PERSONAL INFORMATION

Name: BERHANU
First Name: Michaël
Date of Birth: 03/11/1980
Nationality: French
E-mail: michael.berhanu@u-paris.fr
Webpage: https://labo.msc.u-paris.fr/~berhanu/
ORCID number: 0000-0001-9099-2135

CURRENT POSITION

2024–… Senior Scientist (DR2) **CNRS**
" Matière et Systèmes Complexes" **MSC** ("*Matter and Complex systems"*) **UMR 7057**
Université Paris Cité (formerly Université Paris Diderot),,

2010–2024 Permanent researcher (CRN) **CNRS** at **MSC**.

EDUCATION

2020 Habilitation thesis defense (HDR) (faculté des sciences de l'université de Paris).
11/12/2020 " Wave interactions and wave turbulence in presence of dissipation "

2005-2008 PhD thesis "Turbulent magnetohydrodynamics in liquid metals flows",
Physics, University Pierre et Marie Curie,
Laboratoire de Physique Statistique, Ecole Normale Supérieure, France
Supervisors: **Stéphan Fauve** and **Nicolas Mordant**.

2005 Master of Physics, option statistical physics and out of equilibrium phenomena.
Ecole normale supérieure de Lyon, France

PREVIOUS POSITIONS

2008– 2010 Post-doctoral researcher at Clark University (Massachusetts/USA) in the group of **Arshad Kudrolli**. Experimental research about capillarity and geomorphology

SUMMARY

51 articles in international peer-reviewed journals. Web of Science 1661 citations, h-index 23
6 "editors' suggestions" or editor's choice.

3 Proceedings in international conferences

23 invited seminars

6 invited talks in international conferences

CURRENT RESEARCH INTERESTS

● Hydrodynamics of the erosion by dissolution and application to geomorphology

● Water surface Waves and Wave Turbulence.
Nonlinear waves interactions and Gravity-capillary wave turbulence.
Surface waves generation by an underwater moving bottom. Application to tsunami generation.

● Turbulence and free surface flows. Interaction between surface waves and flows.

● Experimental out-of-equilibrium statistical physics.
Granular gas of particles with magnetic dipolar interactions.

REVIEWING ACTIVITIES

Scientific Referee for Physical Review Letters, Physical Review Fluids, Physical Review E, Physical Review X, Journal of Fluid Mechanics, Physics of fluids, EPL, Langmuir, International Journal of Heat and Fluid Flow, Journal of Geophysical Research Earth Surface …

Grant reviewer for ANR (French funding agency), FONDECYT (Chilean National Science and Technology Commission), IDEX Sorbonne University, Emergence Mairie de Paris, European commission (*Marie Skłodowska-Curie individual fellowships)*.

FUNDING

ANR PRC, PhysErosion (2023-2027). Main **PI** of a joint project between MSC, IPGP (Institut de Physique du Globe, PI Olivier Devauchelle), ISTO (Institut des Sciences de la Terre d'Orléans, PI Cyprien Soulaine) et ILM (Institut Lumière Matière, Lyon, PI Jean Colombani).
148 700 € at **MSC** (total amount 505 000 €).

IDEX, université de Paris, *Riverdiss* (2021-2023), Joint project between MSC and IPGP (Institut de Physique du Globe). **PI** with Olivier Devauchelle (IPGP), 50 000 €.

ANR Défis de tous les savoirs (JCJC) *Erodiss* (2017-2021) 250 000 €, **PI**.

BQR Université Paris Diderot *Gaz granulaire magnétique* (2012) 13 500 €, **PI**.

ANR Blanche *Turbulon* (2012-2016) PI : Éric Falcon.

MEMBERSHIPS OF SCIENTIFIC SOCIETIES

Member of the European Mechanics Society (Euromech), of the Société Française de Physique (SFP) and of the American Physical Society (APS), of the European Geoscience Union. (EGU).

MAJOR COLLABORATIONS

Hydrodynamics of erosion by dissolution. Funding ANR. IDEX Université de Paris.
Sylvain Courrech du Pont (MSC)**, Julien Derr** (RDP, ENS Lyon)**, Olivier Devauchelle** (IPGP)**,**
Cyprien Soulaine (ISTO, Orléans)**, Jean Colombani** (ILM, Lyon), **Sabrina Carpy** (LPG, Nantes)

Fragmentation of 2D floating materials and Sea-ice analogy. **Michel Tsamados** (UCL, London)

Wave turbulence in the International Space Station. Funding CNES and ESA. Collaboration with **Stéphan Fauve** (LPENS, Ecole Normale Supérieure), **Eric Falcon** (MSC).

Dissolution patterns experiments. **Arshad Kudrolli** (Clark University, Massachusetts, USA)

Wave turbulence and hydrodynamic turbulence.
Eric Falcon (MSC), **Félicien Bonnefoy** (Ecole Centrale de Nantes, France) …

Granular media and statistical physics. **Gustavo Castillo** (University O'Higgins, Rancagua, Chile)

SERVICE

2011 – 2024 Organizer of the weekly seminars of MSC laboratory
(more than 150 seminars organized)

ORGANISATION OF SCIENTIFIC MEETINGS

2022 Organization with Sylvain Courrech du Pont and Piotr Szymczak (Warsaw university, Poland) of a summer-school "*Flow and phase change of a solid*." selected by the CISM (International Centre for Mechanical Sciences), Udine, Italy.

2022 Organization and chair with Arshad Kudrolli of an invited session at the APS March Meeting (Division of Fluid Dynamics): *"Solid-Fluid Coupled Melting and Dissolution Dynamics Shaped Landscape Evolution"*.

2017 Workshop, Non-linear interactions between waves. Rencontres du Non-Linéaire, Paris.

2013 Workshop, Non-linear hydrodynamics waves: Wave interactions and Wave turbulence, Paris. GDR Phénix

TEACHING ACTIVITIES

2026-… Lecturer Hydrodynamic Instabilities. M1, Physics Department, University Paris Cité

2011–2021 Examiner for the competitive admission in the Ecole Normale Supérieure, the Ecole Nomale Supérieure Paris Saclay, the Ecole Normale Supérieure de Lyon and the Ecole Polytechnique (2020). Written and oral exams in Physics.

2015–2018 2022 Lecturer - Experimental physics projects, Physics Department, University Paris Cité.

2005– 2008 Teaching assistant at the Ecole Normale Supérieure de Paris (ENS) in physics.

Experimental physics and Hydrodynamics.

OUTREACH

September 2020: "Pint of Science Festival online". “Waves in weightlessness".

2020-2025. Team leader with Adrian Daerr of the team of the Université de Paris at the "French Physicists’ Tournament”.

May 2016, 2017, 2018 et 2019. Organization of a formation « Complex materials and carbon nanomaterials » for high school teachers. Lecture about surface waves.

Since 2010. Regular participation to the « Fête de la Science ».
2013-2014 Setup of interactive experiments about foam physics.

SUPERVISION OF GRADUATE STUDENTS AND POSTDOCTORAL FELLOWS

2025– 2026 Post-doctoral researcher. **Augustin Maller**.
Erosion by turbulent flows. Now Patent engineer.

09-2021-11-2024 PhD Student. **Martin Chaigne**.
“Erosion by dissolution at large Reynolds number.”

2017– 2020 Post-doctoral researcher. **Adrien Guérin**.
Erosion by run-off flows. Now Ecology-river technical supervisor (Au Fil de l'Eau, France)

2015-2016 Post-doctoral researcher. **Florence Haudin**.
Nonlinear water surface waves.
Co-supervised with Eric Falcon.
Now Scientific Software Developer at Quantstack (France)

2013-2016 PhD Student. **Simon Merminod**.
“Self-organization of vibrated and magnetized particles: structure, dynamics and transitions”.
Co-supervised with Eric Falcon.
Now postdoc at Harvard University (USA), after a first postdoc period at Brandeis University (USA).

2012-2014 Post-doctoral researcher. **Leonardo Gordillo**.
Generation of tsunami waves. Axa Research Fund Fellowship.
Co-supervised with Eric Falcon.
Now Ass. Prof at University of Santiago (Chile)

2012-2016 PhD Student. **Timothée Jamin**.
“Interactions between free-surface waves and hydrodynamic flows”.
Co-supervised with Eric Falcon.
Now freelance scientific journalist after two postdoc periods at MIT (USA) then at ENS Lyon).

MAJOR PUBLICATIONS

1. M. Chaigne, S. Carpy, M. Massé, J. Derr, S. Courrech du Pont and M. Berhanu
   Emergence of tip singularities in dissolution patterns.
   PNAS 120 (48) e2309379120, **2023**

   General explanation of sharp patterns emerging in nature by dissolution and melting by the means of a geometric mechanism.

2. M. Chaigne, **M. Berhanu** and A. Kudrolli,
   Dissolution Dissolution-driven propulsion of floating solids
   PNAS 120 (32) e2301947120, **2023**

   Demonstration and analysis of a new propulsion mechanism using solutal convection to propel small boats made with fast dissolving materials like sugar or salt.

3. A. Guérin, J. Derr, S. Courrech du Pont and **M. Berhanu**
   Streamwise dissolution patterns created by a flowing water film.
   Physical Review Letters 125 (19), 194502 **2020** "Featured in Physics" "Editors' Suggestion"

   First experimental report of a pattern of a longitudinal dissolution pattern using a run-off flow. Application in geomorphology to understand the emergence of dissolution grooves.

4. **M. Berhanu,** E. Falcon, G. Michel, C. Gissinger and S. Fauve
   Capillary wave turbulence experiments in microgravity
   EPL (Europhysics Letters) 128 (3), 34001, **2020**

   Wave turbulence experiments performed in the International Space Station
   Funding by ESA (European Space Agency) and CNES (French Space Agency).

5. **M. Berhanu**, R. Monchaux, S. Fauve, N. Mordant, F. Pétrélis, A. Chiffaudel, et al.
   Magnetic field reversals in an experimental dynamo
   EPL (Europhysics Letters) 77, 59001 **2007**

   First observation of the spontaneous reversals of the magnetic field generated in a dynamo experiment with liquid sodium. Collaboration Von-Karman Sodium (ENS Paris, ENS Lyon, CEA Saclay SPEC).