

Curriculum vitae di *Carlo Massimo Casciola*

PERSONAL DETAILS

Family name, First name: Casciola, Carlo Massimo

Researcher unique identifiers ORCID 0000-0001-8795-4517, Scopus 6701320914

URL for the web site: <https://sites.google.com/uniroma1.it/flumacs>

• **Education and key qualifications**

1986 Master in Mechanical Engineering
Faculty of Engineering/ Department of Mechanics and Aeronautics/Sapienza University of Rome/Italy

• **Current position(s)**

2007 - Full Professor of Fluid Dynamics
Faculty of Civil and Industrial Engineering/ Department of Mechanics and Aerospace Engineering/Sapienza University of Rome/Italy
2022 - Dean of the Faculty of Engineering/Sapienza University of Rome/Italy

• **Previous position(s)**

2000 - 2007 Associate Professor of Fluid Dynamics
Faculty of Civil and Industrial Engineering/ Department of Mechanics and Aerospace Engineering/Sapienza University of Rome/Italy
1992 - 2000 Researcher of Fluid Dynamics
Faculty of Civil and Industrial Engineering/ Department of Mechanics and Aerospace Engineering/Sapienza University of Rome/Italy
1986 - 1992 Researcher
INSEAN (National Institute of Naval Hydrodynamics)/Italy
1990 - 1992 Contract as Professor of Gas Dynamics
Engineering Department/University of Perugia/Italy

RESEARCH ACHIEVEMENTS AND PEER RECOGNITION

Recent Research achievements

Bio- and Bio-inspired Research

- Bottacchiari, M., Gallo, M., Bussoletti, M., and **Casciola, C.M.**, "The lateral stress profile of fluid lipid membranes as revealed by the diffuse interface approach", Biophysical Journal (2025), <https://doi.org/10.1016/j.bpj.2025.07.041>
- Gabriele, L., Parlato, S., Silvani, G., Peruzzi, G., Caprini, D., Sinibaldi, G., Rossi, S., Fragale, A., Romagnoli, G., Canini, I., Mencattini, A., **Casciola, C.M.**, "A novel vascularized tumor-on-a-chip model for tracking melanoma-dendritic cell interactions following combined romidepsin and type I IFN therapy", Cancer Research, 85 (8 Supplement 1), 1209-1209, 2025. DOI: <https://doi.org/10.1158/1538-7445.AM2025-1209>.
- Bottacchiari, M., Gallo, M., Bussoletti, M., and **Casciola, C.M.**, "The diffuse interface description of fluid lipid membranes captures key features of the hemifusion pathway and lateral stress profile", PNAS Nexus, 3(8), pg. 300, 2024.
- Bussoletti, M., Gallo, M., Bottacchiari, M., Abbondanza, D., and **Casciola, C.M.**, "Mesoscopic elasticity controls dynamin-driven fission of lipid tubules", Scientific Report, 14(1), 1043, 2024. DOI: <https://doi.org/10.1038/s41598-024-64685-2>.
- Bottacchiari, M., Gallo, M., Bussoletti, M. and **Casciola, C.M.**, The local variation of the Gaussian modulus enables different pathways for fluid lipid vesicle fusion, Sci. Rep. 14(1), 2024.
- Bottacchiari, M., Gallo, M., Bussoletti, M. and Casciola, C.M., Activation energy and force fields during topological transitions of fluid lipid vesicles, Comm. Phys. 5(1), 2022.
- Silvani, G., Scognamiglio, C., Caprini, D., Marino, L., Chinappi, M., Sinibaldi, G., Peruzzi, G., Kiani,

M.F. and **Casciola, C.M.**, Reversible cavitation-induced junctional opening in an artificial endothelial layer, *Small* 15(51), 2019.

- Parlato, S., Grisanti, G., Sinibaldi, G., Peruzzi, G., **Casciola, C.M.**, Gabriele, L., “The on-a-chip cross-talk between cancer and immune system in the era of immunotherapy”, *Lab on a Chip* 2021, 21, 254-271.

Mesoscale Models of Phase Change

- Garbin, V., Bothe, D., Brenn, G., **Casciola, C.M.**, Colin, C., Marengo, M., Risso, F., Tryggvason, G., Lohse, D., “Bubbles and bubbly flows”, *International Journal of Multiphase Flows*, p.105240, 2025.
- Gallo, M., Occhioni, F. Magaletti, F. **Casciola, C.M.**, “Complex transition pathways in boiling and cavitation”, *Journal of Fluid Mechanics* 2025;1019. doi:10.1017/jfm.2025.10591
- Gallo, M., and **Casciola, C.M.**, “Vapor bubble nucleation in flowing liquids”, *International Journal of Multiphase Flows*, in press 23 July 2024, 104924. DOI: <https://doi.org/10.1016/j.ijmultiphaseflow.2024.104924>.
- Abbondanza, D., Gallo, M., and **Casciola, C.M.**, “Collapse of microbubbles over an elastoplastic wall”, to appear in the *Journal of Fluid Mechanics*, 2024.
- Gallo, M., Magaletti, F., Georgoulas, A., Marengo, M., De Coninck, J. and **Casciola, C.M.**, A nanoscale view of the origin of boiling and its dynamics, *Nat. Comm.* 14(1), 2023.
- Magaletti, F., Gallo, M. and **Casciola, C.M.**, Water cavitation from ambient to high temperatures, *Sci. Rep.* 11(1), 2021.
- Gallo, M., Magaletti, F., **Casciola, C.M.**, “Heterogeneous bubble nucleation dynamics”, *Journal of Fluid Mechanics* 2021, Volume 906 10 January 2021, A20.
- Gallo, M., Magaletti, F., **Casciola, C.M.**, “Thermally activated vapor bubble nucleation: the Landau-Lifshitz/Van der Waals approach”, *Phys. Rev. Fluids.* 3, 053604, 2018.
- Magaletti, F., Marino, L., **Casciola, C.M.**, “Shock formation in the collapse of a vapor nano-bubble”, *Phys. Rev. Lett.* 114, 064501, 2015.

Atomistic Models

- Pfeiffer, P., Shahrooz, M., Tortora, M., **Casciola, C.M.**, Holman, R., Salomir, R., Meloni, S. and Ohl, C.-D., Heterogeneous cavitation from atomically smooth liquid-liquid interfaces, *Nat. Phys.* 18(12), 2022.
- Tortora, M. and Meloni, S. and Tan, B.H., Giacomello, A., Ohl, C.-D. and **Casciola, C.M.**, The interplay among gas, liquid and solid interactions determine the stability of surface nanobubbles, *Nanoscale* 12(44), 2020.
- Tortora, M., Zajdel, P., Lowe, A.R., Chorazewski, M., Leao, J.B., Jensen, G.V., Bleuel, M., Giacomello, A., **Casciola, C.M.**, Meloni, S., Grosu, Y. “Giant Negative Compressibility by Liquid Intrusion into Superhydrophobic Flexible Nanoporous Frameworks”, *Nano Letters* 2021.
- Amabili, M., Grosu, Y., Giacomello, A., Meloni, S., Zaki, A., Bonilla, F., Faik A., **Casciola, C.M.**, “Pore Morphology Determines Spontaneous Liquid Extrusion from Nanopores”, *ACS-nano* 13, 2, 1728–1738, 2019.
- Tinti, A., Giacomello, A., Grosu, Y., and **Casciola, C.M.**, “Intrusion and extrusion of water in hydrophobic nanopores”, *Proceedings of the National Academy of Sciences USA*, 2017, 114(48), E10266–E10273, published ahead of print November 14, 2017.

Experimental Research

- Caprini, D., Battista, F., Zajdel, P., Di Muccio, G., Guardiani, C., Trump, B., Carter, M., Yakovenko, A., Amayuelas, E., Bartolome, L., Meloni, S., Grosu, Y., and **Casciola, C.M.**, Giacomello, A., “Bubbles enable volumetric negative compressibility in metastable elasto-capillary systems”, *Nature Communications*, 15, 5076, 2024. DOI: <https://doi.org/10.1038/s41467-024-49136-w>.
- Sinibaldi, G., Occhicone, A., Alves Pereira, F., Caprini, D., Marino, L., Michelotti, F. and **Casciola, C.M.**, Laser induced cavitation: Plasma generation and breakdown shockwave, *Phys. Fluids* 31(10), 2019.
- Occhicone, A., Sinibaldi, G., Danz, N., **Casciola, C.M.**, and Michelotti, F., “Cavitation bubble wall pressure measurement by a novel electromagnetic surface-wave enhanced pump-probe configuration”, *Applied Physics Letters*, 114, 134101, 2019.
- Caprini, D., Sinibaldi, G., Marino, L., **Casciola, C.M.**, “A T-Junction device allowing for two simultaneous orthogonal views: application to bubble formation and break-up”, *Microfluidics and*

Nanofluidics 22:85, 2018.

Turbulence in Complex Fluids

- Serafini, F., Battista, F., Gualtieri, P., and Casciola, C.M., “The role of polymer molecular weight distribution in drag-reducing turbulent flows”, *Journal of Fluid Mechanics*, 2025;1007:A10. doi:10.1017/jfm.2024.1110.
- Serafini, F., Battista, F., Gualtieri, P., and **Casciola, C.M.**, “Polymers in turbulence: any better than dumbbells?”, *Journal of Fluid Mechanics*, 987, R1, 2024. DOI: <https://doi.org/10.1017/jfm.2024.384>. (The paper was addressed in the Focus on Fluids - J. Fluid. Mech. ”Less is More”, Emily Ching 2024.
- Serafini, F., Battista, F., Gualtieri, P. and **Casciola, C.M.**, Drag reduction in turbulent wall-bounded flows of realistic polymer solutions, *Phys. Rev. Lett.* 129(10), 2022.
- Serafini, F., Battista, F., Gualtieri, P., and **Casciola, C.M.**, “The role of polymer parameters and configurations in drag-reduced turbulent wall-bounded flows: comparison between FENE and FENE-P”, *International Journal of Multiphase Flows*, 165 10447, 2023.
- Mollicone, J.P., Battista, F., Gualtieri, P., **Casciola, C.M.**, “Turbulence dynamics in separated flows: the Generalised Kolmogorov Equation for inhomogeneous anisotropic conditions”, *Journal Fluid Mech.* vol. 841, pp. 1012-1039 (2018).

Bibliometry

The list of published papers can be found at

https://scholar.google.com/citations?hl=en&user=iIiWpyoAAAAJ&view_op=list_works&sortby=pubdate

The Hirsh Index is H = 39 (44), 4814 (6387) citations based on the Scopus Database (Google Scholar).

Peer recognition

- 2025 - President of ITATEC, the Italian Academy of Engineering and Technology.
- 2024 - Member of ITATEC, the Italian Academy of Engineering and Technology.
- 2023 - Dean of the Faculty of Civil and Industrial Engineering, Sapienza University, Rome.
- 2018 - Member of the AIMETA Directory Board, Italy.
- 2014 - 2020 Senior Fellow of Sapienza School for Advanced Studies (SSAS).
- 2017 ERC Proof-of-Concept INVICTUS (IN VItro Cavitation Through UltraSound).
- 2013 ERC Advanced Grant for the project BIC (Cavitation across scales: following Bubble from Inception to Collapse, agreement # 339446–BIC).
- 2010 Sapienza Excellence Research Award 2010.

A few invited talks

- *On the dynamics of liquid/vapor phase change*, New Directions in Complex Flows, Accademia Nazionale dei Lincei, Roma, Italy, 2025.
- *The Nucleation Process and its coupling to the macroscale*, ILLAS Europe, Napoli., Italy, 2023.
- *Cavitation. Boiling, and Coupling with the Macroscale*, 50 Years of International Journal of Multiphase Flows, Vienna, Austria, 2023.
- *Drag reduction in turbulent pipe flows of realistic polymer solutions (at High WI)*, Complex Particles in Turbulent Flow, Nice, France, 2023.
- *What shall we do with inhomogeneous turbulence?*, A Journey in Fluid Mechanics (in honor of Uriel Frisch), Accademia dei Lincei, Roma, Italy, 2022.
- *Bubble Nucleation in Flowing Liquids*, Fluids and Complexity II, Nice 29-20 November 2021.
- *Modelli a interfaccia diffusa: dalla descrizione atomistica a quella continua*, La Genesi dei Modelli: Teoria, Simulazione e Dati, Accademia dei Lincei, Roma, 2019.
- *Nanopore Intrusion/Extrusion Cycles and Superhydrophobicity Recovery*, SIMAI 2018, Roma, 2018.
- *Cavitation bubbles from nucleation to inertial collapse: a combined Phase Field/Fluctuating Hydrodynamics approach*, CECAM Workshop Addressing Metastabilities, Lausanne, Switzerland, 2017.
- *Overview on Connecting Atomistic to Continuum/Engineering Level Description*, E-CAM Workshops State of the art in mesoscale and multiscale modeling, Dublin, Ireland, 2017.
- *Molecular and Mesoscale Simulations of Cavitation*, MolSimEng 2016, Torino, Italy, 2016.

ADDITIONAL INFORMATION

Carlo Massimo Casciola coordinates a research group formed by a varying number of components, typically

between 15 and 20 including permanent research staff, associate professors, post-docs, and Ph.D. students, operating in the field of **complex fluids**. Under the PI's guidance, the group dealt with theoretical, numerical, and experimental aspects of fluid mechanics, to be understood in a wide sense, ranging from scaling laws in **turbulence**, **viscoelasticity**, **particle transport** in turbulence, **microfluidics**, **nanofluidics**, **Direct Numerical Simulations**, phase transitions and **nucleation processes**, **cavitation**, wettability, protein translocation, **biological barriers permeabilization**. During these years he contributed to establishing a **microfluidic lab** dedicated, in particular, to microfluidic application for biology and medicine, including cavitation damage in different kinds of materials.

Research activity and publications span an uncommonly large range of scientific techniques and interests, including **turbulence**, drag reduction, **molecular dynamics**, **free-energy** and **rare event methods**, **phase-field approaches** for mesoscale modeling, fluctuating hydrodynamics, specialized numerical techniques, micro-fabrication, and design of microfluidic chips, also for biological and biomedical applications. The activity is **strongly multidisciplinary**, involving disciplines such as fluid mechanics, statistical mechanics, applied mathematics, experimental physics, fabrication technology, material science, biology, and medicine.

The opportunity to enlarge the scientific expertise partly followed by the interaction with CECAM (Centre Européenn de Calcul Atomique and Moléculaire), the trans-European organization based in Lausanne fostering fundamental research on advanced computational methods as **Director of the Sapienza-IT CECAM Centre** that allowed contact with renowned researchers active in many different fields. During these years the PI gained substantial experience in the field of High-Performance Computing, initially as an **awardee of PRACE** (Partnership for Advanced Computing in Europe) peer-reviewed **computational grants** for computational resources on Tier0 European HPC infrastructures and successively as a member of the **PRACE and EuroHPC scientific committee** and being consulted by the CINECA HPC infrastructure for the acquisition of pre-exascale machines.

In the 2013 call, he was awarded the prestigious **ERC Advanced Grant** for the project **BIC** (Cavitation across scales: following Bubble from Inception to Collapse, agreement # 339446–BIC), where multi-scale simulation techniques were conceived and developed to address the elusive problem of bubble nucleation treated from the fundamental perspective of atomistic simulation up to innovative mesoscale techniques. Besides direct application to cavitation, unexpected results dealt with nucleation in nanoscale confinement and intrusion extrusion mechanics in nanoporous materials. Among the technological results, was the development of a new photonic pressure sensor for bubble collapse-induced shock wave detection. The results obtained in the BIC context received **attention** also **from** nonspecialized media, with **TV, radio, and newspaper** interviews.

As a follow-up of the project BIC, he obtained funding from the **ERC Proof-of-Concept** (2017 call) for developing the **INVICTUS** (IN Vitro Cavitation Through UltraSound, proposal # 779751) platform for the study of cavitation enhanced endothelial permeability. The idea was to realize a standardized platform hosting a living and **biologically functional endothelium** to mimic a blood vessel on a chip, to understand the effect of ultrasound irradiated microbubbles in increasing the endothelial layer permeability in view of target drug delivery, and brain blood barrier opening. At the moment he is in charge of the **microfluidics unit** of project NEON (PON funded by the Italian Ministry for Instruction, University and Research, MIUR) **for theranostics** applications.

Among the achievements, **mentoring** promising students and fostering **young researchers** enrolled in the PI's research group eventually resulted in **three ERC-Starting-Grant awardees**, **a Marie Skłodowska Curie individual fellowship winner**, and **nine associate and full professors** in Italy and abroad.

Editorial Activity

2021 - Microsystem Technology, Editorial Board.

2017 - International Journal of Multiphase Flows, Editorial Advisory Board.

2012 - 2018 Meccanica, Editorial Board.

2011 - Flow Turbulence and Combustion, Editorial Advisory Board.

2008 - Acta Mechanica, Editorial Advisory Board.

Section Editor of the volume Molecular Modeling in the Encyclopedia of Nanotechnology, (Bushan ed., Springer, 2016).

Other contributions to the research community

2022 - Panel Member for the EuroHPC JU (Joint Undertaking) for deploying HPC infrastructure and an ecosystem in supercomputing technologies.

2007 - 2017 Director of the PhD Program in Theoretical and Applied Mechanics, Sapienza, Italy.
2008 - 2016 Director of the Master Program in Nanotechnology Engineering, Sapienza, Italy.
2010 - 2015 Member of the EuroMech Turbulence Conference Steering Committee.
2014 - 2017 Member of the PRACE Scientific Steering Committee.
2012 - 2016 Director of Sapienza-IT CECAM Centre, Roma, Italy.
2006 - Founding Member, CNIS (Sapienza Centre for Engineering Nanotechnology).

Committee Member CINECA Tenders: PPI4HPC-Evolution of Tier0 systems towards exascale; FENIX Infrastructure within ICEI (Interactive Computing e-Infrastructure).