2024

CNRS in Oceania

01 TITRE CHAPITRE 1

Table of content

CNRS Europe & International

Alain Mermet - Director

Along its very mission to perform basic research for the benefit of society, CNRS has long considered international cooperation as key to research excellence and to the advancement of knowledge at large. By promoting international outreach over its 85 years of existence, the French National Center for Scientific Research has forged a genuine culture of international collaboration among its multiple research communities. Today, with 65% of its scientific production cosigned with a foreign partner and nearly 80 international research laboratories located on all five continents, the CNRS stands as a major stakeholder of basic research on both European and international scenes.

The Direction of European and International affairs

The Direction of European and International (DEI) affairs of CNRS is pivotal in both designing and implementing the cooperation policy of our institution with partners around the world. It relies in particular on a network of 11 permanent representation offices abroad [i], among which the Melbourne office and a recently opened office in Nairobi, Kenya. By exploring new opportunities for cooperation and supporting existing collaborations from a ground perspective, our representation offices are committed to helping CNRS researchers, and French research communities at large, team up with best talents worldwide.

A world scientific player

In a world of moving geopolitical contexts and pressing global challenges, CNRS is committed to promoting science as an instrument of sustained dialogue between countries, as well as an essential driver towards a resilient world. The variety of tools CNRS develops to either explore or structure international collaborations, aims to sustainably strengthen its cooperation networks around multi and interdisciplinary scientific projects. Through the cross fertilization of knowledge across disciplines and across borders, CNRS is resolved to take its share in accompanying and preparing societies to upcoming transitions driven by complex scientific processes such as climate change, artificial intelligence, pandemics crises or the adaptation of socio-ecosystems.

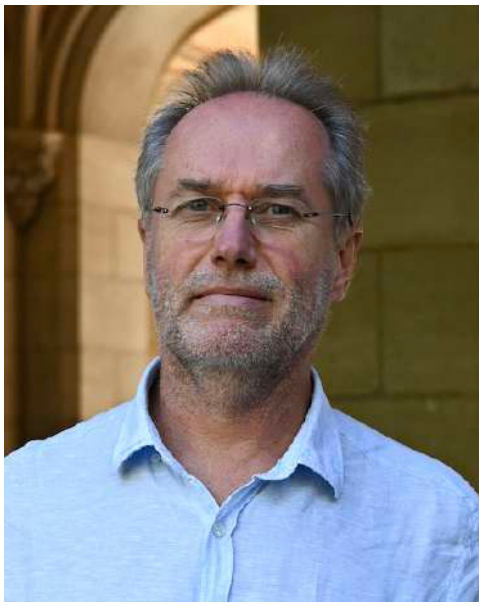
This booklet offers a perspective on the partnerships and cooperation developed by our researchers with their partners in Oceania. It showcases the flagship projects supported by the CNRS, in partnership with their partner institutions overseas, and with other members of the French research ecosystem, including French overseas territories. The CNRS office in Melbourne plays a role in these projects, offering support, assistance, fund-raising, new project initiatives and, above all, representing the CNRS towards its local partners and ensuring that their assignments and projects are a success.

[i] CNRS runs a network of offices in key locations in the world of science: Brussels, New Delhi, Beijing, Tokyo, Singapore, Melbourne, Ottawa, Washington, Rio de Janeiro, Nairobi and Pretoria.

CNRS in Oceania

Thierry Corrège - Representative office Director

Since its opening in December 2021, the CNRS Representative Office for Oceania has been an important tool to help develop collaboration with Australia and New-Zealand. The bureau staff has been totally renewed, with a new director appointed in April 2023, and a new Science and Communication Officer in December 2023.
Despite the closure of borders during 2020, 2021 and part of 2022 in Australia and New Zealand, scientific collaboration with CNRS has remained strong. France is still the sixth scientific partner of Australia, and CNRS remains the major French institution in terms of co-publications. CNRS is also the major non-Australian institution to collaborate with New Zealand. In both countries, the main sectors of collaboration are Earth and Space sciences, Physics, and Environmental and Ecological sciences.



A diverse set of collaborative tools

CNRS has developed tools to help international collaborations, namely International Emerging Actions (IEA), International Research Projects and Networks (IRP and IRN) and International Research Laboratories (IRL). This booklet presents some of these successful programs, together with interviews of our first Fellow Ambassador from Australia, of two PhD candidates from our Joint PhD Program with the University of Melbourne, and of a PhD candidate from our IRL CROSSING. Since we are trying to develop links between Australia and New Zealand and our research units in New Caledonia, French Polynesia and La Réunion, we also present one of them, the UMR ENTROPIE.

The French - Oceania partnership

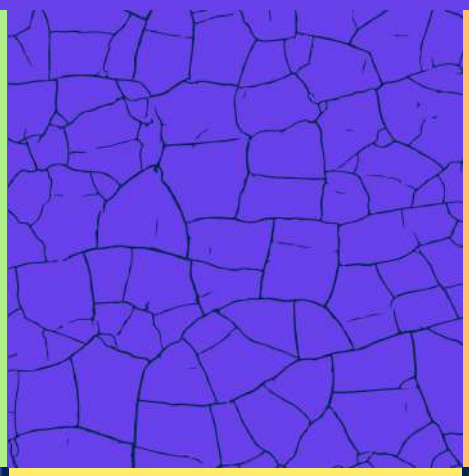
The number of visits from French scientists to the region has reached back the pre-covid levels in 2023. CNRS activity is blooming in Oceania, and there is no sign of it slowing down. Indeed, the decision of New Zealand to joint Horizon Europe in March 2023 opens new perspectives for enhanced cooperation. CNRS is willing to share its long-standing expertise of European framework programs to bolster cooperation with New Zealand partners, as well as with other third countries in the region Finally, CNRS is proud to contribute to the activities of AFRAN (the Australian-French Association for Research and Innovation) and FAST! (French Aotearoa Science, Technology and !nnovation), and we encourage our readers to join these associations, who are instrumental in cementing France, Australia and New-Zealand scientific collaborations.

What is CNRS ?

The Centre National de la Recherche Scientifique (National Center for Scientific Research) is a **research performing organization** founded in 1939. **With over 33.000 staff** spread over 1.000 joint research units, CNRS is the **largest fundamental research organization in Europe** and the second largest research institution in world in terms of number of scientific publications.

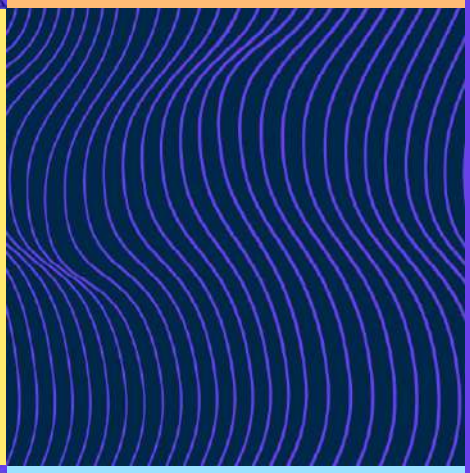
To face the **major challenges of today and tomorrow,** the CNRS carries out research **in all fields of science** through ten specialized Insitutes, in partnership with public sector, social and economic stakeholders. Internationally recognized for its **scientific excellence**, the CNRS is a reference in the world of research as well as for the general public.

More than
55.000
Publications in 2022



4.0
Billions euros budget

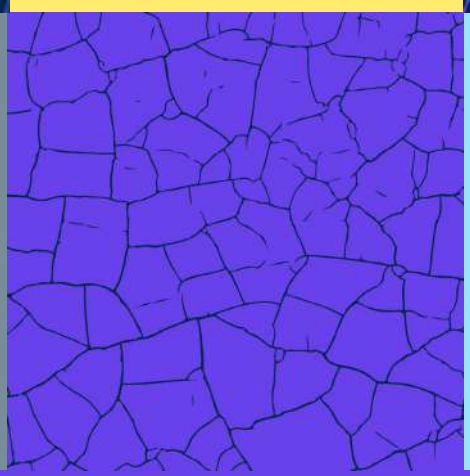
33.000
Staff members
Including
28.000
Scientists



22 Nobel prizes

12 Fields Medals

4th in the 2020 Nature Index Ranking



240 CNRS/company research structures

1st Patent filers in co-deposit with industry in 2022

100 Start-ups created each year

CNRS : A key player in global science

CNRS has set up structured cooperations mechanisms to strengthen its presence worldwide. These include in particular 85 international research laboratories that offer a long-term perspective to the organisation's activity.

65% Of publications co-signed with a foreign laboratory

25% Of our newly-recruited researchers come from outside of France

85 International Research Laboratories

IEA

International Emerging Actions are PI-to-PI projects whose purpose is to explore new fields of research and international partnerships through short-term assignments, the organization of working meetings, and the initiation of early joint research for shared scientific projects. They have a duration of **2 years.**

IRN

International Research Networks structure international scientific community around a common theme or research infrastructure. It promotes the organization of workshops, seminars, and thematic schools organized by network partners in France or abroad. They have a duration of **5 years.**

IRP

International Research Project are collaborative research schemes between one or more CNRS laboratories and partners from one or more foreign countries. They strengthen previously established collaboration through short and medium-term scientific exchange. They have a duration of **5 years.**

IRL

International Research Laboratories are international schemes in which research work is jointly conducted around a shared scientifc focus. They structure, within an identifed location, the signifcant and lasting presence of scientists from a limited number of French and foreign research institutions (a single foreign partner country). International Research Laboratories are proposed by the scientifc Institutes of the CNRS based on structured international collaborations. They involve a high degree of internationalization among the participating teams, as well as a strong concentration of research activity within a partner organization. These IRL last 5 years, and can be extended several times.

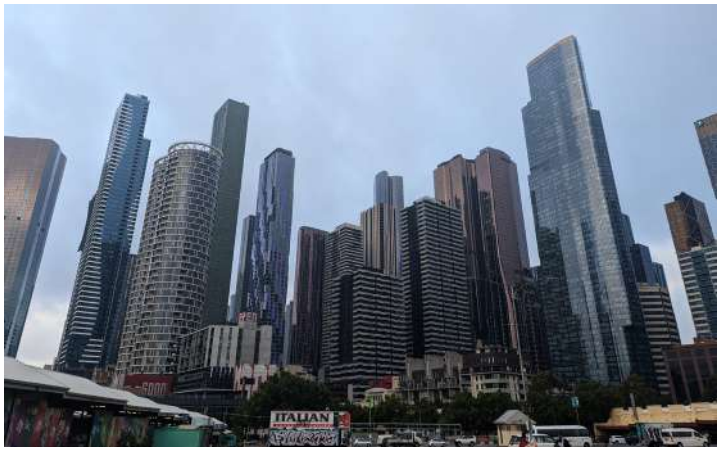
CNRS Representative Office in Oceania

The CNRS Representative office in Oceania was created in September 2021. Oceania was previously included in the CNRS Representative Office in ASEAN & Oceania, located in Singapore. The office is hosted by the University of Melbourne and supported by the Government of Victoria and its agency Invest Victoria.

Adress of the CNRS Representative office :

CNRS Representative Office for OCEANIA
The University of Melbourne
Building 193
Room 228-229
Parkville Vic 3010,
Melbourne, Australia

https://melbourne.office.cnrs.fr/contact-us/



THE MAIN MISSIONS OF THE CNRS OFFICE

Representing
CNRS to the local science and technology players.

Organizing
Visits and meetings for high-level delegations from CNRS

Supporting
The creation of structured collaboration

Communicating
Towards the researchers community (website, X, LinkedIn)

https://au.linkedin.com/in/thierry-correge-2a2408272

https://x.com/CNRSinOceania

CNRS Cooperation with Oceania key figures

37 Structured cooperations with Oceania

33 in Australia

4 in New Zealand

14 International Emerging Actions

7 International Research Networks

15 International Research Projects

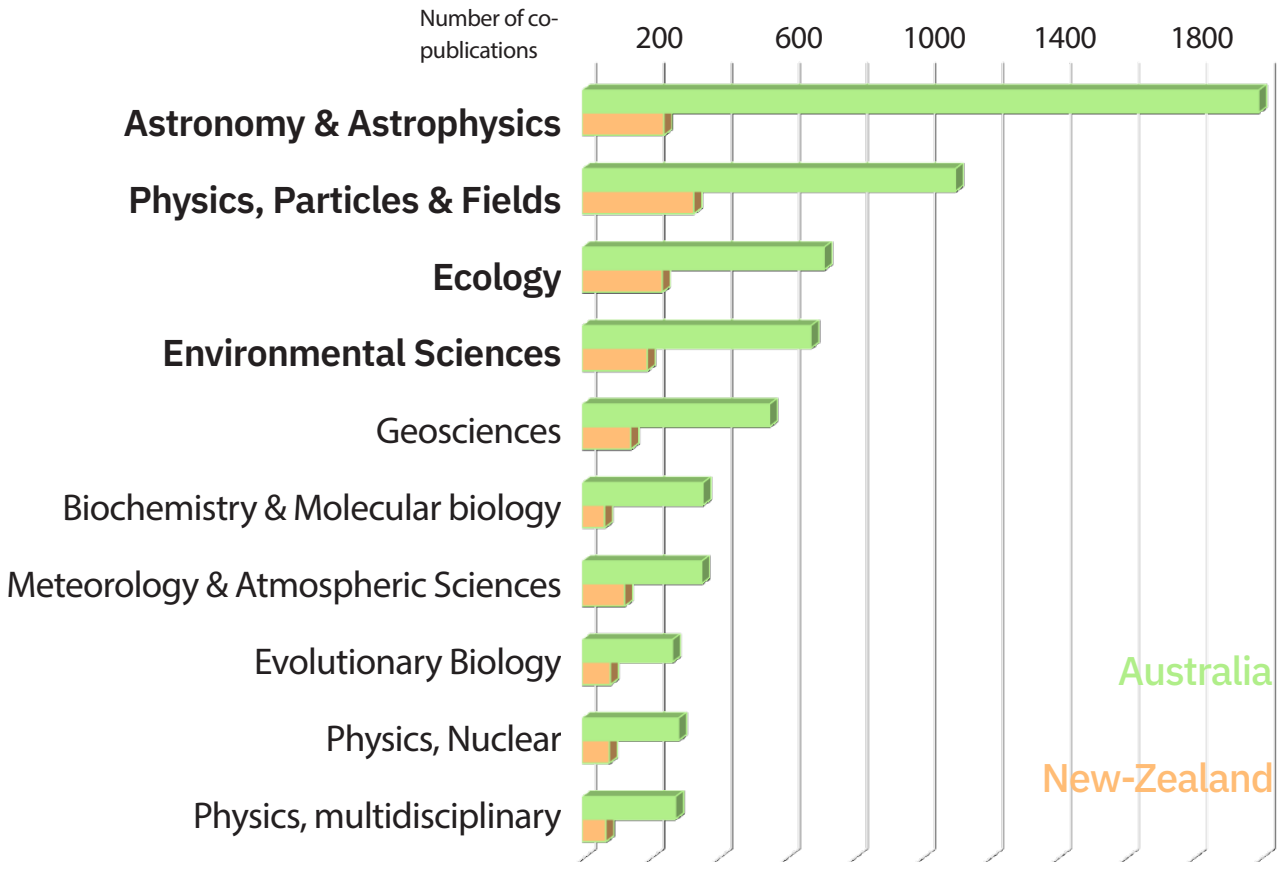
1 International Research Laboratory

9622 Co-publication with Australia (2019 - 2023)

37% of Australia's publications with France

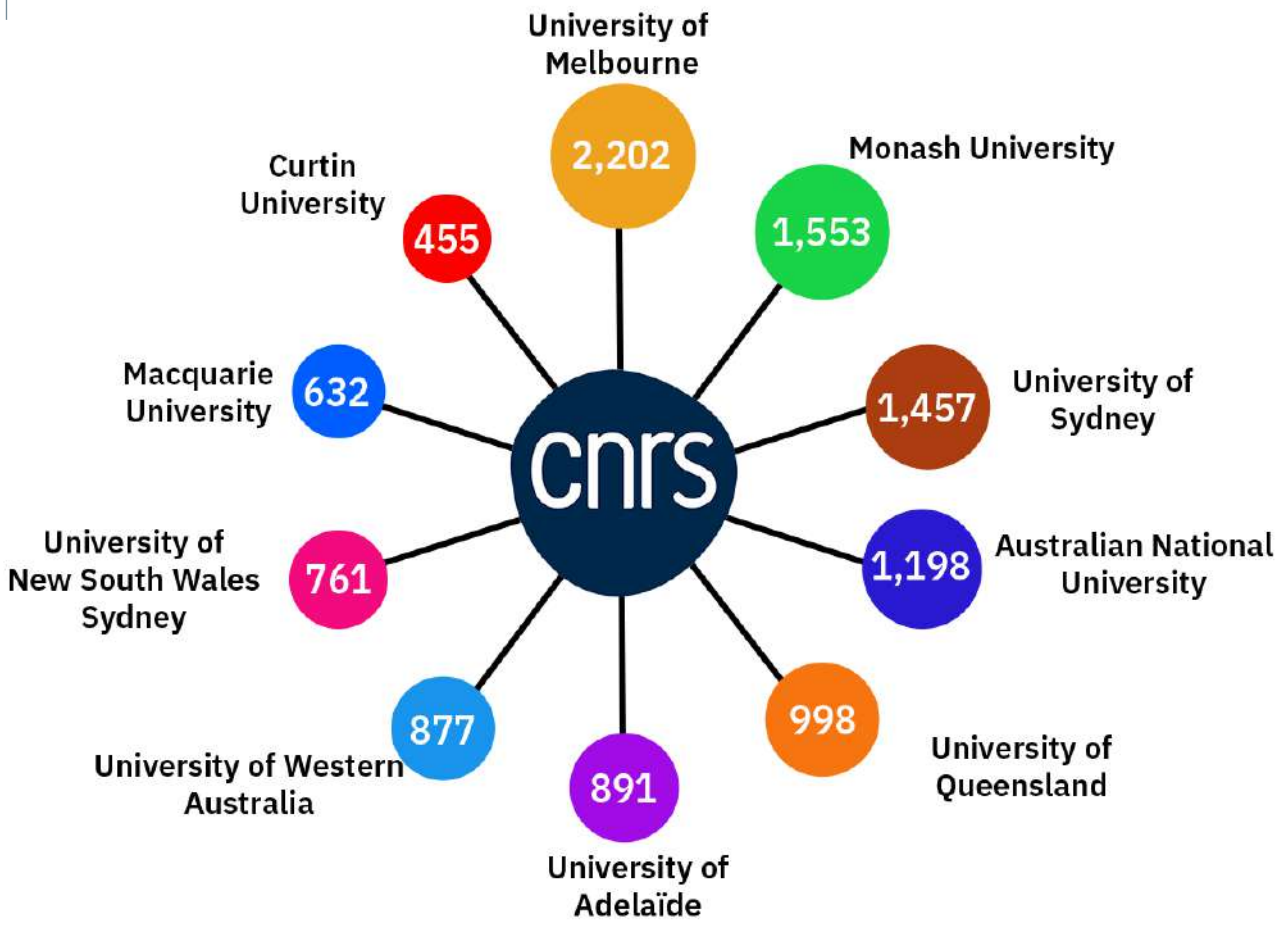
1836 Co-publication with New-Zealand (2019-2023)

41% of New-Zealand's publications with France



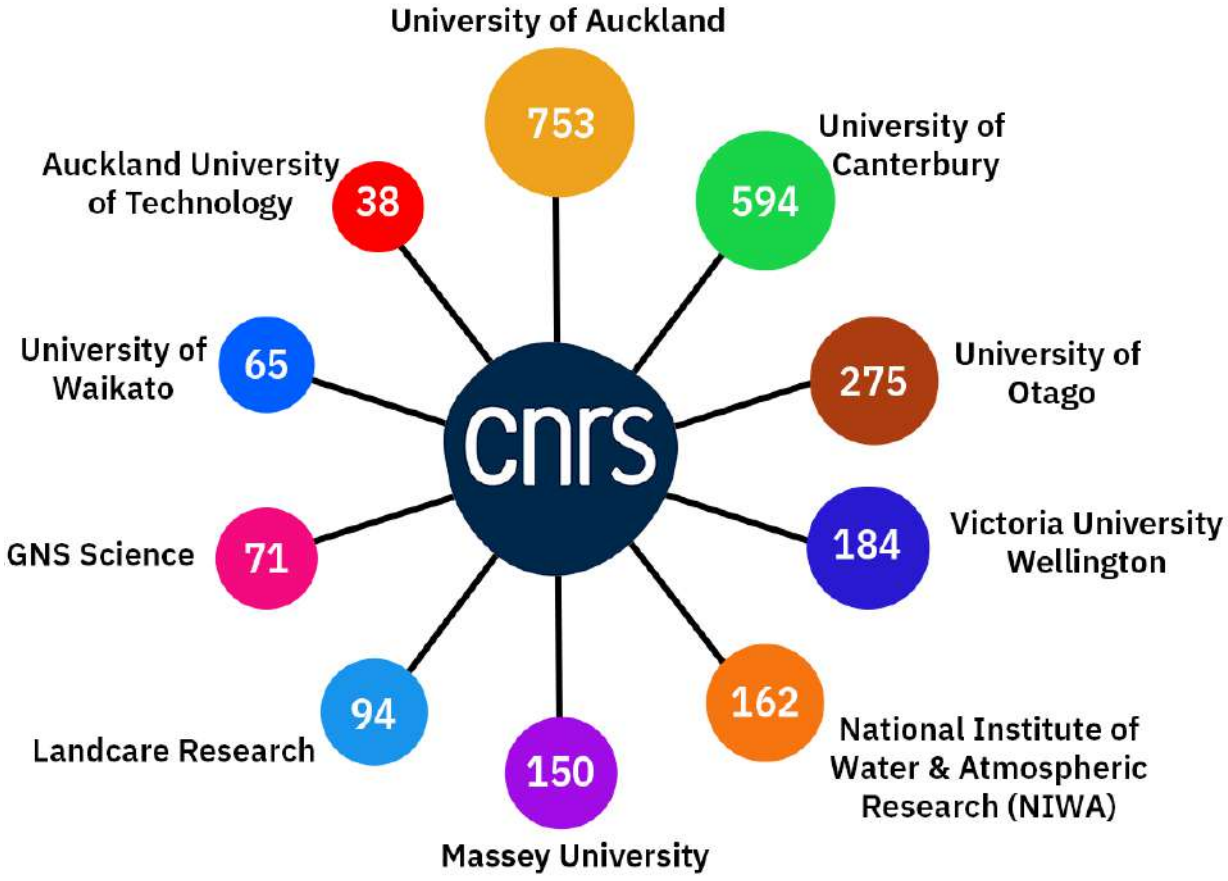
Top 10 areas of research between CNRS and Oceania, in 2019-2023, by number of co-publications

Source : Web of Science and Incities



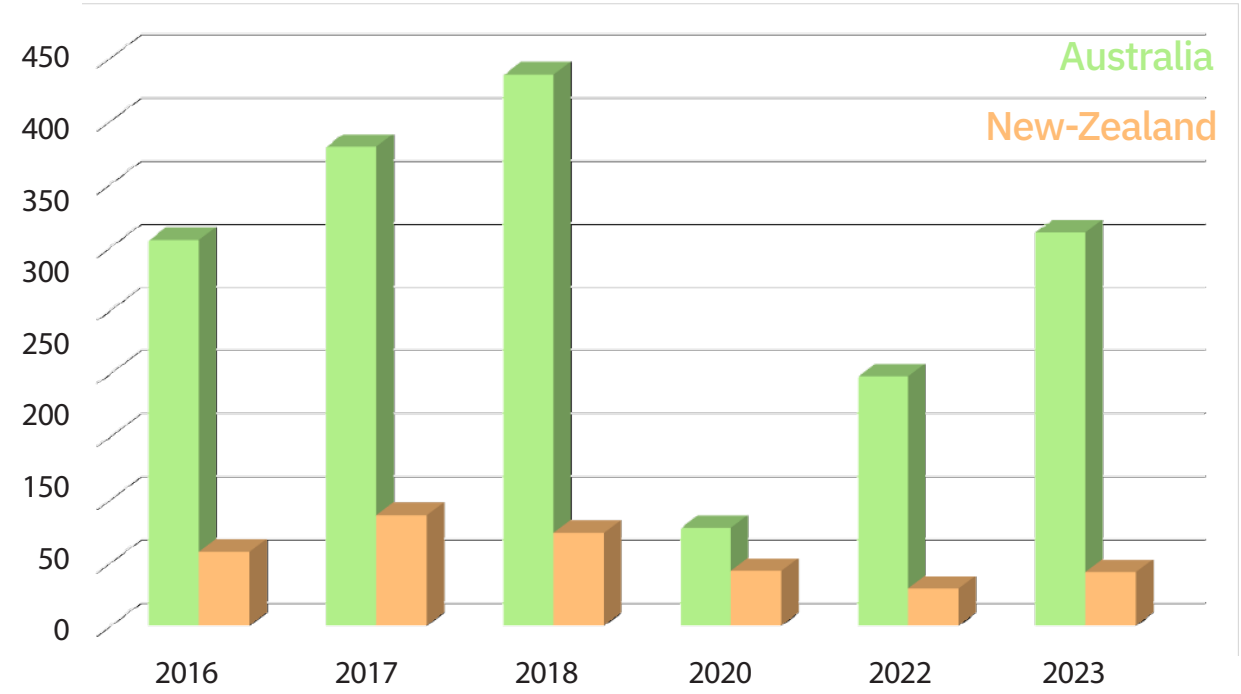
Top 10 CNRS partners for copublication in 2019-2023 for Australia (above) and New-Zealand (below)

Source : Web of Science and Incities



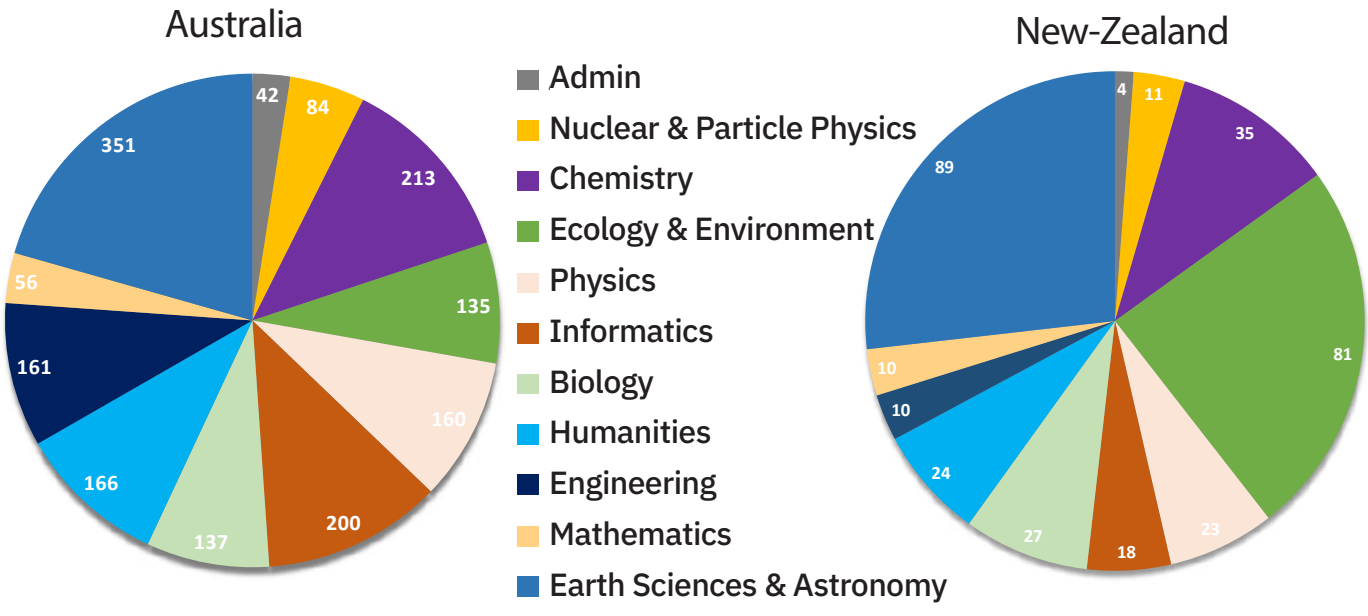
2037 Visits of researchers organized by CNRS in Oceania (2016- 2023)

1705 in Australia 332 in New Zealand



Number of visits organized by CNRS in Australia and New Zealand from 2016 to 2023

Source : CNRS Numbers



Number of visits by field of research (2016-2023)

Source : CNRS Numbers

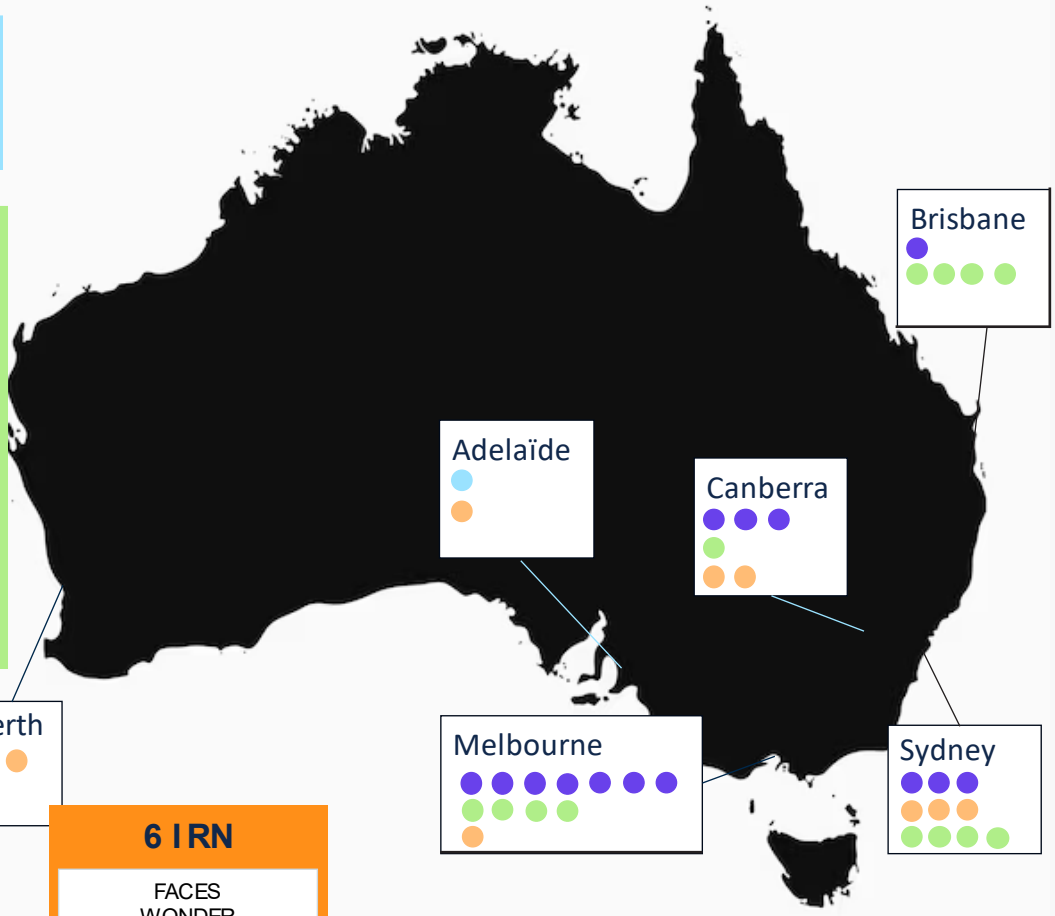
CNRS Cooperations with Australia

1 I RL

CROSSING (Human-machine teaming)

13 I EA

ALFRED
LOTO
COFLACT
KIARMAL
2dh2
DyCaM
FLAMEPROXY
HYSPILL
BONUS
DREEMI
IMAX
Global Geometry of projective varieties
AustraLakes



13 I RP

AIPhFA
CANECEV
ARS
SocMet MM
AMHELIE
APICOLIPID
MATAI
FEMIDAL
NATURBAN
DERECT
ACCES
NEUROSENSOR
XERD-DM

6 I RN

FACES
WONDER
PhilInBioMed
i²
FALCoL
QARESS

THE SCIENTIFIC PARTNERS IN AUSTRALIA

- University of Melbourne
- Australian National University (ANU)
- RMIT University
- Deakin University
- Monash University
- Swinburne University of Technology
- Flinders University
- University of South Australia
- University of Tasmania
- Macquarie University
- University of New South Wales
- University of Sydney
- University of Newcastle
- University of Queensland
- University of the Sunshine Coast
- Queensland University of Technology
- Curtin University
- Murdoch University
- University of Western Australia
- University of New South Wales

International Emerging Actions

CNRS Chemistry

HYSPILL

Unraveling hydrogen spillover in heterogeneous catalysts for hydrogen transportation

Australian Leader : Muxina Konarova - School of Chemical Engineering, The University of Queensland

French Leader : Nuno Rocha Batalha - Institut des Recherches sur la Catalyse et l'Environnement de Lyon

FLAMEPROXY

Beyond the Flames: Advancing Knowledge of Wildfire Impacts with Innovative Proxies

Australian Leader : Anthony Dosseto - School of Earth, Atmospheric and Life Sciences (SEALS), University of Wollongong

French Leader : Marc Benedetti - Institut de Physique du Globe de Paris

2DH2

Modelling electrochemical processes of the hydrogen evolution reaction on two-dimensional materials-based electrodes in alkaline solution

Australian Leader : Yun Wang - Centre for Catalysis and Clean Energy, School of Environment & Science, Griffith University

French Leader : Assil Bouzid - Institut de Recherche sur les Céramiques, Centre Européen de la Céramique

KARMIAL

Target the kinome to fight artemisinin-resistant malaria

Australian Leader : Christian Doerig - School of health and biomedical sciences, RMIT University

French Leader : Françoise Benoit-Vical - Laboratoire de chimie de coordination

CNRS Informatics

BONUS

Blackbox Optimization with a Novel Use of Subspaces

Australian Leader : Lindon Roberts - School of Mathematics and Statistics, The University of Sydney

French Leader : Clément Royer - Laboratoire d'Analyse et Modélisation de Systèmes pour l'Aide à la Décision

ALFRED

Algorithms for Restricted Data Models

Australian Leader : William Seeun - School of Computing and Information Systems, University of Melbourne

French Leader : Adrian Vladu - Institut de Recherche en Informatique Fondamentale

CNRS Physics

DYCAM

Dynamics of casein micelles networks

Australian Leader : Martin Greg - Department of Chemical Engineering, University of Melbourne

French Leader : Pascal Hebraud - Institut de physique et chimie des Matériaux de Strasbourg

COFLACT

Thin-film flows of dense granular suspensions

Australian Leader : Nicolas Francois - Department of Materials Physics, Australian National University

French Leader : Matthieu Roche - Matière et Systèmes Complexes

CNRS Mathematics

GLOBAL GEOMETRY

Global geometry of projective varieties through birational invariants and foliations

Australian Leader : Behrouz Taji - School of Mathematics and Statistics, Anita Lawrence Centre, UNSW

French Leader : Erwan Rousseau - Laboratoire de Mathématiques de Bretagne Atlantique

LOTO

Limit of Transfer Operators in South Pacific

Australian Leader : Cecilia Gonzalez Tokman - School of Physics and Mathematics, University of Queensland

French Leader : Renaud Leplaideur - Laboratoire de Mathématiques de Bretagne Atlantique

CNRS Earth & Space

AUSTRALAKES

A fresh perspective on salty lakes: assessing the role of wind-related sedimentary processes in Australia's lakes

Australian Leader : Jan-Hendrik May - School of Geography, Earth & Atmospheric Sciences, The University of Melbourne

French Leader : Mathieu Schuster - Institut Terre et environnement de Strasbourg

CNRS Biology

DREEMI

Dissecting the role of regulatory elements in the initiation of the epithelial-to-mesenchymal transition using single-cell sequencing technologies

Australian Leader : Pengyi Yang - School of Mathematics and Statistics, The University of Sydney

French Leader : Andrew Oldfield - Institut de Génétique Humaine

CNRS Engineering

IMAX

Integration of 4D imaging, modelling and artificial intelligence to explore the evolution of bone structure

Australian Leader : Peter Pivonka - School of Mechanical, Medical and Process Engineering, Queensland University of Technology

French Leader : Madge Martin - Laboratoire Modélisation et Simulation Multi-échelle

International Research Networks

CNRS Engineering

WONDER

Design of processes and strains for Elaboration of Renewable energy from microalgae

Australian partner : Navid Moheimani - Algae R&D Centre, Murdoch University

French Leader : Olivier Gonçalves/Eric Leroy - Laboratoire Génie des Procédés, Environnement, Agroalimentaire

Other partners : Japan - USA

FACES

Conversion and Energy Storage for stand-alone & maritime applications

Australian partner : Francois Aguey-Zinsou - Material Energy Research Laboratory in nanoscale (MERLin) at The School of Chemical Engineering, University of Sydney

French Leader : Fermín Cuevas - Institut de Chimie et des Matériaux de Paris-Est

CNRS Humanities & Social Sciences

QARESS

QuAntitative Resilience-based managEment and Sustainability for Social-ecological Systems

Australian partner : Quentin Grafton - Crawford School of Public Policy, Australian National University

French Leader : Luc Doyen - Center for environmental Economics, Montpellier

Other partners : Spain, Canada, Cameroon, Netherlands, Germany

PHILINBIOMED

Institute for Philosophy In Biology and Medicine

Australian partner : Paul Griffiths - Charles Perkins Center, University of Sydney

French Leader : Thomas Pradeu - Conceptual Biology & Medicine Group, Université of Bordeaux

Other partners : Austria, UK, USA

CNRS Earth & Space

FALCOL

French-Australian Research Network on the study of the Continental Lithosphere

Australian Partner : Nicolas Thebaud - Centre for Exploration Targeting, University of Western Australia

French Leader : Olivier Vanderhaeghe - Géosciences Environnement Toulouse

I²

Interstellar Institute

Australian Partner : (i) Naomi McClure Griffiths - Research School of Astronomy and Astrophysics, Australian National University (ANU) (ii) Joanne Dawson - Department of Physics and Astronomy, Macquarie University

French Leader : Marc-Antoine Miville-Deschênes - Laboratoire Astrophysique, Instrumentation, Modélisation

Other partners : USA, Germany, Austria, Canada, Greece

International Research Projects

CNRS Engineering

ALPHFA

International Associated Laboratory in Photonics between France and Australia

Australian Leader : Arnan Mitchell - Micro Nano Research Facility and the Integrated Photonics and Applications Centre, RMIT

French Leader : Christian Grillet - Institut de Nanotechnologies de Lyon

AMHELIE

Additive Manufacturing for High PErformance MateriaLs and lattIce StructurEs

Australian Leader : (i) Matthew Dargusch - University of Queensland, (ii) Aijun Huang - Monash University

French Leader : Nicolas Saintier - Institut de mécanique et d'ingénierie, Bordeaux

NATURBAN

Sustainable design: from nature to cities

Australian Leader : Mat Santamouris - School of Built Environment, University of New South Wales

French Leader : Claire Lesieur - AMPERE

NEUROSENSOR

Artificial neuron, sensor, thermo/mechano-receptor, neuromorphic architecture

Australian Leader : Sanjoy Nandi - Research School of Physics, Australian National University

French Leader : Etienne Puyoo - Institut de Nanotechnologies de Lyon

CNRS Biology

SOCMET MM

Social Communication Network in Marine Mammals

Australian Leader : Rob Harcourt - Marine Predator Research Group (MPRG), Macquarie University Marine Research Centre

French Leader : Isabelle Charrier - Paris Saclay Institute of Neuroscience

APICOLIPID

Apicomplexan parasites lipid and membrane biogenesis

Australian Leader : Geoffrey McFadden - School of Biosciences, University of Melbourne

French Leader : Cyrille Botté - Institut pour l'avancée des biosciences

DERECT

Dependence Receptors in Colorectal Tumours

Australian Leader : Frederic Hollande - Centre for Cancer Research, Tumour Heterogeneity in Metastatic Cancer Laboratory, University of Melbourne

French Leader : Patrick Mehlen - Centre de recherche en cancérologie de Lyon

CNRS Ecology & Environment

CANECEV

The roles of cancer in Ecology and Evolution

Australian Leader : (i) Beata Ujvari - School of Life & Env Sciences, Deakin University (ii) Rodrigo HAMEDE - University of Tasmania

French Leader : Frédéric Thomas - Maladies Infectieuses et Vecteurs : Ecologie, Génétique, Evolution et Contrôle MIVEGEC

ACCES

Integrating the oceanographic component on the accessibility of prey into the study of individual predator population responses

Australian Leader : Andre Chiaradia - Phillip Island Nature Parks

French Leader : Claire Saraux - Institut Pluridisciplinaire Hubert Curien, Strasbourg

CNRS Nuclei & Particles

XERD-DM

R&D for Future Generation Experiments, searching for Dark Matter and Neutrinoless Double Beta decay

Australian Leader : Elisabetta Barberio - Stawell Underground Physics Laboratory, University of Melbourne

French Leader : Sara Diglio - Subatech

CNRS Humanities & Social Sciences

FEMIDAL

Formal/Experimental Methods and In-depth Description of Australian Indigenous Languages

Australian Leader : Brett Baker - School of Languages and Linguistics, University of Melbourne

French Leader : Patrick Caudal - Laboratoire de Linguistique Formelle

CNRS Chemistry

MATAI

Multiphoton Absorbers in Therapy and Imaging

Australian Leader : Mark G. Humphrey - Research School of Chemistry, Australian National University

French Leader : Frederic Paul - Institut des sciences chimiques de Rennes

CNRS Informatics

ARS

Advanced Autonomy for Robotic Systems

Australian Leader : (i) Robert Mahony - Australian Centre for Robotic Vision, Australian National University (ii) Dragan Nesic - Department of Electrical and Electronic Engineering, University of Melbourne

French Leader : Tarek Hamel - Laboratoire d'Informatique, Signaux et Systèmes de Sophia Antipolis

International Research Laboratory

CROSSING

French Australian Laboratory for humans / autonomous agents teaming

Australian partners : University of Adelaide, Flinders University, University of South Australia

French partners : CNRS, IMT Atlantique

Industrial partner : Naval Group

Codirection : Jean-Philippe Diguet (CNRS)
Anna Ma-Wyatt (University of Adelaide)

Website : https://crossing.cnrs.fr

Location : University of Adelaide, North Terrace Campus, Brailsford Robertson Building

Launched on 22 February 2021, Crossing aims to propose solutions for humans, artificial intelligence (AI) and autonomous systems to work together effectively and ethically.

It develops 4 pillars of research, which will support industries such as health, defence and "industry 4.0":

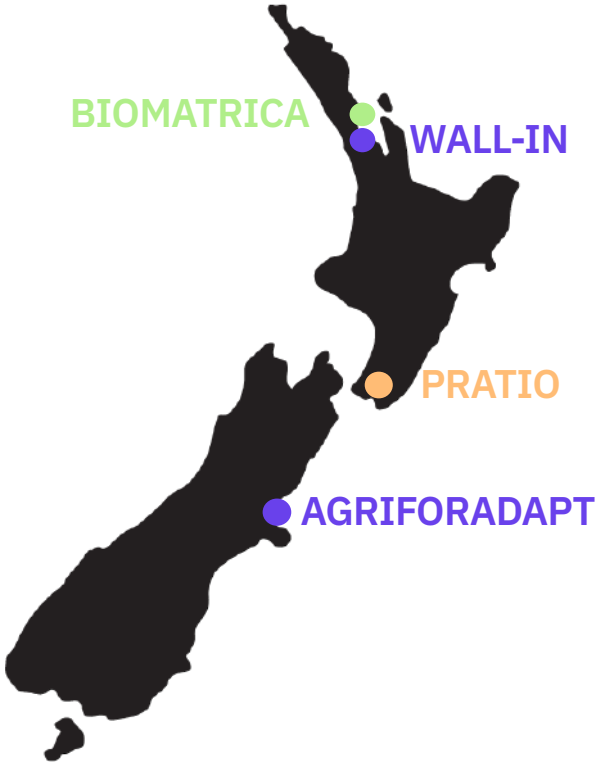
- Improving models and understanding of humans as individuals and groups;

- Improving the effectiveness and implementation of learning algorithms within the environment and the group

- Exploring new interaction paradigms and improving understanding of the behaviour and decisions of autonomous systems;

- Propose task management and hybrid team management solutions.

CNRS Cooperations with New-Zealand



THE SCIENTIFIC PARTNERS IN NEW-ZELAND

- University of Auckland
- University of Canterbury
- Lincoln University
- University of Otago

International Emerging Action

BIOMATRICA

Atrial biomechanics in stroke risk stratification

New-Zealand Leader : Martyn Nash - Auckland Bioengineering Institute, The University of Auckland

French Leader : Olivia Monica Sigovan - CREATIS

International Research Network

PRATIO

Polycystine Radiolaria As a proxy To explore Issues On global environmental change and plankton ecology, biodiversity and biogeochemistry

New-Zealand Partner : Guiseppe Cortese - GNS Science

French Leader : Taniel Danelian - Evolution, Ecologie, Paléontologie, Lille

Other partners : Japan, Germany, USA

International Research Project

WALL-IN

Confining walls-of-Light in nonlinear Kerr resonators

New Zealand Leader : Stephane Coen - Faculty of Science, Physics, University of Auckland

French Leader : Julien Fatome - Laboratoire interdisciplinaire Carnot de Bourgogne

AGRIFORADAPT

High resolution scenarios of adaptation strategies to climate change of perennial agroecosystems

New-Zealand Leader : Alexander Herzig - Manaaki Whenua Landcare Research, Lincoln University

French Leader : Hervé Quénol - Laboratoire : Littoral, Environnement, Télédétection, Géomatique

INTERVIEWS

New-Zealand

Australia

IRP AGRIFORADAPT

AgriForAdapt : the extended project after VinAdapt

Hervé Quénol
Senior Researcher, CNRS, LETG

Hervé Quénol is a geographer-climatologist working as senior scientist at the National Centre for Scientific Research (CNRS) in the LETG (Littoral Environment Remote-Sensing Geomatics laboratory in Rennes, France). His research focuses on the interactions between climate and anthropogenic activities and on analysis and modelling of climate at fine scales in the climate change context. He has developed and applied a multiscalar approach to agroclimatology and urban climatology in several national and international research projects.

What is the IRP AgriForAdapt and how does it differ from VINADAPT ?

The IRP AgriForAdapt (2024-2028) project is a continuation of the IRP VINADAPT (2019-2023), the aim of which was to produce climate change adaptation scenarios for vineyards in France and in New Zealand. The multidisciplinary team (geographers, climatologists, complex systems modellers, agronomists, etc.) has made it possible to achieve the main objectives, i.e. to define strategies for adapting wine-growing areas to climate change based on the spatial variability of the local climate. The IRP AgriForAdapt follows a similar approach, with a general focus on agro-ecosystems (crops and forests) and impact on biodiversity, with the aim of developing strategies for adapting rural areas to climate change. An important part of the research will focus on the impact of these strategies on the environment, using models and ecological indicators.To achieve these objectives, new disciplines (e.g. ecology, forestry) via new French and New Zealand research teams have been integrated into the project.

Research conducted in the IRP AgriForAdapt

Global climate change is having an impact on local climates and, consequently, on agro-ecosystems (crops and forests) and rural landscape. In this context, the expected impacts of climate change raise a number of questions, particularly concerning the implementation of adaptation and mitigation strategies. It is generally at local scale that adaptation and mitigation strategies are applied by local authorities and stakeholders. In this context, prior knowledge of the spatial variability of the local climate and its integration into future climate projections would appear to be essential for defining reasoned adaptation and mitigation strategies at local scale.

Primarily based on a field analysis and modelling approach, the main objective of this project is to spatially optimise changes in agricultural land use in order to achieve the multifunctional objectives of sustainable production, adaptation to climate change and mitigation of its effects.

These scenarios will be developed and applied to pilot sites in France and New Zealand with different climatic configurations (past, current and future), but also where the compromises between agricultural, social, environmental and economic issues are different.

Website : https://melbourne.office.cnrs.fr/project/irp-agroforadapt/

The benefits of Franco-New Zealand partnerships

The objectives of the project require partners from different disciplines with complementary scientific approaches and methodologies. The first French-New Zealand collaboration with the IRP-VINADAPT project has enabled the development of fine spatial-scale climate change adaptation scenarios with specific applications for French and New Zealand viticulture. The complementarity of the partners in climate modeling and in complex systems modelling at regional and local scales has allowed us to achieve these objectives. The main objective of the IRP-AgriForAdapt project is to define strategies for adapting and mitigating territories to climate change by developing Climate-Smart Landscapes (CSL) using multi-criteria geospatial modeling. The aim of this approach is to assess, spatially and at a fine scale, the adaptability of the various agroecosystems studied, not only in terms of climate scenarios, but also in terms of environmental and socio-economic factors. Collaboration between partners in climatology, agronomy, forestry, ecology and geospatial modelling will enable us to achieve these objectives.

New partners and the contribution of INRAE

The French-New Zealand consortium has been strengthened in terms of discipline and methodology, with teams from the CNRS (LECA : Alpine Ecology Laboratory), the Crown Research Institutes (Manaaki Whenua Landcare Research, SCION, Plant&Food Research, NIWA: National Institute of Water & Atmospheric Research), French and New Zealand universities (Université Rennes 2, Université Bretagne Occidentale, Université Bourgogne, Université Grenoble Alpes, Canterbury University, Lincoln University, Victoria University and Otago University) and INRAE.

More generally, our projects on the impact of climate change on agrosystems (specifically viticulture) have always been in collaboration with INRAE laboratories. The official agreement between CNRS, INRAE and Science NZ formalises this multidisciplinary and international collaboration.

CNRS / UNIMELB

CNRS/University of Melbourne joint PhD program : students presentations

Paulo Silva,
PhD Student CNRS/ University of Melbourne

I am a joint PhD student between the University of Melbourne and the University of Lyon, under the CNRS network. My goals are to be able to investigate the dynamics of soil erosion on hillslopes and suspended sediment sources in peri-urban areas.

Dynamics of soil erosion

For that I am developing and implementing low-cost sensor networks in streams and stormwater drainage systems to quantify dynamic sediment yields and fraction derived from each source, mainly during the urbanization process. The expectation is to develop a new approach to achieve these goals and thus have a comparative analysis of river catchments involving research observatories in Melbourne (Australia) and Lyon (France).

Joint program benefits

The joint doctoral program I am enrolled in is a great opportunity to interact and make connections with researchers in the same field and thus gain a broader understanding of current methodologies and technologies related to my research from different perspectives. There are many advantages of doing a joint doctorate between two or more universities, but I can highlight that the established bonds and the exchange of experiences are the strong point for the student's maturity and preparation for a promising career. Furthermore, the experience of living on two different continents and learning about both cultures is a lifetime asset for those who have opportunities like this.

Maria Fernanda Sobierajski Gisi

PhD Student CNRS/ University of Melbourne

Maria is on the French side of the project working at the University of Lyon, she as well as Paulo is developing a low-cost turbidity sensor to understand the transport of suspended sediments in rivers and streams, focusing on river health and monitoring of important ecological parameters. Although both projects run in parallel, the sensors are developed with different technologies and have different applications and issues.

Area of research

Her research has two main goals, one is to advance the studies in low-cost technologies that allow the diffusion of knowledge of open science to all stakeholders equally; the other goal is to use the data collected with these sensors and analyze the effects of urbanization in the streams by following the suspended sediment fingerprint. Using this new technology will allow an enormous increase in the spatial and temporal acquisition of data, with real-time data transmission and energy autonomous systems.

Before arriving at the University of Lyon she did her engineering studies at UFSC in Brazil and specialized in hydraulics and hydrology during her masters at KIT in Germany. During her master thesis she started to have contact with the research community and found herself wanting to continue on this path. After extensive search for PhD programs that specifically tackled sediment transport issues, she matched with this position with the joint program between France and Australia.

Joint program benefits

The outcome of a PhD is much more than the written document, it's the skills acquired by the students in order to achieve the end goal. Skills such as project management, analysis and problem solving, written and oral communication are developed. With the rare opportunity to work in two countries that do not speak her mother language, she is able to build relationships with researchers from various backgrounds. This entire experience greatly expends her world view and improves her research with the help of the numerous talents of colleagues and friends.

IRN FALCOL

French-Australian Research Network on the study of the Continental Lithosphere

The IRN FALCoL is an international network of scientists devoted to the increase in knowledge on the formation and evolution of the continental lithosphere, which should pave the way to a more reasonable, responsible and sustainable use of the subsoil's resources.

Members of the IRN

The members of the IRN FALCoL are mostly researchers and teachers from France appointed at the GET (Géosciences Environnement Toulouse) and at GeoRessources in Nancy and from the University of Western Australia and the CSIRO in Perth.

Periodite boudin in Greenstones

FALCoL Areas of Research

The IRN FALCoL builds on a more than ten year long research collaboration at the interface of academia and industry with the goal of linking fundamental and applied problematics, as well as training the next generation of geologists of the private and public sectors. The main outcome of the IRN FALCoL has so far been related to :

(i) Organization of a workshop on the Geology of Central Africa in Toulouse in 2021.

(ii) Participation of FALCoL members to the Inter Guiana Geological Conference in Georgetown in 2022.

(iii) Organization of a workshop, in 2023, on the geology of the Guiana Shield and of the West Africa Craton that allowed to confront views from researchers from Africa, South America, Australia, Canada, and Europe.

(iv) In 2024, participation of FALCoL members to the SAXI final meeting in Belem and to the Granulites & Granulites conference in Verbania.

Website : https://melbourne.office.cnrs.fr/project/irn-falcol/

Tonalitic gneiss, San Pedro, Ivory Coast

The benefits of the Franco-Australian partnership in FALCoL

The complementary expertise of the different partners of the network allows to develop a multimethod approach of the Earth Sciences combining petrology, structural geology, geochemistry, geochronology, tectonics, geodynamics and numerical modeling, integrating scales from the mineral to the lithosphere. In France, mining activities ended in the late 20th century and research projects are mostly focused on the fundamental questions, whereas exploitation of the subsoil is one of the pillars of Australia's economy. This leads to very distinct perspectives regarding the exploitation of mineral and energetic resources, which should be confronted to maintain a habitable planet and reach fair standards of living for future generations.

The Future of the IRN FALCoL

The present members of the IRN FALCoL are mainly specialists of deep seated geological processes and not so much on element transfers related to the external cycle (weathering, erosion, transport and sedimentation). In the near future, we intend to develop this aspect as it is key to assess the impact of human activities on the dissemination of pollutants in the Environment. Moreover, it is planned to develop research programs that will go beyond Earth Sciences and reach Humanities as well as open the door to a large public. Indeed, to meet the challenges of the energy and ecology transitions will require to define territorial scenarios for the subsoil that will be consistent with the needs of the human societies without adding stress on the environment and climate.

Workshop on the geology of the Guiana and West African continental lithosphere Ardeche from August 19th to 29th 2023 - Members of the FALCoL International Research Network as well as researchers from Senegal, Cameroun, Ghana, Ivory Coast, Guyana, Suriname, Brazil, Netherland, Ireland, Scotland, Australia and France.

IRL CROSSING

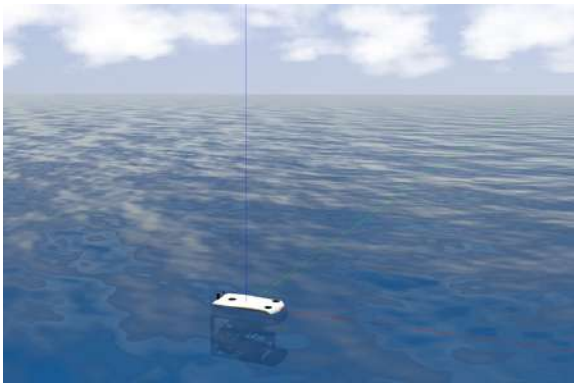
Presentation of an IRL Crossing doctoral student

Katell Lagattu,
PhD Student ENSTA Bretagne / Flinders

My name is Katell Lagattu, I am 23 years old, and I am currently pursuing a PhD at IRL-CROSSING in Adelaide. This is a Naval Group CIFRE Defense PhD, with ENSTA Bretagne and co-supervised by Flinders University. My research focuses on the management of faults in underwater drones using deep reinforcement learning methods. The goal is to train the robot to overcome these faults, enabling it to operate autonomously during its missions.

Why did you choose this cotutelle between ENSTA Bretagne and Flinders ?

I chose this cotutelle arrangement between ENSTA Bretagne and Flinders because both institutions have specialized research laboratories in the field of my PhD, which is autonomous robotics and machine learning. My supervisors from ENSTA Bretagne and Flinders each bring their own areas of expertise, guiding me in the right direction and helping me make progress. It was also a great opportunity for me to carry out a part of my PhD abroad.



BENEFIT OF A COTUTELLE AND CIFRE PROGRAM

The benefits of such a cotutelle primarily lie in the diversity of research teams, which encourages creativity and innovation. It is very interesting to compare different research approaches. Additionally, this cotutelle enables me to spend a year in Australia, which has always been my dream destination. The advantage of a CIFRE thesis is that it allows me to have direct contact with a company and collaborate with them on the practical application of my research. It's not just about theory but a real-world use case that will be beneficial to a company.

FOCUS AT CROSSING

At CROSSING, I'm working on applying my deep reinforcement learning algorithms to a simulated drone (see figures). The main goal is to test these algorithms on real drones at Flinders in the future. I'm closely collaborating with my main supervisor at CROSSING. Being part of CROSSING also lets me interact with other French students who are working on similar topics..

Website : https://crossing.cnrs.fr/

IRP XERD-DM-V

XEnon Time Projection Chambers : R&D for Future Generation Experiments, searching for Dark Matter and investigating the nature of neutrinos

Shedding light on the nature of dark matter and studying the properties of neutrinos are among the main priorities of modern particle and astroparticle physics today. Worldwide, more than a dozen direct detection experiments are prepared to observe rare signals induced by dark matter candidates and neutrinos in ultra-sensitive, low-background detectors. One of the leading technologies today are the dual-phase liquid xenon Time Projection Chambers. This is a well-established technology, proven to be scalable from a few tens of kg of target mass to the current multi-ton detectors LZ (7t target mass, in US) and XENONnT (6t target mass, in Europe). These detectors have recently achieved the most stringent limits on dark matter searches and demonstrated their exceptional capabilities for additional rare event detections. Despite the exciting prospects for the current running experiments, there is broad consensus in the community of the need for a larger detector, able to further increase the sensitivity to rare events searches.

Should the current generation of instruments provide evidence of signals, a large detector will be essential as the nature of dark matter and neutrinos become open to exploration. In that context, this IRP is developed as a natural continuation of the International Emerging Action (IEA) intitled XERD-DM-0vbb. With this IEA that ended at the end of 2023, the members of the SUBATECH laboratory and the School of Physics at the University of Melbourne (UoM), joined their efforts to prepare the playground for the next generation liquid xenon DARWIN detector. In that respect, the two groups are contributing to R&D activities as well as to analysis via the search for dark matter candidates and investigation of the nature of neutrinos using the data of the current running XENONnT experiment.

THE XENON COLLABORATION & THE XENONNT EXPERIMENT

The experiments of the XENON collaboration, with today XENONnT, aim to find the first direct evidence of the existence of Dark Matter in the universe via its scattering with xenon target nuclei. XENONnT will also be able to investigate other important phenomena for new rare events physics (axions, neutrinoless double beta decay, ...).

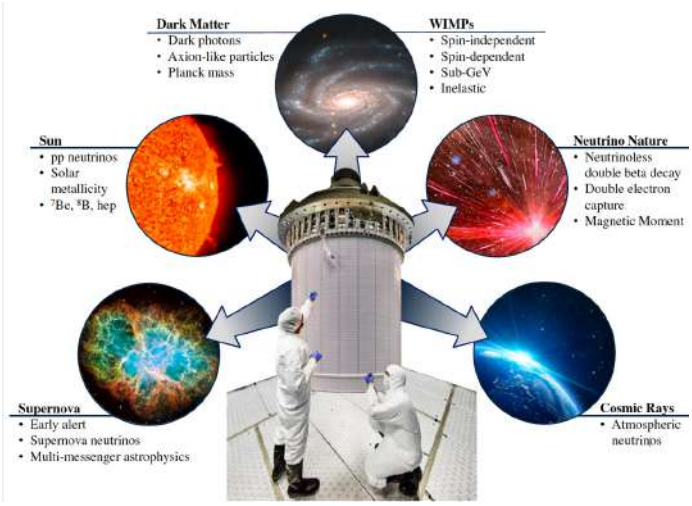
After the success of its predecessors, the fourth-generation detector of the XENON program, XENONnT started its data taking in 2021. The detector is located in the underground laboratory of Gran Sasso (LNGS), in Italy: the telescope is filled with liquid xenon over 1.5 meters high and 1.5 meters in diameter, containing a total of ten tons of xenon, surrounded by a shield of water and rock, its heart is the quietest place on earth.

Since 2009, the CNRS Nuclei & Particles Institute is involved in the XENON collaboration with contributions to the XENON100, XENON1T and XENONnT experiments. In particular, the in2p3 has deployed the largest service stations dedicated to liquid xenon, the ReStoX1 and ReStoX2 units. They allow the storage, distribution and recovery of xenon from the XENON collaboration facilities.

The XENONnT experiment

Above : on the ground floor, the "ball" on the left is the ReStoX1 unit

Down : on the right hand side, the "cylinder" is the ReStoX2 unit



The science channels of a next-generation liquid xenon observatory (figure taken from https://arxiv.org/pdf/2203.02309.pdf)

THE DARWIN CONSORTIUM

The DARWIN consortium is working to realize the ultimate next-generation xenon-based detector which will allow to significantly advance in our current knowledge of astrophysics, particle physics, nuclear physics, solar physics, and cosmology. The DARWIN experiment will be primarily designed to search for a large variety of dark matter particle candidates, but it will be also sensitive to different rare events processes including the detection of neutrinos from our Sun, the atmosphere, and Galactic supernovae.

Its working principle will consist of a time projection chamber filled with xenon (similar to the one employed for the XENON experiments), but its size will be the largest one ever reached for this kind of detectors. A possible realization of the detector under study consists of 50 tons of liquid xenon as a target.

Center Of Excellence

The ARC Centre of Excellence for Dark Matter Particle Physics (CDM) is a collaborative research centre that aims to solve one of the universe's fundamental mysteries – the nature of dark matter.

It is funded by the Australian Research Council and administered by the University of Melbourne, in partnership with the Australian National University, Swinburne University of Technology, University of Adelaide, the University of Sydney and the University of Western Australia.

The Centre's research encompasses the experiments and R&D on dark matter direct detection (including DARWIN), precision metrology, Large Hadron Collider dark matter searches and a strong theory group. The Centre's theorists are involved in a wide range of research activities, including construction of dark matter models, evaluation of constraints on dark matter interactions arising from existing and future experiments, complementary constraints on dark matter interactions arising from astrophysics, improved calculations of dark matter scattering rates in direct detection experiments, and an evaluation of astrophysical uncertainties in dark matter direct detection rates.

STAWELL UNDERGROUND PHYSICS LABORATORY

The centre is carrying out the first major dark matter direct detection experiment in Australia, which will be located in the Southern Hemisphere's only underground laboratory, the Stawell Underground Physics Laboratory (SUPL). Construction of SUPL began in 2019 and was completed in August 2022. SUPL has initiated a vigorous dark matter direct detection experimental program and there are plans to extend its physics program to neutrino physics. The center, primarily built to host the SABRE experiment, is also involved in future larger scale experiments such as DARWIN, in quantum sensors R&D for future direct detection experiments and in the CYGNUS collaboration.

The benefits of the Franco-Australian partnership in XERD-DM-v

The four groups involved in the proposed IRP project (SUBATECH, LPNHE Laboratory, Univeristy of Melbourne and University of Sydney) are already part of the XLZD consortium. All of them have an acknowledged expertise on rare events direct detection, nevertheless their know-how is complementary: while the members of the French laboratories have undisputed competences in liquid xenon TPCs detectors, the Australian partners expertise encompasses the experiments and R&D on dark matter direct detection (one of the UoS member has also a longstanding experience within the LZ collaboration and is part of the steering committee of the XLZD consortium), signal modelling, data interpretation and data acquisition systems of large-scale experiments

This complementarity is a key point for the success of the proposed project. French and Australian participants to the project will coordinate their work to jointly contribute to R&D activities as well as to perform sensitivity studies on different scenarios of dark matter candidates and neutrino physics in the context of the preparation for future generation liquid xenon detectors.

The XLZD Consortium

Three world leading collaborations (XENON, LZ and DARWIN) recently unite forces in the XLZD Consortium aiming at designing and building a single, common and ultimate multi-ton experiment for rare events searches. Current detectors LZ and XENONnT have the same science goals but differ in many technical details. Building this collaboration, will allow us to explore and select the best option from both worlds, strengthening our R&D efforts by combining ideas and resources. With between 40 and 100 tons of xenon we will achieve a lot more than ever before!

All the fourth members of the IRP : SUBATECH, LPNHE Laboratory, the University of Melbourne and the University of Sydney are part of this consortium. This IRP aimes at further reinforcing the link and collaboration between the two countries by building a French-Australian program around the preparation of the XLZD/DARWIN experiment.

This program will provide France and Australia with an outstanding opportunity to participate in an exciting project of international significance in fundamental physics. The collaboration will result in a better understanding of our Universe notably via the search for dark matter candidates and neutrino properties. The results will be published in international physics journals. Additionally, the project will lay the foundation for a common infrastructure and effective network of knowledge focused on common interests on astrophysics rare-events search and Xe-based detector R&D.

Website : https://melbourne.office.cnrs.fr/project/irp-xerd-dm-v/

IRN FACES

French-Australian research network committed to the energy transition

The French-Australian research network on Conversion and Energy Storage is a collaborative scientific network aiming at providing global energy solutions. The IRN-FACES gathers a multidisciplinary expertise on materials chemistry for electrochemical devices and hydrogen technologies, taking full advantage of their complementarity through efficient system integration. Owing to common bilateral interests, IRN-FACES pays particular attention to maritime-related applications: ship propulsion and off-grid energy systems adapted to islands, coastal areas and remote isolated regions.

The members of FACES

The task force of the IRN-FACES gathers more than 80 permanent researchers from eight CNRS French laboratories (ICMPE, ICMCB, IEM, IMN, IMS, FEMTO-ST, Laplace and Ampère) and five Australian Universities (Univ. Sydney, UNSW, Deakin Univ., UNiSA and Flinders Univ). This large association enables us to cover a broad and unique range of expertise ranging from the discovery and optimization of novel functional materials to their integration in efficient systems. The IRN-FACES is coordinated by Fermin Cuevas (ICMPE/France) and François Aguey-Zinsou (University of Sydney, Australia)

The creation of the IRN

The IRN-FACES was launched in 2020 after two successful bilateral working meetings in Sydney (Australia) and Le-Croisic (France) in 2018 and 2019, respectively. Owing to the Covid-19 pandemic, most of the programmed activities of the network had to be postponed in 2020 but the resilience of IRN-FACES was demonstrated through the organisation of bilateral webinars and the running of internal research projects between French and Australian teams..

FACES expertise

Our research projects concern both novel energy materials and their implementation in efficient integrated systems considering simultaneously the two most flexible and exchangeable energy vectors: hydrogen and electricity. We work on electrochemical energy storage devices, such as batteries and supercapacitors, as well as on the whole hydrogen energy chain: hydrogen production, storage and conversion.

We are fully convinced that hydrogen and electricity should be exploited in association for boosting the transition from fossil fuels towards decarbonised energy solutions. If fully mastered, these exchangeable vectors will strongly contribute to limit climate changes and guarantee energy independence. For instance, in mobile applications, hydrogen-fed fuel cells are suitable in electric powertrains for heavy vehicles and long distances, while batteries are more efficient for light-vehicles. Similarly, for the management of the intrinsic intermittency of renewable energies, energy storage in batteries is preferred for daily fluctuations while the hydrogen chain electrolyser-storage-fuel cell is more efficient for monthly and seasonal fluctuation periods. Thus, the massive production, storage and export of hydrogen from water splitting, the carbon-free mobility using batteries for light vehicles and fuel cells for heavy-duty ones and the management of intermittency of renewable energies are key end-user targets for both French and Australian IRN FACES laboratories.

The French-Australian partnership

Though our two countries are faraway, we share common interests and have complementary strengths. France and Australia are major maritime countries, being at the first and third position ranking in terms of maritime Exclusive Economic Zone (EZZ), respectively. Moreover, besides being close to the dynamic Asian market, Australia neighbours several French overseas territories such as New Caledonia, Wallis and Futuna as well as French Polynesia. As maritime countries, France and Australia also share common climate and environmental concerns. Owing to global warming, sea level rises affect French and Australian citizens as well as natural environment in coastal and island regions. Marine propulsion, largely based on diesel engines, is also a serious source of environmental pollution. Scientific breakthroughs on decarbonized energy will globally contribute to mitigate these issues. Locally, the development of efficient stand-alone systems for carbon-free production, storage and conversion in coastal regions and off-grid remote areas is a necessity to ensuring and securing access to energy for people at affordable cost.

Australia is expected to play an important role on the eve of the energy transition as result of the strategic opportunities of renewable energies, the abundance of Australian raw materials for the new energy technologies, and its ability to serve as a platform for large-scale demonstration of innovative energy technologies. However, unlike France, Australia still currently lacks capacity to translate basic and / or applied research to the manufacturing and commercialization of new technologies. In the battery and hydrogen sector many of these translations are yet to happen. France has strong academic scientific capacities on energy and a proven know-how of partnership research with industry and tools (including technology incubators) allowing the transition of technologies towards their commercialization. An effort to structure scientific cooperation on key technological fields/challenges (in particular, renewable energies, stand-alone energy storage and system integration) is therefore a lever for France's positioning strategy as a partner of Australia on the sector

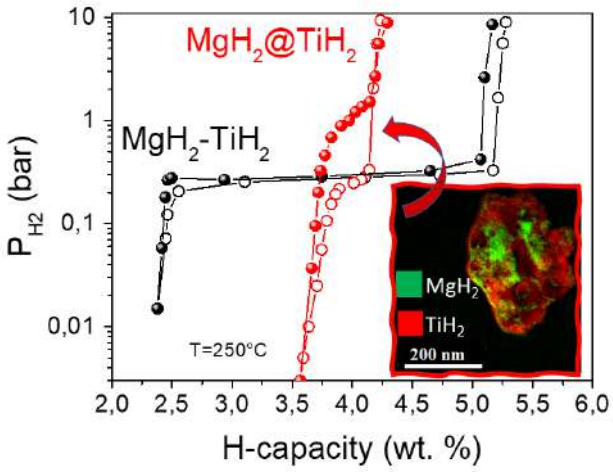
The IRN-FACES workshop at Le Croisic, France, in 2019

Research Activities in FACES

Several common projects are currently running between French and Australian groups of the IRN faces on manyfold topics such as hydrogen storage materials, cathodes for Li-ion batteries, electrocatalysts for CO2 reduction and optimum efficiency of PEM (Proton Exchange Membrane) fuel cells.

Hydrogen Storage

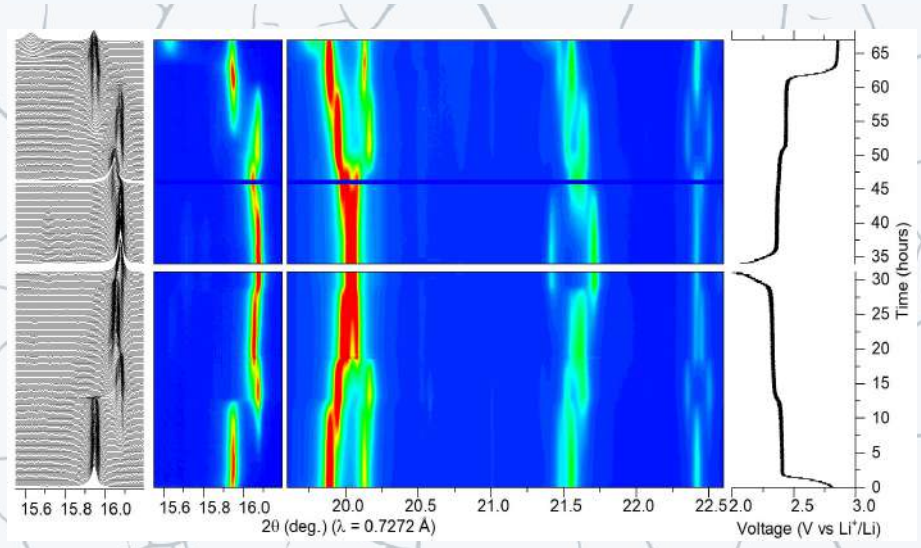
In the field of hydrogen storage, magnesium hydride is considered as one of the most efficient stores, but its thermodynamic stability needs to be reduced for many practical applications. To face this issue, a share project between the ICMPE/CNRS and the University of Sydney focuses on the understanding of size and interfacial effects in nanostructured Mg. By using mechanochemistry under hydrogen gas, MgH2 nanoclusters have been successfully embedded in a TiH2 matrix to form MgH2@TiH2. Their thermodynamic hydrogenation properties given by pressure-capacity isotherms show fundamental differences as compared to MgH2-TiH2 mixtures. Large hysteresis and destabilization effects are observed which origin will be further understood by microscopy methods and NMR facilities available in our labs.



Pressure composition isotherms at 250°C of MgH2 nanoclusters embedded in TiH2 (MgH2@TiH2) compared to bi-phasic MgH2-TiH2 mixtures. The microstructure of MgH2@TiH2 as observed by scanning transmission electron microscopy is shown (copyright ICMPE/CNRS)

Metal-ion batteries

Concerning the development of new chemistries for metal-ion batteries, the main concerns are the stability upon long range cycling or in storage. Some of them are addressed in the frame of the collaboration between ICMCB/CNRS and UNSW using especially developments used at the Australian Synchrotron. For example, together we understood the structural rearrangements occurring at the atomic scale in LixMoO2 phases during the lithium electrochemical (de)intercalation. X-ray diffraction experiments were performed in situ during the operation of the battery and many phase transitions were highlighted. These phase transitions are related to the ordering of cations during cycling, both lithium and molybdenum ions, and they modify significantly the transport properties (electronic and ionic) within the electrode and thus the performance of the battery.



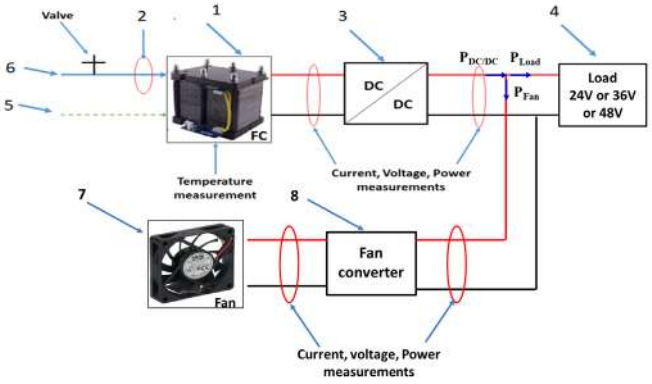
X-ray diffraction patterns recorded in situ during the operation of the battery (charge and discharge). Selected ranges of the full patterns are shown as lines (left) or contour plots (center) in order to highlight the structural transitions occurring in LixMoO2 phases. The electrochemical curve recorded during the in situ experiment is shown on the right (copyright ICMCB/CNRS).

Steam electrolyzers

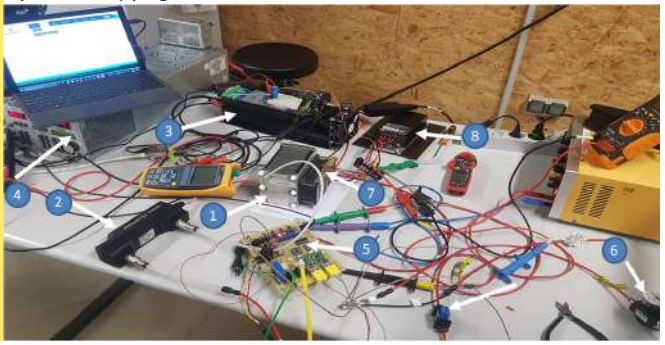
Another bilateral collaboration aims at studying well known catalysts used in steam electrolyzers for other types of electrochemical and photochemical reactions. It is conducted by a large partnership involving two French CNRS laboratories (IMN and ICMCB) and two Australian universities (UNSW and Flinders). Mixed conducting oxides, that show transport of both electronic and ionic defects (primarily oxygen defects) have been largely studied as electrodes for high temperature electrolysers. In general, they show superior catalytic activity than pure electronic or pure ionic conductors. The project is to apply these catalysts for other types of reactions that are commonly studied at UNSW. Early results have shown that a mixed conducting Pr doped ceria powder infiltrated with nickel can be used as an efficient catalyst for the photo thermal methanation of CO2. More experiments and additional characterizations are under way, including a student exchange between UNSW and IMN that will aim at further investigating these promising results.

Fuel cell systems

Let's finish with an exciting collaboration on fuel cell systems. As for any fuel powered power system, optimal fuel consumption is required.
Regarding especially fuel cell systems (dedicated to stationary or transport applications), high efficiency can only be achieved over a narrow band of the power range. Operating the fuel cell system within this narrow band at the maximum efficiency point is then critical and key to maximize the potential of the fuel. However, the maximal efficiency point is evolving in real time as the operating conditions vary. Parameters such as operating temperature, operating gas pressures, and operating humidity are factors that affect the maximum efficiency point. Thus, a new approach for developing MEPT (Maximum Efficiency Point Tracking) strategies, inspired by MPP tracking systems for renewable sources such as PV panels, has been developed for PEM fuel cell systems, in a common project between FEMTO-ST/CNRS in Belfort, France and the UNSW in Sydney, Australia.



Experimental validation on an open-cathode 200W PEM fuel cell system (copyright FEMTO-ST/CNRS)



The future of FACES

In 2022, with the opening of international borders, the activities of the IRN-FACES have gained new momentum. Our network will participate and organize satellite workshops in two world-wide prestigious conferences that will be held in Australia: IMLB 2022-Sydney for batteries and MH 2022-Perth for hydride materials. We are also taking part in the organization of the Bordeaux Summer School MATES on Advanced Energy Storages. These scientific exchanges are expected to be reinforced through the project AUFRANDE (Australia France Network of Doctoral Excellence), submitted Horizon Europe 2022, with several PhD shared positions in laboratories belonging to the IRN-FACES. These positions will be launched in collaboration with French and Australian industrial partners belonging to the battery market and the hydrogen space.

Website : https://melbourne.office.cnrs.fr/project/irn-faces/

IRP ALPHFA+

International Research Project in Photonics between France and Australia

The ALPhFA+ International Research Project is a photonics research project, involving five laboratories in France (Institut des Nanotechnologies de Lyon – INL, Institut Fresnel, Femto-ST, Centre de Nanosciences et Nanotechnolgies – C2N, and Xlim), and five in Australia (RMIT University, Swinburne University, Australian National University (ANU), Macquarie University and Sydney University). It receives support from Centre national de la recherche scientifique (CNRS), Ecole centrale de Lyon and RMIT University [i].

The IRP Overall

At its core, the International Research Project ALPhFA+ serves two functions. Firstly, it consolidates existing collaborative ties that pre-date the initiative and then uses this as a platform to generate new interactions between researchers. It's also instrumental in navigating the landscape of funding opportunities. The financial support from this initiative enables face-to-face interactions between France and Australia, effectively nurturing interaction and building deep relationships between researchers situated in different corners of the world.

Overall, ALPhFA+ serves as a collaborative platform that promotes international research cooperation, knowledge exchange, and innovation in photonics.

Group photo taken during the inaugural Workshop of the Australian Research Council Centre of Excellence in Optical Microcombs for Breakthrough Science (COMBS) – a 7-year funded Centre bringing together many ALPhFA members from RMIT University, University of Sydney, Swinburne University, CNRS and École Centrale de Lyon and is actively expanding this collaboration.

Areas of research

ALPhFA+ has three areas of focus: photonic chips, metamaterials, and mid-infrared photonics.

The first explores the potential to miniaturise systems (often the size of an entire laboratory bench), into low-cost, manufacturable micro-chips the size of a fingernail, like those inside a computer or smartphone.

Metamaterials explores the engineering of structures on the surface of these chips at the nanoscale, which are impossible to see with the human eye. The objective is to change the material's properties, creating opportunities for flat lenses and even holographic displays.

Mid-infrared photonics is important for detecting molecules – crucial for pollutant and toxic agent identification and precision astrophysics, including the James Webb Telescope.

For example, our project can create chips that produce light that is as bright and coherent like a laser, yet spans every colour of the rainbow. This is achieved through collaborative ground breaking efforts in super-continuum generation between Arnan's team at RMIT University, Australian National University, CEA-LETI in Grenoble and Christian's team at Institut des Nanotechnologies de Lyon.

THE BENEFITS OF THE PARTNERSHIP

France - Christian Grillet

"Our partnership thrives on complementary expertise. As an example, Australia excels in mid-infrared research, and we had to rely on our Australian colleagues to kick-start our own integrated mid-infrared program. The same applies to a new axis of research – thin film lithium niobate pioneered by Arnan. We literally couldn't have started these projects without the expertise of our colleagues in Australia – which really tells you how significant this collaborative effort is.

In addition to his scientific input and vision, Arnan aids in facilitating research through his knowledge of the Australian scientific funding landscape, but also – believe it or not – the European one, connecting people and assistance for travel and workshops. The purpose of International Research Project ALPhFA+ is to strengthen existing collaborations, support initiatives and foster new interactions, and Arnan is crucial in facilitating this."

Australia - Arnan Mitchell

"Our Australian partners, ANU and Macquarie, laid the groundwork for this project's inception, particularly in mid-infrared research and lab equipment setup. However, it's our French collaborators who bring a crucial aspect we lack: world-leading semiconductor industries.

French companies like Soitec and STMicro are instrumental in the global microelectronics industry – such a semiconductor ecosystem is absent on such a scale in Australia. Their involvement has propelled mid-infrared science into an industrial context, focusing on system engineering and applications. This engagement gives us access to French industrial chip foundries like LETI, giving us insight into scale up manufacture. The opportunity to engage deeply with these experts creates a trajectory for our research to get out of the lab and into real world impact.

I also really value working in partnership with Christian, building programs to train the next generation of researchers. We have done this by establishing several doctoral training programs, bringing together the communities across France and Australia [ii]. "

The Future of the IRP AlFPHA +

The subsequent phase for ALPhFA+ is founded on fostering collaboration in more substantial projects. We're committed to sustaining joint PhD initiatives – currently around 60 across Australia and France – and we aim to maintain this momentum.

We are also planning on creating an international research laboratory centred in Melbourne, to host both French and Australian researchers. This collaborative effort will leverage the newly established ARC Centre of Excellence in Optical Microcombs for Breakthrough Science (COMBS) as a hub for photonics researchers in Australia and Europe, connecting universities, industries and government agencies such as the Australian and European Space Agencies.

This strategic initiative enhances cross-border research collaboration and resource utilisation, propelling ALPhFA+ into a new phase of impactful research.

[i] https://eclausion.ec-lyon.fr/

[ii] https://aufrande.eu/

Website : https://melbourne.office.cnrs.fr/project/irp-alphfa/

UMR ENTROPIE

Presentation of the UMR ENTROPIE

ENTROPIE, a Joint Research Unit (UMR) established in 2015 through the merger of two units, one at the IRD of New Caledonia (COREUS) and the other at the University of La Réunion (ECOMAR), has undergone significant growth and development under the dynamic leadership of Professor Claude Payri (2015-2020) and Professor M. Lecorre (2021-2026) which led to the arrival of researchers, support staff, lecturers. Presently, the unit operates under five research organizations: the Institute of Research for Development (IRD), the University of La Réunion (UR), the French Institute for Research and Exploitation of the Sea (IFREMER), the University of New Caledonia (UNC), and the National Center for Scientific Research (CNRS - INEE).

The scientific strategy of ENTROPIE

As for its scientific strategy, ENTROPIE is distinctive in its focus on studying evolutionary processes and resilience of coastal, reef, and offshore ecosystems at various spatiotemporal scales through human interactions with resources and the environment. With dual locations in the Pacific Ocean (New Caledonia) and the Indian Ocean (La Réunion), ENTROPIE is mobilized around the large tropical Indo-Pacific region: in the French overseas departments and territories (Reunion, New Caledonia, Wallis & Futuna, Eparsian Islands, French Polynesia, Mayotte) and in partner and neighboring countries to the south (Madagascar and the island states of the western Indian Ocean, Indonesia, Oceanian island states (Vanuatu, Fiji, Papua New Guinea, Samoa, etc.).

Hence, the unit's research spans four thematic axes aiming to: i/ investigate the influence of local and large-scale forcings on biogeochemical cycles and physicochemical characteristics of reefs, lagoons, seamounts, and coastal and offshore ecosystems; ii/ better understand the structure and functioning of marine organisms, from individuals (characterization, distribution) to populations (evolutionary and adaptive processes); iii/ characterize the vulnerability and resilience of biological communities, emphasizing life history traits and population dynamics in the face of natural and anthropogenic changes and iv/ study the health status of ecosystems, the exploitation, and management of certain resources to assist in their protection and conservation in collaboration with local managers.

ENTROPIE in New Caledonia

The UMR is situated accross two locations: the IRD centre in Nouméa, New Caledonia, and the Moufia campus in Saint-Denis, La Réunion. The mainland also hosts several IRD members, returning from assignments under hosting agreements with the University of Perpignan Via Domitia, the IRD-Occitanie center in Montpellier, the Oceanology Laboratory in Villefranche-sur-Mer and the IUEM (European Universitary Institute of the sea) in Brest. Currently comprising 122 members, including 78 permanent staff, including 35 IRD personnel, 22 IFREMER, 18 UR, 2 CNRS, and 1 UNC, forming a pool of complementary skills, including ecologists, ecophysiologists, and geneticists specializing in marine sciences, as well as specialists in oceanography, climatology, remote sensing, and data processing to propose conservation, enhancement, and sustainable management strategies.

Thus, the ENTROPIE UMR is a member of the Observatory of Earth Sciences (OSU-Réunion) and a member of two Research Federations: "Observatory of Natural Environments and Global Changes" (OMNCG - FED4128) and "Biosafety and Health in Tropical Environments" (BioST - FED4126). The ENTROPIE UMR is also a founding member of Labex-CORAIL since 2010. ENTROPIE researchers are members of the consortium for Research, Higher Education, and Innovation in New Caledonia (CRESICA). This interrelation allows researchers and institutes located in New Caledonia to rely on amplified human and technical resources, an expanded field of expertise, and the ability to conduct multiple research projects, all resulting in an amplification of scientific dynamics.

The main partners in the Oceania

As far as Oceania is concerned, the location of the Nouméa site enables UMR researchers to exchange and develop work in partnership with numerous countries and territories, with Pacific Islands Countries and Territories but also, on the scale of the insular Pacific, with Australia, New Zealand and Japan. We share many common themes, notably the preservation and enhancement of its biodiversity and natural resources. ENTROPIE's geographical location is therefore an asset for regional exchanges on this essential issue.

A number of initiatives in which ENTROPIE researchers have played a leading role attest to this. Examples include the CLIPSSA project "Pacific Climate Local Knowledge and Adaptation Strategies" (Wallis and Futuna, French Polynesia, New Caledonia and Vanuatu), the KOREL project "Training in reef monitoring and assessment in Vanuatu" and CARIOCA "Coral acclimatization to ocean acidification around CO2 seeps" (Papua New Guinea). Numerous cutting-edge programs involving research fields as varied as physic, mathematics, ecology, physiology, genetics are also developed in collaboration with Australia, New-Zeland and Japan notably with CSIRO, Southern Cross University, Australian Institute of Marine Science, Auckland University, Okinawa Institute of Science and Technology (e.g., CORALCARE “CRISPR genome-editing of corals to understand the genetic response of corals to ocean warming”).

Portait of Véronique Berteaux-Lecellier

Véronique Berteaux-Lecellier, a senior researcher with the French National Centre for Scientific Research (CNRS) based at ENTROPIE-Nouméa, and is also the assistant to the CNRS Scientific Director for New Caledonia. Specializing in cellular and molecular genetics, her expertise lies in functional genomics. Prior to venturing into marine research, she led a research laboratory investigating the role of organelles in cellular behavior, earning her the CNRS bronze medal.

In 2009, she decided to focus on marine research using molecular technologies to unravel the acclimatization and adaptation capacities of coral to face environmental changes. By developing the seascape genomics approach with collaborators among which one of the pioneers in landscape genomics, S. Joost (EPFL Swiss), she contributed to the first predictive maps of coral adaptative capacities to thermal stress around New-Caledonia.

To facilitate their transfer into practical action, she co-founded the MANACO (Modern tools for innovative coral reefs MAnagement and Conservation), consortium. MANACO, currently uniting members from over 20 countries, including twelve Pacific countries or territories, forms a collaborative network of coral reef stakeholders. The network includes local communities, volunteers, decision-makers, and scientists, all sharing commitment to addressing common challenges in coral reef management.

Leveraging seascape genomics advanced knowledge of coral thermotolerance markers, allowed the development of predictive maps showcasing the adaptive potential of coral reefs and their connectivity therefore paving the way for regional coral reef management strategies. Indeed, as genetic variants can be exchanged between countries, the best investment for preserving the reefs on one country could require the protection of neighboring countries' reefs.

Building a concerted regional action is therefore crucial for Pacific islands communities to implement and strengthen sustainable and resilient reef conservation strategies. The ReCoVer project, focusing on reinforcing reef conservation in the South Pacific by identifying corals adapted to thermal stress from New Caledonia to Australia, mark a significant step in this direction and should soon extend to the east of New Caledonia with the co-construction, within MANACO, of projects with countries and territories to the east of New Caledonia (CORALL, FINDHEAT). The establishment of regional connected sanctuaries for heat-adapted corals, facilitated by this collaborative approach, will undoubtedly foster coral reef resilience and support associated biodiversity in a sustainable manner.

Website : https://umr-entropie.ird.nc/index.php/home

CNRS FELLOW AMBASSADOR

First CNRS Fellow-Ambassador from Australia - Laurajane SMITH

In 2023, CNRS launched a new program called "Fellow-Ambassador", to attract the world's greatest minds to come and spend time in France to interact with our scientists. Each one of the 10 CNRS Institutes invited such a prominent figure in its field for a three-year fellowship. The Institute of Humanities and Social Sciences chose Professor Laurajane Smith, from the Australian National University in Canberra. She talked to us about her career, and what it will mean to be Fellow-Ambassador.

Originally trained in archaeology, I am a scholar in heritage and museum studies. When I graduated from my undergraduate degree, I found work in the heritage management sector and was immediately confronted by the intensity of passion heritage can engender and the political consequences of this.

My move into academia was informed by my professional work and was precipitated by a concern to engage with how and why expert understandings of heritage work to marginalise a range of social groups and communities. At the core of my work in heritage and museum studies is mapping out and understanding the political nature of heritage and the consequences it has to a range of social debates and social justice issues.

My early work was concerned with understanding how heritage policy and law was used by the state to regulate Indigenous political activism, and I have a long-standing interest in how heritage is used by working class communities to assert solidarity and challenge misrecognition and economic and political marginalisation in the face of deindustrialisation. More recently my work has highlighted the emotional registers of heritage and how emotions facilitate remembering and forgetting and energise the mobilisation of heritage in political movements, and in particular populist positions.

Overall, my work re-theorises heritage as a practice of meaning making, of engaging with the past to help navigate social problems and the processes of change in the present.

I challenge the idea that heritage is best understood as material 'things' – there is no such thing as heritage after all – rather it is something that we do to negotiate place and meaning in the present and set aspirations for the future. The things that people call heritage, and indeed the intangible heritage practices defined by UNESCO, are the cultural tools we use to draw on the past to help understand present day issues.

In developing this argument, I am perhaps best known for the heuristic devise of the 'authorised heritage discourse' that describes European traditional ideas of heritage/patrimoine that have become embedded in the practices of authorising bodies such as UNESCO and ICOMOS. This has provided a language for researchers and practitioners who wish to challenge how authorised or expert understandings of heritage can exclude and marginalise sectors of society and maintain the of the status quo.

Links with France

Interestingly, they are developing with the invitation to become a fellow ambassador. While I had done some research work in the early 2000s at UNESCO over the development of the 2003 Intangible Cultural Heritage Convention, I am only now developing specific research connections.

Although based in Australia (and for a time the UK) my work is very much addressed to international audiences. In 2011, I worked, with Gary Campbell to establish the Association of Critical Heritage Studies, its founding conference occurring at the University of Gothenburg (Göteborgs universitet) in 2012.

The Association aims to support international debate in what is now known as Critical Heritage Studies, which in turn aims to foster research in the social and political phenomena of heritage.

The role of CNRS Fellow Ambassador

I understand my role as promoting research in Critical Heritage Studies between the Francophone and Anglophone world. To this end, colleagues from the CNRS and I are aiming to develop workshops for 2024 and 2025 on two ongoing debates in the field. The first, with Cyril Isnart (CNRS) and Lucie Morisset (Université du Québec à Montréal – UQAM), will bring together Francophone and Anglophone heritage researchers to explore and compare the history of two distinct traditions in heritage and museum studies.

In particular, the workshop, and a high-impact volume arising from the workshop, will expose Anglophone academics to French heritage authors, publications and themes that are not well understood in the English-speaking world. We hope that the workshop will lead to joint research projects exploring synergies between these two traditions.

The second will facilitate dialogue between museum professionals and academics working in France and internationally on restitution and repatriation of cultural materials and human remains. This will be particularly timely given recent changes to French policy and law with respect to restitution.

Euclid telescope's view of spiral galaxy IC 342
Credit : EUCLID telescope

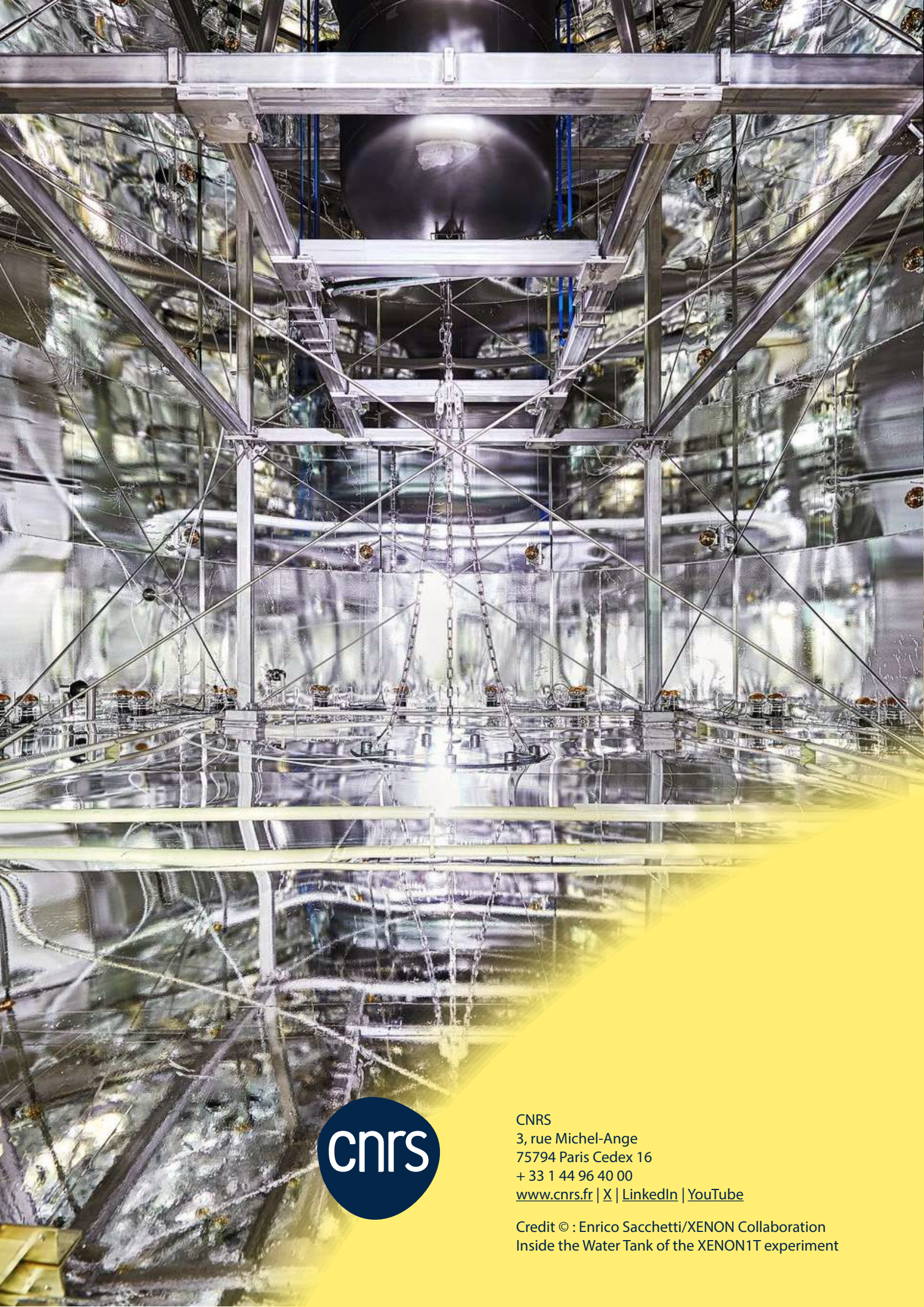
Publication : CNRS in Oceania - 2024
CNRS Representative Office in Oceania
The University of Melbourne
Building 193 Room 228-229
Parkville Campus, Parkville VIC 3010
Australia

Production and layout :
Communications ofcer
CNRS Representative Office in Oceania
www.oceania.cnrs.fr

Credit front cover:
Philip Island National Park - IRP ACCES
Group of little penguins returning from sea to the colony to care for their chicks

RÉPUBLIQUE FRANÇAISE
Liberté
Égalité
Fraternité

cnrs



CNRS
3, rue Michel-Ange
75794 Paris Cedex 16
+ 33 1 44 96 40 00
www.cnrs.fr | X | LinkedIn | YouTube

Credit © : Enrico Sacchetti/XENON Collaboration
Inside the Water Tank of the XENON1T experiment