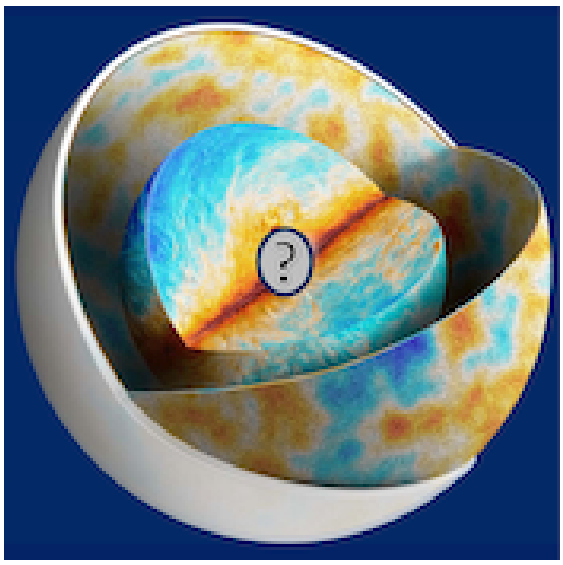
Colloque national CMB-France #7



Rapport sur les contributions

https://indico.in2p3.fr/e/36914

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

Status and future plans for the South Pole Observatory (SPO)

mardi 14 octobre 2025 16:30 (20 minutes)

The South Pole Observatory (SPO) brings together the BICEP and SPT collaborations with the goal of providing state-of-the-art constraints on inflationary gravitational waves. The BICEP program has a long history of setting constraints on the tensor-to-scalar ratio r, including the current leading constraint $\sigma(r) = 0.009$ (PRL, 2021). Future results will benefit from the increased sensitivity of the BICEP Array (which began deployment in 2020), as well as combining data with the South Pole Telescope (SPT) for delensing. Current forecasts predict that this combined effort will reach $\sigma(r) \sim 0.004$ with already acquired data, and $\sigma(r) \sim 0.001$ by the 2034 observing season. In this talk, I will present recent and planned upgrades to BICEP Array and SPT, as well as outline joint analysis effort to achieve high-fidelity lensing reconstruction and delensing.

Auteur: VERGÈS, Clara (LBNL)

Orateur: VERGÈS, Clara (LBNL)

Classification de Session: Future missions

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

Map-level Beam Treatment

mercredi 15 octobre 2025 11:40 (20 minutes)

Traditionally beams are treated in the harmonic space. However, it imposes several disadvantages like inability to treat non-spherical beams, always requiring an approximation. In the context of Simons Observatory experiment, we demonstrate a different approach based on treating the beams on a map-level. Accelerated by JAX and powered by FURAX software, it allows to circumvent the limitations of harmonic analysis and open new straight-forward ways to look on the non-spherical beams, far-sidelobes and polarization effects.

Auteur: BASYROV, Artem (APC, CNRS)

Orateur: BASYROV, Artem (APC, CNRS)

Classification de Session: CMB results and analysis

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

ACT-DR6 Power Spectrum Foreground Model and Validation on non Gaussian simulations

lundi 13 octobre 2025 14:20 (20 minutes)

The Atacama Cosmology Telescope (ACT) Data Release 6 (DR6) delivers some of the most precise small-scale measurements of the cosmic microwave background, requiring accurate treatment of astrophysical foregrounds at millimeter wavelengths. In this talk, we will present the DR6 parametric foreground model, which accounts for Galactic dust, extragalactic sources, and secondary CMB anisotropies. We detail several tests to validate the capability of the DR6 parametric foreground model to describe current observations and complex simulations, and show that cosmological parameter constraints are robust against model extensions and variations.

Auteur: Dr BERINGUE, Benjamin (APC, CNRS)

Orateur: Dr BERINGUE, Benjamin (APC, CNRS)

Classification de Session: Ground-based observatories

ID de Contribution: **4** Type: **Non spécifié**

QUBIC: taking advantage of Bolometric Interferometry with Spectral Imaging and news from the instrument

lundi 13 octobre 2025 15:40 (20 minutes)

QUBIC, the Q-U Bolometric Interferometer for Cosmology, is a telescope that observes the polarisation of the sky in the millimetre-wavelength range. Its goal is to detect the primordial B-modes of polarisation in the CMB by combining the sensitivity of bolometers with the good understanding of interferometry systematics. This dual aspect of QUBIC allows it to perform spectral imaging, that is, obtaining spatial and spectral information of the sky simultaneously. This makes the separation of components with complex spectral energy distributions easier, hence improving the performance of foreground removal.
I will first present the instrument and how spectral imaging impacts map creation. I will then give a status update on the instrument.

Auteur: HUCHET, Alexandre (APC)

Orateur: HUCHET, Alexandre (APC)

Classification de Session: Ground-based observatories

ID de Contribution: **5** Type: **Non spécifié**

Revisiting FIRAS in 2025: new baryonic feedback constraints from CMB spectral distortions

lundi 13 octobre 2025 17:50 (20 minutes)

Measurements of spectral distortions of the CMB are one of the pillars on which we built our standard cosmological model. While measurements of CMB anisotropies have massively improved since their discovery, CMB spectral distortion were last measured by the COBE/FIRAS mission in the 1990s over the full sky. I will show how a re-analysis of archival data of COBE/FIRAS using modern foreground cleaning techniques allowed us to improve by 2-to-3 times the original FIRAS constraints on CMB spectral distortions. I will show in particular how our new results on y distortions together with modern hydrodynamical simulations and implicit likelihood techniques can be used to constrain baryonic feedback processes in galaxy formation, and inform future analyses of large-scale structure data from e.g. Euclid. I will then discuss how the prospects for new experiments like BISOU or FOSSIL are particularly promising in light of these results.

Auteur: FABBIAN, Giulio (Institut d'Astrophysique Spatiale (IAS))

Orateur: FABBIAN, Giulio (Institut d'Astrophysique Spatiale (IAS))

Classification de Session: CMB results and analysis

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

Simons Observatory: News and Prospects

mardi 14 octobre 2025 11:50 (20 minutes)

The Simons Observatory (SO) is already taking data and moving toward full science operations with its suite of small- and large-aperture telescopes. In this talk I will present recent updates on the project and outline its scientific potential, based on new forecasts.

Auteur: M. LOUIS, Thibaut (LAL)

Orateur: M. LOUIS, Thibaut (LAL)

Classification de Session: CMB results and analysis

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

Unbiased r constraints with SMICA for future ground-based CMB B-mode polarisation observations

mercredi 15 octobre 2025 10:00 (20 minutes)

Measuring r in low SNR, foreground-dominated observations of CMB B-modes is prone to biases that are hard to avoid and estimate when the exact properties of foreground emission are not known a priori. We use SMICA to forecast constraints on r for future ground-based observations and obtain unbiased constraints for various levels of foreground complexity.

Auteurs: M. STEIER, Alexander (LBNL); DELABROUILLE, Jacques (IN2P3); Dr GHOSH, Shamik (LBNL)

Orateur: DELABROUILLE, Jacques (IN2P3)

Classification de Session: CMB results and analysis

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

Polarized emissions from the local bubble

mercredi 15 octobre 2025 09:40 (20 minutes)

We present the development of a local bubble model designed to characterize polarized Galactic foregrounds emission at high Galactic latitudes. The framework focuses on modeling the polarized dust emission (Stokes Q and U) as well as the synchrotron contribution, under the hypothesis of a magnetized local cavity surrounding the Solar neighborhood. By combining observational constraints with simplified physical hypothesis for the local magnetic field geometry and matter distribution, the model provides a physically motivated description of the polarization patterns observed in the microwave sky. This approach offers an alternative to purely empirical templates, enabling a more robust interpretation of high-latitude foregrounds and their spatial correlations. Applications to Cosmic Microwave Background (CMB) polarization studies are possible and under development, with an emphasis on reducing systematic uncertainties in the search for primordial B-modes.

Auteur: REGNIER, Mathias (IRAP)

Orateur: REGNIER, Mathias (IRAP)

Classification de Session: CMB results and analysis

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

The Atacama Cosmology Telescope sixth data release: ACT DR6

lundi 13 octobre 2025 14:00 (20 minutes)

In March 2025, the Atacama Cosmology Telescope (ACT) collaboration released its last cosmological analysis along with a new cosmic microwave background (CMB) dataset. The sixth data release (DR6), including data collected from 2017 to 2022, covers 40% of the sky at arcminute resolution providing precise maps of CMB temperature and polarization. In this talk, I will give an overview of the challenges faced during the ACT DR6 analysis and discuss our constraints on the standard model of cosmology and its extensions.

Auteur: LA POSTA, Adrien (Oxford University)

Orateur: LA POSTA, Adrien (Oxford University)

Classification de Session: Ground-based observatories

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

Modeling and Mitigating Half-Wave Plate Systematics in CMB Polarization Measurements

mercredi 15 octobre 2025 09:00 (20 minutes)

We investigate the impact of non-ideal half-wave plates (HWPs) on CMB polarization measurements in experiments such as the Simons Observatory and LiteBIRD. Because both foreground emission and instrumental effects vary with frequency, they are closely intertwined, and addressing one without the other can interfere with our estimation of cosmological parameters.

Through end-to-end simulations, we demonstrate that neglecting HWP frequency dependence produces significant polarization leakage, skewing foreground spectral parameters and leading to substantial bias in the B-mode power spectrum. We propose a JAX-based component separation framework that explicitly incorporates the non-ideal HWP response, enabling a joint treatment of instrumental effects and astrophysical components.

Auteur: TSANG KING SANG, Ema (APC-CNRS)

Orateur: TSANG KING SANG, Ema (APC-CNRS)

Classification de Session: CMB results and analysis

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

SPT-3G D1: CMB Temperature and Polarization Power Spectra and Cosmology from 2019–2020 Observations of the SPT-3G Main Field (1)

lundi 13 octobre 2025 14:40 (20 minutes)

I will present measurements of the temperature and E-mode polarization angular power spectra of the cosmic microwave background (CMB) from observations covering 4% of the sky with SPT-3G, the current camera on the South Pole Telescope. These maps are the deepest ever used in a CMB TT/TE/EE analysis. Both the maps and resulting power spectra have been rigorously validated through blind and unblind tests. Our measurements of the lensed EE and TE spectra are the most precise to date from $\ell = 1800$ to 4000 and $\ell = 2200$ to 4000, respectively. My presentation will cover the measured band powers, validation methods, data model, and cosmological implications.

Auteur: CAMPHUIS, Etienne (Institut d'Astrophysique de Paris)

Co-auteurs: KHALIFE, Ali; BALKENHOL, Lennart

Orateur: CAMPHUIS, Etienne (Institut d'Astrophysique de Paris)

Classification de Session: Ground-based observatories

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

SPT-3G D1: CMB Temperature and Polarization Power Spectra and Cosmology from 2019–2020 Observations of the SPT-3G Main Field (3)

lundi 13 octobre 2025 15:20 (20 minutes)

In the final part of this series of presentations, I will present cosmological implications from the cosmic microwave background (CMB) temperature and E-mode polarization power spectrum measurements previously introduced based on SPT-3G data. My presentation will cover the comparison and combination of the SPT data, as well as other contemporary CMB data sets, with state-of-the-art baryon acoustic oscillation measurements produced by DESI. I will close with an overview of ongoing SPT analyses and the future of the experiment.

Auteur: BALKENHOL, Lennart (Institut d'Astrophysique de Paris)

Orateur: BALKENHOL, Lennart (Institut d'Astrophysique de Paris)

Classification de Session: Ground-based observatories

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

A minimally noisy and maximally likely CMB lensing estimator

mardi 14 octobre 2025 10:50 (20 minutes)

Gravitational lensing of the Cosmic Microwave Background (CMB) is becoming one of our sharpest cosmological probes, with surveys such as SPT-3G and the Simons Observatory delivering deep polarization maps. In this talk, I will present a new optimal estimator for CMB lensing, which outperforms the widely used quadratic estimator in both accuracy and robustness. I will highlight recent advances that rely exclusively on cross-correlations between independent CMB map splits, effectively eliminating instrumental and atmospheric noise biases in the lensing power spectrum. This approach enables unbiased and nearly optimal lensing reconstruction, paving the way for precision cosmology with next-generation CMB surveys.

Auteur: LEGRAND, ll783 (DAMTP, University of Cambridge)

Orateur: LEGRAND, ll783 (DAMTP, University of Cambridge)

Classification de Session: CMB results and analysis

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

Impact of realistic noise and foregrounds on r forecasts for PICO

mardi 14 octobre 2025 15:40 (20 minutes)

The Probe of Inflation and Cosmic Origins (PICO) is a space mission submitted to the Astro2020 Decadal Review as an inflation probe. In a previous paper (Aurlien et al, 2023), the PICO team demonstrated performance based on simplifying assumptions, in particular, white homogeneous noise. We present updated r forecasts, based on end-to-end simulations, for a realistic noise including inhomogeneous sky coverage and 1/f noise, and increasing foreground model complexity.

Auteur: RUSSIER, Elisa

Co-auteurs: HENSLEY, Brandon; LAWRENCE, Charles; DELABROUILLE, Jacques; CARRON, Julien; TANG, Julien; GORSKI, Kris; REMAZEILLES, Mathieu; KESKITALO, Reijo; BELKNER, Sebastian; GHOSH, Shamik; HANANY, Shaul

Orateur: RUSSIER, Elisa

Classification de Session: Future missions

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

Probing Inflation with PICO: Iterative internal lensing reconstruction and delensing pipeline on a full-sky mission with realistic noise and foregrounds

mardi 14 octobre 2025 15:20 (20 minutes)

Unambiguously detecting the primordial gravitational waves signal requires precise subtraction of confounding foregrounds, which have much larger amplitude. One such foreground is B-modes generated by gravitational lensing of E-modes.

We validated an optimal map-based delensing pipeline on simulations, with different complexities of noise including white and 1/f noise, homogeneous and inhomogeneous sky coverage, and realistic foregrounds emissions. We compare the delensing pipeline at map-level and at power spectra level.

Auteur: TANG, Julien (LBNL/CPB)

Co-auteurs: HENSLEY, Brandon (JPL); LAWRENCE, Charles (JPL); RUSSIER, Elisa (LBNL/CPB); DE-LABROUILLE, Jacques (LBL/CPB); CARRON, Julien (University of Geneva); GORSKI, Krzysztof (JPL); RE-MAZEILLES, Mathieu (Instituto de Física de Cantabria (IFCA)); KESKITALO, Reijo (LBL); BELKNER, Sebastian (Chinese Academy of Sciences/ University of Geneva); GHOSH, Shamik (LBL); HANANY, Shaul (UMN)

Orateur: TANG, Julien (LBNL/CPB)

Classification de Session: Future missions

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

SPT-3G D1: CMB Temperature and Polarization Power Spectra and Cosmology from 2019–2020 Observations of the SPT-3G Main Field (2)

lundi 13 octobre 2025 15:00 (20 minutes)

In the second part of this talk, I will first briefly present the lensing bandpowers used in this analysis. These are lensing data inferred from the E-mode polarization maps using the Marginal Unbiased Score Estimator (MUSE), and they are the most precise to date at $L > 350$. Second, I will present constraints on ΛCDM and a few of its extensions with CMB data, highlighting the constraining power of ground-based experiments SPT-3G and ACT. I will show the consistency between SPT-3G, ACT and Planck in constraints on ΛCDM and the status of the Hubble tension and clustering of matter. I will also compare constraints on the excess of lensing previously seen in Planck data to that from SPT-3G and in combination with ACT. I finish by presenting constraints on neutrino mass and additional relativistic species from the CMB.

Auteur: Dr CAMPHUIS, Etienne (IAP-CNRS and Sorbonne University)

Co-auteurs: KHALIFE, Ali Rida (IAP-CNRS and Sorbonne University); Dr BALKENHOL, Lennart (IAP-CNRS and Sorbonne University)

Orateur: KHALIFE, Ali Rida (IAP-CNRS and Sorbonne University)

Classification de Session: Ground-based observatories

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

Semi-blind component separation for measuring the CMB B-mode polarization

mercredi 15 octobre 2025 10:20 (20 minutes)

The LiteBIRD satellite mission, an international collaboration led by the Japanese space agency (JAXA), aims to measure the CMB B-mode polarization with high precision, utilizing high-sensitivity instruments and large sky coverage to constrain the tensor-to-scalar ratio with unprecedented precision. The main difficulty in measuring this component lies first in its extremely small amplitude, especially compared to polarized astrophysical foregrounds. One notable component separation method is Spectral Matching Independent Component Analysis (SMICA), a semi-blind method relying on statistical independence of the components to effectively separate them. The method has proven to be successful, being the reference method of component separation in measuring CMB temperature with the Planck mission. The present work revolves around adapting this component separation method to the context of polarization measurement with a satellite mission, specifically for the faint B-mode signal. In this regime, the variation of the spectral properties of the foreground components across the sky is extremely significant, complexifying the problem and requiring novel techniques to counteract. The presentation will feature the ongoing development of the method, along with the current expected performance when applied to the nominal LiteBIRD configuration.

Auteur: TRAN, Hoang Viet (APC, Université Paris Cité)

Orateur: TRAN, Hoang Viet (APC, Université Paris Cité)

Classification de Session: CMB results and analysis

ID de Contribution: **18** Type: **Non spécifié**

Low-noise, high angular resolution dust polarization maps using scattering transforms on Planck multifrequency data

mercredi 15 octobre 2025 12:20 (20 minutes)

Accurate statistical characterization of Galactic foregrounds is crucial for extracting cosmological information from CMB polarization data. However, the complexity of the interstellar medium leads to non-Gaussian structures that cannot be fully captured by traditional summary statistics, like the power spectrum. On the other hand, simulation and machine-learning approaches, while informative, face limitations: the former rely on simplifying physical assumptions, and the latter require large volumes of realistic training data that are in general not available. Further complicating the problem, polarized foregrounds are never observed in isolation but are always mixed with nuisance signals, including the CMB and instrumental noise.

A promising alternative to traditional methods for the statistical characterization and modeling of the Galactic polarized foregrounds is provided by scattering transforms (ST). These are a mathematically grounded set of summary statistics that efficiently capture multiscale, non-Gaussian features of complex physical fields and can be robustly estimated from limited data.

In this talk, we will discuss recent progress in applying ST to Planck data in order to separate the Galactic polarized foregrounds from the CMB and instrumental noise. Crucially, we will show some first steps in using information across multiple frequency channels, and we will present maps of Galactic polarized foregrounds separated from CMB and instrumental noise. These results highlight the potential of ST in exploiting both spatial and spectral information in the task of Galactic polarized foreground modeling, laying the groundwork for a more complete generative modeling approach, that could subsequently be applied to more recent data, such as ACT, SPT, or SO.

Auteur: Dr TSOUROS, Alexandros (LPENS Paris)

Co-auteurs: Prof. ALLYS, Erwan (LPENS Paris); Prof. BOULANGER, Francois (LPENS Paris); Prof. DELABROUILLE, Jacques (Lawrence Berkeley National Laboratory); Mlle RUSSIER, Elisa (Lawrence Berkeley National Laboratory)

Orateur: Dr TSOUROS, Alexandros (LPENS Paris)

Classification de Session: CMB results and analysis

ID de Contribution: **19** Type: **Non spécifié**

Enhancing Euclid science through cross-correlation with CMB lensing

mardi 14 octobre 2025 11:30 (20 minutes)

Combining CMB and large-scale structure (LSS) data allows us to probe cosmic evolution from recombination to the present, constraining the amounts of baryonic and dark matter and testing general relativity on cosmological scales, as well as shedding light on the nature of dark energy. In this talk, I present preliminary results from the clustering analysis of a magnitude-limited galaxy sample from the Euclid Q1 data release, and its cross-correlation with CMB lensing convergence maps from Planck and the Atacama Cosmology Telescope (ACT). These findings demonstrate the remarkable potential of the Euclid survey to deliver precise cosmological constraints in forthcoming releases, and highlight how cross-correlation with CMB probes can yield robust results that overcome the limitations of auto-correlation analyses of dense galaxy samples.

Auteur: Dr LEMBO, Margherita (Institut d'Astrophysique de Paris (IAP))

Orateur: Dr LEMBO, Margherita (Institut d'Astrophysique de Paris (IAP))

Classification de Session: CMB results and analysis

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

Solving Bayesian imaging inverse problem with scattering transform : application to instrumental decontamination

mercredi 15 octobre 2025 12:40 (20 minutes)

Extracting a signal of interest (LSS, CMB, Galactic emission⋯) from contaminated observations is a central challenge in many astrophysical and cosmological analysis. However, instrumental systematics, Galactic foregrounds or other contaminants usually makes the forward process stochastic and non-invertible, leaving the inverse problem ill-posed. A probabilistic framework is therefore required to recover a distribution of signals compatible with the observed data. In a Bayesian setting this require to introduce a prior distribution for the signal of interest. However, specifying a physically-driven prior of complex non-gaussian processes is often difficult. In this work, we propose to use a maximum entropy generative model parametrised by scattering transform (ST) statistics for the signal of interest. Leveraging these ST-based generative models, we develop an iterative algorithm to estimate a posterior distribution of maps which are solution of the inverse problem. We validate our approach on large-scale structure, weak lensing and turbulence fields, under a challenging forward model including noise, beam, and masks. We show that our approach recovers key astrophysical statistics like the power spectrum, one point PDF and Minkowski functionals.

Auteurs: TSOUROS, Alexandros (LPENS); ALLYS, Erwan (LPENS); PIERRE, Sébastien (LPENS)

Orateur: PIERRE, Sébastien (LPENS)

Classification de Session: CMB results and analysis

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

SZ power spectrum status

Planck has been producing the first tSZ power spectrum estimate from “all-sky” y-map in 2013. New estimates has been produced from updates of the ymap in parallele to estimation derived from the CMB data analyses by Planck, ACT and SPT. The latter just released there last results in the last month. I will review the different (sometimes in tension) signal estimates (and analyses they are derived from) as well as the ingredients of the modelling of the signal with emphasis on the “baryonification effect”. A bit more than 10 years after the Planck tSZ spectrum release this will make a census of where we stand, waiting for the next generation experiments.

Auteur: DOUSPIS, Marian (IAS)

Orateur: DOUSPIS, Marian (IAS)

Classification de Session: CMB results and analysis

ID de Contribution: **22** Type: **Non spécifié**

The BISOU optical concept design

mardi 14 octobre 2025 14:20 (20 minutes)

The last and only measurement of the CMB spectrum was performed by COBE-FIRAS in 1991, showing that it is close to a perfect blackbody emission. However, deviations referred to as CMB spectral distortions are expected. Due to its limited sensitivity, FIRAS could only give upper limits, leading to new space missions being proposed to perform this measurement. The balloon-borne mission BISOU (Balloon Interferometer for Spectral Observations of the primordial Universe) will serve as a pathfinder, performing the first detection of the y-parameter distortion, while also establishing the measurement concept. During BISOU CNES Phase A, a laboratory breadboard of the instrument is being developed at the Institut d'Astrophysique Spatiale (IAS). It will enable us to study the various subsystems and to characterize systematic effects of this new concept, particularly of the optical system.

This presentation outlines the optical modeling process of the BISOU instrument. I will begin with an overview of the optical concept of its Fourier Transform Spectrometer (FTS), followed by the first overall configuration based on geometric optics. The design was refined and optimized through iterations using Gaussian beam propagation, enabling more realistic modeling of the instrument's optical performance. The outcome is an optical configuration that incorporates key constraints such as size and thermo-mechanical limitations. I will present the current concept and the simulation results concerning the co and cross polarisation beam performance, including the ellipticity, together with the remaining steps required to finalize the design and prepare for the associated breadboard implementation.

Auteur: LOQUET LE GALL, Morgane (IAS)

Co-auteurs: Prof. MAFFEI, Bruno (Institut d'Astrophysique Spatiale); FOR THE BISOU COLLABORATION

Orateur: LOQUET LE GALL, Morgane (IAS)

Classification de Session: Future missions

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

CMB Applications of FURAX

mercredi 15 octobre 2025 11:20 (20 minutes)

I will present three applications of FURAX, a JAX-powered, open-source framework designed for modular and efficient CMB data analysis. First, I will discuss mapmaking—the conversion of time-ordered data into sky maps—with an emphasis on strategies to mitigate systematic effects. Second, I will show how FURAX enables robust component separation in the map domain, extracting CMB signals from sky maps while accounting for the spatial variability of foreground contaminants. Finally, I will demonstrate how to use FURAX to perform time-domain component separation by reconstructing atmospheric emission maps from CMB observations. The talk will be accompanied by tutorial notebooks to support hands-on exploration.

Auteur: SOHN, Wuhyun (APC / CNRS)

Orateur: SOHN, Wuhyun (APC / CNRS)

Classification de Session: CMB results and analysis

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

TES proton irradiation result analysis for future space applications

mercredi 15 octobre 2025 09:20 (20 minutes)

Planck-HFI highly sensitive bolometers were considerably affected by cosmic-rays, producing spurious signals appearing as glitches in the raw astrophysical data. Since, the effect of cosmic rays on detectors is a major concern for future similar space missions. Their instruments will have a larger detection surface, an increased sensitivity, and much more stringent requirements on the suppression of systematic effects. To study the impact of cosmic rays on detector prototypes in operational conditions, IAS has designed a state-of-the-art cryogenic system to irradiate particles by coupling this facility to particle accelerators. An irradiation campaign has been carried out on LiteBIRD-HFT TES prototypes to study their response to particle hits. We present the results and the analysis of this first test campaign.

Auteur: BESNARD, Anaïs (Institut d'Astrophysique Spatiale (IAS))

Co-auteurs: Prof. MAFFEI, Bruno (IAS); Dr SAUVAGE, Valentin (IAS)

Orateur: BESNARD, Anaïs (Institut d'Astrophysique Spatiale (IAS))

Classification de Session: CMB results and analysis

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

Searching for Parity Violation in the CMB Bispectrum

lundi 13 octobre 2025 18:30 (20 minutes)

Claims have appeared in the literature of a statistically significant signal of parity violation in higher-order correlation functions from galaxy surveys. I will present some estimators of parity violation for the CMB bispectrum.

Auteur: Dr BUCHER, Martin (APC)

Orateur: Dr BUCHER, Martin (APC)

Classification de Session: CMB results and analysis

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

Constraining the full mass distribution of Planck protocluster candidates with CMB lensing

mardi 14 octobre 2025 09:00 (20 minutes)

Context
Galaxy clusters in formation, or protoclusters, are important sites regarding the star formation history and the evolution of large scale structures, but only their galaxy members have been observed so far. The majority of their mass is expected to be under the form of non baryonic dark matter and intergalactic cold gas.

Aims
The Planck high redshift star-forming fields sample recenses 2151 candidates, among which 1012 fall within the footprint of the Atacama Cosmology Telescope (ACT). The lensing of the Cosmological Wave Background (CMB) by foreground structures allows us to monitor the entire mass distribution of protoclusters for the very first time.

Methods
We use the CMB lensing data from ACT to obtain a mean surface density for the Planck protocluster sample. We then infer the best-fitting parameters for the Navarro-Frenk-White and Einasto density profiles and compute R₂₀₀, an approximation for the virial radius.

Results
The integration of the mass along the line of sight yields values between 1.6 and 1.9 10¹⁵ solar masses. The Einasto model fits the surface density profile better and the corresponding R₂₀₀ values are found to be quite low compared to that of galaxy clusters, which can be interpreted as a sign that these structures are far from being virialised.

Conclusions
We present new arguments showing that the Planck high redshift sample is composed of protoclusters by tracking their full mass for the first time. We also provide estimations for their mean R₂₀₀ without using the virial theorem and find evidence that these protoclusters are mainly out of equilbirium.

Auteur: DUSSERRE, Tanguy (Institut d'Astrophysique Spatiale)

Orateur: DUSSERRE, Tanguy (Institut d'Astrophysique Spatiale)

Classification de Session: CMB results and analysis

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

Updating the mass calibration of the Planck cluster sample

mardi 14 octobre 2025 09:20 (20 minutes)

The second Planck catalogue of Sunyaev-Zeldovich sources (PSZ2) was originally presented by the Planck Collaboration as part of their 2015 data release. Along with the catalogue, a cosmological analysis was also published, conducted on the PSZ2 cosmological sample that contains 439 high signal-to-noise cluster candidates. However, this analysis was limited by the precision of its mass calibration, i.e. the relation between the measured observable, in this case the Sunyaev-Zeldovich (SZ) signal, and the underlying halo mass, an essential step to compare detected cluster counts with theoretical predictions of cluster abundance. The mass calibration was done with a scaling relation between SZ signal and hydrostatic mass derived with X-ray data, which was then corrected with the introduction of a hydrostatic mass bias calibrated with weak-lensing (WL) data. In this talk, I present the cosmological constraints we obtained with updated mass calibrations, using a larger X-ray sample and either a larger pointed WL observation sample or wide-field Dark Energy Survey (DES) shear data. I will compare these constraints with various other cosmological studies, with a particular focus on comparing the constraints derived with DES data with recent South Pole Telescope and eROSITA studies sharing the same mass calibration.

Auteur: AYMERICH, Gaspard (Institut d'Astrophysique Spatiale, Université Paris-Saclay)

Orateur: AYMERICH, Gaspard (Institut d'Astrophysique Spatiale, Université Paris-Saclay)

Classification de Session: CMB results and analysis

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

Simons Observatory's Small Aperture Telescopes : Updates on the survey and data analysis pipeline

mardi 14 octobre 2025 12:10 (20 minutes)

The Simons Observatory (SO) is an ensemble of telescopes located in the Atacama Desert in Chile, targeting the detection of primordial B-modes in the polarization of the cosmic microwave background (CMB). The Small Aperture Telescopes (SATs) have been taking data for over a year and have already delivered their first CMB maps, which are currently under analysis. In this talk, we will present the first SAT maps and provide an update on the current status of the survey and data analysis challenges, focusing on our filter+bin map-making and on Megatop, one of the pipelines being developed within the collaboration to go from the maps to r.
[complementary to Thibaut Louis' talk]

Auteurs: VILLARRUBIA AGUILAR, Amalia (APC); MASSON, Pierre (APC)

Orateurs: VILLARRUBIA AGUILAR, Amalia (APC); MASSON, Pierre (APC)

Classification de Session: CMB results and analysis

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

LiteBIRD status

mardi 14 octobre 2025 15:00 (20 minutes)

I will present the current status of the LiteBIRD JAXA mission, after it entered in reformation period since September 2024, and recently went through a key review at JAXA in September 2025.

Auteur: MONTIER, Ludovic (IRAP)

Orateur: MONTIER, Ludovic (IRAP)

Classification de Session: Future missions

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

Discussion

mardi 14 octobre 2025 17:10 (1h 50m)

Panelists: N. Aghanim, J. Delabrouille, J. Errard, S. Galli, L. Montier

Auteurs: DELABROUILLE, Jacques (LBL/CPB); ERRARD, Josquin (APC / CNRS); MONTIER, Ludovic (IRAP); AGHANIM, Nabila (Institut d'Astrophysique Spatiale); GALLI, Silvia (IAP)

Classification de Session: future of CMB observations (discussion)

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

Towards de-lensing of BICEP with SPT-3G

mardi 14 octobre 2025 11:10 (20 minutes)

The tightest constraints on the tensor-to-scalar ratio (BK18) are strongly limited by gravitational lensing, which can be reduced by high-resolution SPT-3G observations. SPT-3G and BICEP (SPO) have collected now enough data to achieve, in principle, 3 times better constraints on r than currently published (sigma(r) \sim 0.003 vs 0.009 now)), thanks to de-lensing. I'll discuss initial lensing work on these extremely deep maps towards this objective.

Auteur: CARRON, Julien (University of Geneva)

Orateur: CARRON, Julien (University of Geneva)

Classification de Session: CMB results and analysis

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

Optimisation and Forecasting Studies for CMB Spectral Distortion Experiments

mardi 14 octobre 2025 14:40 (20 minutes)

In the 1990s, the COBE/FIRAS mission measured the Cosmic Microwave Background (CMB) spectrum and demonstrated that its spectral energy distribution is extremely close to a perfect blackbody. However, theory shows that tiny departures from a black body are expected at the level of $\Delta I/I \simeq 10^{-5}$, known as spectral distortions. The two main types of CMB spectral distortions are the y-distortion, arising from energy release in the optically thin regime at redshifts $z < 5 \times 10^4$, and the chemical potential or μ-distortion, imprinted in the optically thick regime at $z > 5 \times 10^4$. Measuring these faint signals is challenging, but it will provides unique access to the thermal history of the Universe, from the very early Universe to now, which cannot be extracted in any other way.

High-precision spectroscopy of the CMB is one of the three themes selected by the ESA Voyage 2050 programme. Since 2011, several dedicated space missions have been proposed, including PIXIE, PRISTINE, and FOSSIL. In addition, balloon-borne experiments such as BISOU are being considered as pathfinders for a future space mission targeting CMB spectral distortions.

I will present the latest optimisation of the instrument and forecasting studies of the BISOU (CNES Phase A) and FOSSIL (ESA M8 proposal) instruments, both dedicated to measuring CMB spectral distortions. Fisher forecasts and optimisation of instrument design and mission parameters (frequency range, scanning strategy, mission duration, etc.) are performed by combining the outputs of two complementary models: a versatile photometric model based on key instrument subsystem choices and parameters, and a sky emission model that accounts for spatially varying foregrounds across the frequency range relevant to CMB spectral distortions.

Auteur: COULON, Xavier (IAS)

Co-auteurs: Prof. MAFFEI, Bruno (IAS); Dr AGHANIM, Nabila (IAS)

Orateur: COULON, Xavier (IAS)

Classification de Session: Future missions

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

Non-Gaussianity in multidetector component separation

lundi 13 octobre 2025 18:10 (20 minutes)

SMICA (Spectral Matching Independent Component Analysis) is a non-parametric method (Delabrouille et al. 2003; Cardoso et al. 2008) that operates in the spherical harmonic domain. It relies on the assumptions of statistical isotropy and Gaussianity of the signals. In this work, we relax the Gaussianity assumption to allow for weak non-Gaussianity, including three-point correlation functions of the foreground components. This extension enables the construction of an f_NL estimator directly in frequency space, effectively shifting bispectrum analysis to the component separation step.

Auteur: CITRAN, Michele (APC, IJCLab)

Orateur: CITRAN, Michele (APC, IJCLab)

Classification de Session: CMB results and analysis

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

Furax: A Unified Framework for CMB Data Analysis with JAX

mercredi 15 octobre 2025 11:00 (20 minutes)

We present Furax, a Python library for solving inverse problems in astrophysical and cosmological data analysis, with focus on CMB observations.

Why JAX? JAX provides JIT compilation, automatic differentiation, and seamless GPU/TPU parallelization essential for large-scale matrix operations in CMB analysis. Its functional programming paradigm enables efficient, composable linear operators.

Why Furax? Modern CMB pipelines require high-performance linear algebra and sophisticated optimization algorithms. Furax provides high-level abstractions while maintaining computational efficiency, with seamless integration into existing tools (TOAST, SOTODLib, Pixell).

What Furax provides: A comprehensive suite of linear operators (block-diagonal, Toeplitz, HEALPix projections), robust mapmaking with preconditioning, observation operators (HWP, polarizers), and component separation methods. The modular architecture enables flexible composition of complex analysis pipelines.

Auteur: CHANIAL, Pierre (APC)

Co-auteurs: SOHN, Wuhyun (APC); BIQUARD, Simon (APC); KABALAN, Wassim (APC); BASYROV, Artem (APC)

Orateur: CHANIAL, Pierre (APC)

Classification de Session: CMB results and analysis

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

Towards the measurement of spectral distortions from space: from BISOU to FOSSIL

mardi 14 octobre 2025 14:00 (20 minutes)

Both standard and non-standard physics processes inevitably lead to distortions of the CMB blackbody shape. They provide a unique opportunity to reveal a novel tracer of the early Universe, particle physics and structure formation. The presentation will cover some of the ongoing efforts in BISOU (Cnes Balloon project) and FOSSIL (ESA M8 proposal) to design and fly a future satellite aimed at achieving an unprecedented leap forward in sensitivity, allowing us to detect these spectral distortions. Latest updates on the status of the ESA M8 proposal for spectral distortions FOSSIL will be provided.

Auteur: AGHANIM, Nabila

Co-auteurs: MAFFEI, Bruno; BISOU & FOSSIL, collaborations

Orateur: AGHANIM, Nabila

Classification de Session: Future missions

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

KAIROS

mardi 14 octobre 2025 16:50 (20 minutes)

The proposal to build a high-frequency Small Aperture Telescope (SAT) as a new component of the Simons Observatory has gained increasing momentum over the recent years. This initiative, named KAIROS, is under evaluation for funding through the CNRS RI² program ("Recherche à risque et à impact"), with the backing of three CNRS institutes: IN2P3, INSU, and INP.

KAIROS aims to deploy a focal plane of approximately 30,000 LEKID detectors, covering two polarization-sensitive frequency bands above 200GHz. The French collaboration will take responsibility for the full development of all instrumental subsystems.

By extending the Simons Observatory's frequency coverage into the high-frequency regime, KAIROS will significantly enhance our ability to map the polarized emission from interstellar dust, one of the main foregrounds obscuring the primordial CMB B-mode signal. This improved characterization of galactic dust contamination is essential for pushing the limits of inflationary cosmology.

We will present an overview of the proposed instrument concept and its anticipated scientific impact within the broader Simons Observatory framework.

Auteur: Dr ERRARD, Josquin (APC / CNRS)

Orateur: Dr ERRARD, Josquin (APC / CNRS)

Classification de Session: Future missions

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

Recovering unbiased CMB polarization maps using modern ground-based experiments

mercredi 15 octobre 2025 12:00 (20 minutes)

Based on https://arxiv.org/abs/2509.16302

Auteur: BIQUARD, Simon (APC / CNRS)

Orateur: BIQUARD, Simon (APC / CNRS)

Classification de Session: CMB results and analysis

ID de Contribution: **39** Type: **Non spécifié**

Astrophysical Constraints from the kSZ

mardi 14 octobre 2025 09:40 (20 minutes)

High-precision observations of the Cosmic Microwave Background (CMB) will yield improved measurements of the kinetic Sunyaev–Zel'dovich (kSZ) effect. In order to investigate the sensitivity of the kSZ signal to astrophysics, we build a neural-network emulator of the kSZ power spectrum, trained on the LoReLi II reionisation simulations, to enable fast inference of galaxy properties during reionisation. Forecasts with mock observations show that Stage V experiments, like CMB-HD, can constrain both the gas conversion timescale and ionising escape fraction parameters, while constraints on the minimum halo mass are less precise. Crucially, our method yields an independent estimate of the CMB optical depth with uncertainties about twice as small as Planck. These results establish the kSZ power spectrum as a powerful probe of reionisation-era astrophysics and a complementary route to measuring the optical depth.

Auteur: Dr MC BRIDE, Lisa (Institut d'Astrophysique Spatiale)

Orateur: Dr MC BRIDE, Lisa (Institut d'Astrophysique Spatiale)

Classification de Session: CMB results and analysis

ID de Contribution: **41** Type: **Non spécifié**

DESI DR2

lundi 13 octobre 2025 16:50 (20 minutes)

Orateur: BURTIN, Etienne (IRFU/CEA - Université Paris-Saclay)

Classification de Session: CMB results and analysis

ID de Contribution: **43** Type: **Non spécifié**

Combining Planck, SPT and ACT

lundi 13 octobre 2025 17:30 (20 minutes)

We present a coherent cosmological analysis that combines data from the Planck satellite, the Atacama Cosmology Telescope (ACT), and the South Pole Telescope (SPT). We construct a unified likelihood that jointly fits temperature and polarization power spectra from all three datasets, implementing consistent modeling of Galactic and extragalactic foregrounds as well as instrumental systematics. This approach reduces reliance on external priors and improves the robustness of parameter estimation. In particular, the joint framework delivers tighter constraints on ΛCDM parameters, improving precision by up to ~ 20% relative to Planck alone. We further show that both ΛCDM and simple model extensions remain highly robust against variations in astrophysical foreground assumptions, and that several previously reported tensions (such as the preference for nonzero curvature, $A_L > 1$, or inconsistencies in τ between TT and low-ℓ EE) are significantly reduced or eliminated. Overall, this work demonstrates the feasibility and robustness of combining the three major CMB datasets, and highlights the central role of foreground modeling for the science goals of upcoming high-sensitivity CMB surveys

Auteur: TRISTRAM, Matthieu (IJCLab, CNRS)

Orateur: TRISTRAM, Matthieu (IJCLab, CNRS)

Classification de Session: CMB results and analysis

ID de Contribution: **44** Type: **Non spécifié**

CMB + BAO + SN: Bayesian Model Comparisons and Cross-Dataset Tensions

lundi 13 octobre 2025 17:10 (20 minutes)

We present a unified assessment of Bayesian model comparisons and cross-dataset tensions for the (still) standard ΛCDM model and some minimal extensions (curvature Ω_K, sum of neutrino masses $\sum m_\nu$, dynamic dark energy w, or w_0 and w_a) in light of data from the cosmic microwave background (CMB), baryon acoustic oscillations (BAO), and supernovae (SN). Our analysis highlights how specific combinations drive or relieve tensions.

Auteur: Dr HERGT, Lukas (IJCLab, IN2P3, CNRS)

Co-auteurs: Dr HENROT-VERSILLÉ, Sophie (IJCLab, IN2P3, CNRS); Dr TRISTRAM, Matthieu (IJCLab, IN2P3, CNRS); SCOTT, Douglas (UBC)

Orateur: Dr HERGT, Lukas (IJCLab, IN2P3, CNRS)

Classification de Session: CMB results and analysis

ID de Contribution: **46** Type: **Non spécifié**

Cosmology with KiDS-Legacy

lundi 13 octobre 2025 16:30 (20 minutes)

The fifth (and final) data release of the Kilo-Degree Survey (KiDS) provides significantly more than just an increase in survey area. Instead, additional observations couple with improvements in data quality, data reduction, and value-added data-products, to make KiDS-DR5 the most robust and reliable release produced by KiDS to date. We leverage the lensing sample from this state-of-the-art dataset (called KiDS-Legacy) to perform the most robust and precise analysis of cosmic shear to date, finding KiDS-Legacy to be wholly consistent with the results from the Planck Cosmic Microwave Background (CMB) analyses. This talk will discuss how this dataset differs with respect to previous KiDS releases, and focus in particular on how these differences have influenced the analysis of cosmic shear with KiDS-Legacy. I will discuss the causes of systematic variation in the parameter constraints that we observe between KiDS data releases, and discuss the implications that these systematic effects have for future analyses of cosmic shear, and how their role in the agreement between KiDS and the CMB analyses of Planck, ACT, and SPT.

Auteur: WRIGHT, Angus (Ruhr University Bochum)

Orateur: WRIGHT, Angus (Ruhr University Bochum)

Classification de Session: CMB results and analysis

ID de Contribution: **48** Type: **Non spécifié**

Projected-fields kSZ estimator

mardi 14 octobre 2025 10:00 (20 minutes)

In this talk, I will present the projected-fields kSZ estimator, where the kSZ signal is squared before cross-correlating it with a LSS field to avoid the cancellation of the signal due to electron velocity, which is equally likely to be positive or negative. Crucially, this estimator does not require spectroscopic redshift information.
I will discuss new developments on the projected-fields estimator, namely the halo-model implementation, improved theoretical modeling, comparison to simulations, and bias-hardening of the estimator.

Auteur: KUSIAK, Ola (Cambridge)

Orateur: KUSIAK, Ola (Cambridge)

Classification de Session: CMB results and analysis