance duality relation using a non-parametric regression method

Authors: **Akshay Rana**, Deepak Jain, Shobhit Mahajan, Amitabha Mukherjee
Journal: JCAP 07 (2016) 026
Impact Factor: 7.280 link
arXiv:1511.09223

7) Constraints on the Transition Redshift using the Cosmic Triangle and Hubble Phase Space Portrait

Authors: **D**arshan Kumar, Akshay Rana, Deepak Jain, Shobhit Mahajan, Amitabha Mukherjee
Journal: Int. J. Mod. Phys. D 32, 2350039 (2023)
Impact Factor: 2.4 link

arXiv:2205.13247

8) Examining temporal variation of Fermi coupling constant using SNe Ia light curves.

Authors: **Akshay Rana**, Vedanta Thapar, Hari Prasad S.V., Sandra Elsa Sanjai
Journal: Under review in Physics Review D
arXiv:2207.1006

9) Testing the Constancy of Type Ia Supernova Luminosities with Gaussian Process

Authors: **Akshay Rana**
Journal: Physics of the Dark Universe, Volume 52, June 2026, 102256
Impact Factor: 6.40 link
arXiv:2509.19494

10) Spectral Chebyshev Approximation of Cosmic Expansion in Gravity

Authors: **Akshay Rana**
Journal: Under Review in Physics of the Dark Universe
arXiv:2510.16120

Talks Given

National and International talks
1) Galaxy Coffee seminar at **Max- Planck institute of Astronomy**, Heidelberg, Germany on 12 July, 2018. click here

2) Seminar at **Institute of Theoretical Physics**, University of Heidelberg, Heidelberg Germany on 11 July, 2018. click here

3) Cosmology Seminar at **Max Planck Institute of Astrophysics**, Garching, Germany on 10 July, 2018. click here

4) Seminar in Lensing meeting at **Max Planck Institute of Astrophysics**, Garching, Germany on 09 July, 2018. click here

5) Talk in "Conference on Shedding Light on the Dark Universe with Extremely Large Telescope at **International Centre of Theoretical Physics** ICTP (Trieste), Italy on 4 July, 2018. click here

6) Seminar at **SISSA, Trieste**, Italy on 26 June, 2018. click here

7) Weekly cosmology seminar at Cosmology and Astro-particle physics group, **University of Geneva**, Geneva, Switzerland on 15 June, 2018. click here

8) Talk given at Young Astronomer Meeting (YAM), **IUCAA** Pune, 11-16 Sep 2017 titled as "Probing Distance Duality Relation using a model independent approach". click here

9) Talk given at 29th Indian Association for General Relativity and Gravitation **(IAGRG) meeting, IIT Guwahati**, 17-20 May 2017 titled as "Null test of cosmic curvature using cosmic chronometers and gravitational lensing". click here

10) Talk given at Franco- Indo Astronomy school, **IUCAA Pune**, 11-17 Feb, 2017 titled as "Bounds on Graviton mass using weak lensing and SZ effect in Galaxy clusters".

11) Talk given at Astro-statistics Course, **IUCAA, Pune**, 2-10 Jan. 2017 titled as "3D distribution of image separation in strong gravitational lensing systems using Gaussian process". click here

12) Talk given at IAGRG-32 at **IISER Kolkata** 19-21 December, 2022, titled as "Temporal variation of Fermi coupling constant using type Ia supernovae light curves".click here.

Invited Lectures

1) Invited lecture in , **Centre for Cosmology, Astrophysics, and Space Science (CCASS) at GLA University, Mathura** on November 5, 2022, titled as "Recent Astrophysical Observational Data Sets." click here

2) Invited lecture in Department of Physics, **Ashoka University**, 18 April, 2022 titled as "Fundamental constants through the Cosmological spectacles". click here

3) Invited lecture series in DSKC Conference, **Miranda House College, University of Delhi**, Delhi, 23-24 July, 2022 titled as " Markov Chain Monte Carlo: A physics oriented approach". click here

4) Invited lecture in Astronomy club and Department of Physics, **Bhaskaracharaya College of Applied Sciences, University of Delhi**, Delhi, 26 February, 2021 titled as "Voyage into the dark side of the Universe". click here

5) Invited lecture series in DSKC Conference, **Miranda House College, University of Delhi**, Delhi, 07-08 July, 2021 titled as "Does graviton has mass?". click here

6) Invited lecture in Faculty Seminar Series by IQAC and Physics Society **St. Stephen's College, University of Delhi**, Delhi, 07-08 July, 2021 titled as "Voyage into the dark sector of the universe". click

here

Events Organized

1) Member (created website for the workshop), Local organizing committee in National workshop on **"Shedding light on the dark side of the Universe"**, 8-9 Feb 2019, Hindu College, University of Delhi. click here

2) Resource person for Hands-on session titled as "**Data analysis in Cosmology**" in National workshop on **"Shedding light on the dark side of the Universe"**, 8-9 Feb 2019, Hindu College, University of Delhi. click here

3) Resource person and organizer of the **Three weeks e-crash course on Python and Latex** organized by Department of Computer Science and Center of Theoretical Physics, Department of Physics, St. Stephen's College. click here

Poster Presentation

1) Poster Presented at Post- Planck Cosmology meeting, **IUCAA**, Pune 9-12 Oct 2017 titled "**Model independent estimate of Angular Diameter Distance using gravitational lenses**".

2) Poster presented at 35th Astronomical Society of India **(ASI) meet, BIRLA auditorium, Jaipur** 6-10 March 2017 titled "**Probing Distance Duality Relation using time delay lenses**".

Contribution as a mentor

For undergrad students at St. Stephen's college

1) Mentored a group of six undergraduate students to **win GURU-DHAWANI, a national-level antenna design and simulate challenge** sensitive to radio emissions emerging from Jupiter. It was organised by IUCAA & Fergusson Collage, Pune. click here **Special mention: St. Stephen's college team ranked first among 16 teams across India.** click here

2) Guided a group of four students to work on a project titled as **" Modelling COVID-19"** where we studied & predicted the impact of lockdown in Indian scenario during the peak of COVID in first wave. click here

3) Co-mentored a team of eight undergraduate students to participate in a National level competition **"SWANtenna20: SWAN Antenna Design Challenge 2020"** hosted by IUCAA, Pune & RRI, Bangalore. click here

4) Supervised a team of two undergraduate students to participate in international University Physics Competition 2020 and **earned grade A**. click here

5) Supervised a student (B.Sc. Physics Hons III year 2020) for a project titled as **"Cosmic acceleration of the universe using the Hubble data"**. click here

6) Assisted the Physics Society to establish the **modelling & computational club**.

7) Supervising a group of three students from the ongoing B.Sc. Hons. III yr batch to study the **temporal variation of Fermi coupling constant using the light curve studies of type IA supernovae.** Project is under review for publication. For draft of article click here

8) Supervising a group of two students of ongoing B.Sc. Hons. IIIyr batch to study the **behavior of resonant states in quantum mechanical systems using transfer matrix approach.** Preprint is under preparation.

9) Assisting the Physics society members to establish the **OPEN-CV** lab to study the real time complexities of the dynamic mechanical systems.

Other academic and administrative responsibilities

1) Organizing the **Faculty Seminar series** since July 2021 under the guidance of IQAC coordinator Dr. Aditya Pratap Deo, History Department, St. Stephen's College.

2) Helped in preparing **college brochure** under the guidance of Dr. Sangeeta Luthera Sharma, History Department, St. Stephen's College.

3) Hold the post of **Deputy superintendent of Examination** for Open Book Exam (OBE) June 2021 under the guidance of Superintendent of exam Dr. Jacob Cherian, St. Stephen's College, University of Delhi.

4) Appointed as the **Tutor For Admission (TFA) nominee** for college admissions for session 2020-21 & 2021-22.

5) Member of the core **NAAC Sterring Committee**, St. Stephen's college. Handled the **Criterion-4 "Infrastructure and Learning resources"** alone under the guidance of NAAC coordinator Dr. Vibha Sharma, Chemistry Department, St. Stephen's College.

6) Assisted alumni cell coordinator Ms. Davina Smith in the establishment of the **Alumni cell** of St. Stephen's collage

7) Assisted Dr. Violet Macwan in data compilation for **NIRF ranking & India Today ranking 2022**.

8) Appointed as **Faculty Assistant Coordinator** at IQAC 2022-23. click here

Workshops and Summer schools attended

1) Attended a Faculty Development Programe (FDP) on **Machine Learning and Pedagogy** at Deen Dayal Upadhyaya College, University of Delhi. click here

2) Attended a **national level workshop as college representative** in Shyam Lal College, University of Delhi, Dated 31 March, 2020 titled as **New Education Policy & Accreditation of HEI's: The Way Ahead**. click here

Extra curricular activities

1) Written article for a popular science magazine "**Vigyan Aap Ke lia**" (Hindi) titled as **Telescopes: The messengers of the Universe**. click here

2) Prepared a proto type of **Android Application for Delhi University B.Sc. Physics syllabus.**

3) Student membership of **Astronomical society of India (ASI)** science popularization team.

Hobbies

1) Poetry writing
2) Marathon running, Long distance cycling.
3) Amateur Astronomer, Science Popularization, Scientific writing.