High Meadows Environmental Institute
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Nicolò Scapin

Curriculum Vitae

Education

3/2018–6/2022	**Ph.D. in Fluid Mechanics**, *Royal Institute of Technology (KTH)*, Stockholm, SE, **Advisor:** Prof. Luca Brandt **Thesis title:** *Phase-changing flows: numerical methods and fully resolved simulations* Defended on June 15th, 2022 (PhD thesis available [here](#))
9/2014–4/2017	**MSc in Energy Engineering**, *Politecnico di Milano*, Milan, IT
9/2011–7/2014	**BSc in Energy Engineering**, *Politecnico di Milano*, Milan, IT

Research experience

1/2023–Present	**Postdoctoral Research Fellow**, *High Meadows Environmental Institute (HMEI) and Department of Mechanical and Aerospace Engineering*, Princeton University, Princeton, NJ

Mentors: Prof. Luc Deike and Prof. Gabriel Vecchi

Main activities:
○ Research topics: air-sea interaction, wind waves, breaking ways, sea sprays
○ Mentorship a graduate student working on ocean waves
○ Write scientific proposals in order to access high-performance computing facilities funded by NSF (ACCESS)

3/2018–12/2022	**Graduate Research Assistant**, *Department of Engineering Mechanics*, Royal Institute of Technology (KTH), Stockholm, SE

Main activities:
○ *FluTAS* project: development of an open source, modular and multi-physics code able to run on hybrid architectures CPU/GPU ([GitHub repository](#))
○ Mentorship: co-supervision of three younger Ph.D. students working in multiphase flows
○ EUROFusion project: development of numerical algorithms for liquid metal-plasma interaction
○ Write scientific proposals in order to access high-performance computing facilities in Sweden, Norway, Italy and US

Teaching experience

2/2024–Present	**Lecturer and Teaching Assistant for the Course *ENV330/MAE330 Ocean Waves***, *High Meadows Environmental Institute*, Princeton University, Princeton, NJ

Main activities:
- ○ Delivered frontal lectures about the physics of ocean waves to 20+ undergraduate students (40 hours per semester)
- ○ Facilitated hands-on activities, enhancing students' understanding of theoretical concepts through practical application (15 hours per semester)
- ○ Assessed student performance by grading assignments and the final exam

9/2018–12/2021 **Teaching Assistant in the several undergradute courses in Solid and Fluid Mechanics**, *Department of Engineering Mechanics*, Royal Institute of Technology (KTH), Stockholm, SE

Main activities:
- ○ Performed hands-on activities, enhancing students' understanding of theoretical concepts through practical application (20 hours per semester)
- ○ Assessed student performance by grading assignments and the final exam

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Industrial experience

6/2017–2/2018 **Research Engineer**, *ENI S.p.A.*, Milan, IT

Main activities:
- ○ Development of two and three-phase Eulerian solvers to model the transport of hydrocarbons in complex geometries
- ○ Participation in the start-up and the ramp-up activities of the giant gas field Zhor (Egypt)

Funding acquisition

2023 **HMEI Fellowship** to support the research at **Princeton University** (**$300k** over three years)

2023 **International Postdoctoral Grant** awarded from the **Swedish Research Council - Vetenskapsrådet** to support the research at **Princeton University** (**3.10 MKr/$290k** over three years). Note: renounced due to incompatibility with HMEI Fellowship

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Awards & International Projects

2024 **Seal of Excellence** awarded from the **European Commission** on the Marie Curie Postdoctoral Fellowship (**Evaluation mark:** 96.80%)

2023 **Seal of Excellence** awarded from the **European Commission** on the Marie Curie Postdoctoral Fellowship (**Evaluation mark:** 91.40%)

2024 Co-PI of the **INCITE project on scalar transport in turbulent bubbly flows** with Dr. Parisa Mirbor (PI). Awarded allocation: 50000 node hours of computing time in Polaris

2022 **ERCOFTAC Da Vinci Competition finalist**: among the top 5 Ph.D. theses in fundamental and applied Fluid Mechanics among European Universities. **Read the interview here**

2022 **Fellowship ($5k) for the 17th Summer Program** at Center for Turbulence Research, Stanford (CA, USA)

2021 Participation of the **PRACE project Multiphase Rayleigh–Bénard convection** with Luca Brandt (PI). Awarded allocation: 50 million core hours of computing time in Marconi-100 (CINECA, Italy)

2020	**Fellowship ($5k) for the 16th Summer Program** at Center for Turbulence Research, Stanford (CA, USA). Suspended due to pandemic
2018	**PhD Research Scholarship** *Hybrid multiscale modelling of transport phenomena for energy efficient processes*, founded by the *Swedish Research Council* (VR) (Grant 2016-06119)
2014-2017	**Merit-based scholarship for excellent students (tuition waiver)**, founded by *the Ministry of Public Education* in Italy
2014	**Scholarship ($6k)** founded by *ENI S.p.A.* for excellent students in the field of energy engineering

Skills

Operating systems: Linux/Unix-based, Windows

Programming languages and Softwares: Fortran90, C, C++, Python, Matlab, LaTeX, Bash, Office Package

Parallel Processing: MPI, OpenMP, OpenACC, CUDA

Languages

Italian (Native Language), English (Proficient), German (Basic), Swedish (Basic)

Publications

Manuscripts in preparation (P)

P1. **N. Scapin**, J. Wu, J. Thomas Farrar, B. Chapron, S. Popinet, L. Deike. "Growth and dissipation of wind-forced breaking waves", *In preparation for Geophysical Research Letter*

Submitted/Accepted manuscripts (S)

S1. **N. Scapin**, J. Wu, J. Thomas Farrar, B. Chapron, S. Popinet, L. Deike. "Momentum fluxes in wind-forced breaking waves", *In press in the Journal of Fluid Mechanics*, Arxiv Link: http://arxiv.org/abs/2411.03415.

Journal papers (J)

J10. S. Z. Salimi, **N. Scapin**, E. R. Popescu, P. Costa, L. Brandt. "A Volume-of-Fluid method for multicomponent droplet evaporation with Robin boundary conditions", *Journal of Computational Physics* (2024): 113211

J9. A. M. Bilondi, **N. Scapin**, L. Brandt, P. Mirbor. "Turbulent convection in emulsions: the Rayleigh–Bénard configuration", *Journal of Fluid Mechanics* 999 (2024): A4

J8. A. Demou, **N. Scapin**, M. C. Esposito, P. Costa, F. Spiga, L. Brandt. "Effects of Rayleigh and Weber numbers on two-layer turbulent Rayleigh–Bénard convection", *Journal of Fluid Mechanics* 996 (2024): A23

J7. V. Agrawal, A. Kulachenko, **N. Scapin**, O. Tammisola, L. Brandt. "An Efficient Isogeometric/Finite-Difference Immersed Boundary Method for the Fluid-Structure Interactions of Slender Flexible Structures", *Computer Methods in Applied Mechanics and Engineering* 418 (2024): 116495

J6. **N. Scapin**, A. D. Demou, L. Brandt. "Evaporating Rayleigh-Bénard convection: prediction of interface temperature and global heat transfer modulation", *Journal of Fluid Mechanics* 957 (2023): A12

J5. M. Crialesi-Esposito, **N. Scapin**, A. D. Demou, M. E. Rosti, P. Costa, F. Spiga, L. Brandt (2023). "FluTAS: A GPU-accelerated finite difference code for multiphase flows", *Computer Physics Communication* 284 (2023): 108602

J4. **N. Scapin**, F. D. Barba, G. Lupo, M. E. Rosti, C. Duwig, and L. Brandt. "Finite-size evaporating droplets in weakly compressible homogeneous shear turbulence", Journal of Fluid Mechanics 934 (2022): A15

J3. A. D. Demou, **N. Scapin**, M. Pelanti, and L. Brandt. "A pressure-based diffuse interface method for low-Mach multiphase flows with mass transfer", *Journal of Computational Physics* 448 (2022): 110730

J2. F. Dalla Barba, **N. Scapin**, A. D. Demou, M. E. Rosti, F. Picano, and L. Brandt. "An interface capturing method for liquid-gas flows at low-Mach number", *Computers & Fluids* 216 (2021): 104789

J1. **N. Scapin**, P. Costa, and L. Brandt, "A volume-of-fluid method for interface-resolved simulations of phase-changing two-fluid flows", *Journal of Computational Physics* 407 (2020): 109251

Peer-reviewed Proceedings (C)

C1. **N. Scapin**, A. Shahmardi, W. H. R. Chan, S. S. Jain, S. Mirjalili, M. Pelanti and L. Brandt "A mass-conserving pressure-based method for two-phase flows with phase change", *Proceedings of the Summer Program, Center for Turbulence Research* (2022)

Book chapters (B)

B1. W. Yang, M. Chung, L. Deike, T.-L. Hsieh, M. Igbinoba, E. Levin, S. Menemenlis, I. Mitevski, G. Rios, **N. Scapin**, G. A. Vecchi "Tropical cyclones and associated impacts: overview of tropical Cyclones and historical perspective", Elsevier, *In press* (2025)

Conference oral presentations (O)

O19 **N. Scapin**, J. Wu, T. Farrar, B. Chapron, & L. Deike, *Momentum and energy fluxes in wind-forced breaking waves at high wind speeds*, **76th Annual Meeting of the APS Division of Fluid Dynamics**, November 2024, Salt Lake City, Utah.

O18 C. Martin Blanco, **N. Scapin**, J. Wu, T. Farrar, B. Chapron, & L. Deike, *Direct numerical simulations of wind wave growth of a broad banded wave spectrum*, **76th Annual Meeting of the APS Division of Fluid Dynamics**, November 2024, Salt Lake City, Utah.

O17 **N. Scapin**, J. Wu, S. Popinet, L. Deike, *Numerical simulations of wind-wave interaction at high wind speeds*, **Ocean Sciences Meeting**, February 2024, New Orleans, Louisiana, US.

O16 **N. Scapin**, J. Wu, S. Popinet, L. Deike, *Direct numerical simulations of coupled turbulent wind-wave flow at high wind speed*, **75th Annual Meeting of the APS Division of Fluid Dynamics**, November 2023, Washington, DC.

O15 A. M. Bilondi, **N. Scapin**, L. Brandt, P. Mirbor, *Heat transfer enhancement in turbulent Rayleigh Bénard convection with liquid-liquid emulsions*, **75th Annual Meeting of the APS Division of Fluid Dynamics**, November 2023, Washington, DC.

O14 A. M. Bilondi, **N. Scapin**, L. Brandt, P. Mirbor, *Multiphase Turbulent Rayleigh–Bénard convection with Bubbles*, **75th Annual Meeting of the APS Division of Fluid Dynamics**, November 2022, Indianapolis, Indiana.

O13 **N. Scapin**, A. Shahmardi, M. Pelanti, L. Brandt, *Contact-line treatment for phase-changing flows in a diffuse interface framework*, **International Conference of Numerical Methods in Multiphase Flows**, September 2022, Venice, Italy.

O12 S. Zamani Salimi, **N. Scapin**, A. Gruber, L. Brandt, *A volume-of-fluid method for multicomponent evaporating two-phase flow*, **European Fluid Mechanics Conference**, September 2022, Athens, Greece.

O11 L. Brandt, A. Demou, **N. Scapin**, A. Shahmardi, M. Pelanti, *Contact-line treatment for phase-changing flows in a diffuse interface framework*, **European Fluid Mechanics Conference**, September 2022, Athens, Greece.

O10 N. Mastroianni, **N. Scapin**, L. Brandt, *An efficient pressure-correction method for the two-fluid model*, **European Fluid Mechanics Conference**, September 2022, Athens, Greece.

O9 **N. Scapin**, A. Demou, L. Brandt, *Evaporating Rayleigh-Bénard convection: prediction of interface temperature and heat transfer modulation*, **European Fluid Mechanics Conference**, September 2022, Athens, Greece.

O8 L. Brandt, **N. Scapin**, F. Picano, C. Duwig, *Simulations of finite-size evaporating droplets in weakly-compressible homogeneous shear turbulence*, **74th Annual Meeting of the APS Division of Fluid Dynamics**, November 2021, Phoenix AZ, United States.

O7 **N. Scapin**, L. Brandt, *A robust low-Mach solver for phase-changing flows*, **74th Annual Meeting of the APS Division of Fluid Dynamics**, November 2021, Phoenix, AZ, USA.

O6 A. Demou, **N. Scapin**, M. Pelanti, L. Brandt, *A pressure-based diffuse-interface method for two-phase flows with mass transfer*, **74th Annual Meeting of the APS Division of Fluid Dynamics**, November 2021, Phoenix, AZ, USA.

O5 A. Demou, L. Brandt, P. Costa, M. Crialesi Esposito, **N. Scapin**, M. E. Rosti & F. Spiga, *FluTAS: a GPU-accelarated solver for multiphase flow applications*, **74th Annual Meeting of the APS Division of Fluid Dynamics**, November 2021, Phoenix, AZ, USA.

O4 **N. Scapin**, F. Dalla Barba, G. Lupo, P. Costa, M. E. Rosti, C. Duwig & L. Brandt, *Finite-size evaporating droplets in homogeneous shear turbulence*, **EUROMECH Colloquium 621 "Transport and fluxes in dispersed turbulent flows"**, July 2021, Virtual Congress.

O3 **N. Scapin**, G. Lupo, C. Duwig & L. Brandt, *Interface-resolved evaporating droplets in homogeneous shear turbulence*, **73rd Annual Meeting of the APS Division of Fluid Dynamics**, November 2020, Chicago IL, United States (Virtual Conference).

O2 **N. Scapin**, E. Popescu, P. Costa, C. Duwig & L. Brandt, *A combined low-Mach number Volume of Fluid method for phase-changing two-phase flow*, **WCCM-ECCOMAS 2020**, January 2021, Virtual Congress.

O1 **N. Scapin**, P. Costa & L. Brandt, *A volume of fluid method for interface-resolved simulations of evaporating flows*, **72nd Annual Meeting of the APS Division of Fluid Dynamics**, November 2019, Seattle WA, United States.

Invited presentations (I)

I3. *Phase-changing flows: numerical methods and fully resolved simulations*, October 6, 2022, École Centrale de Lyon (Lyon, France). **Coordinator: ERCOFTAC Da Vinci Competition**.

I2. *Weakly compressible simulations of evaporating droplets*, March 2, 2022, Department of Mechanical Engineering (virtual presentation). **Coordinator: Prof. R. Ni, Johns Hopkins University (Baltimore, US)**.

I1. *Weakly compressible simulations of evaporating droplets*, February 15, 2022, Complex Fluids and Flows Unit (virtual presentation). **Coordinator: Prof. M. E. Rosti, Okinawa Institute for Science and Technology (Okinawa, Japan)**.

Service to the Research Community

11/2024– Present **Chair of APS-DFD Sessions**, *See* here *for the link*

07/2019– Present **Peer reviewer**, *Journal of Computational Physics (2022: 2 assignments), Computer and Fluids (2019-2020-2021: 2 assignments per year), Journal of Fluid Mechanics - Rapids, (2023: 1 assignment), European Journal of Fluid Mechanics/B (2019-2023: 3 assignments per year), Computer Physics Communication (2024: 1 assignment), Nature Computational Science (2024: 1 assignment)*