## France-Berkeley Fund Annual Report 2024



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Established in 1993 as a partnership with the French Ministry of Foreign Affairs, the France-Berkeley Fund (FBF) promotes and supports scholarly exchange between faculty and research scientists at the University of California and their counterparts in France.

Through its annual grant competition, the France-Berkeley Fund provides seed money for innovative, bi-national collaborations in all disciplines. The Fund's core mission is to advance research of the highest caliber, to foster interdisciplinary inquiry, to encourage new partnerships, and to promote lasting institutional and intellectual cooperation between France and the United States.

## FROM THE DIRECTORS

It is a great pleasure to offer our 2024 Final Report. As readers can see, the France-Berkeley Fund has had a busy and exciting year serving researchers whose projects are on-going from last year, as well as welcoming 21 new projects beginning on July 1, 2024. We were excited to hear of the numerous in-person FBF activities, and of the travel to both Berkeley and France that took place over the past year. Before welcoming the new grantees, it gives us great pleasure to announce somewhat belatedly that we were extremely fortunate to have Rachaël Longuépée join us as our new Program Coordinator in October 2023 since which time she has impressed everyone in mastering every aspect of the program and then some! Besides managing the on-going projects, the call and initiation of new projects, and the organization of our annual meeting, which took place in Berkeley on June 3, Rachaël provides expert supervision of our wonderful French and American student assistants in the Undergraduate Research Apprenticement Program (URAP) at UC Berkeley who conducted very informative interviews with recent FBF awardees which can be seen posted on our website (https://fbf.berkeley.edu/news-archive). Our thanks and appreciation goes out to Rachaël for a stellar job in her first year!

Looking forward to the present academic year, we are delighted to support 21 new projects in 2024-5 (https://fbf.berkeley.edu/people/grant-recipients/grantsawarded-2024) thanks to the generous sponsorship of the French Ministry of Foreign Affairs, the UC Berkeley Office of the Vice Chancellor for Research, as well as the Lawrence Berkeley National Laboratory. This year's cohort showcases the extraordinary diversity of interests and methods that characterizes the FBF: from projects on "Polarity Reversals of the Earth's Magnetic Field" to "Capturing the Multi-scale Nature of Life at the Molecular Level", "Remodeling Photosynthesis to Combat Hidden Hunger", "Climate Migration: Justice, inclusion, and AI solutions in the U.S. and France", and "The Arts of Death and their Artification: Funeral orations, ephemeral funeral architecture and aristocratic tombs in early modern France and Italy (16th-17th centuries) ", to mention only a few examples. We look forward to seeing all of the new projects progress over the grant period. We wish all of our awardees the best of luck in pursuing their research goals.

We sincerely thank the many proposal reviewers at Berkeley and in France, together with our Executive Committee, who generously dedicated their time and effort to the evaluation process. We also wish to recognize our French colleagues in the consulate in San Francisco, the Washington Embassy, and the Ministries in Paris for their enthusiastic support and interest in the France-Berkeley Fund—among many others: Mireille Guvet, Counselor for Science and Technology, and Mohamed Bouabdallah, Cultural Counselor at the French Embassy in Washington; Frédéric Jung, Consul General of France in San Francisco, Emmanuelle Pauliac-Vaujour, Attachée for Science and Technology, and David do Paço, Attaché for Academic Cooperation in the French Consulate in San Francisco, and Christophe Delacourt, Claude Douteau, and Elise Binet at the Ministère de l'Enseignement Supérieur et de la Recherche.

We are delighted to wrap up a successful 2023-2024 year of fruitful cooperation between researchers and colleagues on both sides of the Atlantic. We very much look forward to another successful year in 2024-2025.

Larry M. Hyman Clément Sanchez **Co-Directors** 

## FBF NEWS

## **FBF Website Updates!**

Visit fbf.berkeley.edu to browse!

## **Our Nobel Laureates**

Since its inception in 1993, the France-Berkeley Fund (FBF) has fostered interdisciplinary bi-national collaborations of the highest caliber. Among its past grantees are individuals who have shaped their academic fields and are Nobel Prize laureates in several categories.

Chorles H. Townes was one of these grantees. His research in quantum electronics wc1s integral in odvancing maser and loser technologies. Townes, received an FBF grant in 1994 for his project "Etude de la perte de masse des etoiles evoluees" with French co-PI Jean Lefevre from Observatoire de la Cote d'Azur URA 1361 CNRS. Townes received the nobel prize in physics in 1964. He was appointed University Professor at U.C. Berkeley in 1967, where he focused on radio astronomy research.

Another such grantee, Gerard Debreu, native of Calais, France, received his grant in 1995 and the Nobel prize in Economic Sciences in 1983. The title of his FBF project was "Economic Mathematics." His co-PI Bernard Cornet was from Universite Paris 1 Pantheon-Sorbonne. He became a professor at UC Berkeley in 1962. His research centered on the theory of general equilibrium in the principles of supply and demand in market economy.

George Smoot received three FBF grants in 2000, 2003, and 2008 respectively. He completed his 2000 project: "Precision Cosmology from CMB Data Processing" with James Bartlett from Observatoire Midi-Pyrenees, Toulouse. His 2008 project: "Empowering the CMB: Measuring Power Spectra from the Planck Mission"was completed with French co-Pi James G. Bartlett of Dep. Physique, Universite Paris 7 Denis-Diderot, Paris. He did his 2003 FBF project: "Precision Cosmology from CMB Analysis" with the same co-PI. Smoot received the Nobel prize in physics in 2006. First an astrophysicist at Lawrence Berkeley National Laboratory since 1974, he became a U.C. Berkeley Physics Professor in 1994. His research centers on experimental astrophysics and observational cosmology.

Randy Sheckman and co-PI Bruno Antonny of CNRS Institut de Pharmacologie Moleculaire et Callulaire received a FBF grant in 2005 for their "Architecture of the COPII coat and mechanisms of vesicle formation' project. Scheckman was awarded the Nobel prize in Physiology and Medicine in 2013. His laboratory researches vesicular transport in eukaryotic cells. He also serves as the Choir of the Scientific Advisory Board for the Aligning Science Across Parkinson's (ASAP) research initiative, which mobilizes research efforts to find a cure for Parkinson's.

Saul Perlmutter received multiple FBF grants, including for his1997 project: "Measurement of the cosmological parameters using type i. supernova" with Rayn.ld Pain from LPNHE, Universites Paris VI & VII, Paris, his 2001: 'Nearby Supernova Factory project" with Pierre Antilogus from Institut de Physique Nucleaire de Lyon, and his 2008 project: "The Nearby Supernova Factory" with Gerard Sm.dja from Institut de Physique Nucleaire de Lyon, Villeurbanne. His research led to the discovery of the acceler.ting expansion of the Universe. He was awarded the Nobel prize in Physics in 2011. He teaches physics at UC Berkeley and is a senior scientist at Lowrence Berkeley National Laboratory. Among other endeavors, he is the Lead Scientist of the international Supernova Cosmology Project.





Randy Scheckman

Saul Perlmutter

George Smoot





Gerard Debreu



Charles Townes



## **IES & FBF Undergraduate Research Apprentice** Team



FBF was delighted to have the support of the IES Undergraduate Research Apprentice Team (URAP). The URAP team composed of UC Berkeley students as well as UC Berkeley and SciencesPo dual degree students. The URAP team worked on various projects throughout the year for FBF, including the FBF interview series. FBF would like to thank Claire Ducharme, Lisette Gomez-Galvan, Annelies Van Haften, Paula Roggisnoli, David Eick, Sitara Gupta, Atiana Novikoff, Chris Ojeda, Luca Zislin and Paul Lesgourgues for their contributions to FBF this year!

## FBF launches new interview series!

FBF is continuing an interview series lead by the Undergraduate Research Apprentice Team (URAP). Members of the IES URAP Team interviewed FBF Principle Investigators to learn more about them and their projects. The interviews can be found on the News section of the FBF website.

## An interview with Robert Braun

### Lily Shandalove

Lily Shandalove interviewed Robert Braun about his research funded by a 2022 France-Berkeley Fund grant. Robert Braun, an associate professor in sociology at UC Berkeley, to learn more about his current research on"Intergroup Solidarity and Social Integration: Micro-level evidence from the Holocaust in Belgium, France, the Netherlands and Poland."As a recent PHD graduate from Cornell University, Braun has taught at many schools beyond Berkeley including Northwestern, and has now written two books. The time spent in this interview was focused on Braun's research interests, his academic journey, and his experience as an undergraduate and postgraduate.



Can you start with introducing yourself and giving us a littlebackground on your academic journey and how you have gotten to where youare now?

RB: My name is Robert Braun, I am an associate professor of sociology, at UC Berkeley. I started out as an undergraduate student in history, but switched halfway through my undergraduate career to the social sciences because I was more interested in sort of general, bigger picture kind of patterns. So I ended up becoming a sociologist and then I worked for a couple of years at a newspaper in the Netherlands. That was something I always thought I wanted to do, work as a journalist, but I absolutely hated the job. Sol went back and, one of the concerns I had about being a journalist was that it was too fast, too quick of a turn around, you never really had the time to digin and really figure out what was going on. So that made me think that maybe writing a dissertation would be another way of doing that. Sol decided to apply to graduate school and applied allover the world and happened to endup in the United States getting an offer from Cornell.

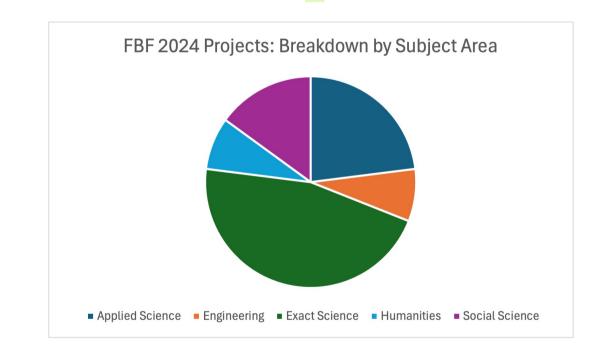
Continues at https://fbf.berkeley.edu/news/interview-robert-braun

May 28, 2024

## NFW **COLLABORATIONS**

The FBF is pleased to sponsor 21 outstanding projects in 2024-25, with awards totaling \$255 482.

Climate migration Funeral orations Photosynthesis Geometric deep learning History of fascism Superheavy elements Superconductivity



licrobial communities

Theoretical particle physics Empire

Arithmetic geometry

Mughal

## Remodeling photosynthesis to combat hidden hunger Crysten Blaby, UC Berkeley

Bahia Khalfaoui Hassani, University of Pau and Pavs de l'Adour

One-third of the world's population is affected by zinc deficiency. Often referred to as "hidden hunger," this condition results from diets high in calories but low in nutrients. This project aims to establish the foundations of an innovative strategy to combat hidden hunger by increasing the zinc content of crops.

The roles of priority effects in microbial transmission to developing seeds and microbial impacts on seedling establishment Johan Leveau, UC Davis

Matthieu Barret, The Research Institute on Horticulture and Seeds

"Seeds are central to our food production system. They are also hosts of diverse microbes, including pathogens that use seeds as vectors to spread disease. To date, little research is available on how microbes colonize seeds, particularly from flowers during pollination and seed development. In this project, we will test how the timing of microbial arrival on flowers affects their ability to colonize seeds, and how this ultimately impacts seed germination and seedling growth. "

Exploration of mRNA localization and translation in glial cells Meng-meng Fu, UC Berkeley Martine Cohen-Salmon, Collège de France

Astrocytes are non-neuronal, or glial cells in the brain that perform important functions in regulation of neurotransmisstion and maintenance of the blood-brain barrier. Each astrocyte has processes that contact neurons and processes that contact blood vessels. We aim to exchange techniques to understand how local mRNAs build these distinct processes.

Post-Selection Inference Challenges in scRNA-Seq data from Patient Cohorts Elizabeth Purdom, UC Davis Pierre Neuvial, Universite Paul Sabatier

"Single-cell sequencing of mRNA expression levels (scRNA-Seq) is an experimental technology that sequences the mRNA of individual cells, allowing for the determination of which genes are being utilized by which cells – for example which genes are utilized differently in patients with different health conditions. But like many genomic-scale technologies, drawing valid conclusions from scRNA-Seq requires extensive pre-processing and careful statistical analysis. Yet common preprocessing steps for scRNA-Seq data can render statistically invalid the downstream methods that find such genes, resulting in far too many false positives. Our collaborative research project proposes to evaluate the impact of these problems in the analysis of scRNA-Seq data and determine procedures that mitigate these effects.

Flow-EIT: A Label-free Electrical-impedance-tomography-based Flow Cytometry for Diagnosis and Cell Therapy Jun-Chau Chien, UC Berkeley Arnaud Pothier, XLIM Research Institute, UMR 7252 CNRS-Limoges University

Cell sorting is a critical process in a range of cell-based therapies, including regenerative medicine, stem cell therapy, and immunotherapies such as CAR-T cell treatments. However, conventional cell detection and cell sorting approaches requires tagging target cells with fluorescent labels or magnetic beads using antibodies that can interact with cells, inducing unwanted phenotypic changes, and making them difficulty in transplantation due to the challenge of eluting these labels. On the other hand, conventional "label-free" techniques suffer from inadequate imaging resolution and low throughput. This project overcomes these challenges by proposing a novel Flow-EIT system that can construct sub-cellular 3D impedance tomography from fast-flowing cells at high-throughput through spatial-confined sensing electric fields.

### New horizons for Shimura varieties Tony Feng UC Berkeley Matteo Tamiozzo, Université Sorbonne Paris Nord

The PIs are all broadly speaking working in the mathematical disciplines of number theory and algebraic geometry, but with complementary expertise which puts them in an ideal position to make novel inroads on the important theory of Shimura varieties. Shimura varieties are mysterious and subtle mathematical objects, which are at the core of many of the most spectacular breakthroughs in number theory of the past 70 years. The Ph.D. thesis of Mingjia Zhang, a Junior Scholar on this proposal, constructed a new bridge to Shimura varieties from another area of mathematics. The proposed collaboration aims to explore and exploit this new bridge.

Polarity Reversals of the Earth's Magnetic Field Bruce Buffet, UC Berkeley Emmanuel Dormy, ENS, Paris

The Earth's magnetic field has erratically reversed polarity over geological time (typically 3 or 4 times per million years). The origin of polarity reversals is currently unknown. Brute force numerical simulations are not sufficient to resolve this question, so we propose a new approach that combines dynamical systems with stochastic methods to characterize the role of turbulent flow in the Earth's interior. Our goal is to interpret the geological record of polarity reversals and establish testable hypotheses that can be assess against available observations.

### Neural modulation resulting from an innovative form of non-invasive brain stimulation Richard Ivry, UC Berkeley Florent Lebon, Université de Bourgogne

The current project seeks to foster knowledge in non-invasive brain stimulation (NIBS), a method for safely perturbing brain activity. NIBS is employed in basic research to test functional hypotheses concerning brain-behavior relationships with increasing translational applications. The goal of this collaboration is to further examine the effect of new type of NIBS developed by the UC Berkeley team on cortical physiology.

### Discovering beyond the Standard Model physics in a future Higgs factory Simon Knapen, Lawrence-Berkeley National Laboratory Quentin Bonnefoy, Université de Strasbourg

"Among next-generation particle colliders, the Future Circular Collider (FCCee) at CERN stands out as a precision machine able to probe much beyond what is currently known, delving deep into the mysteries associated to the weak force and the Higgs boson. It also provides a remarkable example of a worldwide effort, featuring the USA and France as major actors. With this project, we wish to assess what precisely is the reach of the FCCee in terms of prominent theories which tackle the grand questions left about particle physics as we know it. Our results will be crucial to understand and expand the physics case for the FCCee and to inform CCee detector physicists and engineers about the desired design targets.

### Next Generation Superheavy Element Experiments Roderick Clark, Lawrence-Berkeley National Laboratory Benoit Gall, Strasbourg University

Extending the Periodic Table of elements is a compelling scientific adventure, which catches the imagination of scientists and the general public. Whether the most massive elements continue to obey the organizing principle of the table – which sorts the lighter elements into the familiar groups with recognizable recurring patterns of chemical reactivity – remains a central question in chemistry, while determining the limits of nuclear mass and charge is one of the hottest topics in nuclear physics. This is a proposal for seeding a new US-French collaboration to perform, as part of a broader international coalition, search-and-discovery experiments for new elements.

Geometric Deep Learning for Particle Tracking at the Large Hadron Collider Paolo Calafiura, Lawrence-Berkeley National Laboratory Jan Stark, Université Toulouse III - Paul Sabatier and CNRS/IN2P3

Physicists are currently upgrading the world's most powerful particle collider, the LHC at CERN, as well as the associated particle detectors to increase the collision rate by an order of magnitude beyond the initial design. This will lead to a deluge of data, which, among many other things, will allow the first direct study of the ""Mexican hat"" shape of the Higgs potential. Processing and analyzing this wealth of data is a tremendous challenge: data analysis will depend on affordable software and computing, and therefore the physics reach of the HL-LHC will be limited by how efficiently these resources can be used. Big gains in physics reach appear to be possible by the development and deployment of novel methods for particle track reconstruction based on geometric deep learning. The teams at Berkeley and at L2IT, a new laboratory specializing in innovative analysis techniques created in 2020, are leaders in this field. The two teams have established complementary approaches, and the goal of this proposal is to enable a collaboration that leads to the publication of a unified solution that can be deployed in LHC experiments.

## CUPID-CROSS-BINGO Neutrinoless double-beta decay search with cryogenic calorimeters

Brian Kurt Fujikawa, Lawrence-Berkeley National Laboratory Benjamin Schmidt, CEA Saclay

The project CUPID-BINGO-CROSS aims to develop and test cryogenic detectors to investigate a hypothetical process called neutrinoless double beta decay. If observed this would demonstrate that neutrinos are Majorana particles, a first for fermions, which in turn may provide the explanation for the observed matterantimatter asymmetry in the Universe. CUPID-BINGO-CROSS leverages new detector technologies to demonstrate a path towards the beyond next-generation experiments.

## Superconductivity in Cuprates Beyond the Superconducting Dome Inna Vishik, UC Davis

Andrea Gauzzi, Sorbonne Université, Paris, France

The question of why copper oxides become superconducting at high temperature is one of the greatest outstanding challenges in physics. Within the present collaboration between UC Davis and Sorbonne University, by means of advanced synthesis and characterization techniques, we intend to study the unusual electronic properties of cuprates in the strongly overdoped region of the phase diagram, which remains little studied and markedly different from the other regions.

### Developing a charged particle track reconstruction software for the Electron-Ion Collider

Shujie Lie, Lawrence-Berkeley National Laboratory **David Rousseau**, CNRS/IN2P3 and U Paris Saclay

We propose to use the opportunity of this France-Berkeley Fund (FBF) to promote collaboration between the Berkeley Lab (LBNL) in U.S. and IJCLab in France on the development of an ACTS-based software framework for charged particle (e.g. electrons, protons, and pions) track reconstructions at the future Electron-Ion Collider (EIC).

### Capturing the multi-scale nature of life at the molecular level Xavier Darzacq, UC Berkeley Ignacio Izeddin, ESPCI Paris

"The aim of this proposal is to introduce event-based sensors (EBSs), also known as neuromorphic vision sensors, to disrupt the study of cellular life with the tools of fluorescence microscopy and more specifically single-molecule localization microscopy (SMLM) and its applications. The overarching aim of this proposal is to pioneer a universal approach to examine the spatial organization and dynamics of individual proteins in cells and their functions, in particular to study multiscale processes in space and time. We will focus on the study of RNA polymerase II (RNA Pol II) dynamics and spatial organization given its central role in transcription regulation."

"History is never Sure": Memory, Phantasm and Restitution Between the two Shores of the Mediterranean. The Afterlives of Soliman al-Halabi Stefania Pandolfo, UC Berkeley Natalie Delbard, Université de Lille

Recent and past events in Europe and the Middle East point to the need to take seriously the share of the image and imagination in the production of war, and for the possibility of treating images otherwise, undoing representations and opening the space of a potential history. While on the Southern shore of the Mediterranean people struggle over national and religious identities reconfigured during colonization, the former colonial powers rest unable to recognize this entanglement. It is in this context that our projectengages the history of Soliman al-Halabi, a character from the Napoleonic expedition to Egypt (1798-1801), whose skeleton is kept in France, at the Museum of Natural History, as a specimen of "Fanatic", while streets and schools are named after him in Middle Eastern cities, and he is presented as a nationalhero and as a martyr. Our project poses the question of the becoming of al-Halabi's remain, at a time when in France and elsewhere the debate rages around the restitution of human remains and of ritual and artworks looted during colonization.

The Arts of Death and their Artification: funeral orations, ephemeral funeral architecture and aristocratic tombs in early modern France and Italy (16th-17th centuries). Déborah Blocker UC Berkeley

Anne Régent-Susini, Paris III Sorbonne nouvelle

The project we are submitting to the France Berkeley Fund deals with the funerary practices of French and Italian aristocrats in early modern times (1500-1800), the "arts of death" they mobilized/implemented (ceremonies, sculptures, real or fictitious epitaphs...) and the uses (political, religious and cultural) that were made of them. More specifically, we would like to explore the reason for which, within the framework of funerary practices, these practices have gradually been perceived as arts, and their productions as works of art. We are both historians of literature, art, cultures and beliefs - with a more comparative inflection for Deborah, and a more rhetorical one for Anne. Financial support from the FBF would enable us to organize two international and interdisciplinary meetings, which would bring these approaches into dialogue with other disciplines, in a methodological, historical and cultural reflection which is likely to contribute to a better understanding of how the transformation of a cultural practice into "art" occurs and enfolds.

### The Mughal Empire and the Neighboring World: Intellectual and Material Exchanges

Asad Q. Ahmed, UC Berkeley Naveen Kanalu Ramamurthy, Ecole des hautes études en sciences sociales

The project analyzes the intellectual networks, material exchanges, and scholarly interactions between the Mughal Empire in South Asia and its neighboring regions of the Middle East, Iran, Central and Southeast Asia. It examines how practices in Mughal scholarly circles were produced through interactions with the larger Islamic world by reconstructing the textual and material imprint of manuscript culture in languages like Arabic, Persian, and Turkish. In doing so, it shines a new light on a perennial question for the humanities and the global reading public: how do we write a non-Eurocentric history of early modern circulation of ideas?

## The Governance Challenges of a Planetary University Seth Frey, UC Davis

Chahab Nastar, Learning Planet Institute

Young people have the right to co-design the future. What does it look like to recognize and enable that vision? My collaborators at the Learning Planet Institute (LPI) in Paris, France are envisioning a global-scale student-governed virtual school system based upon principles of student-directed education. I have been invited by LPI's leadership to spend part of my sabbatical at the Institute advancing the selfgovernance design of their ""Planetary University,"" as well as the scientific questions it surfaces: the computational design and long-term stability of large multi-level governance systems operating under resource constraints.

### Climate Migration: Justice, Inclusion, and AI Solutions in the U.S. and France Therese Peffer, UC Berkeley Nathalie Ortar, Ecole Nationale des Travaux Publics de l'Etat-University of Lyon

Climate change is intensifying extreme weather events, disproportionately affecting urban and marginalized populations, with observed and worsening impacts in both France and California. This global crisis and the potential displacement of 1.2 billion people by 2050 highlight the need for addressing climate-induced migration with a focus on justice and social inclusion. We are seeking France-Berkeley funding to support a site visit to the Oakland EcoBlock, and to produce a collaborative book of case studies and best practices on AI technologies and strategies to improve justice and equity for frontline and migrant communities.

# SUPPORT **OUR WORK**

"The project has deepened our working relationship and also enhanced or established relationships for all who have participated in it. We are certain that these connections will bear fruit in other contexts in the years ahead."

- TODD HICKEY (Classics, UC Berkeley) and JEAN-LUC FOURNET (Collège de France / EPHE)

"The France-Berkeley Fund has been fantastic support for the initiation of this research trajectory. Without it, this project could not have proceeded in this collaborative fashion. It has advanced the research career of a Berkeley junior faculty member, provided valuable training for a Berkeley PhD, and led to an academic research position for a recent French PhD. These collaborative relationships will be sustained into the future." - NICHOLAS SWANSON-HYSELL (Earth & Planetary Sciences,

"This has been an invaluable experience for the junior researchers involved and it has directly facilitated the establishment of larger-reach projects between Lyon and Berkeley."

- MARY FIRESTONE (Environmental Science, Policy & Management, UC Berkeley) and GRAEME NICOL (Laboratoire Ampère, Université de Lyon)

The France-Berkeley Fund is committed to advancing innovative research and international exchange across the humanities and sciences. Help ampllify our work by making a gift to our grant fund. Gifts to the FBF help sustain cutting-edge collaborations that bring together faculty, researchers, and junior scholars from UC Berkeley and institutions throughout France.

ACKNOWLEDGEMENTS

The France-Berkeley Fund gratefully acknowledges the partners and collaborators whose efforts and support are crucial to our program. In particular, we thank: Christophe Delacourt (Responsable Pôle Expertise et gestion des programmes de coopération internationaux); Claude Douteau, Kristiana Stoitseva, Patricia Geltz, Elise Binet Mahé, Corrine Perret, and their colleagues at the French Ministry of Higher Education, Research and Innovation; Kimberly Carl (Director, IT Systems and Services, UC Berkeley Office of the Vice Chancellor for Research); Rebecca Bishop (Financial Analyst, UC Berkeley Office of the Vice Chancellor for Research); Gia White (Administrative Director, Institute of European Studies, UC Berkeley); IES Undergraduate Research Apprentice Team 2024.

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UC Berkeley) and YVES GODDÉRIS (Observatoire Midi-Pyrénées, CNRS / Université Toulouse)

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