

SENIOR RESEARCH FELLOW · PHD

Inter-University Centre for Astronomy and Astrophysics, Pune, India - 411007

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Cosmology and Large Scale Structure - Dark matter haloes, their evolution and distribution in the cosmic web - Galaxy formation, feedbacks and their impacts on host haloes - Cosmological (hydrodynamical) simulations, Analytical halo formation models and numerical experiments - Self-similar haloes and galaxies.

I primarily work on an interface between cosmology and astrophysics of galaxies, trying to understand and build a physical model of the impacts of galactic astrophysical processes on the dark matter haloes. This will not only make it easier to study cosmology and dark matter physics with haloes but also helps build a consistent picture of galaxy formation and evolution.

EXPERIENCES

Research

PhD Research Fellow at IUCAA

PI: Prof. Aseem Paranjape 2020-present

• I have run N-body and hydrodynamics simulations of cosmological volumes using GADGET4 and SWIFT codes including some of the

- Using structure finding codes such as ROCKSTAR and VELOCIraptor, I have made halo catolgues and merger trees.
- I have studied cosmological information such as matter power spectrum and various halo and galaxy properties in simulations.
- Besides my own simulations, I have also worked on simulations produced by large collaborations such as IllustrisTNG and EAGLE.
- I also worked on Self-similar models of halo formation and evolution along with galaxy formation.
- I also worked with semi-analytical models of dark matter haloes and galaxies and did numerical experiments with such models.

MS Thesis at IISER Bhopal

PI: Prof. Sukanta Panda

2018-2019

• I worked on cosmological perturbations in an anisotropic Bianchi type-I background and its evolution in a Bouncing model.

PUBLICATIONS

The quasi-adiabatic relaxation of haloes in the IllustrisTNG and EAGLE https://doi.org/10.1093/cosmological simulations mnras/stad297

PREMVIJAY VELMANI, ASEEM PARANJAPE

Properties beyond mass for unresolved haloes across redshift and cosmology using correlations with local halo environment https://doi.org/10.1093/

Sujatha Ramakrishnan, Premvijay Velmani

A self-similar model of galaxy formation and dark halo relaxation

https://doi.org/10.1088/
1475-7516/2024/05/080

PREMVIJAY VELMANI, ASEEM PARANJAPE

Dynamics of the response of dark matter halo to galaxy evolution in IllustrisTNG

https://doi.org/10.48550/arXiv.2407.08030

PREMVIJAY VELMANI, ASEEM PARANJAPE

The evolving role of astrophysical modelling in dark matter halo relaxation https://doi.org//10.48550/response arXiv.2408.04864

Premvijay Velmani, Aseem Paranjape

Conferences and Events

The Abdus Salam International Centre for Theoretical Physics

Trieste, Italy

SUMMER SCHOOL ON COSMOLOGY 2022

July 2022

• Presented a talk on "Impact Of Galaxy Formation On The Dark Matter Haloes In The Cosmic Web" at ICTP, an UNESCO organisation.

International Centre for Theoretical Sciences

Bengaluru India

LARGEST COSMOLOGICAL SURVEYS AND BIG DATA SCIENCE 2023

April 2023

- · Worked on a mini project analysing redshift space distortion information from mock DESI data
- Presented a talk on "Impact Of Galaxy Formation On The Dark Matter Haloes In The Cosmic Web" at ICTP, an UNESCO organisation.

Inter-University Centre for Astronomy and Astrophysics

Pune, Indi

PUNE-MUMBAI COSMOLOGY AND ASTRO-PARTICLE MEETING - 2

• Presented a talk on "Interplay of baryonic galaxies and their host dark haloes - Insights from self-similar analysis"

February 2024

Tata Institute of Fundamental Research

Mumbai, Indic

Pune-Mumbai Cosmology and Astro-Particle Meeting - 3

September 2024

· Discussion focussed meeting

Korea Institute for advanced Study(KIAS)

Hilton yeongju, South Korea

11TH KIAS WORKSHOP ON COSMOLOGY AND STRUCTURE FORMATION

October 2024

• Presnted a talk and a poster on "Interplay of galaxy formation and the evolution of dark matter haloes in the cosmic web - Dynamics of Relaxation".

OTHER TALKS

Inter-University Centre for Astronomy and Astrophysics

Pune, India

LAST FRIDAY TALK

November 2023

• Presented a talk on "Impact Of Galaxy Formation On The Dark Matter Haloes In The Cosmic Web".

Inter-University Centre for Astronomy and Astrophysics

Pune, Indic

LAST FRIDAY TALK

March 2024

• Presented a talk on "A self-similar model of galaxy formation and dark halo relaxation".

Education

Inter University Centre for Astronomy and Astrophysics (IUCAA affiliated to JNU)

Pune, Maharashtra

DOCTOR OF PHILOSOPHY

July 2019 - July 2024

- Thesis title: Interplay of galaxy formation and the evolution of dark matter haloes in the cosmic web
- Thesis advisor: Prof. Aseem Paranjape

Indian Institute of Science Education and Research (IISER) Bhopal

Bhopal, Madhva Pradesh

BACHELOR OF SCIENCE AND MASTER OF SCIENCE (BS-MS) DUAL DEGREE

August 2014 - May 2019

- Obtained a CPI/CGPA of 9.4 with major in Physics and a minor in Mathematics.
- MS thesis: "Evolution of anisotropic perturbations in bouncing cosmology" under the guidance of Prof. Sukanta Panda.

Tamil Nadu Board of Secondary Education

Chennai, Tamil Nadu

CLASS 12 - PLUS TWO

Graduated March 2014

• 94.58 %, Obtained 96.25 % excluding language subjects.

Tamil Nadu Board of Secondary Education

Chennai, Tamil Nadi

CLASS 10 - SSLC

Graduated April 2012

- $93.6\,\%$, Obtained $99.33\,\%$ excluding language subjects and 100 % in science.

Awards and fellowships.

Aug.2021 Senior Research Fellowship, Inter-University Centre for Astronomy and Astrophysics	Pune, India
Aug.2019 Junior Research Fellowship , Inter-University Centre for Astronomy and Astrophysics	Pune, India
Jan.2019 Junior Research Fellowship, Council of Scientific & Industrial Research	New Delhi, India
Aug.2014 INSPIRE Scholarship, IISER, Department of Science & Technology	Bhopal, India
June.2014 Cash Prize Award, Second rank in 12th board exam	Chennai, India
April.2012 SSLC cash prize award, Centum in 10th board exam	Chennai, India

Professional Skills

COMPUTER SKILLS

Programming Python, Bash, C, C++, IDL, Fortran, R, Wolfram, Matlab/Octave

Python libraries Includes numpy, scipy, pandas, astropy, cobaya, camb, colossus, casa, h5py, sklearn, matplotlib, seaborn,

getdist, pyqtgraph, vispy, vpython, pyopengl, pyopencl, pycuda, conda, mpi4py and PyQt5

Simulation tools GADGET4, SWIFT, ROCKSTAR, VELOCIraptor, MUSIC2-monofonIC

Analytical tools Mathematica (packages xTensor, xCoba, xPert, xPand), Maple, Python sympy

Linux system administration, Bash, distros including Arch Linux, Ubuntu, Fedora, RHEL, SUSE, Centos;

Operating system Windows administration, Visual Studio, Powershell, Windows Subsystem for Linux;

Remote adinistration, SSH, HPC clusters with PBS jobs scheduler and NFS storage.

Markup Languages LaTeX, HTML, CSS, Markdown, MS Office/ Libreoffice

Media creation Adobe Creative Cloud apps, DaVinci Resolve, Blender, Poser, Audacity

TEACHING SKILLS

Physics Cosmology, Astrophysics, General relativity, Mathematical and Computational methods

Academic Achievements

May 2022 Summer School on Cosmology 2022 , Invited with funds by ICTP, UNESCO	Trieste, Italy
Jun 2018 CSIR UGC NET - Physics, Qualified JRF with a score of 115 and all India rank of 116	India
Aril 2014 JEE MAIN / AIEEE , Qualified with a score 190	India
May 2014 NEET UG / AIPMT , Qualified with a score of 350.	India
June 2014 JEE ADVANCED , Qualified with a rank of 4056 within OBC category.	India
June 2016 SOLOLEARN - Python , Completed with certification	

Hobbies & Interests

A strongly curiosity driven and challenge seeking person.

READING I use the world wide web to explore various topics in both natural science and others such as history, politics, technology and sustainable development, with a rational viewpoint.

EXPLORATION As a foodie, I travel to various places with special focus on trying different food.

Sports Primarily football, badminton, table tennis and swimming.

OTHER PERSONALITY I am a foodie, experimental cook, nutritionist, fitness freak, audiophile (also amateur singer), electrical/electronics hobbyist, amateur astronomer and computer gamer.

I enjoy doing lots of home experiments driven by my own curiosity. And I can relate with prof. R Feynman that "Nearly everything is really interesting if you go into it deeply enough". I like challenges and I don't like doing simple things repetitively, so I keep exploring various new things. Trying to comprehend the logic behind complex things is my pleasure.

Extracurricular Activity

IUCAA open science day	Pune, India
PRESENTED A POSTER ON BASICS OF COSMOLOGY	Feb 2023
IUCAA open science day	Pune, India
CREATED A VIDEO EXPLAINING PROBES OF COSMOLOGY	Feb 2021
IUCAA open science day	Pune, India
DEMONSTRATED CREATION OF GRAVITATIONAL WAVES	Feb 2019
Singularity-15, IISER Bhopal	Bhopal, India
BAD AD HOC HYPOTHESIS ON GRAVITY AT THE COSMIC HORIZON	April 2015
Singularity-16, IISER Bhopal	Bhopal, India
SCIENCE EXHIBITION DEMONSTRATION OF A MEGA DOMINO EFFECT SYSTEM	September 2016

IISER Science Council
HEAD OF ARTIFICIAL INTELLIGENCE AND ML CLUB; MEMBER OF PHYSICS, MATHEMATICS AND ASTRONOMY CLUB

Astronomy and Space Technology Awareness Camp

WORKSHOP BY SPATS OF IIT KGP

April 2015

Mimamsa 2015 by IISER Pune

NATIONAL SCIENCE QUIZ

Mimamsa 2016 by IISER Pune

NATIONAL SCIENCE QUIZ

Alanuary 2016

Bhopal, India

Bhopal, India

January 2016

January 2016

School level
Competitions

- · Winner in Science quiz intra school. Got selected in science talent exam conducted by The Hindu Educational Plus.
- Winner in debate about Education System.

References_

Prof.Dr. Aseem Paranjape, Associate Professor, IUCAAPune, IndiaProf.Dr. Sukanta Panda, Associate Professor, Department of Physics, IISER BhopalBhopal, India

Chennai, India