Understanding the Galaxy/Matter Connection in the Era of Large Surveys

Report of Contributions

https://agenda.infn.it/e/40975

Contribution ID: **3** Type: **not specified**

Welcome Address

Monday, 16 September 2024 10:00 (5 minutes)

Session Classification: Review

Contribution ID: **4** Type: **not specified**

Review results RU Milano

Monday, 16 September 2024 10:05 (45 minutes)

Session Classification: Review

Contribution ID: **5** Type: **not specified**

Talk

Session Classification: Review

Contribution ID: **6** Type: **not specified**

Talk

Session Classification: Review

Contribution ID: **7** Type: **not specified**

Talk

Session Classification: Review

Contribution ID: **8** Type: **not specified**

Review results RU RM3

Monday, 16 September 2024 11:15 (45 minutes)

Presenter: BRANCHINI, Enzo Franco (Istituto Nazionale di Fisica Nucleare)

Session Classification: Review

Contribution ID: **9** Type: **not specified**

Talk

Session Classification: Review

Contribution ID: **10** Type: **not specified**

Review results RU Torino

Monday, 16 September 2024 12:00 (45 minutes)

Session Classification: Review

Contribution ID: **11** Type: **not specified**

Talk

Session Classification: Review

Contribution ID: **12** Type: **not specified**

Talk

Session Classification: Review

Contribution ID: **13** Type: **not specified**

Talk

Monday, 16 September 2024 14:15 (15 minutes)

Session Classification: Probing the nature of the Dark Matter from the Large Scale Structure of the Universe

Contribution ID: **14** Type: **not specified**

Talk

Monday, 16 September 2024 14:30 (15 minutes)

Session Classification: Probing the nature of the Dark Matter from the Large Scale Structure of the Universe

Contribution ID: **15** Type: **not specified**

Talk

Monday, 16 September 2024 14:45 (15 minutes)

Session Classification: Probing the nature of the Dark Matter from the Large Scale Structure of the Universe

Contribution ID: **16** Type: **not specified**

Talk

Monday, 16 September 2024 15:00 (15 minutes)

Session Classification: Probing the nature of the Dark Matter from the Large Scale Structure of the Universe

Contribution ID: **17** Type: **not specified**

Talk

Monday, 16 September 2024 15:15 (15 minutes)

Session Classification: Probing the nature of the Dark Matter from the Large Scale Structure of the Universe

Contribution ID: **18** Type: **not specified**

Talk

Monday, 16 September 2024 16:15 (15 minutes)

Session Classification: Probing the nature of the Dark Matter from the Large Scale Structure of the Universe

Contribution ID: **19** Type: **not specified**

Talk

Monday, 16 September 2024 16:30 (15 minutes)

Session Classification: Probing the nature of the Dark Matter from the Large Scale Structure of the Universe

Contribution ID: **20** Type: **not specified**

Talk

Monday, 16 September 2024 16:45 (15 minutes)

Session Classification: Probing the nature of the Dark Matter from the Large Scale Structure of the Universe

Contribution ID: **21** Type: **not specified**

Talk

Monday, 16 September 2024 17:00 (15 minutes)

Session Classification: Probing the nature of the Dark Matter from the Large Scale Structure of the Universe

Contribution ID: **22** Type: **not specified**

Talk

Monday, 16 September 2024 17:15 (15 minutes)

Session Classification: Probing the nature of the Dark Matter from the Large Scale Structure of the Universe

Contribution ID: **23** Type: **not specified**

Talk

Tuesday, 17 September 2024 09:00 (15 minutes)

Session Classification: Cosmology from Galaxy Redshift Surveys

Contribution ID: **24** Type: **not specified**

Talk

Tuesday, 17 September 2024 09:15 (15 minutes)

Session Classification: Cosmology from Galaxy Redshift Surveys

Contribution ID: **25** Type: **not specified**

Talk

Tuesday, 17 September 2024 09:30 (15 minutes)

Session Classification: Cosmology from Galaxy Redshift Surveys

Contribution ID: **26** Type: **not specified**

Talk

Tuesday, 17 September 2024 09:45 (15 minutes)

Session Classification: Cosmology from Galaxy Redshift Surveys

Contribution ID: **27** Type: **not specified**

Talk

Tuesday, 17 September 2024 10:00 (15 minutes)

Session Classification: Cosmology from Galaxy Redshift Surveys

Contribution ID: **28** Type: **not specified**

Talk

Tuesday, 17 September 2024 11:00 (15 minutes)

Session Classification: Cosmology from Galaxy Redshift Surveys

Contribution ID: **29** Type: **not specified**

Talk

Tuesday, 17 September 2024 11:15 (15 minutes)

Session Classification: Cosmology from Galaxy Redshift Surveys

Contribution ID: **30** Type: **not specified**

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Session Classification: Cosmology from Galaxy Redshift Surveys

Contribution ID: **31** Type: **not specified**

Talk

Tuesday, 17 September 2024 11:45 (15 minutes)

Session Classification: Cosmology from Galaxy Redshift Surveys

Contribution ID: **32** Type: **not specified**

Talk

Tuesday, 17 September 2024 12:00 (15 minutes)

Session Classification: Cosmology from Galaxy Redshift Surveys

Contribution ID: **33** Type: **not specified**

Talk

Tuesday, 17 September 2024 14:00 (15 minutes)

Session Classification: Testing LCDM with clustering statistics

Contribution ID: **34** Type: **not specified**

Talk

Tuesday, 17 September 2024 14:15 (15 minutes)

Session Classification: Testing LCDM with clustering statistics

Contribution ID: **35** Type: **not specified**

Talk

Tuesday, 17 September 2024 14:30 (15 minutes)

Session Classification: Testing LCDM with clustering statistics

Contribution ID: **36** Type: **not specified**

Talk

Tuesday, 17 September 2024 14:45 (15 minutes)

Session Classification: Testing LCDM with clustering statistics

Contribution ID: **37** Type: **not specified**

Talk

Tuesday, 17 September 2024 15:00 (15 minutes)

Session Classification: Testing LCDM with clustering statistics

Contribution ID: **38** Type: **not specified**

Talk

Tuesday, 17 September 2024 16:00 (15 minutes)

Session Classification: Testing LCDM with clustering statistics

Contribution ID: **39** Type: **not specified**

Talk

Tuesday, 17 September 2024 16:15 (15 minutes)

Session Classification: Testing LCDM with clustering statistics

Contribution ID: **40** Type: **not specified**

Talk

Tuesday, 17 September 2024 16:30 (15 minutes)

Session Classification: Testing LCDM with clustering statistics

Contribution ID: **41** Type: **not specified**

Talk

Tuesday, 17 September 2024 16:45 (15 minutes)

Session Classification: Testing LCDM with clustering statistics

Contribution ID: **42** Type: **not specified**

Talk

Session Classification: Testing LCDM with clustering statistics

Contribution ID: **43** Type: **not specified**

Talk

Session Classification: Probing the nature of the Dark Matter from the Large Scale Structure of the Universe

Contribution ID: **44** Type: **not specified**

Talk

Tuesday, 17 September 2024 15:15 (15 minutes)

Session Classification: Testing LCDM with clustering statistics

Contribution ID: **45** Type: **not specified**

Talk

Monday, 16 September 2024 15:30 (15 minutes)

Session Classification: Probing the nature of the Dark Matter from the Large Scale Structure of the Universe

Contribution ID: **46** Type: **not specified**

Talk

Tuesday, 17 September 2024 10:15 (15 minutes)

Session Classification: Cosmology from Galaxy Redshift Surveys

Contribution ID: **47** Type: **not specified**

Talk

Tuesday, 17 September 2024 12:15 (15 minutes)

Session Classification: Cosmology from Galaxy Redshift Surveys

Contribution ID: **48** Type: **not specified**

Detecting Relativistic Doppler in Galaxy Clustering via Multi-tracing a Single Galaxy Population

The description of gravity, i.e. the theory of general relativity, plays a crucial role in our understanding of the universe. However, confirmations of the validity of this theory on cosmological scales have hitherto eluded us. In this context, the detection of relativistic Doppler via galaxy power spectrum measurements could further confirm the validity of general relativity at scales very far from the strong-gravity-field regime, where instead it has been tested with exquisite accuracy. The Doppler term acts as an imaginary correction in the relation between the galaxy density contrast and that of matter, which mostly affects the large-scales usually plagued by cosmic variance. Cross-correlation power spectra seem to be much more promising than auto-correlation ones, due to the presence of the relativistic effect in a non-vanishing imaginary term that might be relevant even at intermediate scales. Moreover, relativistic Doppler is sample-dependent, so different galaxy populations display different contributions in their power spectra. In the search for the optimal galaxy samples to achieve a detection of the relativistic term, we can split a galaxy population according to luminosity, and even perform a multi-tracer analysis with auto-correlations of the two sub-samples and their cross-power spectrum. We are thus able to devise a technique enjoying multi-tracer benefits out of a single dataset and obtain a detection well above 5σ.

Primary author: MONTANO, Federico (Istituto Nazionale di Fisica Nucleare)

Presenter: MONTANO, Federico (Istituto Nazionale di Fisica Nucleare)

Contribution ID: **49** Type: **not specified**

The cross-correlation between CIB and galaxy clustering

Understanding the intricate relationship between star-formation rates from Comic Infrared Background(CIB) and other large scale structure tracers holds key insights into the evolving cosmic landscape. By cross-correlating the CIB data and other large-scale structure (i.e. CMB lensing and galaxy clustering), we can unravel the underlying dynamics and give better constrains on the models as well as retrieve the primordial information hidden behind the interference of these tracers. With the galaxy clustering data from Euclid in the near future, we can unravel the information hidden in the redshift distribution of star forming rate by its cross-correlation with Cosmic Infrared Background data from Planck. Thus, a better tomographic constrain on the halo model can be achieved.

Primary authors: HAN, Jiakang; Prof. CAMERA, Stefano (Università degli Studi di Torino & INFN Torino)

Presenter: HAN, Jiakang

Contribution ID: **50** Type: **not specified**

Studying the large-scale structure of the Universe with radio data

Galaxy surveys can be photometric (big volumes but also big redshift errors) or spectroscopic (accurate redshifts but small volumes). The technique that goes beyond this compromise is hydrogen intensity mapping (HI IM). Indeed, radio telescopes tomographically characterise the Universe, detecting the redshifted 21 cm radiation emitted by cosmic neutral hydrogen: both large areas and spectroscopic information are ensured. In this talk, I will present the HI IM technique and discuss its challenges and opportunities. In particular, I will show how we address the (in)famous contaminant separation problem with first-of-their-kind data from the MeerKAT telescope single-dish observations. Within the MeerKLASS collaboration, we started an effort to test and optimise the available contaminant cleaning methods directly on data. We assess their effectiveness by measuring the expected cross-correlation signal with an overlapping galaxy dataset. I'll present our results, which are encouraging and relevant for the forthcoming direct detection of the IM signal with MeerKAT. Our ongoing work demonstrates that a radio array operating as a collection of independent telescopes can probe the IM cosmological signal, marking a milestone for the cosmology science case with the entire SKA Observatory (which the MeerKAT dishes will be part of).

Primary author: CARUCCI, Isabella Paola (INAF - Trieste)

Presenter: CARUCCI, Isabella Paola (INAF - Trieste)

Contribution ID: **51** Type: **not specified**

Controlling systematics in spectroscopci galaxy clustering

I will show recent updates on the Euclid strategy to control systematics of the spectroscopic sample used for galaxy clustering.

Primary author: MONACO, Pierluigi (Istituto Nazionale di Fisica Nucleare)

Presenter: MONACO, Pierluigi (Istituto Nazionale di Fisica Nucleare)

Contribution ID: **53** Type: **not specified**

The peculiar velocity and momentum density bispectra

I examine galaxy peculiar velocities as a cosmological probe and compute their kernels in standard perturbation theory up to second order. With these, I construct the peculiar velocity power spectrum and bispectrum at tree level. I find agreement with the literature for the former and I derive the expression for the latter for the first time. As a byproduct, I also derive the bispectrum of the so-called momentum density, i.e. the density-weighted peculiar velocity field. Focussing on the two new bispectra, I compare them to the well-studied bispectrum of galaxy clustering. I find that, in general, both of them can provide constraints on the growth rate of cosmic structures tighter than those obtained with the galaxy clustering bispectrum, making them a compelling cosmological probe in themselves and, all the more so, to complement standard galaxy clustering analyses.

Primary author: Prof. CAMERA, Stefano (Università degli Studi di Torino & INFN Torino)

Presenter: Prof. CAMERA, Stefano (Università degli Studi di Torino & INFN Torino)

Contribution ID: **54** Type: **not specified**

Understanding Projection Effects for Cosmological Posterior Distributions

I will discuss how to understand and cope with projection effects concerning posterior distributions from cosmological experiments, with a particular focus on LSS surveys.

Primary author: RAVERI, Marco (Istituto Nazionale di Fisica Nucleare)

Presenter: RAVERI, Marco (Istituto Nazionale di Fisica Nucleare)

Contribution ID: **55** Type: **not specified**

On the optimal extraction of the Alcock Paczynski signal from voids

Cosmic voids, large under-dense regions in the Universe, serve as promising laboratories for extracting cosmological information. They offer opportunities to explore deviations from Λ and provide insights into dark energy and modification of gravity. Upcoming surveys like Euclid will enable detailed void analyses, allowing access to a huge number of voids. Voids' significance lies in their spherically symmetric property when stacked, becoming standard spheres. However, observationally, they exhibit two types of distortions crucial for extracting cosmological information: redshift-space distortions (RSD), caused by galaxy velocities, and geometrical distortions, arising from the use of incorrect cosmological models when converting observed redshifts into distances (Alcock-Paczynski test). Current RSD models are insufficient for smaller voids. A new technique, utilizing a reconstruction method based on the Zel'dovich approximation, extends analyses to smaller voids and enhances the precision of parameter constraints.

Primary author: DEGNI, Giulia (Università Roma Tre)

Presenter: DEGNI, Giulia (Università Roma Tre)

Contribution ID: **56** Type: **not specified**

Pioneering Advancements in Modelling the Galaxy Three-Point Correlation Function

For galaxy clustering, constraining cosmological parameters using the three-point correlation function has historically been hindered by the computational cost of modelling. Here, we introduce a new emulator developed as part of an Euclid Preparation Key Project, which significantly accelerates MCMC evaluations. For the first time in a simulation study, we present constraints on cosmological parameters by combining two- and three-point statistics. Additionally, we discuss ongoing activities related to modelling the 3PCF in the highly non-linear regime, exploring pioneering models for galaxy biasing up to next-to-leading order perturbative models.

Primary author: GUIDI, Massimo (University of Bologna)

Presenter: GUIDI, Massimo (University of Bologna)

Contribution ID: **57** Type: **not specified**

Towards a full modelling of the 3PCF at the BAO scales

Higher-order correlation functions (such as the three-point correlation function, 3PCF) will play a crucial role in future cosmological surveys since they complement the information provided by the (more commonly used) lower-order correlation functions (e.g., the two-point correlation function, 2PCF) allowing a significant gain in the cosmological information extracted from Large Scale Structure.
However, one problem relies upon the fact that producing models for the 3PCF is challenging both theoretically, but also computationally, so this has currently become a major bottleneck preventing the possibility of massive 3PCF analyses.

In this talk, I will present a new work in which we developed a Machine-Learning emulator to produce models of the anisotropic 3PCF of matter at BAO scales. We use this model to explore the potential constraints we can have on cosmological parameters with future surveys, and the ability to robustly detect the BAO peak in the 3PCF. I also present a new emulator for the total and no-wiggle power spectrum, which is capable of reproducing the original with an accuracy <1% at all scales. This work is a pilot project that opens the possibility of a full emulation of 3PCF models.

Primary author: MORESCO, Michele (Universita' di Bologna)

Co-authors: GUIDI, Massimo (University of Bologna); FARINA, Antonio (Istituto Nazionale di Fisica Nucleare); VEROPALUMBO, Alfonso (Istituto Nazionale di Fisica Nucleare)

Presenter: MORESCO, Michele (Universita' di Bologna)

Contribution ID: **58** Type: **not specified**

PBJ: a fast pipeline for the analysis of Stage-IV galaxy clustering data

Ongoing spectroscopic Stage-IV galaxy surveys, such as Euclid and DESI, are starting to deliver high precision data that will allow to map the Universe over unprecedented volume and measure cosmological observables with high precision, with the ultimate goal of investigating the dark sector. Inferring cosmological parameters from such measurements requires fast and flexible analysis pipelines and a tight control over systematics, both theoretical and observational. Additionally, maximising information extracted from the data by including both nonlinear scales and higher order statistics is crucial to ensure the success of these cosmological experiments. I will present recent developments in PBJ, a Bayesian inference pipeline for the joint analysis of the power spectrum and bispectrum, an describe results from Stage-III data from the BOSS survey. The pipeline features the state-of-the art EFTofLSS model for the nonlinear galaxy power spectrum and a tree-level model for the bispectrum, as well as the possibility to include data from the post-reconstruction power spectrum, and several sampler to explore the parameter space. I will also give an overview of the usecases within the Euclid collaboration, which include updated forecasts, investigation of projection effects in the posterior distributions for extended cosmological models, the analysis of beyond-LCDM cosmologies and studies of systematics impact on the cosmological constraints.

Primary author: MORETTI, Chiara (SISSA)

Presenter: MORETTI, Chiara (SISSA)

Contribution ID: **59** Type: **not specified**

HI intensity mapping with MeerKAT

Neutral hydrogen (HI) intensity mapping is arising as a novel probe of the Large Scale Structure of the Universe, and the MeerKAT radiotelescope is being used in the so called single-dish mode to test this technique as a precursor of the SKAO. These observations are characterised by a variety of systematics and astrophysical foregrounds that are much more intense than the cosmological signal and therefore limited the possibility to detect it. I will present the results of the analysis of the data taken during the MeerKAT 2021 observing season and I will show how, by means of internal cross-correlation, it is possible to mitigate the impact of systematics and reach a detection of the HI auto-power spectrum.

Primary author: BARBERI SQUAROTTI, Matilde (Università degli Studi di Milano)

Presenter: BARBERI SQUAROTTI, Matilde (Università degli Studi di Milano)

Contribution ID: **60** Type: **not specified**

Cosmological results from one year of DESI observations

In its first year of observations the Dark Energy Spectroscopic Instrument (DESI) has built the largest map of galaxy redshifts to date, I will present the first set of cosmological results, coming from measurements of the baryonic acoustic oscillations (BAO) characteristic scale. The analysis of the full shape of the power spectrum is still ongoing but there is a chance that the results will public by the date of the meeting, in which case I will include them in my presentation.

Primary author: BIANCHI, Davide

Presenter: BIANCHI, Davide