Colloque national Action Dark Energy 2024 - 8ème édition

Rapport sur les contributions

https://indico.in2p3.fr/e/32522

ID de Contribution: **1** Type: **Non spécifié**

DESI

mardi 29 octobre 2024 09:30 (30 minutes)

Orateur: DE MATTIA, Arnaud

Classification de Session: Présentations

ID de Contribution: **2** Type: **Non spécifié**

UNIONS/CFIS

lundi 28 octobre 2024 14:00 (30 minutes)

Orateur: HERVAS PETERS, Fabian (CEA/IRFU/DAp-AIM/Cosmostat)

Classification de Session: Présentations

ID de Contribution: **3** Type: **Non spécifié**

4MOST

Orateur: SORCE, Jenny

Classification de Session: Présentations

ID de Contribution: **6** Type: **Non spécifié**

eROSITA

mercredi 30 octobre 2024 09:00 (30 minutes)

Orateur: CLERC, Nicolas (IRAP)

Classification de Session: Présentations

ID de Contribution: **7** Type: **Non spécifié**

WST

mercredi 30 octobre 2024 10:00 (30 minutes)

Orateur: YECHE, Christophe (CEA Irfu/SPP)

Classification de Session: Présentations

ID de Contribution: **8** Type: **Non spécifié**

Impact of clusters' connectivity on their evolution and gas accretion

mardi 29 octobre 2024 14:50 (20 minutes)

Matter distribution around clusters is highly anisotropic from their being the nodes of the cosmic web.The number of filaments they are connected to, i.e., their connectivity, should reflect the level of anisotropy in the matter distribution and must be, in principle, related to their physical properties.
In this presentation, I will first address the influence of the local connectivity of clusters on cluster properties, by using the hydrodynamical simulation IllustrisTNG.The mass of clusters mainly influences the geometry of the matter distribution: massive halos are significantly more connected to the cosmic web than low-mass ones. Beyond the mass-driven effect, cluster connectivity appears to trace different dynamical state with different accretion histories.
Secondly, I will focus on gas distribution in the same simulated cluster sample. Whereas hot plasma is virialised inside clusters, the warm hot inter-galactic medium (WHIM) is accumulating and slowly infalling at cluster peripheries. Inside clusters, hot gas traces cluster structural properties, such as substructure fraction and elliptical shape. In contrast, WHIM gas outside clusters follows the DM distribution by tracing cosmic filament patterns. Finally, these numerical predictions are compared to soft X-ray observations.

Orateur: GOUIN, Céline (IAP)

Classification de Session: Présentations

ID de Contribution: **9** Type: **Non spécifié**

Precision cosmology with LSST: Development of an unbiased cosmic shear estimator

mercredi 30 octobre 2024 11:00 (20 minutes)

Since cosmic shear was first observed in 2000, it has become a key cosmological probe and promises to deliver exquisite dark energy constraints. Next-generation surveys like LSST will provide images with an unprecedented galaxy density, marking the dawn of the era of precision cosmology with cosmic shear. However, shear is inferred from coherent distortions of galaxy shapes, and the relation between galaxy ellipticities and gravitational shear is a serious potential source of bias.
We are developing a shear estimation method that makes no assumption on galaxy shapes, in order to avoid the shortcomings of a simulation-based shear calibration. Our method relies on estimating the image's second moments and evaluating how they respond to a shear applied to the coordinate system without altering the image itself.We also evaluate analytically the noise bias due to the non-linearity of the estimator, and confront it with the bias derived from noisy image simulations, which allows a fast and precise noise bias correction.

Orateur: VAN DEN ABEELE, Enya

Classification de Session: Présentations

ID de Contribution: **10** Type: **Non spécifié**

EUCLID

mardi 29 octobre 2024 10:00 (30 minutes)

Orateur: Dr PIRES, Sandrine (CEA Saclay)

Classification de Session: Présentations

ID de Contribution: **11** Type: **Non spécifié**

J-PAS

lundi 28 octobre 2024 16:30 (30 minutes)

Orateur: HERNANDEZ-MONTEAGUDO, Carlos (IAC)

Classification de Session: Présentations

ID de Contribution: **12** Type: **Non spécifié**

ARRAKIHS: The New ESA F-Class Mission to Investigate the Nature of Dark Matter

mardi 29 octobre 2024 14:00 (30 minutes)

The “Analysis of Resolved Remnants of Accreted galaxies as a Key Instrument for Halo Surveys” (ARRAKIHS) mission will explore the ultra-low surface brightness universe to investigate the nature of Dark Matter. ARRAKIHS was selected in November 2022 as the next F-class mission at ESA for Phases 0/A/B, with an estimated launch date in 2030. The ARRAKIHS science consortium, led by IFCA (Spain) in partnership with several European research centers and space companies, is collaborating with ESA to launch an array of visible and infrared cameras on board a mini-satellite in Low Earth Orbit. The goal of ARRAKIHS is to test the predictions of different Dark Matter models and baryon physics mechanisms on the halo structure as well as on the statistics of halo satellites and stellar streams for a representative sample of MW-type galaxies in the nearby Universe. In this talk, I will provide a progress report on the ARRAKIHS mission after successfully passing Phase 0/A and we continue working on Phase B that will end in early 2026 with the mission adoption.

Orateur: GUZMAN, Rafael

Classification de Session: Présentations

ID de Contribution: **13** Type: **Non spécifié**

Reevaluating the cosmological redshift: insights into inhomogeneities and irreversible processes

mercredi 30 octobre 2024 11:40 (20 minutes)

Understanding the expansion of the Universe remains a profound challenge in fundamental physics. The complexity of solving General Relativity equations in the presence of intricate, inhomogeneous flows has compelled cosmological models to rely on perturbation theory in a homogeneous FLRW background. This approach accounts for a redshift of light encompassing contributions from both the cosmological background expansion along the photon's trajectory and Doppler effects at emission due to peculiar motions. However, this computation of the redshift is not covariant, as it hinges on specific coordinate choices that may distort physical interpretations of the relativity of motion.

In this study, we show that peculiar motions, when tracing the dynamics along time-like geodesics, must contribute to the redshift of light through a local volume expansion factor, in addition to the background expansion. By employing a covariant approach to redshift calculation, we address the central question of whether the cosmological principle alone guarantees that the averaged local volume expansion factor matches the background expansion.

We establish that this holds true only in scenarii characterized by a reversible evolution of the Universe, where inhomogeneous expansion and compression modes mutually compensate. In the presence of irreversible processes, such as the dissipation of large-scale compression modes through matter virialization and associated entropy production, the averaged expansion factor becomes dominated by expansion in voids that cannot be compensated anymore by compression in virialized structures. Furthermore, a Universe where a substantial portion of its mass has undergone virialization, adhering to the background evolution on average leads to significant violations of the second law of thermodynamics. Our approach shows that entropy production due to irreversible processes during the formation of structures plays the same role as an effective, time-dependent cosmological constant, i.e. dynamical dark energy, without the need to invoke new unknown physics. Our findings underscore the imperative need to reevaluate the influence of inhomogeneities and irreversible processes on cosmological models, shedding new light on the intricate dynamics of our Universe.

Auteur principal: Dr TREMBLIN, Pascal (CEA Paris-Saclay)

Orateur: Dr TREMBLIN, Pascal (CEA Paris-Saclay)

Classification de Session: Présentations

ID de Contribution: **14** Type: **Non spécifié**

Modified gravity interpretation of the evolving dark energy in light of DESI data

lundi 28 octobre 2024 15:40 (20 minutes)

The Dark Energy Spectroscopic Instrument (DESI) collaboration has recently released measurements of baryon acoustic oscillation (BAO) from the first year of observations.A joint analysis of DESI BAO, CMB, and SN Ia probes indicates a preference for time-evolving dark energy. We evaluate the robustness of this preference by replacing the DESI distance measurements at $z < 0.8$ with the SDSS BAO measurements in a similar redshift range. Assuming the w_0w_aCDM model, we find an evolution of the dark energy equation of state parameters consistent with ΛCDM. Our analysis of χ^2 statistics across various BAO datasets shows that DESI's preference for evolving dark energy is primarily driven by the two LRG samples at $z_{\rm eff} = 0.51$ and $z_{\rm eff} = 0.71$, with the latter having the most significant impact.

Taking this preference seriously, we study a general Horndeski scalar-tensor theory, which provides a physical mechanism to safely cross the phantom divide, $w = -1$. Utilizing the Effective Field Theory of dark energy and adopting the w_0w_aCDM background cosmological model, we derive constraints on the parameters $w_0 = -0.856 \pm 0.062$ and $w_a = -0.53^{+0.28}_{-0.26}$ at 68% CL. from Planck CMB, Planck and ACT CMB lensing, DESI BAO, and Pantheon+ datasets, showing good consistency with the standard w_0w_aCDM model. The modified gravity model shows a preference over ΛCDM at the 2.4σ level, while for w_0w_aCDM it is at 2.5σ. We conclude that modified gravity offers a viable physical explanation for DESI's preference for evolving dark energy.

Auteur principal: CHUDAYKIN, Anton (University of Geneva)

Co-auteur: KUNZ, Martin

Orateur: CHUDAYKIN, Anton (University of Geneva)

Classification de Session: Présentations

ID de Contribution: **15** Type: **Non spécifié**

Going beyond FLRW in an inhomogeneous Universe: the Szekeres exact solution of GR

mardi 29 octobre 2024 11:30 (20 minutes)

Despite its global successes, the LambdaCDM standard model of cosmology
faces currently a number of tensions and anomalies, due to some
mismatch between early and late cosmic time physical representations. Indeed, in the era of precision cosmology, large scale inhomogeneities can no more be neglected. Fortunately, an exact GR solution exists, which is perfectly well suited for this purpose. This inhomogeneous solution ofthe field equations exhibits a pressureless matter-cosmological constant gravitational source and is devoid of any
symmetry. Moreover, it possesses the FLRW model as a homogeneous limit and can therefore be smoothly matched to the standard representation at the inhomogeneity-homogeneity transition. In this talk, the Szekeres solution and its main interesting properties, as well as the equations needed to use this solution in a cosmological context will be presented. Then the use of neural networks will be proposed to allow, in the future, a fitting of the huge amount of data becoming available to constrain the model.

Auteur principal: Dr CÉLÉRIER, Marie-Noëlle (Observatoire de Paris)

Orateur: Dr CÉLÉRIER, Marie-Noëlle (Observatoire de Paris)

Classification de Session: Présentations

ID de Contribution: **16** Type: **Non spécifié**

Type Ia supernova spectrophotometric standardisation and application to the ZTF spectra sample

mercredi 30 octobre 2024 12:00 (20 minutes)

Type Ia Supernovae (SNe Ia) are reliable standard candles for measuring cosmic distances due to their nearly constant maximum luminosity. Standardisation methods have been developed to reduce intrinsic scatter and improve distance estimates. Traditional photometric method reaches a 8% precision in distance, but the SNFactory (SNf) [1] survey has suggested that a spectroscopic approach can reach 4%.

In this study, we attend to validate this spectroscopic method called the Twins Embedding [2] [3] (TE) using an other survey. The Zwicky Transient Facility (ZTF) spectra sample [4] has around 700 spectroscopic SNe, four times larger than SNf for the same selection cuts, but with lower Signal-to-Noise ratio. We will also study the robustness of TE under different observational conditions and data qualities.

During the talk, I will present the Twins Embedding method, his performance dependancy on different data sample qualities, and the first results of ZTF spectral standardisation.

References

[1] G. Aldering et al., "Overview of the nearby supernova factory,"vol. 4836, Dec. 2002. doi: https://doi.org/10.1117/12.458107.

[2] K. Boone et al., "The twins embedding of type Ia supernovae I: The diversity of spectra at maximum light,"The

Astrophysical Journal, vol. 912, May 2021. doi: https://doi.org/10.3847/1538-4357/abec3c.

[3] K. Boone et al., "The twins embedding of type Ia supernovae II: Improving cosmological distance estimates,"The

Astrophysical Journal, vol. 912, May 2021. doi: 10.3847/1538-4357/abec3b.

[4] M. Rigault et al., "ZTF SN Ia DR2: Overview,"Sep. 2024. doi: 10.48550/arXiv.2409.04346. doi : https://doi.org/10.48550/arXiv.2409.04346

Auteur principal: GANOT, CONSTANCE

Co-auteurs: Dr RIGAULT, Mickael (IP2I); Dr COPIN, Yannick (IP2I-IN2P3, Université de Lyon)

Orateur: GANOT, CONSTANCE

Classification de Session: Présentations

ID de Contribution: **17** Type: **Non spécifié**

The ZTF SN Ia DR2 sample

lundi 28 octobre 2024 15:10 (30 minutes)

With already more than 3,000 Type Ia supernovae (SNe Ia) ready for cosmology, ZTF will be in future years the state-of-the-art low-redshift sample needed to anchor Stage IV supernovae surveys, e.g. LSST.

I will first introduce the ZTF survey, as well as the DR2 SN Ia sample. I will then present an overview of DR2 results, which focuses on supernovae diversity and astrophysical biases. I will finally discuss the remaining steps to achieve cosmological parameters inference.

Auteur principal: GINOLIN, Madeleine (IP2I/IN2P3/CNRS)

Orateur: GINOLIN, Madeleine (IP2I/IN2P3/CNRS)

Classification de Session: Présentations

ID de Contribution: **20** Type: **Non spécifié**

Euclid preparation: simulations and non-linearities beyond LCDM

lundi 28 octobre 2024 17:20 (20 minutes)

Orateur: BRETON, Michel-Andrès (Laboratoire d'Astrophysique de Marseille)

Classification de Session: Présentations

ID de Contribution: **21** Type: **Non spécifié**

Impact of the galaxy cluster environment on the stretch distribution of type-Ia supernovae with ZTF

mardi 29 octobre 2024 15:10 (20 minutes)

Understanding the impact of astrophysical environment on type Ia supernovae (SNe Ia) properties is crucial to minimize systematic uncertainties in cosmological analyses aiming at constraining the properties of Dark Energy using this probe. We investigated the dependence of the SN Ia SALT2.4 light-curve stretch on the distance from their nearest galaxy cluster to study a potential effect of the intracluster medium (ICM) environment on SNe Ia intrinsic properties. We used the largest SN Ia sample to date, the ZTF DR2 sample, and cross-matched it with existing X-ray, Sunyaev-Zel'dovich, and optical cluster catalogs in order to study the dependence between stretch and distance to the nearest detected cluster from each SN Ia. In this presentation, I will show how clusters can help understanding SNe Ia astrophysical systematics and how SNe Ia offer a new avenue to studying the evolution of star formation rate in clusters. Our work supports previous evidence that the age of the stellar population is the underlying driver of the bimodial shape of the SN Ia stretch distribution. It also indicates that SNe Ia search at high redshift targeted towards clusters to maximize detection probability should be considered with caution as the stretch distribution of the detected sample would be strongly biased towards the old sub-population of SNe Ia. Furthermore, we show that the effect of the ICM environment on the SNe Ia properties appears to be significant up to the splashback radius of clusters. This is compatible with previous works based on observations and simulations of a galaxy age gradient with respect to cluster-centric distance in massive halos. The next generation of large area surveys will provide an order of magnitude increase in the size of SNe Ia and cluster catalogs. This will enable more detailed analyzes of the impact of halo mass on the intrinsic properties of SNe Ia and of the fraction of quenched galaxies in the outskirts of clusters, where direct measurements are challenging.

Auteur principal: RUPPIN, Florian (IP2I Lyon)

Orateur: RUPPIN, Florian (IP2I Lyon)

Classification de Session: Présentations

ID de Contribution: **23** Type: **Non spécifié**

A Non-Gaussian Universe?

mardi 29 octobre 2024 14:30 (20 minutes)

Modifying the unconstrained small-scale initial conditions of the Universe could be a game changer for our understanding of cosmic structure formation and address challenges in small-scale galaxy formation. In this talk, I will present you my investigations of the effects of significant small-scale primordial non-Gaussianity (PNG). I have found that such PNGs introduce a distinct and potentially detectable feature in the matter power spectrum around the non-linear scale. This feature is promising to solve the S8 tension, which would then be a smoking gun of non-trivial inflationary physics. I will also demonstrate you that PNGs result in typical galaxy-sized halos reaching half of their present-day mass earlier and experiencing a quieter merging history for z<3 compared to the Gaussian case. At z=0, their environment between 0.5 to 4 virial radii, is less dense than in the Gaussian scenario, potentially affecting the universality of the NFW profile. This quieter merging history and less dense environment could have significant implications for the formation of bulges and bars in galaxies.Based on hydrodynamical simulations that I conducted, I will show that with all feedback prescriptions eing otherwise identical, simulations with a positively skewed distribution form galaxies slightly later than in the standard ΛCDM model and lead to simulated galaxies with more disky kinematics than in the standard case. Thus, such small-scale PNG could potentially help alleviate simultaneous tensions in cosmology and galaxy formation.

Orateur: STAHL, Clément (ObAS)

Classification de Session: Présentations

ID de Contribution: **24** Type: **Non spécifié**

Quantum algorithm for collisionless Boltzmann simulation of self-gravitating systems

mardi 29 octobre 2024 11:00 (30 minutes)

Auteur principal: Prof. YOSHIDA, Naoki (University of Tokyo)

Orateur: Prof. YOSHIDA, Naoki (University of Tokyo)

Classification de Session: Présentations

ID de Contribution: **25** Type: **Non spécifié**

COmoving Computer Acceleration (COCA): N-body simulations in an emulated frame of reference

lundi 28 octobre 2024 14:50 (20 minutes)

Interpretability and accuracy are pivotal challenges in the application of machine learning to cosmology. If machines find something humans don't understand, how can we check (and trust) the results? In this presentation, I contend that addressing this concern is not always obligatory, when machine learning is used to build an emulator of an expensive model. I will elucidate this argument through a case study where the use of neural networks is safe *by construction*. COmoving Computer Acceleration (COCA) is a hybrid framework interfacing ML with an N-body simulator. The correct physical equations of motion are solved in an emulated frame of reference, so that any emulation error is corrected by design. This approach corresponds to solving for the perturbation of particle trajectories around the machine-learnt solution, which is computationally cheaper than obtaining the full solution, yet is guaranteed to converge to the truth as one increases the number of force evaluations.

Auteur principal: LECLERCQ, Florent (Institut d'Astrophysique de Paris)

Orateur: LECLERCQ, Florent (Institut d'Astrophysique de Paris)

Classification de Session: Présentations

ID de Contribution: **26** Type: **Non spécifié**

Study of cosmic expansion anisotropy with type Ia supernovae from ZTF.

mercredi 30 octobre 2024 11:20 (20 minutes)

The cosmological principle assumes the isotropy of our Universe. The high coverage of the Zwicky Transient Facility survey (ZTF) makes it possible to carry out an unprecedented study of the veracity of this principle by using observation of type Ia supernovae (SNe Ia).
This unique low redshift ($z < 0.15$) survey with more than 3000 SNe Ia in the second data release (ZTF-DR2-SNe Ia) which spread across the northern sky, we can develop an analysis to study a possible anisotropy of H_0. In this talk, I will present a preliminary analysis attending to quantify the sensitivity of detecting anisotropies, like a dipole effect, with realistic simulation reproducing the ZTF-DR2-SNe Ia.

Auteur principal: BARJOU-DELAYRE, Chloé

Co-auteur: ROSNET, Philippe (Laboratoire de Physique de Clermont, Université Clermont Auvergne & CNRS/IN2P3)

Orateur: BARJOU-DELAYRE, Chloé

Classification de Session: Présentations

ID de Contribution: **27** Type: **Non spécifié**

Growth rate measurement using LSST type Ia supernovae

Type Ia supernovae (SNe Ia) are well-known distance indicators. Through the distance recovered from SNe, it is possible to recover their host galaxy's peculiar velocities (PVs). The PV field measured by SNe Ia enables us to constrain the growth rate of cosmic structure. Using a realistic simulation of SNe light curves, as expected from LSST, we have analyzed the sample bias due to selections and contamination. We have used the Maximum Likelihood method to recover the growth rate constraints from LSST SNe Ia PVs. We have produced a forecast for the 10 years of LSST surveys under various scenarios and assumptions.

Auteur principal: ROSSELLI, Damiano (CPPM)

Orateur: ROSSELLI, Damiano (CPPM)

Classification de Session: Présentations

ID de Contribution: **28** Type: **Non spécifié**

Precise Weak-Lensing Cosmology with imprecise redshifts: Euclid preparation and DES ‘finalisation’

lundi 28 octobre 2024 14:30 (20 minutes)

The precision of cosmological constraints derived from key observations in imaging surveys hinges on accurately measuring the true redshift distributions of tomographic redshift bins, particularly their mean redshifts.
Two approaches are commonly used. One involves using photometry with spectroscopic (or deep-photometry) counterparts. This approach is based on matching the fluxes of photometric subsamples and extrapolating them to the full sample (e.g., via SOM).
The other approach involves comparing sky distributions through angular clustering: the redshift distribution of a photometric sample is inferred by cross-correlating it at small angles with spectroscopic data localised in narrow redshift bins.

I will begin the presentation with concrete examples of the impact of photo-z on the 3x2-point analysis. I will then present aspects of the DES Y6 redshift pipeline, particularly how these two approaches are used together to provide robust estimates. Additionally, I will discuss the ongoing work on the Euclid pipeline, which benefits from a greater availability of spectroscopic data.

Auteur principal: D’ASSIGNIES DOUMERG, William

Orateur: D’ASSIGNIES DOUMERG, William

Classification de Session: Présentations

ID de Contribution: **29** Type: **Non spécifié**

Spec-S5: exploring the 2 < z < 4.5 Universe

mercredi 30 octobre 2024 09:30 (30 minutes)

Spec-S5 (2035-2045), building on the success of the DESI experiment, will be a new platform dedicated to map hundreds of millions of stars and galaxies in three dimensions, to address the problems of inflation, dark energy, light relativistic species, and dark matter. The instrumental design consists in an upgrade of both the Mayall and the Blanco telescopes, with a twin design: each telescope will have a 6-meter primary mirror, 13,000 robotically-controlled fibers, and 23 spectrographs. The DESI-2 experiment (2029-2035), using the DESI instrument, will be used as a pathfinder.

Orateur: RAICHOOR, Anand (EPFL)

Classification de Session: Présentations

ID de Contribution: **30** Type: **Non spécifié**

Update on the ω_m tension.

mardi 29 octobre 2024 17:30 (20 minutes)

The tension on the Hubble constant can be reformulated as a tension on the matter density parameter ω_M. This has the advantage that ω_M is more directly connected to the CMB-derived parameters, unlike the Huble constant. With the recent DESI measurement, the tensoin is raised up to over6 σ, stronger than the tension on the Hubble constant.

Auteur principal: BLANCHARD, ALAIN (IRAP , OMP)

Orateur: BLANCHARD, ALAIN (IRAP , OMP)

Classification de Session: Présentations

ID de Contribution: **31** Type: **Non spécifié**

Validation of the Euclid Cluster Catalogue with external data

mardi 29 octobre 2024 11:50 (20 minutes)

The *Euclid* spacecraft was launched in July 2023 to the Earth-Sun Lagrange point L2. The mission will produce one of the largest galaxy cluster catalogues with tens of thousands of clusters over the 15 000 square degrees of its extragalactic sky survey. This catalogue will need to be validated with external data, in order to check for newly discovered clusters, to prepare analyses of cluster multi-wavelength scaling relations, and to characterize the *Euclid* selection function. In preparation, we used the Dark Energy Survey (DES) Y1 RedMaPPer catalogue as surrogate for the *Euclid* catalogue to put in place our validation procedures with different millimeter, optical, and X-ray surveys . We used two complementary matching methods to find counterparts for clusters in position, but also in redshift. These methods will be explained with the example of crossmatches between RedMaPPer and the SRG eROSITA catalogue, which contains a large sample of X-ray clusters in the western Galactic hemisphere.

Auteur principal: WIDMER, Anaïs

Orateur: WIDMER, Anaïs

Classification de Session: Présentations

ID de Contribution: **32** Type: **Non spécifié**

Density-split for the DESI BGS

lundi 28 octobre 2024 17:00 (20 minutes)

The Bright Galaxy Survey (BGS) is the densest galaxy sample of the DESI project, and the closest in redshift range (z<0.2). At such small redshift scales, the constraint on cosmological parameters is dominated by the “cosmic variance”, a statistical error due to the small volume of universe considered. Alternative clustering analysis methods, such as Density-Split or Multi-Tracer analysis have shown a clear improvement on those constraints.
In this talk, I will present the method, its analysis pipeline using an emulator for the theoretical model in the cosmological inference and preliminary results for the DESI BGS.

Auteur principal: BOUCHARD, Simon (LPNHE)

Orateur: BOUCHARD, Simon (LPNHE)

Classification de Session: Présentations

ID de Contribution: **33** Type: **Non spécifié**

Impact of the errors induced by the Halo Mass Function mapping at different masses definitions on cosmological parameters constraints.

mardi 29 octobre 2024 17:10 (20 minutes)

The galaxy cluster count is a particularly effective probe to constrain cosmological parameters and study the limits of the ΛCDM model. Indeed, the abundance of galaxy clusters is strongly correlated with cosmological parameters such as Ω_m, σ_8, and the dark energy equation of state. Future surveys such as Euclid will enable us to acquire astrophysical data on a very large number of clusters. The statistical uncertainties linked to the observations will therefore be greatly reduced, and it seems necessary to ask questions about the uncertainties linked to the theoretical predictions of the cluster count, such as the halo mass function. Certain mass functions have been calibrated using N-body simulations and the Virial masses of the dark matter halos. However, the observable masses are the masses where the astrophysical processes of the baryons are preponderant, such as M_{200c} and M_{500c}. It therefore seems necessary to be able to establish a robust relation between the HMFs calibrated at M_{vir} and the HMFs at other mass definitions. To do this, two methods are available; the first is based on the sparsities of the halos and the stochastic nature of their masses. The second is based on the universality of dark matter density profiles. This project aims to quantify the systematic errors in the mapping between different mass functions using these two methods to reduce the uncertainties in the theoretical predictions of the cluster counts and thereby improve the robustness of the cosmological constraints.

Auteur principal: GAYOUX, Théo (LUTH - Observatoire de Paris-Meudon)

Orateur: GAYOUX, Théo (LUTH - Observatoire de Paris-Meudon)

Classification de Session: Présentations

ID de Contribution: **34** Type: **Non spécifié**

ZTF SN Ia DR2: Exploring SN Ia properties in the vicinity of under-dense environments

mercredi 30 octobre 2024 12:20 (20 minutes)

The unprecedented statistics of detected Type Ia supernovae (SNe Ia) brought by the Zwicky Transient Facility (ZTF) enable us to probe the impact of the large-scale structure (LSS) on the properties of these objects. With a volume-limited selection of ZTF-Cosmo-DR2 SNe Ia overlapping with the SDSS-DR7 survey footprint, we investigated the distribution of their properties with regard to voids detected in the SDSS-DR7 galaxy sample. We further used Voronoi volumes as a proxy for local density environments within the LSS. I will present the results of this investigation and their possible consequence when considering cosmological analyses with SNe Ia.

Auteur principal: AUBERT, Marie (LPC / CNRS / IN2P3)

Orateur: AUBERT, Marie (LPC / CNRS / IN2P3)

Classification de Session: Présentations

ID de Contribution: **35** Type: **Non spécifié**

Lemaitre : An independent measurement of the dark energy equation of state from a new set of SNeIa : Dataset and Lightcurve model

mardi 29 octobre 2024 16:30 (20 minutes)

We present the Lemaitre project, an independent effort to measure the Dark Energy equation of state (w,wa) using (1) a new set of type Ia supernovae (SNe Ia) from the ZTF, SNLS (years 4 and 5), and Subaru/HSC surveys, covering the redshift range 0.02 < z < 1.3, (2) a completely new cosmology inference pipeline. The Lemaitre effort aims to address the tension between recent (w,wa) measurements and LCDM predictions.

In this talk, we provide an overview of the Lemaitre project, starting with the dataset. We
present a general overview of the dataset, we discuss the surveys, data selection criteria and the calibration chain.

Constraining the Dark Energy equation of state with SNe Ia requires precise measurements of SN Ia standardized luminosity distances. To derive these distances the inference chain relies on an empirical spectrophotometric model of SNe~Ia, trained on the dataset used for the Hubble diagram. In this talk, we present a key component of the Lemaitre inference chain: a new framework for training empirical spectrophotometric models called 'NaCl' (Nouveaux Algorithmes de Courbes de Lumière). This framework is able to efficiently train a model while propagating all known sources of errors and systematics (measurement- and calibration- but also modeling-uncertainties) in the training, enhancing the accuracy of the lightcurve parameters used in the cosmological analysis.

We present results of trainings performed using NaCl on realistic simulations of the LEMAITRE dataset. We show that NaCl can accurately describe SN Ia lightcurves and spectra, providing a robust framework for the LEMAITRE analysis.

Auteur principal: AHMED EMAM OSMAN, Mahmoud (LPNHE)

Orateur: AHMED EMAM OSMAN, Mahmoud (LPNHE)

Classification de Session: Présentations

ID de Contribution: **36** Type: **Non spécifié**

Litmus Tests of the flat LCDM model

With the increase in data quality and quantity, the concordance cosmological model is under increasing tension. Therefore, it has become necessary to test the various hypotheses underlying the model: is the metric Friedman-Robertson-Lemaître-Walker? Is the Universe flat? Is dark energy the cosmological constant? Using state-of-the-arts data and analysis methods, I will show litmus tests of some of these hypotheses. I will then show how the combination of Type Ia supernovae from LSST and BAO data from the 5 years DESI survey will allow us to perform these tests.

Auteur principal: Prof. L'HUILLIER, Benjamin (Sejong University)

Orateur: Prof. L'HUILLIER, Benjamin (Sejong University)

Classification de Session: Présentations

ID de Contribution: **37** Type: **Non spécifié**

Galaxy formation and cosmic web

Orateur: CADIOU, Corentin

Classification de Session: Présentations

ID de Contribution: **38** Type: **Non spécifié**

Moving to exa-scale - challenges to (large) cosmological simulations

mardi 29 octobre 2024 15:30 (30 minutes)

The sample size of galaxies used to probe the large-scale distribution of galaxies and thereby cosmology is ever growing thanks to data from Euclid or the upcoming LSST. However, the current generation of numerical codes (GADGET, RAMSES) that are key to generate mock catalogues to compare the observations to are seeing their limit.
In this talk, I will present two routes, one clever and one less so, to beat cosmic variance from a numerical perspective. I will first discuss the "genetic modification"technique –which allows to craft \LambdaCDM initial conditions –and how it can be turned into a cosmology tool. Moving on, I will present current development in numerical simulations, focusing notably on the code Dyablo in development in France. This code is built from the ground up to operate fully on GPUs. It holds promise to scale on exascale-era supercomputers, providing us with a cosmological hydrodynamical code that could, potentially, simulate tens to hundreds times more galaxies than currently possible.

Orateur: CADIOU, Corentin (IAP)

Classification de Session: Présentations

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Toward an Independent Measurement of Dark Energy's Equation of State from a Novel Set of SNeIa: Cosmological Inference in LEMAITRE

mardi 29 octobre 2024 16:50 (20 minutes)

The LEMAITRE project (Latest Extensive Mapping of Acceleration with Independent Troves of Redshifted Explosions) seeks to deliver an independent measurement of the distance-redshift relation in the late universe through a previously unpublished set of Type Ia supernovae (SNeIa) from ZTF, SNLS years 4-5, and HSC. Within this framework, we are developing and testing a streamlined, likelihood-based cosmological inference model designed to simplify the inference process, enhance reproducibility, and provide more precise confidence intervals.

Traditional methods often depend on intricate simulations to adjust for methodological biases. The LEMAITRE approach, however, integrates all significant effects directly into the statistical model. The analysis is thus significantly accelerated and simplified, making results easier to replicate. The project includes a comprehensive plan for method characterization and validation through a series of data challenges, which progressively increase in complexity and realism.

We present the current development stage of our methodology and its successful performance in an initial data challenge. This proposal outlines the remaining work plan leading up to the unblinding of the LEMAITRE dataset.

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Classification de Session: Présentations