Elbereth conference 2022

mercredi 23 mars 2022 - vendredi 25 mars 2022

Observatoire de Meudon

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Welcome speech

Talk / 78

Detecting the day-side emission of the temperate rocky exoplanet TRAPPIST-1b

Auteur: Achrène Dyrek[1]

Co-auteurs: Elsa Ducrot [2]; Giuseppe Morello [3]; Pierre-Olivier Lagage [2]

[1] *CEA Saclay*

[2] *CEA*

[3] *IAC*

Auteur correspondant achrene.dyrek@cea.fr

The TRAPPIST-1 (T-1) planets are among the most promising candidates for the first detailed study of temperate terrestrial exoplanets with the James Webb Space Telescope (JWST). CEA is leading a guaranteed-time observation (GTO) program that is dedicated to the observation of 5 occultations of T-1b with the Mid-Infrared Instrument (MIRI) at 12.8 µm (ID: 1279), paired with a similar program at 15 µm (ID: 1177). The reason that motivates these GTOs lays in the fact that T-1b is believed to have a day-side thermal emission large enough to be detected through the observation of a few occultations with MIRI, which could bring key insights into the existence of an atmosphere. In the past, detection of T-1b's occultations was attempted with Spitzer/IRAC, but inconclusive (Ducrot el al. 2020). In this talk, we (1) introduce our pipeline specially designed to analyse photometric time series data, (2) show its feasibility on existing Spitzer observations of bright sources, and (3) move on fainter sources to show its outcomes on realistic simulations of T-1b with JWST/MIRI for different planet properties. To detect low significance signals such as occultations (expected ⊠ 150 ppm for T-1b) our pipeline is based on a Blind source separation (BSS) method. First, we analyse the phase-curves of two hot Jupiters, WASP-12b and WASP-18b, obtained from 190 hours of observations with Spitzer at 3.6 and 4.5 µm. This consists of applying aperture photometry, followed by a wavelet transform to get time and frequency observations scales, and then an Independent Component Analysis (ICA) in the wavelet domain to get rid of the high-frequency scatter (Waldmann et al., 2014, Morello et al., 2015). ICA maximizes the different components non-gaussianity (Stone et al., 2004) (ie. minimizes the negentropy) which is convenient for Spitzer/IRAC as highly non-gaussian systematics is optimal for component separation. Hence we derive an updated upper-constraint on the brightness temperature of the planets. Then, to prepare for GTOs 1279&1177 observations, we test our pipeline on 5 simulated occultations of T-1b at 12.8 and 15 µm. These are made by creating realistic time series observations (Martin-Lagarde et al., 2020), adding detector noises, non-linearities (Klaassen et al., 2021) and temporal drifts (Martin-Lagarde et al.,2020). Data reduction is done using the STScI pipeline. Finally, we compare the outcomes from our BSS approach to a more standard method using parametric noise models. We show that we detect the occultation of T-1b at least at 3σ in both wavelengths for a day-side temperature of 400 K.

Field:

Planetology (including small bodies and exoplanets)

Day constaints:

Can I make the presentation on Wednesday? I teach on Thursdays and Fridays therefore I can not attend the conference on those days.

Talk / 68

A Radio Source-Tracker

Auteurs: Baptiste Cecconi[1]; Erwan Rouille[2]; Boris Segret[3]

[1] *Observatoire de Paris*

[2] *LESIA*

[3] *CENSUS*

Auteur correspondant erwan.rouille@obspm.fr

The development of satellite swarm technology offers new possibilities for space studies and comes with new challenges. Among them is the need of knowledge on the swarm topology and attitude, especially in the context of space based radio interferometry. This paper presents an algorithm that recovers the absolute swarm attitude without the help of external systems such as GNSS (Global Navigation Satellite Systems). This algorithm uses the imaging capability of a low frequency radio interferometer in order to function like a star-tracker using the main radio sources in the sky. The *Lost-In-Space* (LIS) mode is presented in this paper. The *Tracking* mode is yet to be developed. This algorithm is studied
through numerical simulations.
This concept is applied here to the kilometric wavelength spectral range (30kHz-1MHz) but the technique can be expanded to higher frequencies.

Images are reconstructed using an iterative Discrete Fourier Transform (DFT) at two frequencies and using source subtractions. Pattern-matching is run with a voting system implemented on geometrical parameters defined by triangles of sources. The radio sky at low frequency is modelled by extrapolating from sky observed at 50 MHz. Also, the modelled interferometer corresponds to the NOIRE (Nanosatellites pour un Observatoire Interferométrique Radio dans l'Espace) concept study. The accuracy on the recovered swarm attitude is measured for different levels of noise in the interferometric visibilities.

The simulation shows that, under some hypothesis, the suggested pipeline can achieve an attitude knowledge error lower than 1 arcmin for a swarm scale of 100 km. The requirements in terms of memory and computation capability are discussed as well as the limitations of the technique and the simulation.

Field:

Instrumentation

Day constaints:

Talk / 71

When being super makes you too strong for the job: how the super-Eddington regime regulates black hole growth in high-redshift galaxies

Auteur: Warren Massonneau[None]

Co-auteurs: Marta Volonteri ; Yohan Dubois [1]; Ricarda, S. Beckmann

[1] *Institut d'Astrophysique de Paris*

Auteur correspondant warren.massonneau@iap.fr

Super-Eddington accretion is one scenario that may explain the rapid assembly of ~ $10^9\,M_\odot$ supermassive black holes (BHs) within the first billion year of the Universe. This critical regime is associated with radiatively inefficient accretion and accompanied by powerful outflows in the form of winds and jets. By means of hydrodynamical simulations of BH evolution in an isolated galaxy and its host halo with 12 pc resolution, we investigate how super-Eddington feedback affects the mass growth of the BH. It is shown that super-Eddington feedback efficiently prevents BH growth within a few Myr. The super-Eddington accretion events remain relatively mild with typical rates of about 2-3 times the Eddington limit, because of the efficient regulation by jets in that regime. We find that these jets are powerful enough to eject gas from the centre of the host galaxy all the way up to galactic scales at a few kpc, but do not significantly impact gas inflows at those large scales. By varying the jet feedback efficiency, we find that weaker super-Eddington jets allow for more significant BH growth through more frequent episodes of super-Eddington accretion. We conclude that effective super-Eddington growth is possible, as we find that simulations with weak jet feedback efficiencies provide a slightly larger BH mass evolution over long periods of time (~ 80 Myr) than that for a BH accreting at the Eddington limit.

Field:

Compact objects (supernovae, black holes, neutron stars)

Day constaints:

I'd prefer to do the talk in the first two days.

Talk / **83**

Extending marginalized blind deconvolution of AO corrected astronomical images with MCMC methods

Auteur: Alix YAN[None]

Auteur correspondant alix.yan@onera.fr

Adaptive optics (AO) corrected image restoration is particularly difficult, suffering from the lack of knowledge on the point spread function (PSF) in addition to usual difficulties. An efficient approach is to marginalize the object out of the problem and to estimate the PSF and (object and noise) hyperparameters only, before deconvolving the object using these estimations. Recent works have applied this marginal blind deconvolution method, combined to a parametric model of the PSF, to a series of AO corrected astronomical and satellite images. Our work extends it thanks to Markov chain Monte Carlo (MCMC) methods to include error bars on the estimated PSF parameters as well as on object and noise hyperparameters. Finally, we present the obtained results on simulated and experimental astronomical images.

Field:

Not in the above

Day constaints:

Not available on Friday, 25th

Talk / **91**

ANALYSIS OF ORGANIC MATTER AND MINERAL PHASES IN CM CHONDRITES BY TOF-SIMS COUPLED WITH IMAGING

Auteur: Yann Arribard[1]

[1] *IAS*

Auteur correspondant yann.arribard@universite-paris-saclay.fr

The study of CM chondrites allows to obtain information from the first steps of the Solar System history and so better understand the origin of the organic matter. The aim of this study is to determine how the organic compounds structure varies and how they are related to the mineral phases depending on the hydrothermal alteration of the chondrites.
I will present Time Of Flight Secondary Ion Mass Spectrometry (TOF-SIMS) analysis coupled with imaging of slices of different chondrites: Cold Bokkeveld (CM2.2) and Paris (CM2.7-2.9). TOF-SIMS give the atomic and molecular composition, the structure of the organic and mineral phases and thanks to the imaging, the co-localization of those phases. I will focus on the distribution of the different organic families in the samples and their structural properties. Those results will be compared to previous InfraRed (IR) reflectance hyperspectral imaging and Raman analysis.

Field:

Planetology (including small bodies and exoplanets)

Day constaints:

Talk / 94

Title : Global three-dimensional draping of magnetic field lines in Earth's magnetosheath from in-situ measurements

Auteur: bayane Michotte de Welle[1]

[1] *LPP*

Auteur correspondant bayane.michotte-de-welle@lpp.polytechnique.fr

Understanding where the magnetic reconnection occurs at the Earth's magnetopause is one of the important remaining questions about this phenomena. Since the last decades various models predicting the position of the X-line have been made. These models largely depend on the orientation of the magnetic field in the magnetosheath close to the magnetopause, such as the Maximum Magnetic Shear model (Trattner et al 2007). Therefore understanding how it is structured as a function of the solar wind and interplanetary magnetic field is of pivotal importance. Machine learning was used to collect around 45 million measurements in the magnetosheath at 5s resolution in all available Cluster, MMS, Double Star, THEMIS dataset, and to build detailed maps of the field structure in that region as a function of the IMF orientation. It allowed us to reconstruct for the first time the three dimensional magnetic field draping in the dayside magnetosheath from in-situ data only. Our results reveal how the frozen-in condition constrains the draping around the magnetopause. A comparison of the draping obtained with in-situ data with the one from a widely used magnetostatic model (Kobel et al 1994) was made. Differences of up to 180° were found for cone angle between 12.5° and 45°.

Field:

Not in the above

Day constaints:

Talk / 96

Thermal design of the CASSTOR nanosatellite and UV Spectropolarimetry experiment

Auteur: Mina Konaka[None]

Auteur correspondant mina.konaka@obspm.fr

In recent years, the interest in high-resolution UV spectropolarimetry in space has greatly increased. Space mission projects such as Arago (ESA) and Pollux on LUVOIR (NASA) are planned to launch in the 2030-2040 decades. UV spectropolarimetric observations in space will allow the study of stars, exoplanets, and their environments, especially stellar magnetic fields. Existing ground-based high resolution spectropolarimeters only work in the Visible or IR light, due to UV light getting absorbed in the Earth's atmosphere. Thus, LESIA has been developing the first prototypes of UV spectropolarimeters. Moreover, the CASSTOR nanosatellite is proposed to serve both as a technological and scientific demonstrator for high-resolution UV spectropolarimetry in space. The project is currently in phase 0/A, funded by CNES and planned to be launched in 2026.
In this presentation, two aspects will be discussed. The first one is the thermal design and simulation of CASSTOR. Thermal management aims to keep the temperature of the CMOS detector stable and under 260 K as the dark current is highly affected by temperature. In addition, thermal elasticity has a great impact on the optics while spectrum stability is required at sub-pixel level during a spectropolarimetric measurement. Passive thermal design using a radiator, thermal strap, and outside coatings were studied along with the active thermal control device such as a heater. The radiator is put on the side of the nanosatellite pointing at the star as it undergoes the least effect from both the Earth and Sun. In the simulation, the solar flux, albedo, Earth infrared, and internal heat were considered as input heat sources, while radiation to outer space is considered as output in a thermal environment. I will then discussed the design of a UV spectropolarimetry experiment that I will built in thermal vacuum to test the UV polarimeter. This experiment will simulate CASSTOR to increase its technological readness level and confirm the precision of the measurements.

Field:

Instrumentation

Day constaints:

Talk / **84**

3D Modeling of the Hot Jupiter WASP-43 b using the LMDZ Global Climate Model

Auteur: Lucas Teinturier[1]

[1] *LESIA/LMD*

Auteur correspondant lucas.teinturier@obspm.fr

Understanding the atmospheric circulation, radiative transfer, and atmospheric chemistry of exoplanets is crucial to more accurately characterize these objects. In particular, Hot Jupiters are the most observed type of exoplanets. In the last decade, observing efforts have been made to begin the atmospheric characterization of these objects, in parallel to modeling efforts to understand these data.

We set out to use the LMD Generic model, a 3D Global Climate Model developed for paleo-climate and temperate exoplanets studies, to simulate the atmosphere of Hot Jupiters. As a case study, we chose to model WASP 43-b, a Hot Jupiter with an orbital period of 19.5 hours and an equilibrium temperature of 1400 K. This planet has been observed by HST and Spitzer, which makes it one of the most observed Hot Jupiters. It will supposedly be observed by the James Webb Space Telescope.

Our first simulations, using the LMDZ5 dynamical core, are able to replicate the already known atmospheric patterns of the atmospheres such as the equatorial super-rotating jet and the strong day/night temperature contrast, in a non cloudy case. Moreover, we study the effect of the depth of the lower boundary of the model, and the impact of the deep thermal structure on the atmospheric dynamic.

We also set out to use the new massively parallel dynamical core DYNAMICO, developed at LMD. It uses a quasi-uniform icosahedral C-grid instead of a traditional longitude/latitude grid, to solve the

primitive hydrostatic equations assuming a shallow atmosphere.

We are currently working on including a generic scheme in the model which will take into account the condensation and sedimentation of clouds of any species. Confronting these simulations to phase curves will allow the characterizations of clouds condensates in the atmosphere of these hot irradiated planets.

Field:

Planetology (including small bodies and exoplanets)

Day constaints:

not available on thursday morning, nor friday afternoon

Talk / 95

Gas distribution from clusters to filaments in IllustrisTNG

Auteurs: Celine Gouin[1]; Stefano Gallo[2]; Nabila Aghanim[3]

[1] *School of Physics, Korea Institute for Advanced Study*

[2] *IAS*

[3] *Institut d'Astrophysique Spatiale*

Auteur correspondant stefano.gallo@universite-paris-saclay.fr

Galaxy clusters are the most massive gravitationally bound objects in the Universe, and therefore contain an extraordinary amount of information for both cosmology and astrophysics. These are formed by gravitational collapse of dark matter and baryons from primordial density fluctuations. They then continue to accrete matter throughout their history, preferentially through cosmic filaments that connect to their outskirts and form the so called cosmic web. Furthermore, galaxy cluster properties also depend on complex baryonic physics, such as accretion shocks, for example. All these processes are expected to influence the matter distribution in the environment of galaxy clusters.
In this talk, I will present our analysis on the gas distribution from the centre to the outskirts of galaxy clusters from the IllustrisTNG simulation. We show how both the radial and azimuthal distributions are affected by the cluster environments, tracing cluster structural properties as well as showing a strong correlation with the mass assembly history of the cluster.

Field:

Cosmology

Day constaints:

Talk / 82

Exploring high dimensional datasets for an enhanced interactivity and reproducibility: the case of the Euclid Morphology Challenge

Auteur: Hubert Bretonnière[1]

[1] *Institut d'Astrophysique Spatiale*

Auteur correspondant hubert.bretonniere@ias.u-psud.fr

With the new generations of surveys, in astrophysics and cosmology, datasets available to the community become more complex. It is often stated that surveys such as Euclid or LSST will generate a volume of data which needs new methods of analysis. The increase in data volume generally implies more complexity which is translated into an increase of the dimensionality of the parameter space to be explored. With the scientific toolbox becoming more complex, we can extract from those huge datasets an increasing number of parameters, in different filters, at different redshifts or SNRs, coming from different instruments or telescopes. The dimensionality in which the important scientific information lies can become quickly overwhelming.

In this scenario, any researcher can face what we called the « curse of plotting », where the amount of plots to explore all the interesting behavior of a dataset become too large to fit into a scientific paper with a reasonable size. Indeed, a figure being limited to 2D, sometimes 3D plots, the number of combinations between the different parameters of interests need to be restricted, sometimes in spite of scientifically meaningful and important (cor)relations. In addition, some of the extracted data are often a function of some hyper parameters or threshold, that one must fix for the particular context of a paper, sometimes arbitrary and which is not adapted to different science cases. One can try to explore the impact of changing this hyper parameter to the result of the study, but here again, the freedom in the exploration of the parameter space remains limited.

To tackle this curse of plotting, we are developing an interactive interface using the Streamlit python package, which allows the reader of our paper analyzing the Euclid Morphology Challenge to explore in a more extended way the parameter space presented in the paper. With a « user friendly » (and developer friendly) interface, one can reproduce all the figures of the paper, but also go significantly further.
For example, we plot in the paper some metrics as a function of the galaxy magnitude. In the interface, one can plot the same metrics but as a function of radius, redshift, or other physical parameters. The range of parameters and number of bins are also let free, for example to limit the study on nearby galaxies.
Another example is that those metrics are dependent on a threshold defining what is considered as a bad fit. One can continuously change this threshold and see the impact on his.her science. We also present 3D plots, where the x and y parameters can be changed to explore correlations.

In this talk, we propose to show and discuss the power of this tool, and the ease of its implementation. If we are talking about a specific case regarding a paper, one can adapt this idea to any high dimensional dataset, which we think is very important for any scientific paper, both for reproducibility but also completeness of the study. Developing this kind of tools would be a major interest for the next generation surveys, to fully embrace their complexity and amount of information.

Field:

Not in the above

Day constaints:

Talk / 74

Shedding light on galaxies at the end of the reionization epoch with long gamma-ray bursts.

Auteur: Andrea Saccardi[1]

[1] *Observatoire de Paris - GEPI*

Auteur correspondant andrea.saccardi@obspm.fr

Long gamma-ray bursts (LGRBs) are unique tools to probe first galaxies. They are associated with massive stars and their bright afterglows can be used as powerful background sources capable of unveiling the gas along their line of sight. Afterglow spectroscopy allows detailed studies of the

properties of the interstellar medium (ISM) of star-forming galaxies up to the highest redshift. Furthermore, the LGRB afterglow emission fades quite rapidly, allowing the study of the emission properties of their hosts, independently of their brightness at any wavelength.
In this talk, I will show the results obtained with VLT/X-shooter observation of the afterglow of GRB 210905A at z = 6.318. We detect neutral hydrogen, low-ionization, high-ionization and fine-structure absorption lines, as well as a tentative Lyman-alpha emission at velocity > 1000 km/s from the absorbing gas. We were able to determine the metallicity, kinematics and chemical abundance pattern, dust depletion and dust-to-metal ratio of the ISM at z = 6.318. I will place these results in the context of high-redshift GRB hosts and of very high-redshift galaxies.
These results show the very powerful potential of GRBs to access detailed information on the properties of very high-redshift galaxies, independently of the galaxy luminosity. Deep photometric and spectroscopic observations with VLT/MUSE, HST and JWST will offer the unique possibility of combining this information with the properties of the continuum and ionized gas of a z > 6 galaxy.

Field:

Cosmology

Day constaints:

I will be able to make my presentation every day preferably not Thursday 24th afternoon.

Talk / **98**

Subject : The Diffuse Galactic Light : Euclid looking through the interstellar veil.

Auteur: Axel RYMAR[1]

[1] *Université Paris-Saclay*

Auteur correspondant axel.rymar@ias.u-psud.fr

This subject is about the astrophysics of the interstellar medium. In this presentation I will outline the Euclid mission and the relevance of the study of the Diffuse Galactic Light (DGL) in its context. The following questions will be answered :
What is Euclic ? How does an interstellar medium study could have an impact on cosmological studies ? What is the Diffuse Galactic Light and its link with all of it ?
The project : 2 sided : analyzing and characterizing the DGL in order to get rid of it for the Euclid mission and learn more about interstellar dust properties.
Data : Deep field images from Megacam mounted on the Canada France Hawaii Telescope (CFHT).
Method : Confronting the DGL to thermal emission of dust and building a model considering the model THEMIS as a starting point. The numerical tools are : SOC, a radiative transfer code that computes the scattering of dust, and DustEM, a numerical that computes dust thermal emission, extinction and absorption of dust.

Field:

InterStellar Medium

Day constaints:

I'm not here on Thursday the 24th. So either the 23rd or the 25th. See you there.

Talk / **64**

Interchange reconnection dynamics in a solar coronal pseudo-streamer

Auteurs: Etienne Pariat[1]; Théo Pellegrin-Frachon[None]; sophie masson[2]

[1] *LPP*

[2] *LESIA - Observatoire de paris*

Auteur correspondant theo.pellegrin@lpp.polytechnique.fr

The generation of the slow solar wind is still an open problem of heliophysics. One of the existing theories to explain the observed properties of the slow wind is based on the "interchange reconnection": plasma elements, confined low in the solar atmosphere in closed magnetic field (both fieldline footpoints rooted on the photosphere), are dynamically released into open field (one fieldline end extending toward the interplanetary medium) thanks to magnetic reconnections between open and closed magnetic fields. However, the dynamics of the open-closed magnetic boundary remains ill-understood.

My objective is to study a specific coronal magnetic topological structure, pseudo-streamer, that can generate slow solar winds. I have performed 3D magnetohydrodynamics (MHD) numerical simulations of the solar corona and inner heliosphere using a MHD code with adaptive mesh refinement to model the dynamics of the open-closed coronal magnetic field around a pseudo-streamer. I have highlighted the existence of a complex dynamic at the pseudo-streamer boundary, with distinct scenarios for opening the magnetic field initially closed in the pseudo-streamer structure, from the classical, one-step interchange reconnection to an alternance of opening and closing reconnections near the frontier of the connectivity domains.

This work provides a look at the precise dynamics that opens magnetic field for injecting some coronal plasma in the interplanetary medium. Further studies would provide observables for this outcoming flow, that can be measured by Solar Orbiter and Parker Solar Probe.

Field:

Solar & Stellar Physics

Day constaints:

Talk / 99

Ion irradiation of Solar System ice analogs to support TNOs'observations

Auteurs: Elsa Hénault[1]; Riccardo G. Urso[2]; Donia Baklouti[1]; Zahia Djouadi[1]; Rosario BRUNETTO[1]

[1] *IAS*

[2] *Freie Universität Berlin*

Auteur correspondant elsa.henault@universite-paris-saclay.fr

Methanol was detected on Centaur Pholus and on Trans-Neptunian Objects (TNOs) 2002 VE95 and Arrokoth through direct observations of its NIR bands [1,2]. Methanol is commonly found alongside water ice, which is the most abundant species detected on the surface of TNOs [3]. TNOs are believed to have preserved the physico-chemical properties of the first stages of formation of the outer Solar System, but their surfaces are subjected to irradiation by cosmic or solar ions that modify their original chemical composition.

Laboratory studies of energetic processing of methanol by ion-irradiation showed the formation of species such as CO_2 and CO whose abundance depends on the irradiation dose [4,5]. Energetic and thermal processing ultimately produce complex organic molecules in the form of a refractory

residue and induce changes in spectral colors, in particular a reddening of the Vis-NIR spectra of the original samples [6].

We present an experimental setup used to monitor the chemistry induced by irradiation and to provide data relevant to TNOs'observations. The INGMAR experimental setup consists of a high vacuum chamber interfaced to the SIDONIE ion implanter (IJCLab). This allows for irradiation of ice mixtures cooled by a closed-cycle He-cryocooler (12-300 K). Spectroscopic data are acquired in transmittance or reflectance configurations and cover the 0.4-25 µm spectral range.

While chemical complexity, native or driven by energetic processing [7], can be investigated by MIR spectroscopy, Vis-NIR data are necessary to interpret TNOs'and Centaurs'observations. Previous experiments investigated NIR methanol bands as probes of energetic processing [8]. Here we report experiments on $H_2O : CH_3OH$ (1:1) mixtures deposited at 35 or 60 K and exposed to 30 keV H^+ up to doses relevant to TNOs'lifetime in the outer Solar System. We focused on Vis-NIR spectra as we aim at expanding the spectroscopic data available to link chemical composition to the diversity of TNOs'Vis-NIR slopes. We will discuss the implications of our experimental results for the interpretation of current New Horizons and future JWST observations.

References
[1] Merlin, F. et al. 2012, A&A, 544, A20.
[2] Grundy et al. 2020, Science, 367, 6481.
[3] Barucci et Merlin 2020, The Trans-Neptunian Solar System, p. 109-126.
[4] Baratta, G. A. et al. 1994, Planet. Space Sci., 42, 9.
[5] Moore, M. H. et al. 1996, Planet. Space Sci., 44, 9.
[6] Brunetto, R. et al. 2006, ApJ, 644, 646.
[7] Dalle Ore, C. M. et al. 2011, A&A, 533, A98.
[8] Urso, R. G. et al. 2020, ApJ, 894, L3.

Field:

Planetology (including small bodies and exoplanets)

Day constaints:

Available for presentation :
- wednesday 23 afternoon (preferably after 2 pm)
- thursday 24 all day
- friday 25 afternoon (preferably after 2 pm)

Talk / **66**

Long period radial velocity giant planets

Auteur: Florian Philipot[1]

[1] *LESIA*

Auteur correspondant florian.philipot@obspm.fr

Since the first detection of extrasolar planet around Main Sequence star in 1995, about 1000 exoplanets have been detected thanks to the radial velocity (RV) method. Thanks to the increasing monitoring time up to 30 years long-period giant planet with orbital properties close to the giant planets of the solar system can now be, in principle, detected, and recent studies have determined the radial distribution of giant planets from a few tenths to more than 10 au, with the goal of constraining planet formation processes. Based on the detections in the CORALIE-HARPS (resp. Keck-HIRES, APF-Levy and LICK-Hamilton) survey and an estimate of the survey completeness, the studies of the radial distribution of Fernandes et al. 2019 and Fulton et al. 2021 showed a peak of the occurrence rate around 3 au, close to the snow line around solar-like stars, and a decrease in the number of giant planets by star beyond. Those variations could therefore be in agreement with the most accepted formation model for the solar system giant planets.
We re-analysed the longest period planets identified in the two surveys. The orbital properties of the

planets with semi major axis larger than 5-7 au appear to be poorly constrained due to insufficient monitoring, poor temporal sampling (or a combination of both effects) combined with unknowns on the star's properties.
Additional RV measurements and the use of other detection techniques are needed to constrain the radial distribution of the giant planets beyond the snow line and to interpreted those radial distributions.

Field:

Planetology (including small bodies and exoplanets)

Day constaints:

23 or 24 march

Talk / 81

The early and late evolution of our Galaxy through the lens of globular clusters.

Auteur: Giulia Pagnini[None]

Auteur correspondant giulia.pagnini@obspm.fr

Our Galaxy, the Milky Way, is a collection of hundreds of billions stars, gas and dust bound together by gravity. Reconstructing how all the stellar components of the Galaxy formed and assembled over time, by studying the properties of the stars which make it, is the aim of Galactic archeology. In these last years, thanks to the launch of the ESA Gaia astrometric mission, in 2013, and the delivery of its catalogues, we are, for the first time, in the position to bring to light the timeline of events that helped make the Milky Way the galaxy that we observe today. Having survived billions of years to all these events and changes, globular clusters observed today in the Galaxy bear witness of this entire past. They did not necessarily all formed in the Galaxy itself: a fraction of them can indeed have been formed in satellite galaxies accreted by the Milky Way over times. In the recent years, there have been several attempts to constrain the nature of clusters (accreted or formed in the Milky Way itself) and to reconstruct from this the properties of the accretions events experienced by the Milky Way through time. However, in all spaces analyzed so far (mainly kinematic and chemical-abundance spaces), some significant overlap between accreted and in-situ populations can be expected, leading to possibly an incorrect reconstruction of the accretion history of our Galaxy. With my PhD project, we want to make a step forward in the reconstruction of the phases of Galactic mass assembly by coupling the positions in the Galaxy, kinematics and chemical abundance properties of Galactic globular clusters to their internal parameters. We will do this by analyzing a set of dissipation-less high-resolution N-body simulations, and by running new simulations where we will couple the dynamical evolution of the globular clusters in Milky-Way type galaxies to their internal evolution. We will use this set of simulations to interpret current data and also to provide model-based predictions that will be fundamental for future surveys.

Field:

Not in the above

Day constaints:

Mercredi 23 mars, Vendredi 25 mars

Talk / 65

Climate Simulations of Mars at Low Obliquity

Auteurs: François Forget[1]; Lucas Lange[None]; Romain Vandemeulebrouck[1]

[1] *LMD*

Auteur correspondant lucas.lange@lmd.ipsl.fr

In some high latitude craters, intriguing moraines are interpreted to have been deposited by CO2 ice glaciers, essentially frozen from when the local climate was colder (i.e., when Mars obliquity was low) [1]. This scenario has been little studied, but it suggests that the atmosphere could totally collapse into CO2 glaciers, leaving behind a residual atmosphere of only Argon and N2, but 20 times less dense than today [2].

However, these results are based on a radiative equilibrium that does not take into account all the dynamics of the atmosphere. Such periods of low obliquities generally last tens of thousands of years [3], making a complete simulation with a classical Global Circulation Model impossible.

We will present the preliminary results of our climate simulations of Mars at low obliquity based on our new tool which is the Planetary Evolution Model developed at the LMD (Fig 1.). This model allows us to simulate the evolution of the climate, based on the LMD GCM, over long-time steps. Particular attention will be paid to the condensation of the atmosphere in the form of CO2 glaciers, and to the composition of the residual atmosphere.

References:

[1] Kreslavsky and Head, Carbon dioxide glaciers on Mars: Products of recent low obliquity epochs(?). Icarus, 216:111–115, 2011.
[2] Kreslavsky and Head. Mars at very low obliquity: Atmospheric collapse and the fate of volatiles. Geophysical Research Letters, 32(L12202), 2005.

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Acknowledgments:

This project has received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (grant agreement No 835275).

Field:

Planetology (including small bodies and exoplanets)

Day constaints:

ne peut pas être présent le jeudi

Talk / 88

Signature of instabilities in the multi-messenger signal of core-collapse supernovae

Auteur: Anne-Cécile Buellet[1]

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Auteur correspondant anne-cecile.buellet@cea.fr

The final step of the life of a massive star is its collapse and explosion creating a supernova. During the collapse phase, several phenomena happen in the core of the star before the observed explosion. One of these phenomena is the development of instabilities. The collapse creates a shock wave that becomes stationary ~150 km away from the surface of the proto-neutron star (PNS). All the instabilities developing between the shock and the core of the PNS modulate the signal emitted

in gravitational waves (GW) and neutrinos. The aim of my PhD thesis is to study the convection instability evolving within the sphere delimited by the shock. The matter immediately under the shock interacts with the neutrinos emitted by the neutrinosphere. The neutrinos heat up the matter and trigger convection due to the Rayleigh-Taylor instability. This instability plays a crucial role in pushing the shock outward closer to the explosion threshold, producing GW and modulating the emission of neutrinos. To decipher whether the convection will develop or not, we use a criterion that combine several physical parameters. It prevents us from doing expensive simulations varying each parameter, one by one. In this case, the criterion is the ratio between buoyancy and advection time scales in the heating region. Indeed, the Rayleigh-Taylor instability competes with the advection that tends to stabilise the process. As a result, the Ledoux criterion is not enough to predict the evolution of the system. In addition, several length scales must be considered because of the compressibility and the neutrino-heating/cooling. Foglizzo et al. (2006)1 suggested that, if the ratio of the two timescales is less than ~3, then the advection stabilises the convection. I take a new look at the current stability criterion χ established in 2006 where only one length scale was used: H. However,
by distinguishing several length scales: the size of the unstable domain limited by the shock position Hg (or H), the size of the most buoyant region HS and the density scale-height Hρ, we prove that this criterion needs to be updated.

I study toy models to improve the understanding of the phenomena and the relevant parameters that need to be taken into account to define a convection criterion. To do that, I do analytical calculations and confront them to numerical calculations.

Field:

Compact objects (supernovae, black holes, neutron stars)

Day constaints:

Talk / 59

The magnetopause discontinuity: a MMS study.

Auteurs: Francesco Califano[None]; Gerard Belmont[None]; Giulio Ballerini[None]; Laurence Rezeau[None]

Auteur correspondant giulio.ballerini@lpp.polytechnique.fr

The magnetopause boundary seems to escape the general classification of discontinuities since it mixes characteristics of shocks (magnetic field magnitude increase) and those typical for the rotational discontinuities (magnetic rotation), whereas it is very often described as a tangential discontinuity. As, the main issue is the amount of matter/momentum/energy from the solar wind and entering into the magnetosphere, the solution cannot be simply achieved by assuming the discontinuity as strictly tangential, everywhere and at all times. Here we propose to study the magnetopause boundary as a "quasi-tangential" discontinuity, with the normal magnetic component Bn small but not null since even small departures from the standard hypothesis of a zero Bn can lead to noticeable changes in the global properties. In that aim, we look into the MMS database for a large number of magnetopause crossings. For each case we will determine what are the most important features that allow the discontinuity to escape the general classification, i.e. to noticeably change the form of the conservation laws on which the theory of discontinuities is based for non strictly tangential discontinuities. We put a special emphasis on the refined methods that can be
used for determining the spatial gradients from four spacecraft data and on the accuracy that can be attained by these methods.

Field:

Not in the above

Day constaints:

Talk / 76

Analysis of primitive asteroid samples with the Hayabusa2 mission

Auteur: Tania Le Pivert-Jolivet[1]

[1] *Institut d'astrophysique Spatiale*

Auteur correspondant tania.lepivert@ias.u-psud.fr

Primitive asteroids within the solar system are of scientific interest because they recorded the chemical and physical processes that occurred during the planetary formation in the protoplanetary disk.

The Hayabusa2 space mission (JAXA), launched in 2014, studied the asteroid Ryugu and collected samples from its surface. This is the first mission to collect samples of a C-type asteroid, supposed to contain primitive materials. On December 6th, 2020, 5.4 g of samples were brought to Earth by the Hayabusa2 spacecraft. They were stored in a clean chamber that preserves them from any atmospheric contamination in the ISAS (Institute of Space and Astronautical Science, Sagamihara, Japan) Curation Facility. At this time, they were characterised in a non-destructive way by several instruments. One of them, MicrOmega, is a near-infrared (0.99 –3.65 µm) microscope developed by the Institut d'Astrophysique Spatiale. In June 2021, some samples were extracted from the Curation Facility and allocated to several analytical teams, using additional techniques (sometime destructive) to obtain complementary information about the composition of the grains.

The analysis of the complete collection of the samples down to the microscopic scale by MicrOmega, enables us to characterise the mineral and organic composition of Ryugu grains and the links between the different compounds. This will give new insights on the formation of Ryugu and the different alteration processes (space weathering, aqueous alteration, thermal metamorphism, ⋯) that modified the composition of Ryugu and its parent body.

Field:

Planetology (including small bodies and exoplanets)

Day constaints:

I'm not available on Wednesday 23th, but both Thursday 24th and Friday 25th are fine !

Talk / 58

Study of a dayside magnetopause reconnection event detected by MMS and related to a large-scale solar wind perturbation

Auteur: Mohammed Baraka[None]

Auteur correspondant mohammed.baraka@lpp.polytechnique.fr

Magnetic reconnection is a fundamental process that is ubiquitous in the universe and allows the conversion of the magnetic field energy into heating and acceleration of plasma. It's also very important as it is responsible for the dominant transport of plasma, momentum, and energy across the magnetopause from the solar wind into the Earth magnetosphere. Coronal Mass Ejections (CMEs) and Corotating Interaction Regions (CIRs) are the primary large-scale propagating structures and important drivers of unusual space weather disturbances causing magnetospheric activity. The present study reports on a magnetic reconnection event detected by the Magnetospheric Multiscale mission (MMS) on 21 October 2015 around 04:40 UT and related to a large-scale solar wind (SW) perturbation impacting the Earth's magnetopause. Based on OMNI data, the event impacting the Earth's magnetosphere is ahead of weak CIR (SW beta~7 and Alfvénic Mach number~15) where the density

of solar wind is about ~20 cm-3 (compared with average SW density ~3-10 cm -3). Furthermore, the magnetosheath (MSH) density measured by MMS just after the crossing of the magnetopause is about ~95 cm-3 (compared with average MSH density ~20 cm-3). Reconnection signatures such as ion and electron jets, Hall field, and energy conversion are compared with a "classical"reconnection event observed during quiet solar wind conditions.

Field:

Not in the above

Day constaints:

Talk / 63

Large Halo Sparsity, a Fast Detector and Chronometer for Galaxy Cluster Mergers

Auteur: Tamara Richardson[1]

Co-auteur: Pier-Stefano Corasaniti [2]

[1] *LUTH - Observatoire de Paris | PSL*

[2] *CNRS & Observatoire de Paris*

Auteur correspondant thomas.richardson@obspm.fr

Galaxy clusters have proven themselves to be valuable probes of cosmology and astrophysics. However observing galaxy cluster merger events can give us additional insight on the properties of gas inside the intra-cluster medium, dark matter physics or the theory of gravitation, it is therefore of prime interest to devise a fast and reliable way of detecting which clusters have undergone recent mergers.
Here we present a novel approach using halo sparsity and define thresholds $s^{th}_{200,500}(z)$ above which dark matter haloes can be considered as having undergone a recent major merger. We further expand this detection approach to estimate the approximate time at which the last major merger occurred. This work opens the way to detecting and timing major mergers in galaxy clusters solely through measurements of the their mass at different radii.

Field:

Cosmology

Day constaints:

Talk / 85

Jupiter atmosphere as seen from James Webb Space Telescope

Auteur: Pablo Rodriguez-Ovalle[1]

[1] *LESIA*

Auteur correspondant pablo.ovalle@obspm.fr

The James Webb Space Telescope is poised to revolutionize many fields of astrophysics. One such field is planetary science in our own Solar System.
JWST will be able to study planetary atmospheres and small bodies in the infrared spectrum (from

1 to 27 microns). In the case of Solar System planets, this presents an amount of added difficulties, such as the brightness or extent of the planet compared to the sensitivity, saturation limit and FOV of the instruments.
In this presentation we will present the main objectives of the Early Release Science 1373 project, which addresses the study of the Jovian system (Jupiter, its rings, Ganymede and Io). In the PhD I will focus on the study of Jupiter. The ERS 1373 plans to study the Great Red Spot and south polar regions, in order to study the dynamics and chemistry on these zones. Also, we expect to find significant differences in the abundances of chemical species in both regions, due to the impact of the ionical chemistry, that could be happening in the polar regions due to aurorae precipitations.
In order to test the capabilities that JWST can implement on the study of Jupiter's atmosphere, a simulation of the behaviour of the instruments is needed. Then we can check the SNR, spatial and spectral resolution, emission lines that can be retrieved… while we wait the data to be ready.
Radiative transfer and inversion techniques codes will be used to retrieve the temperature and its variations, as well as the distribution of various chemical species present in the atmosphere of the planet, all this thanks to the data from MIRI, onboard JWST. In parallel, we intend to study the polar dynamics with NIRCam in search of possible couplings between wind and temperature fields or abundances by using cloud tracking-correlation methods to retrieve the wind fields of the planet.

Field:

Planetology (including small bodies and exoplanets)

Day constaints:

23 and 24 of March.

Talk / **79**

The Star Formation History of the Milky Way galaxy

Auteur: Valeria Cerqui[None]

Auteur correspondant valeria.cerqui@obspm.fr

In today's Universe, a star is more likely to be found in a galaxy of the mass of the Milky Way than in any other type of galaxy. Understanding how these galaxies formed and evolved is therefore a major challenge in astronomy and the Milky Way gives us the opportunity to study one of these galaxies from the inside with unique details. The history of stellar formation is one of the fundamental pieces of information needed to understand how and when stellar populations came to form the Milky Way as we know it today. However, very little is known about its intensity and variations over time, and the causes of these variations. The history of stellar formation is also one of the most fundamental criteria for judging whether our Galaxy can be considered representative of other galaxies with similar masses. The objective of this thesis work is to measure this history thanks to the large catalogues that have recently become available (Gaia, APOGEE) or are in preparation (WEAVE on the William Herschel Telescope), and to analyse it in the context of our knowledge of galactic stellar populations.

Field:

Not in the above

Day constaints:

For my presentation I will be available on the 24/03 and 25/03.

Talk / **70**

Atmospheric characterization of exoplanets with the medium resolution spectrometer on MIRI/JWST

Auteur: Mathilde Mâlin[1]

[1] *LESIA*

Auteur correspondant mathilde.malin@obspm.fr

Direct observations are required to constrain the physical properties of exoplanet atmospheres. Direct imaging is still challenging as it requires to achieve very high contrasts at small separations. The current generation of instruments are reaching contrast performance that allows us to observe young and warm giant planets that are separated by a few AU from their host star, a favorable configuration to mitigate the diffracted starlight contamination. The Mid-IR Instrument (MIRI) of the recently launched James Webb Space Telescope is equipped with a Medium Resolution Spectrograph (MRS) covering a large spectral range from 5 to 28 microns. At such wavelengths, the star to planet ratio is more favorable than in the near IR and provides access to molecular signatures that are relevant to characterize exoplanet atmospheres at a spectral resolution as large as 3500. We are investigating the feasibility to retrieve those molecules with the method called the "molecular mapping"which allows to disentangle spectrally and spatially the light from the star and the planet. We will present results of performance estimation based on simulations of MIRI observations. Simulating many known direct imaged systems, we detect and retrieve molecules such as CO, CH4, NH3, H2O, PH3, HCN and using a large grid of Exo-REM atmospheric models, we are exploring the sensitivity of the method to determine atmospheric parameters. Finally, we will present a parametric analysis of MIRI/MRS detection capacity, studying the impact of the spectral type and the angular separation on the method's performance. Once combined with near IR data or coronographic data, MIRI-MRS will have the capacity to improve the characterization of exoplanetary atmospheres and to derive constraints on planetary formation.

Field:

Planetology (including small bodies and exoplanets)

Day constaints:

sauf le 24 en fin après-midi

Talk / **101**

The composition of Inner Main Belt Planetesimals

Auteur: Jules Bourdelle de Micas[None]

Auteur correspondant jules.bourdelledemicas@obspm.fr

A novel method of dynamical identification of asteroids families allowed the identification of almost all of them in the inner part of the Main Belt. It also allowed the identification of some asteroids not belonging to any of these families. Thus, we assumed that these objects are remnant of primordial planetesimals and their composition should remain more or less intact since their formation. Once identified, we performed spectroscopic studies in order to determine their surface composition and mineralogy. To do so, we carried out several ground-based spectroscopic observations and we analysed spectral features.
We found that a majority of them belong to the silicate-rich classes (S-complex) with a mineralogy close to the ordinary chondrites. Interestingly, our survey reveals that more than 60% of carbonaceous-rich (C-complex) planetesimals showed hydratation features, meaning then that aqueous alteration processes occurs on these objects. Other taxonomical groups have been found among our planetesimals.

Here I will present the spectroscopic and compositional results provided by our work as well as the implications for planetary formation models.

Field:

Planetology (including small bodies and exoplanets)

Day constaints:

I won't be able to participate on Friday morning.

Talk / **69**

Meteor Showers: from D-criteria to chaos map

Auteur: Ariane Courtot[None]

Auteur correspondant ariane.courtot@obspm.fr

Meteor showers are born when a single parent body (comet or asteroid) ejects several meteoroids, forming a stream which then meets the Earth.
A large number of meteor showers are recorded today, which would mean a similar large number of parent bodies existed in the near-Earth region in a recent past. This casts a doubt on methods used to find meteor showers. These methods rely on D-criteria, which will be critically examined here.
A new tool to study meteor showers will also be presented: chaos maps. First results on this type of maps will be shown as well.

Field:

Planetology (including small bodies and exoplanets)

Day constaints:

I am available on March 23rd and March 24th.

Talk / **56**

Investigation of the homogeneity of energy conversion processes at dipolarization fronts from MMS measurements

Auteurs: Soboh AlQeeq[1]; olivier Le Contel[2]; Patrick Canu[2]; Alessandro Retinò[2]; Thomas Chust[2]; Laurent Mirioni[2]; L. Richard[3]; Y. Aït-Si-Ahmed[4]; Alexandra Alexandrova[2]; A. Chuvatin[4]; N. Ahmadi[5]; S. M. Baraka[6]; Rumi Nakamura[7]; Frederick Wilder[8]; Daniel Gershman[9]; Per arne Lindqvist[10]; Yuri Khotyaintsev[3]; Robert Ergun[8]; James Burch[11]; Roy Torbert[12]; C.T Russell[13]; W. Magnes[7]; R. J. Strangeway[13]; K. R. Bromund[14]; Hanying Wei[13]; F. Plaschke[7]; B. J. Anderson[15]; Barbara Giles[9]; Stephen Fuselier[11]; Y. Saito[16]; B. Lavraud[17]

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[10] *Space and Plasma Group, Royal Institute of Technology, Stockholm, Sweden*

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Auteur correspondant soboh.al-qeeq@lpp.polytechnique.fr

We report on six dipolarization fronts (DF) embedded in fast earthward flows detected by the Magnetospheric Multi-scale (MMS) mission during a substorm event on 23rd of July 2017. We analyzed the Ohm's law for each event and found that ions are mostly decoupled from the magnetic field by the Hall fields. However, the electron pressure gradient term is also contributing to the ion decoupling and likely responsible for an electron decoupling at DF. We also analyzed the energy conversion process and found that the energy in the spacecraft frame is transferred from the electromagnetic field to the plasma (J·E>0) ahead or at the DF whereas it is the opposite (J·E<0) behind the front. This reversal is mainly due to a local reversal of the cross-tail current indicating a substructure of the DF. In the fluid frame, we found that the energy is mostly transferred from the plasma to the electromagnetic field (J·E'<0) and should contribute to the deceleration of the fast flow. However, we show that the energy conversion process is not homogeneous at the electron scales due to electric field fluctuations likely related to lower-hybrid drift waves. Our results suggest that the role of DF in the global energy cycle of the magnetosphere still deserves more investigation. In particular, statistical studies on DF require to be carried out with caution due to these electron scale substructures.

Field:

Solar & Stellar Physics

Day constaints:

9th

Talk / **72**

Dark Energy Tomography with Euclid

Auteurs: Lisa Goh[None]; Martin KILBINGER[1]; Valeria Pettorino[2]

[1] *CEA Saclay/Irfu/DAp*

[2] *CEA Paris-Saclay, Departement of Astrophysics, CosmoStat Lab*

Auteur correspondant lisa.goh@cea.fr

While the Universe is expanding with increasing velocity, the question of what causes this cosmic acceleration remains unsolved. Acceleration seems to act against gravitational attraction, as if a new source of energy, dubbed dark energy, were responsible for it.
In this presentation I give an introduction to my PhD project, where I will attempt to tackle the question of the nature of dark energy, by probing the possibility of dark energy at different redshifts, or what we refer to here as 'dark energy tomography'. Ultimately, my research aims to contribute to the Euclid mission, by extending the likelihood software to test dark energy at different redshift epochs, contributing to the collaboration effort on comparing theoretical predictions with data and finally investigating different machine learning methods to reconstruct the dark energy contribution in each redshift bin.

Field:

Cosmology

Day constaints:

Talk / 90

UVSQ-SAT Attitude Determination to Map the Earth's Radiation Budget

Auteur: Adrien Finance[1]

Co-auteurs: Mustapha Meftah [2]; Christophe Dufour [3]; Thomas Boutéraon [3]; Antoine Mangin [4]

[1] *LATMOS/ACRI-ST*

[2] *LATMOS/IPSL/CNRS/UVSQ*

[3] *LATMOS*

[4] *ACRI-ST*

Auteur correspondant adrien.finance@latmos.ipsl.fr

The energy balance of the earth is an essential climate variable. At the top of the atmosphere, this variable may be measured by calculating the difference between incoming solar flux and outgoing reflected and infrared flux. This is the goal of the UVSQ-SAT mission, which validates miniaturized technology onboard a CubeSat with 1U specifications (11.10 cm × 11.10 cm × 11.35 cm). This satellite was launched into orbit by Space X's Falcon 9 rocket in January 2021 and is fully operational.
Indeed, knowing this orientation allows you to separate the various fluxes and adjust them from the angle to the considered source (Earth, Sun). Different approaches were used to derive the satellite's attitude based on Sun and Nadir pointing as well as data from the inertial measurement unit (IMU). Based on the available sensors, determinists methods and neural networks were constructed to ensure more precise knowledge of attitude determination in all configurations (daylight and eclipse). In order to determine the satellite's orientation, a multilayer perceptron was trained. The varied fluxes were derived from the sensor inputs at each time based on the attitude received.

Field:

Not in the above

Day constaints:

Talk / 106

Monitoring the Atmospheric Dust Optical Depth on Mars with OMEGA/MarsExpress

Auteurs: Mathieu Vincendon[1]; Yann Leseigneur[1]

[1] *Institut d'Astrophysique Spatiale, Université Paris-Saclay, CNRS, Orsay, France*

Auteur correspondant yann.leseigneur@universite-paris-saclay.fr

Dust is everywhere on Mars: deposited on the surface and suspended into the atmosphere. It's a key parameter that affects climate and controls some current surface properties. Dust movements extend over very different spatial scales (few meters to planet scale). To find a link between them, we studied the atmospheric dust by using the near-infrared imaging spectrometer OMEGA onboard Mars Express (3 Martian years of full-operation). We developed a new method in two steps: first one is to define an atmospheric dust index based on the decrease of 2 µm carbon dioxide (CO_2) absorption band when there is atmospheric dust during observations. That required to develop a theoretical model that can predict the CO_2 optical depth in clear atmosphere conditions (without dust). The second step of the method is calibrating this index with the Mars Exploration Rovers (Spirit and Opportunity), which measured optical depth from the Martian ground during the same period as OMEGA. That calibration allows the computation of a dust optical depth from any OMEGA observation. We have applied this method to the entire dataset to study the time and spatial distribution of atmospheric dust. We observed well-known characteristics of the dust cycle (dusty season, interannual variability, ⋯) and dust movements (dust storm travel routes, dust source areas, ⋯). We also notice a time and spatial correlation between seasonal dark flows (recurring slope lineae) occurring on steep slopes of the Martian surface (low spatial scale) and regional atmospheric dust movements (medium-high spatial scale). This can be a first step of finding a link between surface dust movements and atmospheric ones.

Field:

Planetology (including small bodies and exoplanets)

Day constaints:

I will able to make my presentation on Thursday and Friday.

Talk / **77**

Study of the long term variability of the Very High Energy gamma-tay source at the centre of our Galaxy

Auteur: Samuel Zouari[1]

[1] *APC - Université de Paris*

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The Galactic centre is a prime observation target for Very High Energy gamma-rays. A point-like source (possibly linked to the Supermassive Black Hole SgrA*) as well as a diffuse emission covering the central 200 pc have been discovered. With now 16 years of survey by HESS and the latest data analysis tools of gammapy, we performed a spectral and morphological study of the GC, and we monitored its flux since 2004, in search of potential variabilty. Although no such variability was found, this study allowed for a better understanding of HESS sensibility to time variations in this region.

Field:

Compact objects (supernovae, black holes, neutron stars)

Day constaints:

Talk / **73**

Forecasting the power of Higher Order Weak Lensing Statistics with automatically differentiable simulations

Auteur: Denise Lanzieri[1]

Co-auteurs: Francois Lanusse [2]; Jean-Luc Starck [3]; Chirag Modi [4]

[1] *Cosmostat, CEA Paris-Saclay*

[2] *{CNRS}UMR7158*

[3] *CosmoStat, CEA Paris-Saclay*

[4] *Center for Computational Astrophysics,Flatiron Institute*

Auteur correspondant denise.lanzieri@cea.fr

Weak gravitational lensing is one of the most promising tools of cosmology to constrain models and probe the evolution of dark-matter structures. Yet, the current analysis techniques are only able to exploit the 2-pt statistics of the lensing signal, ignoring a large fraction of the cosmological information contained in the non-Gaussian part of the signal. Exactly how much information is lost, and how it could be exploited is an open question.
In this work, we propose to measure the information gain from using higher-order (i.e. non-Gaussian) statistics in the analysis of weak gravitational lensing maps. To achieve this goal, we implement fast and accurate lensing N-body simulations based on the TensorFlow framework for automatic differentiation. By implementing gravitational lensing ray-tracing in this framework, we are able to simulate lensing lightcones to mimic surveys like the Euclid space mission or the Vera C. Rubin Observatory Legacy Survey of Space and Time (LSST). These simulations being based on differentiable physics, we can take derivatives of the resulting gravitational lensing maps with respect to cosmological parameters, or any systematics included in the simulations. Using these derivatives, we can measure the Fisher information content of various lensing summary statistics on cosmological parameters, and thus help maximize the scientific return of upcoming surveys.

Field:

Cosmology

Day constaints:

Talk / **75**

Dynamical effects of the radiative stellar feedback on the HI-to-H2 transition.

Auteur: Vincent Maillard[1]

Co-auteurs: Franck Le Petit ; Emeric Bron

[1] *LERMA - Observatoire de Paris*

Auteur correspondant vincent.maillard@obspm.fr

Molecular clouds are surrounded by an atomic layer where hydrogen is in atomic form (H) instead of molecular form (H2). As one looks deeper into the cloud, the position where H2 becomes more abundant than HI is called the H/H2 transition. This transition controls the fraction of molecular gas, which constitutes the mass reservoir for star formation, as evidenced by the Schmidt-Kennicutt law. Theoretical descriptions of this H/H2 transition have been proposed in the case where the gas is assumed static. In star forming regions, however, Herschel and spatially-resolved ALMA observations have revealed important dynamical effects at the PDR edges of molecular clouds, which could be explained by photo-evaporation resulting in an advance of the ionization front into the neutral gas, or, equivalently, to neutral gas being advected through the PDR.
In a new paper, we extend the analytic theory of the H/H2 transition to include the dynamics of the gas induced by photo-evaporation and find its consequences on the total atomic hydrogen column density at the surface of clouds in presence of a strong UV field, and on the properties of the H/H2 transition. We also include H2 formation on grains, H2 photodissociation, H2 self-shielding and metallicity. The advection of gas through the H/H2 transition caused by photoevaporation reduces the width of the atomic region compared to static models. The atomic region may disappear if the ionization front velocity exceeds a certain value, leading the H/H2 transition and the ionization front to merge. We provide analytical expressions to determine the total HI column density. Finally, we compare our results to observations of PDRs illuminated by O-stars, for which we conclude that the dynamical effects can be strong, especially in low excitation PDRs such as the Horsehead. This new model is tested on recent ALMA observations of a PDR showing the transition between ionized, atomic and molecular gas.

Field:

InterStellar Medium

Day constaints:

Talk / 93

Detection of optical counterparts to Gamma Ray Bursts with LSST and SVOM: challenges and opportunities

Auteur: Roman Le Montagner[None]

Auteur correspondant roman.le-montagner@ijclab.in2p3.fr

By 2023, the Vera C. Rubin observatory will leap forward by generating the largest optical sky survey ever made called the Legacy Survey of Space and Time (LSST). Each night, the LSST will produce a stream of over 10 million alerts that will need to be classified in real-time.
The LSST will rely on alert brokers to process and redistribute this massive alert flow to the scientific community. Among the different brokers selected by Rubin, Fink is an international team of scientists with a large variety of scientific interests, including among others multi-messenger astronomy, supernovae, solar system, anomalies identification, micro-lensing and gamma-ray bursts optical counterparts. The broker is currently deployed in the cloud at IJCLab, Orsay, and it processes the alert stream of the Zwicky Transient Facility as a pathfinder of the LSST.

My PhD thesis aims to analyze this alert stream with state-of-the-art computer science approaches – to deal with the large flux of data from LSST – and especially search for optical counterparts to Gamma Ray Bursts (GRB) detected by the SVOM mission. As a large part of the alerts can behave like GRB counterparts during the early stage of the emissions, we need to filter them. The main contaminants are the moving objects in the sky such as objects from the solar system (SSO). A robust algorithm dedicated to the detection of new SSO will be presented. Finally, the detectability and the methods that will be developed for the detection of GRB counterparts in the LSST alert stream will be presented to open the future work of this thesis.

Field:

Compact objects (supernovae, black holes, neutron stars)

Day constaints:

Talk / 103

Développement de spectro-imageurs X durs à haute densité de pixels pour l'imagerie directe de sources astrophysiques et d'éruptions solaires au-delà de 30 keV

Auteur: Hugo Allaire[1]

[1] *CEA*

Auteur correspondant hugo.allaire@cea.fr

To understand the physical processes behind the most violent events in our Universe, a new generation of space telescopes evolving in the hard X-ray domain is required with enhanced performances in detection sensitivity and angular resolution. Emerging super mirror techniques allow the development of improved resolution and high-energy efficiency spectro-imagers, leading to large focal plane detectors with high pixel density. Modular packaged systems further provide complete front-end features with minimum dead area and tailored to detection plane requirements.

We present MC^2-1K, a new generation of hybrid pixelated detectors, with a 32 x 32 pixels array consisting of a 250 µm pitched pixelated CdTe semiconductor detector point-to-point connected to the spectroscopic channels of a full-custom ASIC. The ASIC named D^2R2 was produced in 2019 in the XFAB 0.18 µm. We demonstrated a median equivalent charge noise of 54 e- RMS, equivalent to 654 eV at 31 keV for a CdTe detector and a triggering capability for 85% of the frame. We developed an acquisition system where the D2R2 ASIC data of 32 rows are encoded in parallel by the 32-channel ADC OWB-1 ASIC. The daughter board with the hybrid detector will be placed in a thermally controlled vacuum chamber for a moderate cooling in order to perform spectroscopic test of the system.

Field:

Instrumentation

Day constaints:

110

Visite of the Observatory of Meudon

Talk / 100

Evolution of Mercury's crust: interactions between impact basins, smooth volcanic plains and deep material

Auteur: Emma Caminiti[None]

Co-auteurs: Alain Doressoundiram [1]; Sébastien Besse [2]

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Mercury is the innermost and smallest terrestrial planets. Improving knowledge of the planet is crucial to our understanding of the formation and evolution of terrestrial planets. Moreover, understanding the global geological history of Mercury will help to explain the role of planet size and solar distance concerning the magmatic and tectonic history of terrestrial planets. Between 2008 and 2015, the NASA/MESSENGER mission obtained data of the surface of Mercury with the aim of understanding the origin and evolution of the surface. The results concluded that extensive volcanism has taken place on Mercury, reshaping the surface over time. Impact basins are among the most important geological features on the surface of Mercury giving the opportunity to study the evolution of the crust through volcanic processes and resurfacing of deep material brought to the surface. Basins are known to have experienced various volcanic episodes after their formation including the setting up of volcanic smooth plains whose spectral differences remain not fully understood. They also allowed the resurfacing of deep material originated from the primary carbon rich crust. Here, we present a study of several spectral units in link with impact basins. We analyse data derived from the Mercury Atmospheric and Surface Composition Spectrometer (MASCS/MESSENGER) and contained in the Mercury Surface Spectroscopy (MeSS) database. Spectral maps of several basins were generated highlighting different spectral units and revealing similarities between basins according to their age and size. It appears that processes at the origin of the similarity between basins are more related to the formation of the basin than to its location on the surface. Moreover, our method provides a detailed study of interactions between spectral units in order to better understand their geological history in relation with deep magmatic processes at the origin of surface volcanism. Our work is part of the preparation of the ESA/JAXA/BEPICOLOMBO mission whose objectives will be in part to continue to study the evolution of a planet close to its parent star and to continue to study Mercury as a planet: its geology, composition, interior and craters.

Field:

Planetology (including small bodies and exoplanets)

Day constaints:

On Friday 25 march please I will not be available on Wednesday and Thursday.

Talk / **60**

Statistical separation of dust and CIB with Wavelet Phase Harmonics (WPH)

Auteurs: Athanasia Gkogkou[None]; Bruno Regaldo Saint-Blancard[None]; Constant Auclair[1]; Erwan Allys[None]; François Boulanger[1]; Guilaine Lagache[2]; Marc-Antoine Miville-Deschenes[None]; Matthieu Bethermin[2]

[1] *LPENS*

[2] *LAM*

Auteur correspondant constant.auclair@phys.ens.fr

Modelling the emission of Galactic dust is a main challenge for CMB polarization experiments. Current models make use of Planck total intensity data plagued by the difficulty of separating dust emission from the Cosmic Infrared Background (CIB). We address this outstanding difficulty from a new perspective compared to previous attempts. We will show that dust and CIB may be statistically separated using their radically different structure on the sky. Our approach makes uses of a CIB model map built from a cosmological simulation and Herschel/SPIRE observations. We use the Wavelet Phase Harmonics (WPH) statistics to separate dust and CIB and derive a statistical, non-Gaussian, model of each component. We demonstrate and validate the separation on mock data, before applying it to Herschel observations of cosmological fields and the diffuse interstellar medium (ISM) at high Galactic latitude. The two models derived from our analysis of Herschel observations are generative models, which may be used to simulate maps of each component, essentially free from mutual contamination. We will present an astrophysical application where we extend our statistical modelling to HI observations to investigate the dynamical coupling of gas and dust, down to the smallest spatial scales, a few hundredths of a parsec in the diffuse ISM, probed by Herschel.

Field:

InterStellar Medium

Day constaints:

Talk / **61**

Constraining hydrostatic mass bias and cosmological parameters with the gas mass fraction in galaxy clusters

Auteurs: Raphaël Wicker[None]; Marian Douspis[1]; Laura Salvati[2]

[1] *IAS*

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The gas mass fraction in galaxy clusters is a convenient tool to use in the context of cosmological studies.

Indeed this quantity allows to constrain the universal baryon fraction Ω_b/Ω_m, as well as other parameters like the matter density Ω_m, the Hubble parameter h or the Equation of State of Dark Energy w.

This gas mass fraction is also sensitive to baryonic effects that need to be taken into account, and that translate into nuisance parameters.
Two of them are the depletion factor Υ and the hydrostatic mass bias $B = (1 - b)$.
The former describes how baryons are depleted in clusters with respect to the universal baryon fraction, while the latter encodes the bias of the mass derived from X-ray observations under the hypothesis of hydrostatic equilibrium.

We will show preliminary results, based on the {\it Planck}-ESZ clusters observed by XMM-{\it Newton}, on both cosmological and cluster parameters.

We will notably discuss our investigation on a possible redshift and mass dependence of the mass bias, which is considered to be non-existent in hydrodynamic simulations based on Λ-CDM, and compare our results with other studies.

Finally we show that our results on the mass and redshift evolution of the mass bias exhibit a sample dependent behaviour, especially given particular mass and redshift selections.
An evolution of the bias nevertheless needs to be taken into account to derive robust cosmological constraints as we show a degeneracy between a redshift dependence of the bias and cosmological parameters.

Field:

Cosmology

Day constaints:

Talk / **57**

Modeling the outburst of Sgr A*

Auteur: Nicolas Aimar[1]

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Auteur correspondant nicolas.aimar@obspm.fr

For the past two decades, outbursts have been observed from the centre of the Milky Way where a supermassive black hole called Sgr A* is believed to reside. Recent observations have shown that the source of these outbursts is close to the event horizon and have an orbital motion around the black hole. Many scenarios are envisaged to explain this phenomenon without really reaching a consensus. During this presentation I will present two models of outbursts ranging from a general analytical "hot spot" model to a more realistic magnetic reconnection model based on kinetics simulations. We will look at several specific cases to understand the parameters of the model to be able to predict future observations.

Field:

Compact objects (supernovae, black holes, neutron stars)

Day constaints:

Talk / **86**

ComPol - a nano-satellite dedicated to long-term study of Cygnus X-1 polarisation

Auteurs: Ion Cojocari[1]; Philippe Laurent[1]

[1] *CEA/DRF/IRFU/DAp*

Auteur correspondant ion.cojocari@cea.fr

ComPol is a proposed CubeSat mission developed in the context of the ORIGINS excellence cluster with contributions from the Laboratory for Rapid Space Missions, Technische Universität München, Max Planck Institut für Physik, Politecnico di Milano and CEA Departement d'Astrophysique. The main goal of the mission is long-term observation of Hard X-ray/soft gamma ray polarisation of Cygnus X-1 and the evaluation of the scientific potential of CubeSat payloads.

The ComPol payload is a stacked Compton Telescope optimized for polarimetry measurements. It is composed of two separate detectors, a silicon drift detector, TRISTAN, as used in the KATRIN experiment for the search of sterile neutrinos and a position sensitive cerium bromide calorimeter coupled to a silicon-photomultiplier matrix developed at CEA. After a brief overview of the interest of gamma ray polarisation studies, this talk will focus on the principle of polarization measurement with a Compton telescope and a description of the calorimeter detector plane. We will also present calibration data for the calorimeter, the energy response and expected point of interaction position reconstruction precision.

Field:

Instrumentation

Day constaints:

Talk / **80**

Mid-infrared emission of OH as a tracer of H2O UV photodissociation in PDRs

Auteur: Marion Zannese[None]

Co-auteurs: Emilie Habart ; Benoît Tabone

Auteur correspondant marion.zannese@universite-paris-saclay.fr

Recent studies have shown that star formation rate is 10 to 100 times lower to precedent models. Different processes can contribute to gas heating and angular momentum addition into the cloud which disperse it and limits star formation. Radiative feedback from massive stars is one of the major mechanism and has a huge impact on their molecular cloud parent and interstellar matter. Stellar feedback can be probed by observations of Photon-Dominated Regions (PDRs) where massive stars far-ultraviolet (FUV) photons (i.e. $6\text{eV} < E < 13.6$ eV) create warm regions of gas and dust photodestructed. OH enhanced by water photodissociation emits in mid-infrared. As Photon-Dominated Regions (PDRs) are illuminated by far-ultraviolet (FUV) radiation, OH lines might be detected in these regions. OH emission may be use to probe the local UV field, pressure and density of these regions. These lines might be detected by the Webb Space Telescope during its observation of PDRs. Our goal is to predict OH mid-IR lines enhanced by water photodissociation for a large range of pressure and UV field to understand the dependence of their intensity with these parameters. In order to predict OH lines, we use the Meudon PDR Code to compute the models. This code simulates their thermal and chemical structure. Then we use `GROSBETA`, which includes radiative pumping, collision excitation and desexcitation and prompt emission, to post-process the outputs. The influence of pressure and UV field on the integrated intensities is studied in details. Finally, we apply our study to the Orion Bar in order to evaluate the detectability of these OH mid-IR lines with the Webb Space Telescope. OH mid-IR lines can only be detected in very illuminated PDRs with high pressure: $P_{gas} > 5 \times 10^7$ K.cm^{-3} and $G_0 > 10^4$. However, their detectability depends a lot on the line-continuum ratio. They need to be high enough so that they can get out of the residual noise due to detectors.

Moreover, these lines peak at the same position as the highly excited rotational lines (such as 0-0 S(3) and 0-0 S(4)) of H_2.

Field:

InterStellar Medium

Day constaints:

I can only present on 23rd afternoon and 25th.

Talk / **102**

Transition from low to high activity states in gamma-ray emitting NLS1 galaxies

Auteur: Anna Luashvili[1]

[1] *Observatoire de Paris*

Auteur correspondant anna.luashvili@obspm.fr

Gamma-ray-emitting narrow-line Seyfert 1 galaxies (NLS1) constitute an intriguing small population of Active Galactic Nuclei (AGN) with debated fundamental properties, unexpected gamma-ray emission and anomalous variability features, possessing properties similar to low power flat-spectrum radio quasars (FSRQ). They are jetted, gamma/radio-loud Seyfert galaxies, with relatively low BH masses, accreting at exceptionally high, near-Eddington rates.
Two bona-fide NLS1 1H 0323+342 and PMN J0948+0022, and one intermediate object between NLS1 and FSRQ sub-classes B2 0954+25A are considered in this work. We analyzed quasi-simultaneous multiwavelength data for two gamma-ray activity states. Two different scenarios are discussed, in the framework of a one-zone leptonic model, where the high energy emission is due to the inverse Compton scattering of BLR or torus photons by energetic electrons of the jet. Using a maximum number of physical constraints such as the jet opening angle, causality and energetic arguments, we show that the transition from low to high state is well described by minimal changes in the jet parameters, favoring the stationary shock scenario at the origin of the particle acceleration. The correlation between radio and gamma-ray emission is explored to investigate the origin of the variability. The intrinsic nature of these sources and their place in the AGN classification are discussed.

Field:

Compact objects (supernovae, black holes, neutron stars)

Day constaints:

Talk / **105**

Study of trace species in the atmosphere of Titan

Auteur: Koyena Das[1]

[1] *LATMOS*

Auteur correspondant koyena.das@latmos.ipsl.fr

Titan is the second-largest moon in our solar system and has a thick atmosphere. It has nitrogen (94.2%) and methane (5.65%) as it's major constituents, with a lot of trace gases. Methane and nitrogen split due to the sun's ultraviolet rays and high energetic particles (from Saturn's magnetic field),

and this results in a variety of organic compounds in the atmosphere. In this research, I am trying to quantify and develop vertical profiles of these trace species using a mass spectra deconvolution code. Data for this study has been taken from Huygens GCMS. The code runs Monte Carlo simulations to vary the intensity of individual fragments and develop vertical profiles of species with poorly known fragmentation patterns. This work shows vertical profiles of ten known species for 10000 simulations.

Field:

Planetology (including small bodies and exoplanets)

Day constaints:

23/03, 24/03,25/03

Talk / **92**

Current and future constraints on cosmology and modified gravitational wave friction from binary black holes

Auteurs: Christos Karathanasis[None]; Danièle Steer[None]; Konstantin Leyde[1]; Eric Chassande-Mottin[None]; Simone Mastrogiovanni[None]

[1] *APC Université de Paris*

Auteur correspondant kleyde@apc.in2p3.fr

Gravitational wave (GW) standard sirens are well-established probes with which one can measure cosmological parameters, and are complementary to other probes like the cosmic microwave background or supernovae standard candles. We focus on dark GW sirens, specifically binary black holes (BBHs) for which there is only GW data. Our approach relies on the assumption of a source-frame mass model for the BBH distribution, and we consider four models that are representative of the BBH population observed so far. In addition to inferring cosmological and mass model parameters, we use dark sirens to test modified gravity theories. These theories often predict different GW propagation equations on cosmological scales, leading to a different GW luminosity distance which in some cases can be parametrized by variables Ξ_0 and n. General relativity (GR) corresponds to $\Xi_0 = 1$. We perform a joint estimate of the population parameters governing mass, redshift, the cosmology, and the modified GW luminosity distance. We use data from the third LIGO-Virgo-Kagra observation run (O3) and find - for the four mass models and for three SNR cuts of 10, 11, 12 - that GR is consistently the preferred model to describe all observed BBH GW signals to date. Furthermore, all modified gravity parameters have posteriors that are compatible with the values predicted by GR at the 90% confidence interval (CI). We then focus on future observation runs O4 and O5: We show that there are strong correlations between cosmological, astrophysical and modified gravity parameters. If GR is the correct theory of gravity, and assuming narrow priors on the cosmological parameters, we recover the modified gravity parameter $\Xi_0 = 1.47^{+0.92}_{-0.57}$ with O4, and $\Xi_0 = 1.08^{+0.27}_{-0.16}$ with O4 and O5. If, however, Nature follows a specific modified gravity model we exclude GR at the $1.7\,\sigma$ level with O4 and at the $2.3\,\sigma$ level with O4 and O5 combined.

Field:

Cosmology

Day constaints:

Talk / **89**

Inferring the escape fractions of ionizing photons from HII regions in the Dwarf Galaxy Survey

Auteur: Lise RAMAMBASON[1]

Co-auteurs: Vianney Lebouteiller [2]; Nick Abel [3]; Arjan Bik [4]; Mélanie Chevance [5]; Ilse De Looze [6]; Frédéric Galliano [7]; Suzanne Madden [7]; Fiorella Polles [8]; Chris Richardson [9]; Daniel Schaerer [10]

[1] *CEA/AIM*

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[5] *Astronomisches Rechen-Institut, Zentrum für Astronomie der Universität Heidelberg*

[6] *Ghent University and University College London*

[7] *AIM, CEA, CNRS*

[8] *SOFIA Science Center, USRA*

[9] *Elon University*

[10] *Observatoire de Genève*

Auteur correspondant lise.ramambason@cea.fr

Part of the ionizing continuum (Lyman continuum, LyC) produced by young stars can leak out of the host galaxy and ionize its surroundings. At high redshift, such LyC-leaking galaxies are among the best candidates to fully account for reionization (Robertson et al. 2013). However, direct measurements are extremely difficult as the LyC photons are easily absorbed by neutral gas on the observed line of sight. Instead, indirect tracers have been used to probe the structure of the interstellar medium (ISM) (e.g. Lyman alpha line, absorption lines) but such methods are also sensitive to line of sight selection effects. Using integrated emission lines in the optical and infrared domain mostly palliates viewing angle dependencies; it is a promising method to make the most of observations with current ground-based facilities (e.g., ALMA) and upcoming space missions (e.g., JWST) that will grant access to many spectroscopic tracers up to redshift above 7. However, a complex modeling step is much needed to take into account the available tracers originating in different phases and to consider a multi-component topology which matches the ISM signatures of known leaking galaxies (Ramambason et al. 2020).
Such complex representative models are crucial to investigate morphology-dependent questions such as the impact of the metal and dust content on the gas distribution and mass in the different reservoirs and the porosity to ionizing radiation. Local low-metallicity galaxies, with quasi-primordial-like physical conditions and with numerous emission lines available, are ideal laboratories to benchmark this new method and explore its predictive power in high-redshift galaxies for which only a few tracers are often observed. To constrain the parameters of this representative galaxy model, we co-developped MULTIGRIS (Lebouteiller & Ramambason in prep.) a new Bayesian code using MCMC sampling. Among the various applications, MULTIGRIS can produce probability density functions of physical parameters, either primary (density, ionization parameter, stellar population age etc…) or secondary (e.g., ionizing photon escape fraction, dust mass, H2 mass).
I will present the results obtained on the Dwarf Galaxy Survey (Madden et al. 2013), a sample of local, low-metallicity galaxies using combinations of Cloudy models (Ferland et al. 2017). We build upon previous results from Cormier et al. (2019) to quantify the larger porosity of the interstellar medium for low-metallicity galaxies, with the inferred topology having more density-bounded regions, leading to photons escaping the HII regions. We explore dependencies of ionizing photons escape fraction on our model parameters and discuss promising line ratios for future localand high-redshift studies.

Field:

InterStellar Medium

Day constaints:

no available on Thursday 24th

Q&A / 109

Q&A

Talk / 67

Characterization of exoplanetary atmospheres with high resolution spectroscopy

Auteur: Adrien Masson[None]

Auteur correspondant adrien.masson@obspm.fr

Over the last decade, the field of exoplanet research and study has entered a new era of atmospheric characterisation, made possible by the development of detection methods based on high-resolution spectroscopy. The instrumental capabilities of *SPIRou*, the infrared spectropolarimeter installed at *CFHT*, allow us to provide new constraints on the composition and atmospheric dynamics of hot Jupiters, which represents a major challenge for our understanding of the formation and evolution of exoplanetary systems.

The objective of my PHD thesis is to develop and implement a complete pipeline of processing and analysis tools for the detection of molecules in the atmosphere of transiting exoplanets atmospheres, using high-resolution spectroscopy data and cross-correlation technics. During this talk, I will briefly present the methods commonly used to detect molecules in a transiting exoplanet spectra whose amplitude is several orders of magnitude below the stellar and earth signal contribution, and the atmospheric properties that can be infered from it, using concrete examples of exoplanets that I have studied during the beginning of my PHD.

Field:

Planetology (including small bodies and exoplanets)

Day constaints:

I can present my talk on any of the 3 conference days, except for Thursday the 24th March afternoon due to lecture attending obligations.

Talk / 62

Astrometric search for exoplanets in the Alpha Cen system with GRAVITY

Auteur: Keegan Thomson-Paressant[1]

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Auteur correspondant keegan.thomson-paressant@obspm.fr

The Alpha Centauri system comprises the two solar-like stars A and B and the red dwarf Proxima. Together they are our closest cosmic neighbours, making them a particularly interesting target for exoplanet searches. We are analysing 3 years worth of astrometric data on Alpha Cen A/B with the hope of recovering an exoplanetary signal. This presents a unique set of challenges due to the proximity of the target, including saturation issues and high proper motion. We have generated a new set of data reduction tools that can be used in concurrence with the pre-existing pipeline in order to mitigate some of these issues. Finally, we are in the process of observing conjunction events

between Alpha Cen A/B and background stars, in order to locate the position of potential planets within the system.

Field:

Planetology (including small bodies and exoplanets)

Day constaints:

Available all three days, no particular preference.