

# STEP'UP PhD Congress 2026 - Congrès des Doctorant·es CDD 2026

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IPGP



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Poster / 3

## Potential tsunamis generated by the on-going Mayotte sismo-volcanic crisis: new scenarios, sensitivity tests, and numerical simulations of generated waves.

Auteur: Noëlie Goasdoué<sup>1</sup><sup>1</sup> IPGP

Speaker information:

PhD 1st year

Poster / 4

## Fluvio-aeolian paleogeographic evolution of the Namib Desert throughout Cenozoic climate and geodynamic changes

Auteur: oscar bruneau<sup>1</sup>Co-auteurs: Abel Guihou<sup>2</sup>; Cécile Robin<sup>3</sup>; Eugene Marais<sup>4</sup>; François Guillocheau<sup>5</sup>; Louis Louis Gaudaré<sup>1</sup>; Olivier Dauteuil<sup>3</sup>; Pierre Dietrich<sup>3</sup>; Régis Braucher<sup>2</sup>; Laurie Barrier<sup>1</sup><sup>1</sup> Université Paris Cité, Institut de Physique du Globe de Paris, CNRS, Paris, France<sup>2</sup> Aix-Marseille University, CNRS, IRD, INRAE, CEREGE, Aix-en-Provence, France<sup>3</sup> Univ Rennes, CNRS, Géosciences Rennes, Rennes, France<sup>4</sup> Gobabeb – Namib Research Institute, Walvis Bay, Namibia<sup>5</sup> 3 Univ Rennes, CNRS, Géosciences Rennes, Rennes, France

Desert landscapes are highly-sensitive environments to climate changes. This high sensitivity is mostly due to their scarce water resources, together with a direct exposure of bare rocks and soils to meteorological phenomena. As a result, in these arid environments, even minor shifts in hydroclimatic conditions can significantly modify hydrography, vegetation cover, and sediment transport by rivers and winds, with major consequences for ecosystems and the people living in and beyond these drylands (~1/3 of the landmass and world population). Clarifying the relationships between desert landscapes and climate variations is therefore essential for anticipating their future evolution. In this context, studying the geological history of desert landscapes is necessary to understand how these systems respond to different climatic disturbances. In this work, we focus on the fluvio-aeolian morphosedimentary dynamics of the Namib Desert in Namibia, throughout Cenozoic climate changes. By reconstructing the paleogeographical evolution of the Namib region since the late Oligocene, we explore how the combined action of fluvial and aeolian processes has driven the spatio-temporal transformations of the regional landscape under varying climatic regimes. We compiled all the geological and geochronological constraints available on the Namib paleolandscapes in the literature, and complemented them with new remote sensing and field observations, as well as additional dating. Based on a critical synthesis of these data, we produced four paleogeographical maps illustrating three main phases of periodic expansion and contraction of the aeolian routing-system and associated landforms. We propose a late Oligocene-early Miocene landscape reconstruction preceding the earliest evidence of aeolian system development, when fluvial networks drained freely toward the adjacent Atlantic Ocean. Then, we document two major Mio-Pliocene changes: the early extension of the Namib Sand Sea and surrounding dune fields associated with an aggradation of the fluvio-aeolian systems, followed by the contraction of the sand sea associated with river incisions. Finally, we also map the present-day landscape to constrain a second major phase of aeolian extension contemporaneous with river incision during the Quaternary. Together, our four paleogeographic reconstructions provide an opportunity to discuss the origins of these landscape changes in terms of climatic and/or geodynamic forcings.

**Speaker information:**

PhD 1st year

**Poster / 5****Beyond Expectations: Unusual Water and Salt Chemistry in the Okavango Delta (Botswana)****Auteur:** Valentin Challier<sup>1</sup>**Co-auteurs:** Marc Jolivet<sup>1</sup>; Nashaat Mazrui<sup>2</sup>; Aline Dia<sup>3</sup>; Mélanie Davranche<sup>3</sup>; Olivier Dauteuil<sup>3</sup>; Maxime Pattier<sup>3</sup>; Lionel Dutruch<sup>3</sup>; Patrice Petitjean<sup>3</sup><sup>1</sup> *IPGP*<sup>2</sup> *Okavango Research Institute*<sup>3</sup> *Géosciences Rennes*

Wetlands developing in semi-arid regions are increasingly affected by salinisation and trace element enrichment; processes that should increase in time with climate changes and anthropic activities. The Okavango Delta (Botswana) provides a rare example of a pristine wetland that nevertheless shows evidence of trace element contamination. This alluvial fan located in the SW termination of the East African Rift System is in the heart of an endoreic drainage network taking its source in Angola and having its outlet in the Makgadikgadi pans. Annual floods enter the Delta, creating permanent and seasonal swamps that isolate thousands of islands of various sizes and shapes. Subsurface (2 to 3 m deep) groundwaters in the Delta are known to be largely alkaline with pH values up to 9, dissolved inorganic carbon values up to 4400 ppm and elevated concentrations of dissolved metals and metalloids, some of which are toxic (arsenic up to 6 ppm, uranium up to 12 ppm, vanadium up to 4 ppm, etc.). A first model explained the formation of the saline groundwater through evapotranspiration of the fresh water brought by the annual flood followed by infiltration through the tree belts surrounding the many islands emerging from the wetlands. However, our recent trace-element geochemical studies of groundwater and sediment in the central part of the Delta, showed that groundwater composition could not result from a simple evapotranspiration of surface water, leading to the proposition of a two-aquifer model. In this model, the two aquifers are hydrologically and chemically separated by a clay-rich layer. The surface aquifer contains circum-neutral pH fresh water while the subsurface aquifer is seal-capped by the clay layer and contains alkaline water. Following this initial result, the present study addresses the nature, composition and origin of salt deposits that have been described on several of these islands of the Delta, especially in its eastern, more humid region. For the first time, we provide a complete major and trace elements geochemical description of these salts and compare them to evaporites from the Makgadikgadi pans. We demonstrate that the composition of the Delta salts (essentially trona) is very different from that of the Makgadikgadi evaporites (mostly halite) but, in some points, similar to that of the alkaline groundwater previously described. Our main hypothesis is that surface water could represent a source for the salt deposits through a coupling of mechanisms involving evaporation and biotic/abiotic (bio)geochemical processes. Here alkaline groundwater could represent a testimony of past similar processes trapped under a clay-rich layer. The concentrations of trace elements in the Delta salts (As: up to 110 ppm, U: up to 12 ppm, V: up to 14 ppm) and potential toxicity to the environment and local populations will be discussed.

**Speaker information:**

PhD 2nd year

**Poster / 6**

## Deep-learning based large-scale automated observation of earthquake surface ruptures

**Auteur:** Xin Liu<sup>1</sup>

<sup>1</sup> *Institut de Physique du Globe de Paris*

Rapid and objective mapping of co-seismic surface ruptures is essential for post-earthquake impact assessment and for improving our understanding of fault geometry, stress transfer, and rupture processes that inform longer-term seismic hazard analyses. However, rupture mapping has traditionally relied on manual interpretation of field observations or remote-sensing data, which is time-consuming and difficult to extend consistently to large spatial extents, multiple earthquakes, and diverse data sources. Here we present an automated deep-learning framework—the Deep Rupture Mapping Network (DRMNet)—a convolutional neural network designed for end-to-end, high-precision detection of co-seismic surface ruptures from multi-sensor imagery. DRMNet is applied to four large continental earthquakes: the 2021 Mw 7.4 Maduo, 2022 Mw 6.9 Menyuan, 2001 Mw 7.8 Kokoxili, and 1905 Mw ~8 Bulnay (Mongolia) events. The framework consistently delineates both primary and subsidiary rupture structures across centimetre-scale drone imagery and metre-scale satellite data. Across diverse tectonic settings, image resolutions, and preservation states, DRMNet achieves precisions approaching or exceeding 90%. By enabling consistent rupture recognition across multiple events, sensors, and timescales, the proposed framework overcomes the event-specific and local-scale limitations of previous approaches, supporting both rapid post-earthquake response and retrospective rupture reconstruction, and laying the groundwork for standardized global surface-rupture inventories.

**Speaker information:**

other PhD students

**Poster / 8**

## High-precision Sb isotopes of carbonaceous chondrites : implications for origin of the MVEs depletion

**Auteur:** Huange Huange<sup>1</sup>

<sup>1</sup> *IPGP*

**Speaker information:**

PhD 2nd year

**Poster / 10**

## QUBIC: Self-Calibration as an Efficient Method to Control Systematic Effects in Bolometric Interferometry

**Auteur:** Eva Elkhoury<sup>1</sup>

<sup>1</sup> *Qubic*

**Speaker information:**

PhD 1st year

**Poster / 11****The GENESIS mission: a new space geodetic satellite to improve the International Terrestrial Reference Frame (ITRF).****Auteur:** Léonie Leroux<sup>1</sup><sup>1</sup> *Université de Paris Cité, Institut de physique du globe de Paris, CNRS, IGN, 75005 Paris, France***Speaker information:**

PhD 1st year

**Poster / 12****Mitigating the impact of solar radiation pressure mismodeling in GNSS station position time series****Auteur:** Julien Barnéoud<sup>1</sup>**Co-auteurs:** Paul Rebeschung<sup>1</sup>; Alvaro Santamaría-Gómez<sup>2</sup>; Sylvain Loyer<sup>3</sup><sup>1</sup> *Université Paris Cité, Institut de physique du globe de Paris, CNRS, IGN, F-75005 Paris, France; Univ Gustave Eiffel, Géodata Paris, IGN, F-75238 Paris, France*<sup>2</sup> *Géosciences Environnement Toulouse, Université de Toulouse, CNES, CNRS, IRD, UPS, Toulouse, France*<sup>3</sup> *Collecte Localisation Satellites, Ramonville-Saint-Agne, 31520, France*

Time series of GNSS station positions play a central role in the study of Earth's surface deformation and in the realization of terrestrial reference frames. Despite significant progress, these time series remain affected by non-geophysical signals, thereby limiting the investigation of millimeter-level deformations. Among these perturbations, periodic signals of satellite origin —particularly harmonics of the draconitic cycle —are a major source of ground motion uncertainty. These effects are mainly attributed to the imperfect modeling of solar radiation pressure (SRP) acting on the satellites.

This PhD project aims to better understand and reduce the impact of these errors on GNSS position time series. The methodology will rely, on the one hand, on the evaluation and implementation of new SRP models within the CNES GINS software and, on the other hand, on the use of orbital diagnostics such as discontinuities between successive orbital arcs to identify missing accelerations. The ultimate objective is to develop improved SRP models capable of significantly reducing undesired periodic signals, thereby enhancing the precision of GNSS observations for the study of long-term geophysical processes.

**Speaker information:**

PhD 1st year

**Poster / 13****Probing Small-scale Lunar Mantle Heterogeneities using High-frequency P-wave Scattering from Shallow Moonquakes**

**Auteur:** Ramon Margarit<sup>1</sup>

**Co-auteurs:** Melanie Drilleau<sup>2</sup>; Philippe Lognonné<sup>2</sup>

<sup>1</sup> *IPGP*

<sup>2</sup> *Université Paris Cité*

Small-scale heterogeneities in the lunar mantle can be detected through high-frequency scattering of seismic waves [1], but their characterization is limited by uncertainties in phase picking. In this study, we present a systematic analysis of P-wave arrival times from shallow moonquakes, using a refined picking strategy based on a detailed characterization of pre-event noise and Signal-to-Noise Ratio (SNR). These improved P-arrival time estimates allow a robust analysis of waveform distortions at high frequencies as a function of epicentral distance. We quantify the amplitude and frequency dependence of P-wave scattering and use these observations to constrain the scale and distribution of small-scale heterogeneities in the deep lunar mantle. Our results will provide new seismic constraints on the thermal state and structural state of the Moon's interior.

[1] Charalambous et al. (2025), Science, doi : 10.1126/science.adk4292

**Speaker information:**

PhD 1st year

**Poster / 14**

## **Compositional analysis of Copahue volcanic ash based on visual methods and machine learning.**

**Auteur:** Ana Micaela Castellani Flores<sup>1</sup>

**Co-auteurs:** Fidel Costa<sup>1</sup>; Marina Rosas Carbajal<sup>1</sup>; Damiá Benet<sup>1</sup>

<sup>1</sup> *IPGP*

**Speaker information:**

PhD 1st year

**Poster / 15**

## **Investigating Abiotic Organic Synthesis in Archean Rocks from the Canadian Shield**

**Auteur:** Ariane Amat<sup>1</sup>

**Co-auteurs:** Barbara Sherwood Lollar<sup>2</sup>; Bénédicte Ménez<sup>1</sup>; Jonas Bruenjes<sup>2</sup>; Min Song<sup>2</sup>

<sup>1</sup> *IPGP*

<sup>2</sup> *Université de Toronto*

**Speaker information:**

PhD 1st year

## PhD Talks / 16

## Probing the Intergalactic Magnetic Field with Gamma-Ray Observations

**Auteurs:** Jeffrey Blunier<sup>1</sup>; Andrii Neronov<sup>2</sup>; Dmitri Semikoz<sup>1</sup>

<sup>1</sup> APC

<sup>2</sup> APC, EPFL

Our Universe is permeated by magnetic fields across a vast range of scales. The key to the origin of cosmic magnetism may lie in the emptiest regions of the Large Scale Structure, called the cosmic voids, where primordial fields from the early Universe are expected to have remained intact. The strength of this weak Intergalactic Magnetic Field (IGMF) can be constrained from below by observations of specific active galactic nuclei called blazars. The latter have jets pointing at the observer that produce high-energy gamma-rays which deposit electron-positron pairs in the intergalactic medium. These pairs are deflected by the IGMF, leading to a suppression of the secondary photon flux produced by inverse Compton scattering. The absence of this flux in current observations allows us to put a lower limit on the strength of the IGMF.

In this talk, I will introduce the motivations and methods behind the IGMF studies. I will present a revision of conservative lower bounds on the IGMF using joint observations from the Fermi Large Area Telescope (LAT) and ground-based Cherenkov telescopes, resulting in a lower limit of  $B \sim 2 \times 10^{-17}$  G. I will then discuss on the importance of the instrumental modelling, specifically the modelling of Fermi-LAT Point Spread Function (PSF) with pulsars and its impact on the study of extended emission around sources. Finally, I will outline further investigations and improvements for IGMF studies including the role of next-generation gamma-ray telescopes and cosmological simulations.

**Speaker information:**

PhD 2nd year

## PhD Talks / 17

## Seismic Coda Envelope as a Distance Proxy for Lunar Impact Localization

**Auteur:** Yanyu Zhang<sup>1</sup>

**Co-auteurs:** Taichi Kawamura<sup>1</sup>; Sabrina Menina<sup>1</sup>; Mélanie Drilleau<sup>1</sup>; Étienne Parizot<sup>2</sup>; Jinhai Zhang<sup>3</sup>; Philippe Lognonné<sup>1</sup>

<sup>1</sup> Université Paris Cité, Institut de Physique du Globe de Paris, CNRS, Paris, France

<sup>2</sup> Université Paris Cité, CNRS, Astroparticule et Cosmologie, F-75013 Paris, France

<sup>3</sup> Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing, China

Meteoroid impacts are a prominent class of lunar seismic sources in the Apollo record. Due to the strong scattering and low attenuation in the lunar crust, these hypervelocity near-surface sources generate waveforms dominated by long codas, producing emergent onsets that obscure body wave phases. Consequently, classical source location based on travel times from confident P and S picking is feasible for only tens of large-magnitude events. In contrast, additional information can be extracted from the characteristic coda shape. Oberst (1989) proposed an empirical method to locate impacts using the distance dependence of coda peak amplitude and rise time, successfully locating

73 events. However, it suffers from limitations including algorithm ill-conditioning, simplified modeling assumptions, and weak sensitivity to distance within ~2000 km.

In this study, we optimized and reformulated the two empirical coda–distance relations by incorporating seismic quanta scattering theory for the distance range up to 1200km. This enables the location of local lunar impacts that are commonly recorded by fewer than three stations and therefore cannot be located using classical travel-time methods. We first validated the method using impacts previously located by P- and S-wave travel times, by artificially limiting the number of stations to one or two. In both cases, the estimated locations agreed with reference solutions within ~200 km and exhibited strong robustness against noise. We then applied the approach to previously non-located impacts in the Apollo catalog. A total of 95 high-amplitude local events with identifiable coda envelope signatures were selected and located on an event-by-event basis using available station observations. The inferred locations are independently cross-validated through the distance dependence of coda shape.

This coda-envelope–based approach provides a practical framework for locating lunar impacts under sparse station configurations and enrich the event catalog for future lunar interior and impact seismicity investigations.

**Speaker information:**

PhD 1st year

**Poster / 18**

## **Understanding pre-eruptive conditions and magmatic processes that led to the 1530 cal. AD eruption at La Soufrière de Guadeloupe**

**Auteur:** Zoe Turpin<sup>None</sup>

**Speaker information:**

PhD 1st year

**Poster / 19**

## **Response of liquid argon to low-energy nuclear recoil in the DarkSide-20k experiment**

**Auteur:** David Fernando Freitas da Silva Cavalcante<sup>1</sup>

<sup>1</sup> APC (Université Paris Cité)

The nature of dark matter remains one of the most compelling open questions in particle physics. Although overwhelming gravitational evidence supports its existence, no direct detection via non-gravitational interactions has yet been achieved. Among the proposed candidates, Weakly Interacting Massive Particles (WIMPs) are strongly motivated theoretically. Extensive experimental efforts have excluded a significant portion of the WIMP parameter space (defined by mass and interaction cross section with baryonic matter) particularly in the high-mass region. Current searches are increasingly focused on the low-mass regime, which remains comparatively unexplored and requires enhanced detector sensitivity.

This work investigates the response of Liquid Argon (LAr) to low-energy nuclear recoils, aiming to improve signal characterization and background discrimination in this challenging region. A detailed understanding of LAr behavior at low energies is essential to enhance the sensitivity of the

upcoming DarkSide-20k experiment, a dual-phase liquid argon time projection chamber designed for the direct detection of WIMPs.

**Speaker information:**

PhD 1st year

**Poster / 20**

## **Foam-assisted (bio)remediation of petroleum-contaminated soil: effects of surfactant formulation on foam behaviour, interfacial properties, and bioavailability**

**Auteur:** Sholpan Baimaganbetova<sup>1</sup>

<sup>1</sup> *Université Paris Cité, Institut de physique du globe de Paris*

Soil contamination by refined petroleum hydrocarbons remains a significant environmental problem due to these compounds' toxicity, persistence, and mobility. Bioremediation has emerged as an environmentally friendly and cost-effective approach that uses microorganisms to degrade hydrocarbons into less harmful substances. However, its overall performance is often limited by nonuniform distribution of biological amendments, preferential flow in highly permeable zones, and insufficient contact between reactive agents and contaminants. In addition, limited oxygen availability in conventional liquid-based systems constrains aerobic biotreatment and reduces microbial degradation efficiency.

Foam-assisted (bio)remediation technologies have shown promise in overcoming these limitations by acting as transport and flow-control media, enabling remediation amendment delivery, contaminant displacement, preferential-pathway blocking, and enhanced oxygen vectorization for aerobic biodegradation through interfacial and multiphase flow processes in porous media. The effectiveness of this approach is governed by the foaming properties, interfacial behavior, and sorption/desorption characteristics of the surfactant formulations injected into porous media.

This work aims to evaluate environmentally friendly and cost-effective surfactant formulations to produce stable foams suitable for biological amendment transport. Surfactant selection is critical: biosurfactants such as rhamnolipid and saponin offer low toxicity and high biodegradability but are more expensive, while synthetic surfactants (Sodium dodecyl sulfate (SDS), Tween 80, Triton X-100, and Cocamidopropyl Betaine (CAPB)) are cheaper but potentially less sustainable. In this study, single (control), binary, and ternary surfactant formulations were investigated through bulk characterization and batch experiments.

Surface activity of surfactants was investigated using dynamic surface tension measurements performed with a Drop Shape Analyzer (DSA 100, Krüss) over a broad concentration range to establish surface tension-concentration relationships and determine critical micelle concentrations (CMC). These measurements were used to assess synergistic effects in mixed surfactant systems, which directly influence foam generation and foam stability under environmental conditions.

Foam behavior was evaluated using bulk foam analysis using the Dynamic Foam Analyzer (DFA 100, Krüss) to characterize foamability, foam stability, and foam structure, which is critical for foam transport in porous media. Foamability was quantified based on initial foam height and generation efficiency, while foam stability was assessed through foam half-life measurements. The foam structure was further analyzed by monitoring the bubble size distribution and its temporal evolution, providing insight into bubble coalescence, coarsening, and liquid drainage mechanisms.

To evaluate contaminant bioavailability, the desorption characteristics of surfactant formulations were planned to be investigated through batch experiments. These experiments aim to quantify surfactant-enhanced desorption of contaminants from soil.

Overall, this study demonstrates how surfactant formulation controls foam properties, interfacial behavior, and contaminant desorption mechanisms. By investigating surface activity, foam generation, foam stability, and desorption processes, the results provide a mechanistic foundation for understanding foam-assisted bioremediation processes.

**Speaker information:**

PhD 2nd year

## Poster / 21

## Multi-wavelength and multi-messenger study of neutrino emitting AGN candidates

**Auteur:** Justin Albinet<sup>None</sup>

**Speaker information:**

PhD 1st year

## Poster / 22

## Improving the Prediction of Interfacial Tension and Adsorption at Fluid-Fluid Interfaces for Mixtures of PFAS and/or Hydrocarbon Surfactants by Considering Synergistic Effect

**Auteur:** Martin Witt<sup>1</sup>

**Co-auteurs:** Dominique Guyonnet<sup>2</sup>; Eric van Hullebusch<sup>3</sup>; Maxime Cochenec<sup>2</sup>; Nicolas Devau<sup>2</sup>; Stéfan Colombano<sup>2</sup>

<sup>1</sup> *Université Paris Cité, BRGM*

<sup>2</sup> *BRGM*

<sup>3</sup> *IPGP*

Per- and polyfluoroalkyl substances (PFAS) are a family of compounds listed as persistent, mobile and toxic, posing significant risks to human health and ecosystems. Some PFAS, notably those present in Aqueous Film-Forming Foam (AFFF) exhibit significant adsorption at fluid-fluid interfaces (e.g., air-water interfaces), which play a crucial role in their transport through soil and groundwater. Furthermore, AFFF formulations contain mixtures of PFAS and hydrocarbon surfactants with anionic, cationic, zwitterionic, and non-ionic species.

Current models for PFAS adsorption typically account for competitive adsorption but don't consider synergistic effect that occurs in presence of surfactants of different charges, thereby limiting their predictive capabilities for AFFF contamination sources.

This study aims to demonstrate that incorporating synergistic effect between PFAS and other surfactants changes the estimated quantities of PFAS adsorbed at fluid-fluid interfaces, and consequently that transport in soil is, in turn, affected.

Our modelling approach, utilizes Szyszkowski parameters for each component, derived from fitting surface tension versus concentration curves for individual surfactant solutions—maintaining consistency with existing non-synergistic models. Furthermore, we will provide new experimental Szyszkowski parameters for specific AFFF-derived PFAS. These values fill a gap in the current literature and can be integrated into both existing and future adsorption models. The adsorption model will be implemented in a transport screening model in the unsaturated zone to assess its impact on PFAS transport in soil.

**Speaker information:**

PhD 1st year

Poster / 23

## Search for Higgs Boson Pair Production in the bby Final State with the ATLAS Detector

**Auteur:** Dian YU<sup>1</sup>

<sup>1</sup> APC, CNRS/IN2P3 and Université Paris Cité (FR), Tsung-Dao Lee Institute (CN)

**Speaker information:**

PhD 1st year

Poster / 24

## Ambient Noise Cross-Correlations along Distributed Acoustic Sensing (DAS) for Imaging the Subsurface at Stromboli Volcano

**Auteur:** Lilian Hebrard<sup>1</sup>

**Co-auteurs:** Eléonore Stutzmann ; Jean-Philippe Metaxian

<sup>1</sup> IPGP

The deployment of dense seismic arrays on volcanoes has increased significantly over the past decades, enabling more precise monitoring of volcanic activity. While short-period sensors are commonly used, Distributed Acoustic Sensing (DAS) represents a promising complementary technology, providing high spatial resolution and remote location of the interrogator. Accurate monitoring requires a robust understanding of seismic wave propagation, particularly within the shallow subsurface beneath the sensors. On volcanic edifices, the distribution of eruptive deposits along the flanks can be highly heterogeneous, leading to strong lateral variations in physical properties that can significantly affect seismic records.

In this study, we use ambient noise cross-correlation to characterize the subsurface velocity structure beneath a 3 km long DAS cable deployed on Stromboli volcano, Italy. We analyse two months of continuous strain rate data acquired on this persistently active volcano, which allows the application of a passive approach. Empirical Green's Functions (EGFs) are retrieved using Phase Cross-Correlation and times-scale Phase Weighted Stack methods. They are validated through comparison with EGFs obtained from collocated short-period seismic sensors. Local phase and group velocities are then computed along the optical fiber and inverted to determine the 2D S-wave velocity profile. We clearly identify 2 distinct regions along the profile which are correlated with changes of local topography, eruptive activity and deposits.

**Speaker information:**

PhD 2nd year

Poster / 25

## Stabilité des panaches volcaniques en effondrement partiel : modélisation de l'éruption du Fogo A (Açores)

**Auteur:** Léa Guichard<sup>1</sup>

**Co-auteur:** Guillaume Carazzo <sup>1</sup>

<sup>1</sup> *IPGP*

L'éruption Fogo A (~4600 ans BP) sur l'île de São Miguel figure parmi les éruptions pliniennes les plus puissantes documentées dans l'archipel des Açores. L'analyse de sa séquence éruptive révèle une phase initiale phréatomagmatique, suivie du développement d'une colonne plinienne soutenue, puis d'un épisode final d'effondrement partiel de la colonne accompagnant la production de coulées pyroclastiques. La transition dynamique entre panache soutenu et effondrement partiel fait de Fogo A un cas d'étude précieux pour comprendre les mécanismes régissant la stabilité des colonnes éruptives. La production simultanée d'un panache dans l'atmosphère et de coulées pyroclastiques au sol lors d'un effondrement partiel de colonne souligne la nécessité de mieux contraindre les différents modes de dispersion des produits volcaniques, et de caractériser l'ensemble des aléas volcaniques associés.

Dans une première étape, nous avons modélisé la phase de panache stable. La remarquable préservation des dépôts de Fogo A, combinée à la grande variabilité des vents dans la région Nord-Atlantique, offre une opportunité unique pour contraindre les paramètres éruptifs à partir de la dispersion des produits volcaniques. Nous présentons ici les résultats de simulations numériques réalisées à l'aide du modèle FALL3D, intégrant à la fois des données de terrain (granulométrie, volume) et 85 ans de vents issus de la base de données Copernicus ERA5, afin de produire des cartes de dispersion de téphras. Plusieurs centaines de simulations déterministes ont été menées afin d'explorer un ensemble de scénarios éruptifs, en se concentrant sur la hauteur de la colonne, la durée de l'éruption et l'influence des tendances directionnelles et de vitesses des vents. Les résultats sont évalués quantitativement par comparaison aux épaisseurs mesurées sur le terrain.

Nos résultats permettent d'identifier les combinaisons de paramètres éruptifs les plus probables juste avant la phase d'effondrement partiel, offrant ainsi un éclairage nouveau sur la dynamique de ces écoulements complexes. En combinant contraintes stratigraphiques, données météorologiques et modélisation numérique multi-scénarios, cette étude contribue à améliorer l'évaluation des aléas volcaniques, en particulier dans un contexte insulaire, où la planification des évacuations reste un défi majeur pour la gestion des crises volcaniques.

**Speaker information:**

PhD 1st year

**Poster / 26**

## **What does microseismicity reveal a century after a major intraplate earthquake? Insights from a temporary seismic experiment in Mongolia.**

**Auteur:** Laure Manceau<sup>1</sup>

**Co-auteurs:** Laurent Bollinger<sup>2</sup>; Yann Klinger<sup>3</sup>; Jean Letort<sup>4</sup>; Battulga Batkhuu<sup>5</sup>; Ulziibat Munkhuu<sup>5</sup>

<sup>1</sup> *CEA - IPGP*

<sup>2</sup> *CEA*

<sup>3</sup> *IPGP*

<sup>4</sup> *IRAP*

<sup>5</sup> *IAG*

Large earthquakes commonly occur along plate boundaries, but, although less frequent, they can also take place within slowly deforming continental interiors. In these intraplate settings, deformation is challenging to measure with geodetic methods, and the long recurrence time of major earthquakes means that direct observations —instrumental or historical —are scarce. Aftershocks and persistent

microseismicity along the faults responsible for these major ruptures therefore provide key information for understanding the behaviour of intraplate fault systems whose seismic potential remains poorly constrained.

The 1905 Tsetserleg–Bulnay earthquake sequence in Mongolia —the largest recorded intraplate rupture sequence, with two magnitude-8 events —provides a unique natural laboratory to explore the dynamics of large intraplate fault systems. More than a century later, this fault system still produces a surprisingly high rate of small earthquakes. To investigate this ongoing activity, CEA (France) and IAG (Mongolia) deployed a dense temporary seismic network at the junction of the main ruptures. Using modern automated processing workflows, we detected and precisely located thousands of micro-earthquakes, revealing the fine-scale architecture of the fault system at depth.

Our observations reveal a highly uneven pattern of microseismicity: some fault segments are highly productive while others are almost quiet. This spatial variability, together with fault kinematics, highlights the role of the stress field orientation in controlling the current activity of the fault system. These observations help revisit how the 1905 earthquake sequence unfolded. Moreover, the depth distribution indicates that the fault system has not fully healed and may still be undergoing long-term post-seismic processes.

Beyond this regional case study, our results highlight the potential of temporary seismic experiments to better characterize fault structure and dynamics in intraplate regions where observations remain limited. This presentation will take the audience from field investigations in the Mongolian steppe to the interpretation of fault processes beneath the surface, offering a broader perspective on the behaviour of intraplate fault systems.

**Speaker information:**

PhD 2nd year

**Poster / 27**

## **Holographic baryons as quantum Hall droplets**

**Auteurs:** Aldo Cotrone<sup>1</sup>; Andrea Olzi<sup>2</sup>; Francesco Bigazzi<sup>3</sup>; Jean-Loup Raymond<sup>4</sup>

<sup>1</sup> *INFN Firenze & Università di Firenze*

<sup>2</sup> *Università di Firenze & APC*

<sup>3</sup> *INFN Firenze*

<sup>4</sup> *APC*

**Speaker information:**

PhD 1st year

**Poster / 28**

## **Source characteristics of Very low frequency earthquakes (VLFE) in the Southern Ryukyu subduction zone**

**Auteur:** Tanguy Delaporte<sup>None</sup>

**Speaker information:**

PhD 2nd year

## PhD Talks / 29

## A modeling perspective on hydro-climate variability in dryland lakes : What is the impact of low- to high-frequency and intensity hydro-climate variability on the rise, development, persistence and demise of Lake Eyre - Kati Thanda ?

**Auteur:** Ahmed Naceur MAMA<sup>1</sup>

**Co-auteurs:** Frédéric Fluteau <sup>2</sup>; Guillaume Le Hir <sup>2</sup>; Jan-Hendrik May <sup>3</sup>; Joep Storms <sup>4</sup>; Mathieu Schuster <sup>5</sup>; Thomas Faraon <sup>6</sup>

<sup>1</sup> *Institut de Physique du Globe de Paris (IPGP), CNRS, Paris, France and School of Geography, Earth and Atmospheric Sciences, University of Melbourne, Australia*

<sup>2</sup> *Institut de Physique du Globe de Paris (IPGP), CNRS, Paris, France*

<sup>3</sup> *School of Geography, Earth and Atmospheric Sciences, University of Melbourne, Australia*

<sup>4</sup> *Delft University of Technology, Delft, the Netherlands*

<sup>5</sup> *Université de Strasbourg, CNRS, ENGEES, Institut Terre et Environnement de Strasbourg, France*

<sup>6</sup> *School of Geography, Earth and Atmospheric Sciences, University of Melbourne, Australia and Université de Strasbourg, CNRS, ENGEES, Institut Terre et Environnement de Strasbourg, France*

Shallow, temporary salt lakes, known as ephemeral playas, are considered among the hydrogeological most sensitive systems to climatic extreme perturbations and flood extent. With a drainage basin exceeding 1,000,000 km<sup>2</sup> and a lake depth of less than 6.5 m, Kati Thanda-Lake Eyre (KT-LE), in Southern Australia, is characterized by a highly variable water balance and large water level fluctuations. It has reached its maximum level only once in the past 150 years, during the 1974-1977 “Great Filling”, emphasizing its status as one of the most unpredictable systems.

During the project, we aim to understand how hydro-climate variability across event magnitudes drives episodic lake filling and drying, and which basin-scale processes (inflow generation, transmission losses, evaporation, and potential groundwater interactions) control the water-level dynamics of KT-LE.

We use the one-dimensional General Lake Model (GLM), forced with hourly ERA5 meteorological and hydrological reanalysis inputs over the 1974–2022 period to simulate daily lake level variations through time.

Initially, in this study, our model, calibrated in terms of surface energy balance and driven by a basin-averaged surface runoff, produces overestimated lake levels compared to satellite measurements. This suggests that basin-scale precipitation signals, largely driven by the northern catchment, do not necessarily reflect hydrological conditions farther south near the lake.

To quantify water losses and the processes controlling them, we first define the fraction of inflow reaching the lake that reproduces the observed lake-level. We find that losses are strongly non-linear through time, exceeding 70–90% during minor floods, when precipitation affects only limited portions of the Lake Eyre Basin, and decreasing toward 0% during major floods, indicating a saturated and fully interconnected basin state. A river-focused analysis using GLOFAS v4.0 suggests that transmission losses derived from spatially averaged ERA5 runoff may be overestimated in years when sub-basin contributions are asynchronous.

Given the large surface area of the basin and the limited in-situ monitoring, these multi-scale results underline the importance of assessing and continuously evaluating the limitations of reanalysis-based climatic and hydrological forcing when applied to arid environments.

**Speaker information:**

PhD 2nd year

**Poster / 30**

## **Model Independent Measurement of ZH Production at FCC-ee**

**Auteur:** Tom FOURNIER<sup>1</sup>

<sup>1</sup> *APC Paris CNRS/IN2P3*

**Speaker information:**

PhD 1st year

**Poster / 31**

## **Boosting the sensitivity of next generation gravitational wave detectors through quantum correlations**

**Auteur:** Isander-Louis AHREND<sup>None</sup>

Frequency dependent squeezing is a crucial and well established technology in current gravitational wave detectors. Future detectors such as Einstein Telescope will heavily rely on this technology since it is the only way to go beyond the standard quantum noise limit and increase the sensitivity of the detectors when we cannot increase the power. Current detectors such as VIRGO and LIGO only require a linear rotation of the squeezing ellipse with frequency. However future gravitational wave detectors are being conceived with detuned signal recycling mirrors. For these detectors the rotation of the squeezing ellipse cannot be linear anymore. To realise this non trivial rotation of the squeezing ellipse several configurations are being considered, requiring at least two filter cavities or one coupled filter cavity. We propose the first experimental demonstration of this frequency dependent squeezing with non trivial rotation of the squeezing ellipse while testing the robustness of these two filter cavity configurations.

**Speaker information:**

PhD 2nd year

**Poster / 32**

## **Building a Catalog for Near-Source Ground Motion Analysis of Moderate Earthquakes using the February 2023 Türkiye Sequence**

**Auteur:** Pauline Gay<sup>1</sup>

<sup>1</sup> *IPGP - ASNR*

Seismic hazard assessment partly relies on the ability to predict ground motion, particularly near the source, where damage is generally the most severe. In this region, existing strong-motion database lack sufficient recordings, leading to poorly calibrated prediction models and large uncertainties. My PhD research aims to confront these models with seismic ground motions recorded close to the fault. To this end, I am building a database from thousands of aftershocks of the two Turkish earthquakes of February 2023 (Mw 7.7 and 7.6, respectively). The study focuses on moderate-magnitude earthquakes (3.5 to 6) recorded at distances shorter than 15 km from their source, representative of reference

scenarios for seismic hazard assessment in mainland France. Using continuous recordings from 101 stations between February 2023 and November 2024, seismic phases are automatically detected and associated into probable events, which are then located using a probabilistic approach and subjected to quality control. Magnitudes are estimated through the inversion of seismic wave displacement spectra. This process led to the identification of 371 usable events, forming the basis for future analyses of near-source ground motions.

**Speaker information:**

PhD 2nd year

**PhD Talks / 33**

## Exploring Gravitational Waves from Extreme Mass Ratio Inspirals (EMRIs) in the Time-Frequency Domain with LISA

**Auteur:** Saptarshi GHOSH<sup>None</sup>

**Co-auteurs:** Gaël Servignat<sup>1</sup>; Quentin Baghi<sup>1</sup>; Alvin J. K. Chua<sup>2</sup>

<sup>1</sup> *Astroparticule et Cosmologie*

<sup>2</sup> *National University of Singapore*

Due to their unparalleled precision for measuring the properties of the massive black holes and testing general relativity, Extreme Mass Ratio Inspirals (EMRIs), which are composed of a massive black hole and a compact object, are one of the most promising sources of gravitational waves for space-based detectors such as the Laser Interferometer Space Antenna (LISA). The intricate nature of the signal, however, makes it difficult for astrophysicists to detect them. Realistic EMRI waveform generation is computationally laborious, which is a significant challenge for their detection and characterization. In order to save computing expenses while maintaining accuracy, we have created an approximated time-frequency representation of the EMRI waveform and LISA response. This representation will be useful not only for EMRIs but also for stellar origin black hole binaries and massive black hole binaries.

**Speaker information:**

PhD 2nd year

**Poster / 34**

## Galaxy overdensity catalogues with Euclid and Spitzer at $z > 1.3$

**Auteur:** Nicolas Mai<sup>1</sup>

<sup>1</sup> *APC*

Galaxy clusters provide a powerful way to study how galaxies evolve. At redshifts up to  $z \sim 1$ , dense regions like clusters tend to host massive quenched galaxies, while isolated galaxies remain more active. However, this trend is less understood at higher redshifts, where some cluster cores still show strong star-formation. When do these changes appear?

In this work, we aim to establish the basis for combining Spitzer and Euclid observations to extend the detection of (proto)clusters candidates at redshifts  $z > 1.3$ . To that end, we use Euclid photometry from the Q1 release and our Spitzer photometry and densities to identify extreme Spitzer overdense regions that host large numbers of passive galaxies.

**Speaker information:**

PhD 2nd year

**PhD Talks / 35**

## **Detailed Modeling of Stochastic Particle Acceleration and Multi-Messenger Emission in AGN Coronae**

**Auteurs:** Sébastien Le Bihan<sup>1</sup>; Martin Lemoine<sup>2</sup>

<sup>1</sup> APC - CNRS,UPC

<sup>2</sup> APC

Stochastic particle acceleration in magnetized turbulent plasmas, and its resulting multi-messenger signatures, has received increased attention in recent years. A detailed modeling of this process is however made complex by the need to treat simultaneously particle acceleration and radiative processes.

We present here a hybrid numerical code that couples AM3 [1], a state-of-the-art, open-source, time-dependent lepto-hadronic radiative modeling tool, with a particle acceleration solver based on a momentum-space transport equation. The acceleration module incorporates recent theoretical developments, in particular the non-linear feedback of accelerated particles on the turbulent cascade [2] and a generalized transport equation in momentum space to model particle acceleration in strong turbulence [3]. This new framework therefore enables a self-consistent modeling of particle acceleration and the associated multi-wavelength and multi-messenger emission, making it a powerful tool to study turbulence-driven acceleration and to produce predictive signatures for comparison with observations.

Recent observations by the Ice Cube collaboration of multi-TeV neutrinos associated with nearby Seyfert galaxies provide specific motivation for this tool [4]. The inferred neutrino flux is at least an order of magnitude larger than the photon flux at similar energies, indicating that neutrinos originate from a region opaque to  $\gamma$ -ray photons. A natural candidate for such an environment is the accreting corona surrounding the central supermassive black hole, where photo-hadronic interactions can occur between the intense radiation field and protons stochastically accelerated by turbulence [5].

Using the hybrid code, we model the coronal plasma including stochastic proton acceleration, feedback on the turbulent spectrum, interactions with the local photon field, and the flow dynamics. The model successfully reproduces the IceCube neutrino flux within a physically motivated corona scenario. This provides a self-consistent explanation for the neutrino emission from NGC 1068 and offers a general framework for studying turbulence-driven particle acceleration and multi-messenger signatures in other astrophysical sources.

[1] M. Klinger et al.: AM3: An open-source tool for time-dependent lepto-hadronic modeling of astrophysical sources, *Astrophys.J.Supp.* 275 (2024) 1, 4

[2] M. Lemoine, K. Murase, F. Rieger: Nonlinear aspects of stochastic particle acceleration, *Phys. Rev. D* 109, 063006 (2024)

[3] M. Lemoine: First-Principles Fermi Acceleration in Magnetized Turbulence, *Phys. Rev. Lett.* 129, 215101 (2022)

[4] IceCube Collaboration: Evidence for neutrino emission from the nearby active galaxy NGC 1068, *Science* 378, 6619, 538-543 (2022)

[5] A. Das, T. Zhang, K. Murase: Revealing the Production Mechanism of High-Energy Neutrinos from NGC 1068, *Astrophys.J.* 972 (2024) 44

**Speaker information:**

PhD 1st year

**Poster / 36**

## **Design and Multi-Scale Evaluation of Colloidal Gas Aphrons (CGA) for Subsurface Remediation**

**Auteur:** Dana Sapobekova<sup>1</sup>

<sup>1</sup> *IPGP*

**Speaker information:**

PhD 1st year

**Poster / 37**

## **Acoustic and seismic characterization of submerged granular flows**

**Auteur:** Armel Chiron<sup>None</sup>

**Speaker information:**

PhD 1st year

**Poster / 38**

## **The Photon Detection System of the DUNE Vertical Drift Detector**

**Auteur:** Mariya MOLLOVA<sup>1</sup>

<sup>1</sup> *APC*

**Speaker information:**

PhD 1st year

**Poster / 39**

## **Active learning with Bayesian neural networks for stellar population synthesis**

**Auteur:** Théo Courty<sup>1</sup>

**Co-auteurs:** Sylvain Chaty<sup>1</sup>; Éric Chassande-Mottin<sup>1</sup>

<sup>1</sup> APC

**Speaker information:**

PhD 1st year

**Poster / 40**

## Testing LISA with the Beam Simulator

**Auteur:** Lucas Pardessus<sup>1</sup>

<sup>1</sup> APC

**Speaker information:**

PhD 1st year

**PhD Talks / 41**

## How does organic matter affect Ce redox speciation and CeO<sub>2</sub> nanoparticle formation?

**Auteur:** Terjini Bhagya De Silva Kiththangodage<sup>1</sup>

**Co-auteurs:** Aline Dia<sup>2</sup>; Charlotte Catrouillet<sup>1</sup>; Fadi Choueikani<sup>3</sup>; Jaimy Scaria<sup>4</sup>; Mathieu Pédrot<sup>4</sup>; Rémi marsac<sup>1</sup>; Yann Sivry<sup>1</sup>

<sup>1</sup> Institut de physique du globe de Paris, 1 Rue Jussieu, 75005 Paris

<sup>2</sup> Univ Rennes, Géosciences Rennes, 35000 Rennes, France

<sup>3</sup> Synchrotron SOLEIL, L'Orme des Merisiers, Saint-Aubin BP48, 91192 Gif-sur-Yvette cedex, France

<sup>4</sup> Univ Rennes, Géosciences Renne, 35000 Rennes, Frances

Understanding the interactions between trace metals and organic matter (OM) is crucial due to its influence on metal speciation, mobility, toxicity, and bioavailability. Cerium (Ce) is of particular interest due to its industrial use, natural occurrence and unique redox chemistry. It exists in both the +III and +IV oxidation states, enabling redox cycling in surface environments. However, the mechanisms by which OM influences the redox behavior of Ce remains poorly understood. In this study, we combined advanced spectroscopic and microscopic analyses with thermodynamic modeling to elucidate the influence of OM on Ce redox processes over a pH range of 4–10 under oxic (ambient atmosphere) and anoxic (N<sub>2</sub> anaerobic chamber) conditions. The results showed a strong pH dependent Ce oxidation in the presence of OM and O<sub>2</sub>, with negligible Ce(IV) at pH 5 and nearly complete oxidation at pH 10. Dissolved oxygen (O<sub>2</sub>) was identified as the primary oxidant, as almost no Ce(IV) was detected under N<sub>2</sub>-atmosphere. At low [Ce], complexation of Ce(III) by OM was identified as key mechanism limiting its oxidation to Ce(IV) whereas, at high [Ce] or the absence of NOM, oxidation was driven by hydrolysis and precipitation of CeO<sub>2</sub> nanoparticles. OM exerted a broader control on Ce speciation by (i) constraining the crystal growth of these nanoparticles to ~2nm crystallites and (ii) accumulating Ce(III) within a ~1nm-thick layer around CeO<sub>2</sub> nanoparticles, tentatively attributed to the formation of CeO<sub>2</sub>-OM-Ce(III) ternary complexes. Overall, these findings provide fundamental insights into the impact of OM on cerium fate in natural environments.

KEYWORDS. Cerium, Organic matter, Redox, CeO<sub>2</sub> nanoparticles

**Speaker information:**

PhD 2nd year

**PhD Talks / 42****TeV transient sources with H.E.S.S.****Auteur:** Pierre Pichard<sup>1</sup><sup>1</sup> APC

– I didn't look carefully enough at the dates, I teach on Tuesday 31st afternoon, so I would appreciate being put in another timeslot :) –

The study of very-high-energy (VHE) gamma-ray astrophysics opens a unique window into the most extreme phenomena in the Universe. This talk provides an overview of the challenges of detecting VHE gamma rays. Imaging Atmospheric Cherenkov Telescopes (IACTs), such as the High Energy Stereoscopic System (H.E.S.S.), enable the observation of these photons by detecting the Cherenkov light produced in extensive air showers. After introducing the techniques, the talk will present some of the main transient sources and their characteristics .

**Speaker information:**

PhD 2nd year

**Poster / 43****Copper binding to natural organic matter studied through UV-Vis absorbance****Auteur:** Héctor Apreza<sup>1</sup>**Co-auteurs:** Fabrice Mahé <sup>2</sup>; Khahn Vy Tran <sup>2</sup>; Noémie Janot <sup>3</sup>; Rémi Marsac <sup>4</sup>; Yann Sivry <sup>4</sup><sup>1</sup> INRAE, Bordeaux Sciences Agro, Université Paris Cité, Institut de physique du globe de Paris<sup>2</sup> Université de Rennes, CNRS, IRMAR - UMR 6625<sup>3</sup> INRAE, Bordeaux Sciences Agro, ISPA –UMR 1391<sup>4</sup> Université Paris Cité, Institut de physique du globe de Paris, CNRS

The bioavailability and ecotoxicity of trace metals (such as Cu, Cd, and Pb) in the environment is largely governed by sorption processes. Natural organic matter (NOM) serves as the primary sorbent in soils and aquatic systems. It is known that NOM binds trace metals through some of its functional groups, particularly carboxylates and phenolates. However, due to its heterogeneous and polydisperse nature, quantifying the speciation of metal binding to NOM remains challenging. Accessing this information would be favourable to model trace metal-NOM binding in natural systems.

UV-Vis spectroscopy is a powerful tool for studying the properties of NOM at environmentally relevant concentrations. In this study, copper binding to reference material leonardite humic acid (LHA) was investigated across varying pH and metal concentrations. A novel data processing approach was developed to deconvolve the absorbance signal across the UV-Vis range, separating contributions from carboxylic and phenolic functional groups. The response of LHA absorbance to changes in proton and metal concentration is separated into the contribution of proton- and Cu-bound carboxylic and functional groups. Simultaneously, the fractions of carboxylic and phenolic functional groups

bound to Cu, protons, and deprotonated are obtained from this approach. Deconvolved speciation results were compared to the predictions of the commonly used geochemical model NICA-Donnan. This study provides a helpful and accessible tool to quantify the speciation of NOM functional groups in the presence of metals.

**Speaker information:**

PhD 2nd year

**Poster / 44**

## Chlorine Incorporation in Iron Phosphate and Borate Glasses for Nuclear Waste Immobilization

**Auteur:** Yanis Daoud<sup>None</sup>

**Co-auteurs:** Cyrille Veronneau ; Daniel Neuville ; Laurent Cormier

Chlorine is a volatile element commonly found in various types of waste, including legacy radioactive waste and waste generated by molten salt reactors. The presence of chlorine in these wastes represents a significant challenge for long-term immobilization, as its vitrification in conventional borosilicate glasses is hindered by the low solubility of chlorine, leading to volatilization losses and potential degradation of the glass matrix.

In this context, iron phosphate glasses have emerged as a promising alternative for nuclear waste immobilization due to their ability to accommodate a wide range of elements and their favorable chemical durability. This study focuses on the mechanisms of chlorine incorporation in P<sub>2</sub>O<sub>5</sub> - Al<sub>2</sub>O<sub>3</sub> - Fe<sub>2</sub>O<sub>3</sub> - X (X = CaO, Na<sub>2</sub>O, SrO) and B<sub>2</sub>O<sub>3</sub> - Al<sub>2</sub>O<sub>3</sub> - Fe<sub>2</sub>O<sub>3</sub> - X glass systems.

The effects of the nature of alkali and alkaline-earth elements, synthesis routes, and chlorine precursors were systematically investigated in order to enhance chlorine solubility in the glass matrices. The objective is to identify the key parameters governing chlorine incorporation and retention, thereby contributing to the development of durable glass formulations for the immobilization of chlorine-bearing nuclear wastes.

**Speaker information:**

PhD 1st year

**PhD Talks / 46**

## One Volcano, Multiple Approaches: A Collaborative Study of Mount Fuji's Seismic Activity

**Auteurs:** Adele Doucet<sup>1</sup>; Hesaneh Mohammadi<sup>1</sup>

**Co-auteurs:** Floriane Riche<sup>2</sup>; Nobuaki Fuji<sup>3</sup>; Léonard Seydoux<sup>1</sup>; Stéphanie Durand<sup>4</sup>; Yosuke Aoki<sup>5</sup>; Jean-Philippe Métaixian<sup>1</sup>

<sup>1</sup> IPGP

<sup>2</sup> UPC

<sup>3</sup> IPGP, Institut universitaire de France

<sup>4</sup> LGL TPE, ENS Lyon

<sup>5</sup> ERI Tokyo

Mount Fuji, located approximately 100 km from Tokyo, threatens more than 30 million people. Despite its last eruption in 1707, the volcano has remained quiet for over three centuries, resulting in relatively limited monitoring and an incomplete understanding of its current state and future eruptive potential.

The aim of this study is to understand how seismic observations can reveal the internal structure and dynamics of Mount Fuji in order to better detect and track magma migration. Reaching this objective relies on close multidisciplinary collaboration, combining complementary expertise to address the volcano's complexity.

We present a unified framework built on two complementary approaches. The first develops an automatic detection and classification strategy for seismic activity using machine learning. By combining wavefield coherence analysis (CovSeisNet) with dimensionality reduction (UMAP), we extract and organize coherent seismic patterns, enabling the identification of known events while revealing previously unresolved structures in the volcano's activity.

To interpret these patterns physically, the second approach investigates the P-wave coda, whose scattered energy is highly sensitive to structural heterogeneities beneath the volcano. This analysis provides constraints on the internal structure and dynamic processes responsible for the observed seismic signatures.

By integrating signal processing and physical modeling within a joint project, we aim to construct a four-dimensional view of source mechanisms and structural evolution beneath Mount Fuji. This collaborative strategy represents a step toward improved monitoring and more robust early-warning capabilities.

**Speaker information:**

PhD 3rd year

**Poster / 48**

## **Longitudinally hemispheric structures in the geodynamo : from their physical origin to their geomagnetic consequences**

**Auteur:** Luc Grasset<sup>1</sup>

**Co-auteur:** Julien Aubert<sup>1</sup>

<sup>1</sup> *IPGP*

The investigation of geomagnetic variations has revealed the presence in Earth's core of a planetary-scale, axially columnar and eccentric gyre flow. Together with the magnetic anomaly of low intensity presently seen beneath the South Atlantic, these structures show that longitudinal hemisphericity is a common feature of the geodynamo. Here, we propose that these hemispherical features result from the onset properties of spherical shell rotating convection in presence of an imposed axial magnetic field, with spatially homogeneous fixed-flux thermal boundary conditions. For an Earth-like range of background magnetic field amplitudes, we find hemispherical critical convection modes that are largely supported by a magneto-Archimedes-Coriolis (MAC) balance and where viscosity plays a secondary role. The morphology of the critical modes is in agreement with the general circulation of the gyre. Pursuing this analysis with fully developed, turbulent self-sustained dynamo simulations, we find that hemispherical modes inherited from convection onset can be maintained if the MAC balance is not perturbed by inertia, the force coming at the next order in the force balance. The presence of the eccentric gyre is therefore conditioned to the magnetic energy matching or exceeding the kinetic energy in the system, the so-called strong-field dynamo regime. The simulations also feature low magnetic intensity anomalies that rotate westward together with the gyre flow. We highlight a strong correlation between the gyre longitudinal position, the low intensity focus of magnetic intensity, and the eccentricity of the dynamo-generated dipole, showing that these hemispherical structures are indeed linked by the properties of magnetic induction.

**Speaker information:**

PhD 1st year

Poster / 49

## Biological Baselines of Magnesium Isotope composition in Mouse Organs and Fluids Across Ages

**Auteur:** Rui Guo<sup>1</sup>

**Co-auteurs:** Frederic Moynier<sup>1</sup>; Toshiyuki FUJII<sup>2</sup>; Esther Lahoud<sup>1</sup>; Tu-Han Luu<sup>1</sup>; Dimitri Rigoussen<sup>1</sup>

<sup>1</sup> *Université Paris Cité, Institut de Physique du Globe de Paris, CNRS, Paris, France*

<sup>2</sup> *Division of Sustainable Energy and Environmental Engineering Graduate School of Engineering, Osaka University  
2-1 Yamadaoka, Suita, Osaka 565-0871, Japan*

**Speaker information:**

PhD 2nd year

Poster / 50

## Speciation, bioaccumulation and biological feedback: towards a new predictive model for the toxicity of metals and their cocktails in aquatic ecosystems

**Auteur:** cbarac Baracchini<sup>1</sup>

<sup>1</sup> *IPGP*

**Speaker information:**

PhD 1st year

PhD Talks / 51

## Deep magma ocean crystallization reconciles the Nb–U and Sm–Nd mantle discrepancy

**Auteur:** Nicolás Cárcamo Villarroel<sup>1</sup>

**Co-auteurs:** Catherine Chauvel<sup>1</sup>; Cécile Hébert<sup>2</sup>; James Badro<sup>1</sup>; Nicolas Wehr<sup>1</sup>; Sebastian Cozma<sup>2</sup>; Stephan Borensztajn<sup>1</sup>

<sup>1</sup> *Université Paris Cité, Institut de Physique du Globe de Paris, CNRS*

<sup>2</sup> *Electron Spectrometry and Microscopy Laboratory, EPFL*

Mass-balance approaches using different geochemical tracers yield contrasting and inconsistent estimates of how the present-day mantle compares to the primitive mantle taken as the bulk silicate Earth (BSE). The Sm-Nd isotopic system suggests it represents only ~20-50% of BSE, whereas the Nb/U ratio implies a fraction higher than 60% [1]. To address this discrepancy, we investigated

whether the solidification of Earth's magma ocean ~4.5 Ga ago could be a contributing factor. To quantify this process, the mineral-melt partition coefficient in the deep mantle must be constrained. To this end, we conducted new laser-heated diamond anvil cell experiments to determine the partitioning coefficients of key trace elements (Nd, Sm, U, and Nb) between a pyrolytic melt and bridgmanite under lower-mantle conditions. Experiments were performed at deep-mantle pressures and temperatures sufficient to achieve complete melting, followed by controlled fractional crystallization. Quantitative major and trace element concentrations in both solids and melts were measured using scanning transmission electron microscopy. These experimental constraints allow us to model deep-mantle crystallization dominated by early bridgmanite formation, followed by ferropericlase and calcium perovskite at more advanced stages.

Using these new partitioning data, we calculate the composition of the crystallized solid and remnant liquid during magma ocean solidification. The crystallized solid may subsequently be enriched by mixing with a fraction of the remnant liquid to produce a source that would later evolve to generate the Continental Crust (CC) and its residual counterpart, the Present-Day Mantle (PDM). Combining the results of our crystallization model with the known composition of the PDM and CC [1], we identify a range of conditions under which the Sm-Nd and Nb-U systems are consistent with geochemical observables. These two ratios are reconciled for the first time without invoking a hidden or lost reservoir. The PDM represents between ~70% and ~98% of the BSE.

These results show that magma ocean solidification plays a significant role in defining and establishing primitive mantle reservoirs, and that its geochemical impact on mantle chemistry should be systematically considered in models of Earth's evolution.

[1] Hofmann, Class & Goldstein (2022), *Geochemistry, Geophysics, Geosystems* 23, e2022GC010339.

#### Speaker information:

PhD 2nd year

#### PhD Talks / 52

## Insights into fault evolution and rupture dynamics in a strike-slip context from 3D Discrete Element models

**Auteurs:** Adélaïde Allemand<sup>1</sup>; Luc Scholtès<sup>2</sup>; Yann Klinger<sup>3</sup>

<sup>1</sup> IPGP

<sup>2</sup> Université Clermont Auvergne, CNRS, IRD, OPGC, Laboratoire Magmas et Volcans

<sup>3</sup> CNRS, IPGP

Strike-slip continental faults often show complex geometries, inherited from their past history. More particularly, they display branches, bends, and steps, also referred to as geometric asperities. Thus, far from being straight-lined, continental strike-slip faults are characterised by disconnected and misaligned sections, whose length and separating distance vary as the faults mature in time.

The presence of those discontinuities (or complexities) along the fault could affect earthquake rupture dynamics; indeed, the extensional or compressional nature of these discontinuities results in stress heterogeneities along the fault system. In addition, depending on the degree of development of the latter, the deformation at fault complexities can show various levels of localisation, balancing between fault segments well connected by fractures and fault portions dominated by damaged zones where the deformation is distributed. As a consequence, fault complexities often act as nucleation- or end-points for seismic ruptures.

In order to study the effect of fault geometry on earthquake ruptures, we developed a 3D numerical model of an evolving continental strike-slip fault, based on the Discrete Element Method (DEM).

In this model, an initially intact medium is subjected to a strike-slip tectonic regime and, thanks to the DEM capability to explicitly describe progressive failure mechanisms, it evolves through different

stages of deformation that eventually lead to the emergence of a structure presenting complexities similar to that of natural faults. We are thus able to analyse the relationship between fault maturity and fault geometry. In addition, multiple local ruptures occur along the fault. Therefore, we can characterise the evolution of the earthquake cycles with geological history: on one hand, for each earthquake, we explore how the rupture is spatially affected by fault complexities; on the other hand, we look at the way successive earthquakes progressively modify the geometry of the fault system. Finally, we compare those observations with natural cases.

**Speaker information:**

PhD 3rd year

**Poster / 53**

## **Temperature-Dependent Particle Formation During Biomass Combustion: A Combined spICP-TOFMS and Magnetic Susceptibility Study**

**Auteur:** Selene Calvel<sup>1</sup>

**Co-auteurs:** Aude Isambert ; Bruno Coudour ; Chad Cuss ; Julie Carlut ; Marc Benedetti ; Mickael Tharaud

<sup>1</sup> IPGP

Wildfires increasingly threaten ecosystems worldwide, yet their impact on nanoparticle formation and environmental mobility remains poorly understood. This study investigates how combustion intensity influences the production, composition, and magnetic properties of inorganic nanoparticles through controlled laboratory experiments on heather biomass. Combining nanoparticles analyses in leachate single-particle inductively coupled plasma time-of-flight mass spectrometry (spICP-TOFMS) and magnetic bulk susceptibility measurements, we characterized samples formed across a range of combustion temperatures (400–800 °C) and durations (5–30 min).

Fresh, organic-rich samples exhibited predominantly diamagnetic behavior. Progressive heating marked increases in saturation magnetization (Ms), suggesting transformation of iron oxide phases with significant changes emerging at 400 °C and intensifying above 550 °C. Leaching experiments revealed pronounced shifts in particle composition: fresh samples released predominantly iron-rich particles (>50%), whereas high-temperature combustion (800 °C) yielded leachates dominated by manganese nanoparticles (>95%). At intermediate temperatures (550 °C), a distinct population of Fe–Mn bimetallic nanoparticles appeared, indicating redox-driven coalescence or intermetallic interactions. Particle concentrations ranged from  $3.0 \times 10^7$  to  $2.7 \times 10^9$  particles g<sup>-1</sup>, with complex release patterns reflecting competing processes of enhanced mobilization, particle coarsening, and aerosolization at extreme temperatures.

Together, magnetic and leaching data provide complementary constraints on fire-induced transformations. We identify multiple nanoparticle-based proxies for wildfire intensity, including enhanced magnetic signatures, manganese enrichment in leachate, bimetallic MnFe particle formation, and shifts in particle mass distributions. These proxies offer new tools for post-fire environmental assessment and improve predictions of particle-mediated contaminant transport in fire-affected landscapes.

**Speaker information:**

PhD 1st year

**Poster / 54**

## Hyperspectral remote sensing of arid environments on Earth and on Mars

**Auteur:** Robin Langouet<sup>1</sup>

<sup>1</sup> *IPGP*

The Asal-Ghoubbet rift in the Republic of Djibouti serves as an exceptional natural laboratory of planetary interest, characterized by complex igneous lithology, hydrothermal alterations, and Holocene evaporitic deposits. The EnMAP (Environmental Mapping and Analysis Program) hyperspectral mission provides a critical opportunity to characterize these surfaces through high-resolution spectroscopy across the VNIR and SWIR domains. While standard Level-2A surface reflectance products are designed for direct scientific use, their application in this arid volcanic context reveals significant limitations, including spectral artifacts in the water vapor absorption bands and inconsistencies in atmospheric masking. These issues can compromise the identification of diagnostic mineral absorption features essential for quantitative mapping. To address these challenges, this study implements a dedicated atmospheric correction workflow starting from Top-of-Atmosphere (L1C) radiance data. By leveraging the MODTRAN6 radiative transfer model, we perform site-specific simulations to account for local atmospheric conditions and acquisition geometry. This approach aims to minimize residual artifacts and ensure physically consistent surface reflectance. Our results demonstrate that customized processing of EnMAP data significantly improves mineralogical classification and spectral identification, providing a robust baseline for comparative remote sensing studies in extreme environments.

**Speaker information:**

PhD 1st year

**Poster / 55**

## Gravitational Wave Bursts from Extreme Mass Ratio Inspirals

**Auteur:** Lukas Arda<sup>1</sup>

<sup>1</sup> *APC Paris*

**Speaker information:**

PhD 1st year

**Poster / 56**

## In situ investigation of nanoparticles heteroaggregation processes in surface waters

**Auteur:** Tahmina Allahverdiyeva<sup>None</sup>

**Co-auteurs:** Allan Philippe ; Yann Sivry

**Speaker information:**

PhD 2nd year

## PhD Talks / 57

## From cosmological experiments to sensitive cryogenic detectors : a cool road to CMB

**Auteur:** Elisa Radjabou<sup>1</sup>

<sup>1</sup> APC CNRS

Have you ever looked up at the night sky and wondered where our world came from, or how it all began? These are the fundamental questions that astrophysicists and cosmologists strive to answer. We now know that the Big Bang is the most robust theory explaining the origin and evolution of our Universe.

Thanks to numerous ground and space experiments, we have observed a relic signal from the dawn of time: the Cosmic Microwave Background, first discovered in 1965.

This relic radiation behaves like a black body at roughly 3 K and contains tiny temperature fluctuations, or anisotropies, on the scale of a few nanokelvins.

Within these fluctuations lies the signal's polarization, categorized into E-modes and B-modes, according to their shape and origin. While E-modes have been extensively mapped, B-modes are the ultimate goal of modern cosmology. They carry crucial information regarding the amplitude of primordial gravitational waves, multi-messenger astronomy, gravitational lensing and more. Because the B-mode signal is incredibly faint compared to the temperature anisotropies we must use hundreds of thousands of the most sensitive detectors and readout systems available.

To capture such subtle signals, our detectors must be cooled to cryogenic temperatures, often as low as 100 mK. Operating at these extremes minimizes thermal noise and allows us to use superconducting materials, which are sensitive enough to register the tiniest variations in cosmic temperature. Indeed those materials exhibit a sharp superconducting to normal transition and are used as very sensitive thermometers.

Determination of performances in terms of sensitivities and bandwidth of such ultra sensitive detectors (transition edge sensors) require the development of methodologies of measurements and analysis. I'm focusing on the reconstruction of transition of the resistance as a function of temperature behind these superconducting sensors. Their response to a step signal is also an interesting tool to recover many dynamic sensor parameters. Finally, I'm building a noise model of these sensors taking into account the evolution of their operating point in the superconducting transition. This study would ease the on-site characterization of large arrays of transition edge sensors.

**Speaker information:**

PhD 2nd year

## PhD Talks / 58

## Analytical Modeling of Mismatch-Induced Noise in Space-Grade differential Low Noise Amplifiers

**Auteur:** That Minh Bao TON<sup>1</sup>

<sup>1</sup> Université Paris Cité, CNRS, Astroparticule et Cosmologie, F-75013 Paris, France

Precision space instrumentation requires a rigorous accounting of noise sources that deviate from ideal models. While traditional **differential Low-Noise Amplifier (LNA)** design focuses on intrinsic thermal and shot noise, stochastic transistor mismatch presents a critical bottleneck in reaching the theoretical noise floor. Specifically, the non-ideal elevation of **flicker noise** is dramatically magnified by these imbalances.

This presentation delivers an analytical framework to quantify **LNA input-referred noise** arising from **design and fabrication offsets**. We derive mathematical relationships between **load, transconductance ( $g_m$ ), and geometric mismatches**, focusing on their role in degrading the **Common-Mode Rejection Ratio (CMRR)** and **Power-Supply Rejection Ratio (PSRR)**. Our

model characterizes these imbalances as a primary driver for the **common-mode-to-differential conversion** of tail current source noise into the signal path. The framework is validated through **Monte Carlo simulations** and **measurement** results from a dedicated **IHP 130nm BiCMOS SiGe integrated circuit**, providing a robust methodology for optimizing high-sensitivity readout chains design in extreme space environments

**Speaker information:**

PhD 3rd year

**Poster / 59**

## **Triggering of a slow-moving landslide by the 2023 Kahramanmaraş Earthquake Doublet, highlighted by satellite image correlation**

**Auteur:** Perrine Salvan<sup>1</sup>

<sup>1</sup> *Institut de Physique du Globe de Paris*

**Speaker information:**

PhD 1st year

**PhD Talks / 60**

## **High-temperature peridotite mylonites reveal deep organic carbon cycle at Oceanic Transform Faults**

**Auteur:** Suzanne JOANNO<sup>1</sup>

**Co-auteurs:** Cecile Prigent ; Manon Bickert ; Muriel Andreani ; Alberto Vitale Brovarone ; Gilles Montagnac ; Clément Herviou ; Benedicte Menez

<sup>1</sup> *Institut de Physique du Globe de Paris*

Hydrothermal circulation and associated alteration of the oceanic lithosphere are the first order control on Earth's volatile cycles and have been proposed as a potential driver of the emergence of life on our planet. Constraining the extent of oceanic lithosphere's alteration, and its consequences on lithospheric composition, carbon budget including abiotic organic compound formation is thus key.

While these processes have been investigated at mid-ocean ridges (MOR), oceanic transform faults (OTFs), which regularly segment MOR, have received comparatively little attention. Recent studies, however, suggest that these plate boundaries can be the locus of deep mantle hydration by downward percolation of seawater-derived fluids (to depths of ~ 25-30 km on (ultra)slow spreading ridges; Prigent et al., 2020; Wang et al., 2022), as well as mantle carbonation by upward percolation of magmatic-derived carbon-rich fluids within the fault zone (Klein et al., 2024). Such fluid circulation is key in establishing chemical, particularly redox, disequilibria that influence carbon speciation. In addition, subduction of fracture zones, the fossilized portion of OTFs, is associated with higher slab seismicity and enriched geochemical signatures in overlying arc lavas (e.g. Paulatto et al., 2017). Together, these observations identify OTF as an important yet poorly constrained component of the Earth's volatile cycle, potentially influenced by both hydrothermal and magmatic processes.

This study focuses on constraining the deep volatile cycle on OTFs, with a particular emphasis on carbon. Using deformed and hydrated peridotites from two OTFs of the Southwest Indian Ridge, we characterized water bearing-components (e.g. amphibole, fluid inclusions) that formed during high temperature deformation (700-900°C).

Hydrated silicate phases (e.g. amphibole) serve as indicators of fluid-rock reactions. Trace element concentrations and enrichments in chlorine, boron and lithium suggest a hydrothermal origin for the fluids interacting with the studied mantle rocks, even at great depths.

Fluid inclusions (FIs), mainly hosted in olivine, occur as trails formed near the brittle-ductile transition of the host mineral. Some trails are associated with the formation of the high-temperature shear bands, suggesting syn-deformational fluid trapping. Raman spectroscopy and FIB-SEM analyses of FIs in olivine reveal various crystalline (including serpentine, brucite, magnetite) and gaseous phases (CH<sub>4</sub> and H<sub>2</sub>) in FIs, suggesting intense fluid-olivine reactions during rock cooling. Carbon-bearing phases, including methane and carbonaceous compounds, also formed together with molecular hydrogen, which was likely produced during olivine serpentinization. Methane concentrations (25-136 ppm) and  $\delta^{13}\text{C-CH}_4$  values (-3.8 to -21.5‰), measured for the first time at OTFs, overlap those reported from SWIR gabbros and sediment-starved hydrothermal systems; more work is needed before making robust constraints on the carbon source.

Overall, our results highlight OTF as active sites of deep hydrogen and carbon cycling and emphasize their role in controlling volatile speciation during high-temperature deformation of the upper mantle.

Klein et al. (2024). Proc. Natl. Acad. Sci. U.S.A. 121, e2315662121.

Paulatto et al. (2017). Nat Commun 8, 15980.

Prigent et al. (2020). Earth and Planetary Science Letters 532, 115988.

Wang et al. (2022). Nat Geosci 15, 741-746.

#### Speaker information:

PhD 2nd year

#### Poster / 61

## Experimental studies and numerical modeling of PFAS concentration using foam fractionation, optimization for the recovery of short- and ultra-short-chain PFAS

**Auteur:** Medet Kamash<sup>1</sup>

<sup>1</sup> IPGP

**Abstract.** This study addresses the current challenges of understanding and managing PFAS contamination. It pays particular attention to the limitations of existing separation technologies and the incomplete description of the mechanisms of PFAS behaviour in air water phase. Through an examination of recent literature, the study identifies key unresolved questions concerning interfacial adsorption, foam formation and the implementation of foam-based separation techniques on a process scale.

Foam fractionation (FF) has been discussed as a promising technique for removing surface-active PFAS, particularly long-chain compounds [1],[2]. However, the efficiency of PFAS enrichment depends not only on intrinsic interfacial properties and foamability, but also on operational parameters such as the air injection rate, the distribution of bubble sizes, the characteristics of porous spargers, the conditions of liquid flow, and the overall column hydrodynamics [3]. The combined influence of these physicochemical and operational factors remains insufficiently systematised.

The proposed research aims to investigate the relationship between PFAS interfacial behaviour, foamability, and enrichment performance in foam fractionation systems in a structured manner. Initially, the work will focus on formulations relevant to AFFF, where complex PFAS mixtures will provide a realistic representation of environmental contamination. Subsequent controlled experiments will focus on individual PFAS compounds in order to isolate the governing interfacial mechanisms. The

investigation will then extend to short- and ultra-short-chain PFAS, whose reduced surface activity poses further challenges for foam-based separation processes.

Through surface tension measurements, foam characterisation and controlled foam fractionation experiments, this research will clarify the mechanisms governing PFAS enrichment in foam systems and identify parameters that could inform future process optimisation.

#### References

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[2] Craig Klevan, Oren Van Allen, Kelly Mukai, Andre Gomes, Shana Xia, Seth Caines, Matthew J. Woodcock, and Kurt D. Pennell. Removal of long- and short-chain PFAS from groundwater by foam fractionation. *Environmental Science: Water Research & Technology*, 11(10):2295–2307, 2025

[3] Angel Chyi En We, Arash Zamyadi, Anthony D. Stickland, Bradley O. Clarke, and Stefano Freguia. A review of foam fractionation for the removal of per- and polyfluoroalkyl substances (PFAS) from aqueous matrices. *Journal of Hazardous Materials*, 465:133182, March 2024..

#### Speaker information:

PhD 1st year

#### Poster / 62

### “YOLO-CL : Deep Machine Learning for Galaxy Cluster detection with LSST”

**Auteurs:** Michel Agüena<sup>None</sup>; Simona Mei<sup>1</sup>; Stephane Ilic<sup>None</sup>; Vinh Phat Tran<sup>1</sup>

<sup>1</sup> *APC/UPCité*

Galaxy clusters are powerful and key cosmological probes that trace the evolution of large-scale structures of the universe and inform models of cosmic evolution. The Vera Rubin Legacy Survey of Space and Time (LSST) will provide deep, wide-field optical imaging, enabling the detection of thousands of galaxy clusters up to high redshifts. I am adapting the YOLO-CL convolutional neural network to detect galaxy clusters directly from LSST survey images. YOLO-CL has demonstrated high completeness and purity in both the SDSS and Rubin/LSST DC2 simulated images of individual clusters, outperforming traditional detection methods based on photometric catalogs. Future work will involve optimizing the model's performance under survey-like conditions and ensuring robust cluster selection functions across redshift and mass ranges. This effort aims to contribute a scalable, high-fidelity cluster detection pipeline for next-generation cosmological analyses.

#### Speaker information:

PhD 2nd year

#### PhD Talks / 63

### Identifying and assessing co-tsunamic travelling ionospheric disturbances: key parameters from the 29th July 2025 Kamchatka earthquake

**Auteurs:** Clélia MARÉCHAL<sup>1</sup>; Elvira Astafyeva<sup>1</sup>; Lucie Rolland<sup>2</sup>; Boris Maletckii<sup>3</sup>; Thomas-Dylan Mikesell<sup>4</sup>; Rajesh-Kumar Barad<sup>1</sup>

<sup>1</sup> *Institut de Physique du Globe de Paris (IPGP), Paris, France*

<sup>2</sup> *Geoazur, Université Côte d'Azur, Valbonne, France*

<sup>3</sup> *Earthquake research Institute of Tokyo, Tokyo, Japan*

<sup>4</sup> *Norwegian Geotechnical Institute (NGI), Oslo, Norway*

Tsunamis are among the most devastating natural hazards, leading to significant human casualties. They are typically triggered by submarine earthquakes, volcanic eruptions, or landslides, and predicting their impact remains extremely challenging.

Although various techniques are currently employed to monitor tsunami propagation in both the near-field (within 500 km of the source) and the far field (beyond 500 km), such as seafloor pressure sensors, DART buoys, and tide gauges, tsunami monitoring continues to be highly challenging.

It is well established that tsunami propagation generates internal gravity waves that can be observed in the ionosphere within 20-60 minutes after their formation at the ocean surface [1,2]. By analyzing total electron content (TEC) measurements obtained from GNSS receivers, co-tsunami ionospheric disturbances (CTIDs) can be detected, and tsunami characteristics can be inferred from properties of these disturbances. However, numerous phenomena originating from both terrestrial and space sources also produce gravity waves, which may be interpreted as tsunami-related signals. In particular, the solar terminator -corresponding to the day-night transition - is a key factor to consider in CTID detection due to its regular and predictable occurrence.

On July 29 2025, a Mw 8.8 earthquake struck near the southern coast of Kamchatka, generating a tsunami that propagated across the Pacific Ocean. This event represents the strongest earthquake since the March 2011 Tohoku-Oki earthquake, offering a valuable opportunity to identify, within TEC time series, the essential parameters needed to differentiate CTIDs from solar terminator effects, as well as to investigate and characterize the associated tsunami signal. In this study, we present a comprehensive analysis of the spatio-temporal characteristics of CTIDs in the Hawaii region.

[1] C.O.Hines, *Can.J.Phys.* 38, 1441(1960).

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**Speaker information:**

PhD 2nd year

**Poster / 64**

## **Exploratory analysis of salt deposits distribution in the Okavango Delta (Botswana) using satellite data.**

**Auteur:** Valentin Challier<sup>1</sup>

**Co-auteur:** Marc Jolivet<sup>2</sup>

<sup>1</sup> *Institut de physique du globe de Paris*

<sup>2</sup> *IPGP*

This poster will discuss about the preliminary results of a teledetection study in the Okavango Delta (Botswana). The aim of the study is to analyse the spatial and temporal distribution of salt deposits on the surface of the Delta, using Sentinel-2 and Pleiade-NEO images.

**Speaker information:**

PhD 2nd year

## PhD Talks / 65

## Preparing for Seismic Observations with Dragonfly: What Will Seismology Look Like on Titan?

**Auteur:** Lorraine Delaroque<sup>1</sup>

**Co-auteurs:** Taichi Kawamura<sup>1</sup>; Antoine Lucas<sup>1</sup>; Sébastien Rodriguez<sup>1</sup>; Keisuke Onodera<sup>2</sup>; Hiroaki Shiraishi<sup>3</sup>; Ryuhei Yamada<sup>4</sup>; Satoshi Tanaka<sup>3</sup>; Mark Panning<sup>5</sup>; Ralph Lorenz<sup>6</sup>

<sup>1</sup> Institut de Physique du Globe de Paris, U. Paris Cité

<sup>2</sup> Institute for Planetary Materials, Okayama U.

<sup>3</sup> Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency

<sup>4</sup> U. of Aizu

<sup>5</sup> Jet Propulsion Laboratory, California Institute of Technology

<sup>6</sup> Johns Hopkins U. Applied Physics Laboratory

*Dragonfly*, NASA's next New Frontiers mission, will explore Titan in the mid-2030s and, for the first time, deploy a seismometer on the surface of an icy moon. Titan is believed to host a subsurface water ocean beneath a thick ice shell, making it a prime target for understanding *icy ocean worlds* and their potential habitability. In this context, seismology provides a unique tool to probe Titan's interior structure, complementing the mission's geochemical and atmospheric investigations. In particular, seismic observation could help constrain the thickness of the ice shell and ocean, detect lateral heterogeneities or convection within the outer ice shell, and assess the present-day activity of the satellite.

However, conducting seismology on Titan will be fundamentally different from doing it on Earth and its neighbors, Moon and Mars. To ensure successful observations, we must first anticipate the type of seismic events that can occur and evaluate which signals are likely to be detectable in such an exotic environment. Titan's surface displays a wide range of geological endogenous features—mountain ranges, vast dune fields, and methane lakes—indicating ongoing internal and surface processes. Among the most promising seismic sources are tidal stresses induced by Saturn, which may generate ice-fracturing events within the ice shell and could represent the largest and most detectable seismic events.

In this study, we present forward simulations of seismic waveforms generated by ice-cracking events, exploring how variations in interior structure models (e.g., ice shell thickness, attenuation properties) affect the resulting signals. We also investigate how environmental noise, such as atmospheric turbulence, and instrumental performance, influence signal detectability. Beyond predicting what *Dragonfly* might record, this work aims to identify robust seismic observables that can constrain Titan's upper internal structure.

**Speaker information:**

PhD 2nd year

## Poster / 66

## Impact of filtering along different scanning directions on CMB galactic foregrounds

**Auteur:** Pierre Masson<sup>1</sup>

<sup>1</sup> APC

We investigate the impact of scan direction-dependent time domain filtering in Simons Observatory SATs. SO SATs scan in azimuth at constant elevation, separated into “rising” and “setting” scans. Simple filter+bin map-making produce biased CMB maps that can be corrected at the power spectrum level via a transfer function (estimated from simulations). While this correction is robust for a random CMB field, it may not be able to capture the effects of filtering anisotropic Galactic foregrounds. Using simulations, we split the data into rising and setting subsets, estimate a CMB transfer function for each split, compute the corresponding power spectra, and perform rising-setting null tests to quantify residual inconsistencies attributable to differential filtering. We repeat the analysis for several galactic masks with increasing sky fractions to characterize how the effect evolves from the galactic plane to less directionally coherent regions.

**Speaker information:**

PhD 2nd year

**Poster / 67**

## Measuring the neutrino mass ordering with KM3NeT/ORCA and JUNO

**Auteur:** Matteo Loup<sup>1</sup>

<sup>1</sup> APC

**Speaker information:**

PhD 1st year

**Poster / 68**

## Paleowind directions, paleosecular variation and relative paleointensity from the MIS 6 (L2) loess of Harletz, NW Bulgaria

**Auteur:** Dragomir Dragomirov<sup>1</sup>

<sup>1</sup> IPGP Paleomagnetism lab

Loess (L) and paleosol (P) sequences represent continuous continental archives of environmental changes. Apart from their significance as paleoclimate archives, they may also record variations of the Earth's magnetic field at high temporal resolution. Confirming the reliability of loess sequences as recorders of geomagnetic secular variations (PSV) and relative paleointensity (RPI) would help build more accurate age models and improve the correlation with marine and lacustrine paleomagnetic records.

Here I will present a paleomagnetic study on the Harletz (NW Bulgaria) loess section, with a main focus on the exceptionally thick L2 (MIS6) interval of the Lower Danube loess province. The main objectives will be to determine whether the Harletz sequence preserves a stable record of the relative paleointensity and the direction of the geomagnetic field and at the same time reconstructing paleowind dynamics and directions, using anisotropy of magnetic susceptibility (AMS).

Demagnetization with alternating field (AF) was performed on oriented samples from the S1, L2 and S2. The characteristic remanent magnetization (ChRM) directions were determined using principal component analysis (PCA). From the stable ChRM components a paleomagnetic direction (inclination and declination) is determined, which reflects the direction of the geomagnetic field during deposition and early diagenesis. A mean direction was calculated using Fisher statistics to assess directional consistency and stratigraphic trends.

RPI proxies were obtained using NRM normalized by ARM and IRM ratios. NRM depends on the strength of the geomagnetic field, the magnetic mineralogy, its concentration and the magnetic grain size distribution. Normalizing NRM by ARM or IRM, which respond differently to mineralogy, magnetic mineral concentration, and magnetic grain size distribution, should allow to isolate the relative variations in the intensity of the geomagnetic field. In parallel, AMS measurements provide constraints on the depositional fabric and dominant paleowind directions during loess accumulation.

**Speaker information:**

PhD 2nd year

**PhD Talks / 69**

## **Influence of out-of-equilibrium outgassing on magma ocean evolution and early habitability of rocky planets**

**Auteurs:** Alexandre de Larminat<sup>1</sup>; Henri Samuel<sup>1</sup>; Angela Limare<sup>1</sup>

<sup>1</sup> *IPGP*

During the early stages of the evolution of rocky planets, heat due to accretion, core formation, and radioactive decay has likely melted their silicate mantles, creating global magma oceans. As the magma ocean cools down and solidifies, dissolved volatiles are progressively outgassed, forming a secondary atmosphere. Greenhouse gases in this atmosphere form an insulating blanket that controls much of the evolution of the magma ocean, making interior-atmosphere coupled evolutionary models crucial for understanding this interplay.

Due to vigorous convection of the magma, these models typically assume efficient outgassing of the magma ocean, in chemical equilibrium with the atmosphere. However, the outgassing efficiency can be limited by the fact that fluid parcels containing dissolved volatiles must reach small pressures in order for bubbles to be formed and volatiles outgassed.

We apply this out-of-equilibrium (i.e., non-instantaneous) outgassing scheme to a 1D parametrized model coupled with a radiative-convective atmosphere. This model was calibrated using joint laboratory experiments and Finite-Volume numerical modeling at finite Prandtl number, allowing us to derive scalings for convective cooling and outgassing efficiency.

We systematically vary initial concentrations in CO<sub>2</sub> and H<sub>2</sub>O and planetary sizes over broad ranges, assuming limited solid-melt segregation in the partially molten viscous mush.

With this coupled model, we then investigate the influence of out-of-equilibrium outgassing on the cooling time of the solidifying magma ocean, along with their consequences on planetary atmospheres and surfaces, and habitability. Key findings include the formation of a water ocean on early Earth less than 10 000 years after the beginning of the magma ocean phase, the possible existence of large volatile reservoirs in the mantle, and new constraints on exoplanet compositions that allow for habitability.

**Speaker information:**

PhD 2nd year

**Poster / 70**

## **Dynamics of magma reservoir before and after volcanic eruptions at Axial Volcano in the Eastern Pacific using time-lapse seismic imaging method**

**Auteurs:** Yan Zhao<sup>1</sup>; Hélène Carton<sup>1</sup>; Satish Singh<sup>1</sup>; Maryam Ardalan<sup>1</sup>; Graham Kent<sup>2</sup>

<sup>1</sup> *IPGP*

<sup>2</sup> *Univeristy of Nevada Reno*

Unraveling the nature (physical state) of magma reservoirs beneath active volcanoes is essential to understand their eruption potential. Magma can be in a pure melt state and hence it is more likely to erupt if supplied by fresh melt from below, or in a mush state that is less likely to erupt. However, imaging magma reservoirs on land and deciphering their physical properties is inherently difficult, but the submarine environment offers more favorable conditions, as exemplified by the fact that magma reservoirs have been commonly imaged beneath fast and intermediate spreading centers. Moreover, when several collocated high-quality seismic datasets are available at different times, time-lapse seismic analysis, commonly used in industry, could be applied to study the evolution of the reservoir through multiple eruptions cycles.

The Axial Volcano is a large submarine volcano at the intersection of the Juan de Fuca Ridge and Cobb hotspot that hosts many hydrothermal vent fields and has erupted three times (1998, 2011 and 2015) in recent years. The volcano was the site of a seismic reflection survey in 2002 and some lines were reshot after the 2011 and 2015 eruptions, respectively in 2012 and in 2019. In this study, we focus on one NW-SE oriented profile and apply time-lapse techniques to investigate changes in the magma reservoir before and after the 2011 and 2015 eruptions. Time-lapse signals could be due to the change in depth of the top of magma reservoir and/or a change in the state (melt versus mush) of the magma. The three data vintages were first processed to remove the effect of the data acquisition footprint, which included deghosting, wavelet shaping, and matching filter application. Dynamic time warping was applied to measure time shifts on stacked images, and amplitude energy changes (reflecting impedance contrast variations) were subsequently computed. In addition, absolute reflection coefficients were calculated to obtain indications on melt fraction evolution through time.

The time-lapse results reveal uplift and subsidence of the magma lens before and after eruptions on the scale of 4ms to 20ms. In comparison with 2002, one year after the 2011 eruption, the southeast portion of the magma lens outside the caldera shows uplift, while the portion beneath the 2011 lava flow inside the caldera exhibits subsidence. Interestingly, the melt percentage has decreased everywhere. Then 4 years after the 2015 eruption, in comparison with 2012, the portion of the magma lens beneath the 2011 lava flow southeast of the caldera show subsidence, whereas the portion beneath the 2015 lava flow inside the caldera has continued to undergo slight uplift, with melt fraction increasing in both regions. The contrasting time shift patterns inside versus outside of the caldera could indicate that different magmatic processes are at play in these regions before and after eruptions.

In this contribution, we will present the details of our time-lapse methodology and insights gained about magma dynamics at Axial Volcano using our methodology.

**Speaker information:**

PhD 2nd year

**PhD Talks / 71**

**numu/antinumu separation tagging Michel electrons in atmospheric neutrino events at DUNE Far Detector**

**Auteur:** Matteo Galli<sup>1</sup>

<sup>1</sup> *APC - Paris*

The Deep Underground Neutrino Experiment (DUNE) is a next-generation long-baseline experiment designed to resolve key questions in neutrino physics, including the neutrino mass ordering, by studying neutrinos produced by an accelerator beam and from natural sources (atmospheric, supernovas and solar). The sensitivity to the neutrino mass ordering from atmospheric neutrinos at DUNE can be enhanced by distinguishing muon neutrinos from antineutrinos. This is possible at the DUNE Far Detectors, which use the Liquid Argon Time Projection Chamber technology, even in the absence of a magnetic field, using Michel electrons to distinguish muons from antimuons produced in charged-current neutrino or antineutrino interactions. My study focuses on improving a method to tag Michel-electrons and evaluate the impact of the  $\mu/\bar{\mu}$  separation efficiency on the DUNE sensitivity to neutrino mass ordering.

**Speaker information:**

PhD 3rd year

**Poster / 72**

## **VELI : Explosive Volcanoes Indonesian Laboratory - From Observation to Research**

**Auteur:** Lorène Boulvais-Abbas<sup>1</sup>

<sup>1</sup> *IPGP*

The VELI instrumented site, accredited by INSU-CNRS in 2009, aims to develop long-term observatory activities on explosive Indonesian volcanoes. Mount Merapi (Central Java) is the primary target, with the deployment of a comprehensive monitoring platform integrating geophysical and geochemical measurements, including seismicity, ground deformation, electrical and thermal parameters, and gas flux and composition.

The multidisciplinary database initially developed within the DOMERAPI ANR project (2013–2017) has been maintained and expanded by VELI for over a decade. It is fully integrated into the monitoring network of BPPTKG and CVGHM, supporting both operational monitoring and scientific research.

Ensuring data and metadata quality is a critical step linking operational monitoring to research applications. To address this need, we developed validation protocols and automated tools for GNSS and seismic data distribution, in compliance with international standards and FAIR principles. These tools provide near real-time data quality control and station health assessment, detect and monitor station site effects, and generate statistical diagnostics on instrumentation performance and metadata consistency.

By filling a current gap in standardized validation procedures, these adaptable tools aim to support data distribution for observatories, agencies, and end users. They are currently being implemented at the volcanological and seismological observatories of IPGP. Future developments include large-scale deployment across approximately 300 volcanic monitoring stations operated by CVGHM in Indonesia.

**Speaker information:**

PhD 1st year

**PhD Talks / 73**

## **Automatic Detection of Diagnostic Absorption Features for Mineral Identification Using Continuous Wavelet Transform**

**Auteurs:** Corentin Feray<sup>1</sup>; Rodolphe Marion<sup>2</sup>; Stéphane Jacquemoud<sup>3</sup>

<sup>1</sup> PSS

<sup>2</sup> CEA

<sup>3</sup> IGP

Due to the variability introduced by physical and chemical properties, acquisition conditions, and spectral mixing, interpreting soil reflectance spectra from hyperspectral imaging is challenging. This variability alters the position and shape of absorption bands. Studying the impact of water content, grain size, and acquisition geometry requires defining parameters that are physically based and interpretable. Tools like Tetracorder rely on fixed spectral libraries. In complex environments where variability distorts absorption shapes, this can be limiting.

Spectral deconvolution is a relevant framework for this purpose because it separates the continuum associated with physical effects, such as illumination, scattering and surface roughness, from absorptions linked to mineralogical signatures. The process involves four steps: continuum removal, absorption detection, parameter optimization and mineral identification. In this study, we present a new absorption detection method based on continuous wavelet transform (CWT).

In the solar domain (400–2500 nm), electronic transitions produce broad absorptions within the visible spectrum. In contrast, SWIR vibrational features are numerous and variable in shape. They also often overlap. This variability complicates automatic detection. While CWT-based approaches are effective for isolated absorption peaks, their performance is compromised when absorption bands overlap. These approaches also rely on manually tuned filtering thresholds that must be adjusted for each spectrum or sensor. Currently, there is no automated method capable of robustly detecting all mineral absorptions in a complex context.

The primary objective of my work is to propose an absorption band detection method adapted to the challenging conditions of hyperspectral imaging to facilitate mineral identification. The workflow automatically detects absorption features and identifies minerals in synthetic, laboratory, and airborne hyperspectral data. It accurately retrieves absorption features and reliably identifies minerals in pure samples and mixtures. Applying the method to the Cuprite image further demonstrates its robustness and relevance through qualitative comparison with a reference tool, such as Tetracorder. These results suggest several directions for future research. One approach would be to analyze absorption parameters other than the position of the absorption band. This would allow us to evaluate mineral detection limits in different contexts and assess how factors such as water content, grain size, and acquisition geometry affect peak detectability.

#### Speaker information:

PhD 3rd year

#### PhD Talks / 74

## Neutron Star Dynamical Love Numbers & Black hole tidal deformability

**Auteurs:** Oscar Combaluzier-Szteinszneider<sup>1</sup>; Thomas Apostolidis<sup>None</sup>

<sup>1</sup> APC (*Astroparticules et Cosmologie*)

Black holes are among the simplest objects to describe with a theory of gravity. To achieve a better understanding of their structure, physicists study how they behave when deformed by an external object.

In this presentation, I will first review the definition of black holes in General Relativity and their main properties. I will then briefly describe how their response to external perturbations can be studied by computing tidal coefficients, the Love numbers. Without going into too much technical details, I will provide an overview of the main results concerning black hole perturbations and explain why they are important for future gravitational wave astronomy.

I will try to avoid technical details to keep this presentation understandable by a broad audience

**Speaker information:**

PhD 2nd year

**Poster / 75**

## Impact of *Escherichia coli* on the Platinum speciation

**Auteur:** Justinel Le Doaré<sup>1</sup>

**Co-auteurs:** Alexandre Gelabert<sup>2</sup>; Aurore Gorlas<sup>3</sup>; Camille Rivart<sup>4</sup>; Charlotte Catrouillet<sup>1</sup>; François Guyot<sup>5</sup>; Gautier Landrot<sup>4</sup>; Marc Benedetti<sup>1</sup>

<sup>1</sup> IPGP

<sup>2</sup> CEREGE

<sup>3</sup> I2BC

<sup>4</sup> SOLEIL-synchrotron

<sup>5</sup> MNHN/IMPMC

The anthropogenic use of platinum (Pt) has significantly altered its biogeochemical cycle over recent decades [1], leading to its increasing dispersion in the environment. Microorganisms, ubiquitous in ecosystems, strongly influence metal speciation. While some metals are essential for microbial metabolism, their transformations may also generate toxic forms that microorganisms mitigate through chelation or redox processes [2]. Although microbial interactions with Pt have been documented, the kinetic pathways and metabolic mechanisms driving Pt redox transformations, particularly at environmentally relevant concentrations, remain insufficiently constrained.

This study investigates the influence of the mesophilic bacterium *Escherichia coli* on Pt and sulfur (S) speciation. Cells were exposed to 100  $\mu\text{M}$  Pt(IV) in nutritive medium, and Pt redox transformations were monitored using X-ray absorption spectroscopy (XAS) at the Pt L<sub>3</sub>-edge. Results show that *E. coli* rapidly reduces Pt(IV) to Pt(II) within 1 hour, followed by further reduction to Pt(0) after 24 hours. Spectroscopic signatures indicate the involvement of S-bearing ligands during the reduction process. Complementary XAS analyses at the S K-edge, performed under the same exposure conditions, reveal an increase in reduced sulfur species (S(-II)) and a concomitant decrease in oxidized sulfur species (S(+V)), highlighting the central role of intracellular sulfur in Pt transformation and detoxification mechanisms.

These findings provide mechanistic insight into the coupling between bacterial sulfur metabolism and Pt redox kinetics, and contribute to a better understanding of microbial controls on Pt speciation and potential environmental mobility.

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2. Gadd, G.M. (2013). Microbial Roles in Mineral Transformations and Metal Cycling in the Earth's Critical Zone. In: Xu, J., Sparks, D. (eds) *Molecular Environmental Soil Science. Progress in Soil Science*. Springer, Dordrecht. [https://doi-org.ezproxy.u-paris.fr/10.1007/978-94-007-4177-5\\_6](https://doi-org.ezproxy.u-paris.fr/10.1007/978-94-007-4177-5_6)

**Speaker information:**

PhD 3rd year

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## **Turbulent mixing of two-phase impactors during giant planetary collisions**

**Auteur:** Angela Limare<sup>1</sup>

**Co-auteurs:** Antoine Rullier ; Maylis Landeau <sup>1</sup>

<sup>1</sup> *IPGP, DFG*

**Speaker information:**

PhD 1st year

Poster / 77

## **Evolution of photosynthetic carbon isotope fractionation in Lake Dziani Dzaha during a high CO<sub>2</sub> event: connecting modern and Precambrian conditions**

**Auteur:** Jonas Frère<sup>1</sup>

**Co-auteurs:** Didier Jezequel ; Gerard Bardoux ; Groleau Alexis ; Magali Ader ; Nelly Assayg

<sup>1</sup> *IPGP*

**Speaker information:**

PhD 3rd year

Poster / 78

## **Acoustic fluidization study in rock avalanches using DEM-type models**

**Auteurs:** Alain Bonvalet<sup>None</sup>; Mangeney<sup>None</sup>; Maury<sup>None</sup>

**Speaker information:**

PhD 1st year

Poster / 79

## **Applying likelihood-based spectral ratios to assess robustness and limitations of earthquake source parameter estimation**

**Auteur:** Naossa Maille Okada<sup>None</sup>

**Co-auteurs:** Claudio Satriano ; Mariano Supino

**Speaker information:**

PhD 1st year

**PhD Talks / 80****Pulse Shape Discrimination and Investigation of Detector Stability for DarkSide 20k****Auteur:** Janna Machts<sup>None</sup>

The DarkSide20k experiment is a direct Dark Matter detector focused on the search for WIMP dark matter. Its main component is a dual-phase Argon Time Projection Chamber (TPC) where WIMPs are mainly detected as nuclear recoils from collisions with Argon nuclei and the subsequent emission of scintillation light as well as ionisation electrons. Since the rate of signal events is expected to be much lower than background events (mainly electron recoils), understanding and rejecting the background is crucial. A major advantage of Argon is the ability to discriminate between electron and nuclear recoil events based on the time profile of the scintillation pulse. This technique is called Pulse Shape Discrimination. Presented are aspects of the PSD technique as well as its importance within the analysis framework of the experiment and the projection of sensitivity limits.

**Speaker information:**

PhD 2nd year

**Poster / 81****Accretion and differentiation of Icy bodies****Auteur:** Leo Mallet<sup>1</sup><sup>1</sup> *IPGP/UPC*

This poster will focus on the behavior of ice and its influence on the thermal evolution of the first planetary bodies, known as planetesimals, in order to determine the age of iron meteorites. For now, this poster will only address the numerical modeling of this thermal evolution.

**Speaker information:**

PhD 1st year

**Poster / 82****Impact of extreme ultraviolet radiation on the scintillation of pure and xenon-doped liquid argon.****Auteur:** Evangelia Nikoloudaki<sup>1</sup><sup>1</sup> *APC*

**Speaker information:**

PhD 3rd year

**Poster / 84****The influence of LIA-induced viscoelastic deformations on geodetic observations in Greenland****Auteur:** Emma Gourrion<sup>None</sup>

The Greenland Ice Sheet (GrIS) is currently undergoing substantial mass loss, with major consequences for both the Earth system and human societies, including a significant contribution to the ongoing acceleration of global mean sea level rise. Accurately estimating the GrIS mass balance therefore represents a major focus of current research. However, it remains challenging and, to date, still imprecise.

One of the main reasons is Glacial Isostatic Adjustment (GIA) - the viscoelastic response of the solid Earth to the growth and decay of ice sheets at its surface. Because geodetic observations are among the most used tools to quantify ice mass changes, robust estimates of GIA corrections are essential for the accurate interpretation of these measurements.

This study focuses on deformations induced by ice mass loss since the Little Ice Age (LIA) and their impact on present-day vertical land motion inferred from GNSS observations. Using a reconstructed history of the GrIS and its peripheral glaciers, we model LIA-driven viscoelastic deformations assuming different Earth models, exploring a range of values for two rheological parameters: the lithosphere thickness and the upper mantle viscosity. These simulations, combined with corrections for GIA associated with the last glacial maximum and the elastic response to contemporary ice melting, are compared against GNSS observations. Our results explain the uplift rates at most of the GNSS stations and are consistent with existing literature, with LIA-induced vertical land motion best accounted for by a 160 km thick lithosphere and an upper mantle viscosity of  $2.73 \times 10^{19}$  Pa·s.

As we explore the rheological structure beneath Greenland, we pay particular attention to the southeastern region, where uplift rates are unusually high. Southeastern Greenland exhibits significant lateral variations in mantle viscosity and lithospheric thickness, likely related to the track of soft material left by the Iceland hotspot. Our simulations support the presence of a low viscosity/thin lithosphere zone in this region, and we further investigate its effects by adding to our modeling an asthenospheric layer within the upper mantle.

Overall, this study demonstrates that deformations induced by the LIA constitute a non-negligible contribution to present-day geodetic signals. Accounting for this component is therefore essential to reduce uncertainties in ice mass balance estimates and to better understand Greenland's contribution to global sea level rise.

**Speaker information:****Poster / 85****Tales of quadrupole modes: Modelling rotational near-degeneracy effect****Auteur:** Bastien Liagre<sup>None</sup>**Speaker information:**

Poster / 86

## Disequilibrium chemistry in the atmosphere of exoplanets

Auteur: Cyril Markovitch<sup>1</sup><sup>1</sup> AIM CEA Paris Saclay

Since the first discovery of a hot Jupiter in 1995 (Mayor & Queloz, 1995), and the detection of the atmosphere of one of them (Charbonneau et al., 2002) the accurate modeling of exoplanetary atmospheres has become central to understand planet formation, chemical composition, and whether their pressure and temperature conditions support the existence of liquid water at their surfaces. With the advent of JWST and the forthcoming ARIEL mission, increasingly precise atmospheric spectra will be available, revealing chemical signatures that challenge traditional models based solely on thermochemical equilibrium. A striking example is the detection of SO<sub>2</sub> in the atmosphere of WASP-39b, which cannot be explained by equilibrium chemistry alone (Tsai et al., 2023). These observations highlight the crucial role of disequilibrium processes.

Recent investigation of disequilibrium chemistry has explored the effects of stellar irradiation and vertical transport (Evans-Soma et al., 2025; Tsai et al., 2023). In this work, we take a step further, and explore non-thermal chemistry driven by fast hydrogen atoms. Such energetic atoms can overcome activation barriers and trigger endothermic reactions inaccessible to the thermal gas. Non-thermal chemistry has been shown to play a key role in Titan's atmospheric chemistry, notably in the formation of complex organic molecules (Hörst et al., 2012) and has been investigated in the context of atmospheric escape (Shematovich, 2010). However, its impact on chemical reaction networks within exoplanet atmospheres remains largely unexplored.

Here, we investigate whether non-thermal chemistry can significantly alter the atmospheric composition of exoplanets. To address this question, we define new rate coefficients that do not consider a Maxwellian energy distribution of species. For instance, the photodissociation of H<sub>2</sub> will give two fast H atoms, which will then mostly elastically interact with the gas, lose their energy until reaching the thermal energy. We track those fast hydrogens with a Monte-Carlo code to reconstruct their energy distribution which will deviate from the Maxwellian distribution. We applied our new Monte-Carlo code to fast hydrogen atoms evolving in an atmosphere of H, H<sub>2</sub> and He.

Our results demonstrate substantial deviations from Maxwellian distribution of velocities and emphasize the importance of incorporating quantum mechanical cross sections for elastic scattering. Comparisons with existing literature validate our approach. This work lays the foundation for incorporating non-thermal chemistry into self-consistent atmospheric models, with future applications to realistic exoplanet atmospheres observed by JWST.

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### References

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- Hörst, S. M. & al (2012)
- Madhusudhan, N. (2019)
- Mayor, M., & Queloz, D. (1995)
- Moses, J. I. & al (2011)
- Shematovich, V. I. (2010)
- Tsai et al (2023)

### Speaker information:

PhD 1st year

Poster / 87

## Do Stars Always Quiet Down with Age? Insights from Stellar Twins

**Auteur:** Lina Borg<sup>1</sup>

<sup>1</sup> *Université Paris Cité, Université Paris-Saclay, CEA, CNRS, AIM*

**Speaker information:**

PhD 1st year

**Poster / 88**

## Attributing gridded land use change carbon emissions to crop and grass production from 2000 to 2020

**Auteur:** Belen Benitez<sup>1</sup>

<sup>1</sup> *ENS - PSL*

**Speaker information:**

PhD 3rd year

**Poster / 89**

## Coupling Atmospheric Fractionation and Hydrodynamic Escape: Implications for Sub-Neptunes

**Auteur:** Junaid Ramzan Bhat<sup>1</sup>

<sup>1</sup> *Department of Astrophysics, CEA*

Sub-Neptunes are the most abundant class of exoplanets found in the universe, yet they have no analogue in our own Solar System. Understanding their atmospheres and the underlying physical processes remains of prime interest. Despite significant progress in exoplanet observations and modeling, many aspects of sub-Neptune atmospheres remain poorly constrained. In particular, their atmospheric evolution and the connection between processes occurring at different heights in the atmosphere remain largely unexplored.

In this work, we aim to investigate how gravitational fractionation in the middle atmosphere above the homopause affects atmospheric loss occurring in the upper atmosphere, and the implications of this interaction for the survival of atmospheres of exoplanets. To this end, we employ a hydrostatic photochemical model with updated H–He–O chemistry to study the effects of gravitational fractionation. This framework is coupled with a one-dimensional hydrodynamic model of atmospheric escape to examine the interaction between these two processes.

Our findings will shed light on how strong the coupling between these processes is, which key chemical processes are involved, and whether there are any inherent limitations to this interaction. The approach developed here can be extended to planets irradiated by strongly flaring M-dwarfs, where atmospheric loss is expected to be much more prominent.

**Speaker information:**

PhD 1st year

**Introduction / 90**

## **Current challenges in physics of the universe**

**After PhD conferences / 91**

## **From PhD to private sector**

**After PhD conferences / 92**

## **From PhD to public research**

**Keynote Conference / 93**

## **Neutrino astronomy from low to high energy**

**Conference / 94**

## **Pariscience festival presentation**