Rubin LSST-France, LPSC Grenoble, 07-09/06/2023

mercredi 7 juin 2023 - vendredi 9 juin 2023

Laboratoire de Physique Subatomique et de Cosmologie

Recueil des résumés

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General news and updates / 1

LSST Observing Strategy: ongoing studies

Auteur: Philippe Gris[1]

[1] *LPC*

Auteur correspondant gris@clermont.in2p3.fr

This presentation will summarize some of the recent DESC developments related to the LSST observing strategy.

Science talks / 2

ZTF DR2 - Linearity of the standardisation process and host dependey

Auteur: Madeleine Ginolin[1]

[1] *IP2I/IN2P3/CNRS*

Auteur correspondant m.ginolin@ip2i.in2p3.fr

I will present the ZTF DR2 final sample of SNe Ia. I will focus on the study of standardisation process, with the study of the linearity of the standardisation relations used for cosmology analysis, as well as the dependency of standardisation on SNe host properties.

Science talks / 3

Performances of the AMICO galaxy cluster algorithm on cosmoDC2 simulation

Auteur: Nathan Amouroux[None]

Auteur correspondant nathan.amouroux@lapp.in2p3.fr

AMICO is an algorithm for the detection of galaxy clusters in photometric surveys, being implemented in DESC. AMICO has been successfully run on cosmoDC2 and the characterization of the produced catalog will be presented (e.g. completeness, purity and mass-richness relation). A first comparison to redMaPPer results will also be presented, highlighting the galaxy population differences between the two catalogs.

Science talks / 4

Anomaly detection in Fink

Auteur: Maria Pruzhinskaya[1]

Co-auteurs: +Fink team ; Emille Ishida [2]; Julien Peloton [3]

[1] *LPC*

[2] *CNRS/LPC-Clermont*

[3] *CNRS-IJCLab*

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The detection of new astronomical sources is one of the most anticipated outcomes of the next generation of large-scale sky surveys. Experiments such as the Vera Rubin Observatory Legacy Survey of Space and Time are expected to continuously monitor large areas of the sky with remarkable deliberation, which will undoubtedly lead to the detection of unforeseen astrophysical phenomena. At the same time, the volume of data gathered every night will also increase to unprecedented levels, rendering serendipitous discoveries unlikely. In the era of big data, most detected sources will never be visually inspected, and the use of automated algorithms is unavoidable. I would like to present the anomaly detection module developed for the Fink broker to search for unusual astrophysical events in the Zwicky Transient Facility alert stream. I will present the first discoveries made with the module including AT2023awt –rare subtype of AM CVn variables. The spectral and photometric follow-up observations of AT2023awt will be discussed. I will also talk about the Fink anomaly Slack- and Telegram-bot, which makes the process of anomalies analysis to be more efficient and convenient for the user.

Science talks / 6

APES: Approximate Posterior Ensemble Sampler

Auteur: Sandro Dias Pinto Vitenti[1]

Co-auteur: EDUARDO BARROSO [2]

[1] *Universidade Estadual de Londrina*

[2] *LPSC*

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This paper proposes a novel approach to generate samples from target distributions that are difficult to sample from using Markov Chain Monte Carlo (MCMC) methods. Traditional MCMC algorithms often face slow convergence due to the difficulty in finding proposals that suit the problem at hand. To address this issue, the paper introduces the Approximate Posterior Ensemble Sampler (APES) algorithm, which employs kernel density estimation and radial basis interpolation to create an adaptive proposal, leading to fast convergence of the chains. The APES algorithm's scalability to higher dimensions makes it a practical solution for complex problems. The proposed method generates an approximate posterior probability that closely approximates the desired distribution and is easy to sample from, resulting in smaller autocorrelation times and a higher probability of acceptance by the chain. In this work, we compare the performance of the APES algorithm with the affine invariance ensemble sampler with the stretch move in various contexts, demonstrating the efficiency of the proposed method. For instance, on the Rosenbrock function, the APES presented an autocorrelation time 140 times smaller than the affine invariance ensemble sampler. The comparison showcases the effectiveness of the APES algorithm in generating samples from challenging distributions. This paper presents a practical solution to generating samples from complex distributions while addressing the challenge of finding suitable proposals. With new cosmological surveys set to deal with many new systematics, which will require many new nuisance parameters in the models, this method offers a practical solution for the upcoming era of cosmological analyses.

General news and updates / 7

M1M3 Tests

Auteur: Dominique Boutigny[1]

[1] *LAPP*

Auteur correspondant boutigny@in2p3.fr

The surrogate mirror M1M3 on its cell has been recently installed on the Telescope Mount Assembly (TMA). There is a whole set of tests to be performed in order to check that the system is performing as expected, first when the TMA is static and later when the TMA is moving.
I will describe the system (as I understand it) and the data analysis which is occurring now within the SIT-COM group.

Science talks / 8

Templates for photometric redshifts from FORS2 data

Auteur: joseph chevalier[1]

Co-auteurs: JOHANN COHEN-TANUGI [2]; Reza Ansari [3]; Sylvie Dagoret [4]; eric nuss [5]

[1] *IJCLab - A2C*

[2] *LUPM, Université de Montpellier*

[3] *Université Paris-Saclay & CEA*

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Following up on the work performed by J. Cohen-Tanugi, E. Nuss, E. Giraud and R. Ansari with FORS2 data, which aims to provide a new set of templates for photometric redshifts estimation in large surveys like LSST, this work focuses on the ways to select and prepare spectral templates from the dataset derived from observations.
Several data reduction methods have been used and photo-z estimates using LEPHARE++ on COS-MOS2020 data were performed as a benchmark to conclude that spectra obtained through stellar population synthesis, based on FORS2 observations, can be used as templates for photo-z codes with the appropriate processing. Finer analysis of these spectra can also help understanding the physical features that are key to accurate photo-z estimation, thus paving the way to a better use of templates-based photo-z codes.

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Impact of blending on DC2 data: Tools and analysis

Auteur: Manon Ramel[1]

[1] *LPSC / IN2P3*

Auteur correspondant manon.ramel@lpsc.in2p3.fr

Galaxy clusters trace the highest peaks in the density of the Universe. Therefore, their abundance is a powerful probe to constrain cosmological parameters, expansion of the Universe and give information on the growth of structures. However, since their density of galaxies is significantly higher, these latter may appear to overlap on the line of sight and have their respective fluxes blended. This effect, called blending, significantly distorts individual galaxy measurements such as their shapes used to measure the weak gravitational effect induced by massive structures.
This talk will introduce a new matching algorithm, friendly, for the detection and characterization of blended system from LSST-DC2 catalogs, in the context of the DESC collaboration. The purpose of

this matching algorithm is to combine several matching procedures and to use well-defined blended systems in order to study their impact on weak lensing galaxy clusters masses, and at the end on cosmological parameters.

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Status on atmospheric parameter inference on last six months of Auxtel spectroscopic observations

Auteurs: Jérémy Neveu[1]; Laurent Le Guillou[2]; Martin Rodriguez Monroy[3]; Sylvie Dagoret[3]; joseph chevalier[4]; marc moniez[5]

[1] *LPNHE*

[2] *LPNHE / Sorbonne Université*

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Progress in the characterisation of the optical properties of the hologram and the improvement of dispersion models in the extraction of spectra has allowed the extraction of some atmospheric parameters with the Auxtel telescope.
We will present the preliminary results of last six months of observations. The current state of atmospheric parameter inference, the current limitations and the progress to be expected will be exposed.

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CBP updates

Auteurs: Jérémy Neveu[1]; Thierry Souverin[None]

[1] *LPNHE*

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We will shortly report the main results obtained with the StarDICE CBP and the advances in the commissioning of the Rubin CBP.

Science talks / 13

Gravitational lensing induced by matter currents

Auteur: Calum Murray[1]

[1] *APC , University of Paris*

Auteur correspondant calum.murray@apc.in2p3.fr

In this talk I will present the effects of gravitational lensing induced by the motion of massive objects. This is a relativistic effect and is much weaker than the deflection of light by density inhomogeneities. I show that while subdominant to the density term future surveys will be able to measure this effect by cross-correlating the lensing convergence field with a reconstructed cosmic-momentum field. I present details of this reconstruction from galaxy redshift surveys and present forecasts for the combination of LSST with other next generation cosmological surveys.

Parallel work sessions / 14

Session parallele: spectroscopie avec AuxTel

Auteurs: Jérémy Neveu[1]; Laurent Le Guillou[2]; Martin Rodriguez Monroy[3]; Sylvie Dagoret[3]; marc moniez[4]

[1] *LPNHE*

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-déflatage en spectroscopie : analyse (Martin, 10 min.)
-déflatage en spectroscopie : hardware (Marc, 10 min.)
-Extraction de spectres (TBD, 20 min)
-Mesure de paramètres atmosphériques : les aérosols après l'eau (TBD, 20 min.)
-Procédure de compensation de variation de couleur due à l'atmosphère (Discussion, 20 min.)

Science talks / 15

Slitless spectrophotometry analysis with StarDICE

Auteur: Thierry Souverin[None]

Co-auteur: Jérémy Neveu [1]

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The number of type Ia supernova observations will see significant growth within the next decade, especially thanks to the Legacy Survey of Space and Time undertaken by the Vera Rubin Observatory in Chile. With this increase, statistical uncertainties will decrease and flux calibration will become the main uncertainty for the characterization of dark energy. To deal with this issue, the StarDICE experiment proposes to measure at the per mil level the spectra of stars from the CALSPEC calibration. These stars can thus become standards of reference for the LSST experiment. StarDICE experiment is currently operating at l'Observatoire de Haute-Provence. With slitless spectrophotometry data and atmosphere simulation, we have been able to extract preliminary spectra of stars as g191b2b or HD116405. In this talk, I will present the ongoing spectrophotometric analysis and the first steps toward full-forward modeling of the StarDice images.

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Detection of Galaxy Clusters on DC2 simulated images with Machine Learning

Auteurs: Kirill Grishin[1]; Michel Aguena[2]; Simona Mei[2]

[1] *Universite de Paris*

[2] *Astroparticule et Cosmologie (APC)*

Auteurs correspondants: mei@apc.in2p3.fr, aguena@lapp.in2p3.fr, grishin@apc.in2p3.fr

The distribution of galaxy clusters, the largest gravitationally bound structures in the Universe, helps us to estimate fundamental constants and constrain different cosmological models. With the expected development and commissioning of astronomical instruments, such as LSST, in the next decade, the depth of imaging data for a significant area of the sky will allow us to select nearly complete samples of galaxy clusters at redshifts up to z~1. To test the cluster detection technique that works directly with the reduced images, we have applied the convolutional neural network YOLO-CL (Grishin et al 2023), trained on SDSS color images for redMaPPer clusters, to precomputed color images for LSST DC2 simulation. In order to reach performance similar to that one for SDSS images we used the same filter set and color scheme for DC2 cutouts. Our results demonstrate that with YOLO-CL trained on SDSS images one can achieve 90% of both purity and completeness.

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The Rubin Galaxies Science Collaboration

Auteur: Simona Mei[1]

Co-auteur: on behalf of the Rubin Galaxies collaboration The Rubin Galaxy collaboration

[1] *APC/IN2P3*

Auteur correspondant mei@apc.in2p3.fr

The Rubin Galaxies collaboration (https://sites.google.com/view/lsstgsc/home) is focused on the scientific exploitation of Rubin observations for galaxy science. We will present the collaboration working packages and how to join. We will advertise the nest collaboration meeting on June 12th-14th in Paris.

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Photometric redshift estimation from galaxy images with machine learning

Auteur: Valentin Brekke[1]

Co-auteurs: Alex Malz ; Francois Lanusse ; Markus Rau ; Michel Aguena ; Shahab Joudaki ; Simona Mei

[1] *APC/IN2P3*

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We will describe a project to test and validate several machine learning techniques to estimate photometric redshift using multi-wavelength galaxy images. This project consists of machine network insertion in RAIL, testing and validation. We will validate and test on both field and cluster galaxies, and for individual and blended galaxies. Our results will be published in several papers lead by the

teams that are developing and testing networks, and we will provide catalogs to the photoz collaboration for comparison with other methods. At APC, we tested a simple CNN, Resnet, DeepNet, and the Pasquet et al. (2019) inception network, which is public and available to the community. This last network has the lower scatter, less outliers and less bias in our preliminary tests. From our preliminary tests it is very efficient in recovering SDSS galaxy photometric redshifts, and it will be the first network that we will isert in RAIL. We will describe our first tests and future activities.

Science talks / 19

Impact of photo-z on Dark Matter Halo membership and the estimation of cosmological parameters

Auteurs: Michel Aguena[1]; Simona Mei[None]

[1] *APC*

Auteurs correspondants: michel.aguena-da-silva@u-paris.fr, mei@apc.in2p3.fr

The abundance of galaxy clusters is a powerful probe for cosmology, especially on large optical surveys where hundreds of thousands can be detected. One of the main techniques that allows us to evaluate the large number of composing galaxies at a low cost is the photometric estimation of redshifts, i. e. photo-zs. Here we intend to evaluate the propagation of the uncertainties of photo-zs on the determination of the cluster redshift and mass proxy, and consequently, on cosmological constraints from cluster abundance. This preliminary work is evaluating the impact on the dark matter halos on the DC2 simulation using FlexZBoost photometric redshifts. Ultimately, the goal will be to evaluate this effect on optically detected galaxy clusters and optimize the application of different photo-zs for cluster cosmology.

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Calibration of the halo mass function on DC2

Auteurs: Michel Aguena[1]; Tom Colin[1]

[1] *APC*

Auteurs correspondants: tom.colin7@orange.fr, michel.aguena-da-silva@u-paris.fr

The halos mass function is the core of the theoretical part for constraining cosmology with galaxy cluster abundance. As it has been tested in other DESC projets, the current implementations of the halo mass function available in CCL (ex: Tinker 2008, Bocquet 2016, etc.) do not describe the mass distribution of dark matter halos found on the cosmoDC2 simulation at the percent level. The goal of this project is to calibrate the parameters of some of the current functional forms using DC2.

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StarDICE overview: status and perspectives

Auteur: Marc Betoule[1]

[1] *LPNHE*

Auteur correspondant marc.betoule@lpnhe.in2p3.fr

To achieve the calibration accuracy required by the VRO supernovae survey, the StarDICE experiment is building a five-stage metrology chain from bright laboratory standards to faint stars, with drastic requirements on each of the steps. In complement to preliminary results from the validation survey presented in separate abstracts, we propose to review the current status of the entire five-stage chain. We can then present plans for the ongoing validation survey, and expectations for the forthecoming science survey.

Science talks / 23

What's in a redshift?

Auteur: Vincent Reverdy[1]

[1] *Laboratoire d'Annecy de Physique des Particules*

Auteur correspondant vincent.reverdy@lapp.in2p3.fr

Redshift measurements are the backbone of modern cosmology. But what is exactly a redshift and how to correctly interpret it? In this talk, I will present a short review of the state of the art of raytracing simulations, why correctly interpreting redshifts might be far more subtle than one could initially think of, and how it may affect cosmological analyses within the LSST survey.

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DESC Project 311: Forecast for Cosmological Growth-Rate Measurement using Peculiar Velocities From Supernovae

Auteur: Damiano Rosselli[1]

[1] *CPPM*

Auteur correspondant rosselli@cppm.in2p3.fr

The goal of the project is to produce realistic forecast for $f\sigma_8$ measurement using peculiar velocities derived from Supernovae Type Ia. We will expand the work done for ZTF by Carreres et al. (https://arxiv.org/abs/2303.01198)

It is possible to measure peculiar velocities of Supernovae Type Ia by comparing their estimated distances from the Hubble Diagram with the redshifts of their host galaxies. Knowing the peculiar velocities of a sample of objects is interesting for testing the cosmological model. Analysing the distribution of these velocities enable us to measure the growth-rate of cosmic structure ($f\sigma_8$) which is directly linked to the theory of gravity assumed in the cosmological model.

It is possible to measure the peculiar velocities of galaxies hosting a type Ia supernova by comparing their estimated cosmological redshift inferred from their distance with the galaxy redshift. Using the LSST observing strategy and SNSIM survey simulator (https://github.com/bastiencarreres/snsim), we simulate realistic light-curves for all the supernovae types. Using a photometric SNe classifier on the simulated light-curves we define the sample for the cosmological analysis, assessing both selection effects and contamination. We recover the supernovae peculiar velocities through the residual of the Hubble Diagram and we measure $f\sigma_8$ parameter using only the velocity information. We plan to test various methods for both measuring the velocities and fitting the cosmology to asses possible biases in the analysis.

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LSST-France code of conduct

Auteur correspondant roucelle@in2p3.fr

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Welcome

Auteurs correspondants: bregeon@in2p3.fr, doux@lpsc.in2p3.fr

- Welcome
- Please fill the Rubin/LSST-France 20243 survey if you haven't! https://forms.gle/7wQ8QVWwveci9t2H6
- Agenda of the meeting (lightning, "ask everything" lunch session, etc)

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Communication/EPO LSST-France

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Computing

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Informatics and Statistics Science Collaboration

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IPAG (TBD)

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News from Rubin and DESC

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180s talks on Rubin/LSST organisation and science !

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Using Graphs to Organize Fink Alerts

Auteur: Julius Hrivnac[1]

Co-auteur: Julien Peloton [2]

[1] *IJCLab*

[2] *CNRS-IJCLab*

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Fink Broker stores received LSST alerts in a hybrid storage, where bulk data are stored in the NoSQL HBase database and their principal relations are captured by the associated Graph database. This data architecture allows a fast navigation in the data and offers advanced algorithms for the search of the hidden structures and relations using Graph theory approaches.

The talk will present the available technologies, the current status of the implementation and the first results. The possibilities and the potential of this approach will be discussed and illustrated on the similar existing projects.

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Characterisation of the outer Solar System and the Oort cloud

Auteurs: Daniel HESTROFFER[1]; Elke Pilat-Lohinger[None]; Marc Fouchard[None]; Melaine Saillenfest[None]

[1] *IMCCE/Paris observatory, CNRS, univ. PSL*

Auteur correspondant daniel.hestroffer@obspm.fr

The dynamics of small Solar System bodies well beyond Neptune has the particularity that — being at the interface of the heliosphere and the interstellar medium — it involves gravitational effects coming from both the Solar System and from the Galactic environment in which it evolves.
Our goal is to understand how such interactions are crucial in shaping the outer Solar system, up to the Oort cloud, over different timescales. These objects being physically and dynamically pristine, it will allow us to build a coherent picture of the history of our Solar System, its formation, and its evolution. While the Gaia mission is characterising the Galactic environment, the LSST survey will provide insight on the dynamics of these distant objects, including long period comets, extreme trans-Neptunain objects, and inter-stellar objects.

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The WaZP DC2 Run: Performance and Comparison to redMaP-Per

Auteur: Rance Solomon[1]

[1] *LAPP*

Auteur correspondant solomon@lapp.in2p3.fr

Galaxy clusters can provide strong constraints on cosmic evolution and as such play a central role in the Dark Energy Science Collaboration efforts. In the era of big cosmological surveys, such as the nearing LSST run, optimized cluster finding algorithms are a necessary tool in the data pipeline process with a few finders already strongly developed: redMaPPer, WaZP, and AMICO. The redMaPPer cluster finder is the most developed of the three cluster finders but uses the red sequence for redshift estimation. Since LSST will be making an extensive photometric redshift catalog, photo-z cluster finders such as WaZP and AMICO would be ideal to implement into the data pipeline. In this talk we will discuss the ongoing developement of the WaZP cluster finder and its performance on DC2 year 5 release compared to identical runs with redMaPPer.

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Lightning talks for newcomers

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SN parallel

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Clusters parallel

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DRP parallel

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