Cosmological Structure Formation

Overview

Even after the success of some of the most finest cosmological observations, we still have incomplete understanding about 95% of the total content of universe. We still do not know the cause of the late time acceleration of the universe. Validity of Einstein General Theory of Relativity at large cosmological scales is still not confirmed and we are still in search for a modified version of general relativity that may explain the dark content of the universe.

Formation of structures in the universe holds the key of these questions. The structure formations both at linear and nonlinear scales contain all the information about our cosmos that can unravel the puzzle of dark matter and dark energy as well as the modified theory of gravity. That is why future observational set ups like Euclid, DES, LSST, SKA, TMT etc aim to provide such decisive answer.

In this regard, it is very important to know the theoretical details for the structure formation as well as the method to connect those theoretical details to the actual observables. Although linear theory for structure formation contains vaulable informaton, it is the nonlinea revolution of the structure formation that holds the key.

The proposed lecture series is aimed towards training researchers who are either working in this field or are interested in working in this field in near future in the field of formation of structure with special emphasis on nonlinear structure formation. The aim is to build trained manpower in the field of large structure formation of the universe and related observational tools who can be actively involved in projects like LSST, Euclid, DESI, SKA, TMT etc.

Objectives of the Course

The primary objectives of the course are as follows:

i) Exposing participants to the physics of large scale structure (LSS) formation in the universe.

ii) Subsequently training them in different observational tools for the LSS with special emphasis on nonlinear structure formation.

iii) Exposing the researchers to different statistical tools related to LSS in the universe.

iv) Enhancing the capabilities of the participants to work in the field of large scale structure formation in the universe so that they can be involved in future cosmological projects specially in those where India is involved.

LectureScedule: (April 9 to 14, 2018)

(All lecture duration will be of 1 hr.)

Day 1: 9 April 2018 (MONDAY) Lecture 1: An Overview on observational cosmology Lecture 2: Basic Cosmology and cosmological probes-I (geometry) Lecture 3: Cosmological Probes-II: cluster counts, gravitational lensing, RSD	**Day 4: 12 April 2018 (THURSDAY)** Lecture 1: Phenomenology of structure formation (biased tracer) Lecture 2: Halo model-I Lecture 3: Halo Model-II Tutorial/Discussions
Day 2: 10 April 2018 (TUESDAY) Lecture 1: Theory of structure formation-I Lecture 2: Theory of structure formation-II Lecture 3: Statistics and ongoing survey Tutorial/Discussions	**Day 5: 13 April 2018 (FRIDAY)** Lecture 1: Unbiased constraints from biased tracer-Cosmology Lecture 2: Unbiased constraints from biased tracer-galaxy formation Lecture 3: Unbiased constraints from biased tracer-future surveys Tutorial/Discussions
Day 3: 11 April 2018 (WEDNESDAY) Lecture 1: Lagrangian Perturbation Theory-I Lecture 2: Lagrangian Perturbation Theory-II Lecture 3: Modified gravity Tutorial/Discussions 1hr	**Day 6: 14 April 2018 (SATURDAY)** Examination and Evaluation

Dates/Venue:	**A: Duration : April 9 – 14 (6 Days)** **B: Venue : Seminar Hall, Centre for Theoretical Physics Jamia Millia Islamia, New Delhi-25, India** ***Number of participants for the course will be limited to fifty.*** ***The last date of application is 1st March 2018***
Who can Attend	• **Ph.D. students working in the areas of Particle Physics and Astro-particle or Cosmo-particle Physics** • **Post-doctoral fellows or young researchers** • **M.Sc. students and advanced under-graduate students** • **Faculty members from reputed academic institutions and universities who may find the course useful for their current or future research**
Fees	The participation fees for taking the course is as follows: • **M.Sc./Ph. D. Students :Rs. 1000** • **Post-doctoral Fellow : Rs. 1500** • **Participants from abroad : US $100** • **Faculty from Academic Institutions: Rs. 2000** ***The participants can be provided accommodation in Jamia Guest House on payment basis (as per official guest house rates) subject to availability.***

Faculty

Ravi Sheth

Professor
Dept. of Physics and Astronomy
University of Pennsylvania, USA

Prof. Ravi Sheth had been educated from Haverford College, Pennsylvania, USA as a Dana S. McGill Scholar. He obtained his Phd from Institute of Astronomy, University of Cambridge, UK where he had been the Marshall Scholar. He has worked as researcher in Fermilab, USA, MPI, Garching, Germany and University of California, Berkeley, USA. Currently he is Professor at Department of Physics and Astronomy, in University of Pennsylvania, USA. He had been a Senior Research Scientist at Abdus Salam International Center For Theoretical Physics, Trieste, Italy. Currently he is also holding numerous visiting positions at AIMS, Cape Town, South Africa, Meudon Observatory, France, IPhT-CEA, Saclay, France, APC, Paris, France, to name a few.

Prof. Sheth research interests involve developing physical models and statistical methods which allow the data from large scale galaxy and cluster surveys to constrain models of galaxy formation

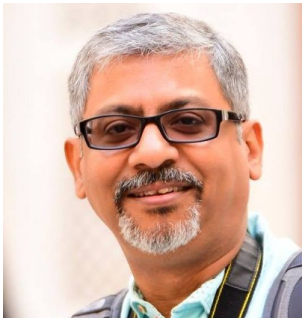
and cosmology.

He had played a major role in the development of Halo model which is the standard model nonlinear clustering and biasing. He developed the first realistic fully analytic model of nonlocal bias using the Excursion set and Peaks theory description of Cosmic Web. He has published more than 150 research papers in these fields.
He has been the Principal Investigator for many NASA Projects. He has been also part of HST project. He has been also the member of NASA Grant Review Panel, DES committee, NASA-Spitzer Proposal Review panel and many more.

Course Coordinator

Anjan Ananda Sen

Professor
Center For Theoretical Physics, JMI, New Delhi, India



Prof. Sen has done his Phd from Department of Physics, Jadavpur University, Kolkata, India. He had been Post Doctoral Fellow at Harish-Chandra Research Institute, Allahabad, India, Instituto Superior Tecnico, Lisbon, Portugal and Dept. of Physics and Astronomy, Vanderbilt University, Nashville, USA.

His research interests include both the early time inflation and late time acceleration in the universe as well as modified gravity theories to explain the late time acceleration of universe. He is also involved in studying the effects of dark energy in large scale structure formation of the universe.

He is part of the International Science Development Team for the Fundamental Cosmology group for the Thirty Meter Telescope (TMT) project. He is also the member of the SKA-India consortium as well as the Associate member of the SKA Science working group on cosmology.

Contact details

Anjan Ananda Sen

Center For Theoretical Physics,

Jamia Millia Islamia, New Delhi 110025

Phone : 0091-11-2673 8819 (O),

Email : aasen@jmi.ac.in,
anjsen@gmail.com

Registration Link : http://www.gian.**iitkgp.ac.in/GREGN**