



# Carmelo Filippo Munafò

## Curriculum Vitae

*"La fantasia è più importante del sapere, perché il sapere è limitato". -A.Einstein*

### PERSONAL DATA

Date of Birth 26/05/1996, Barcellona P.G.(ME), Italy  
Citizenship Italian  
Residence Via Granaro 5, 98059, Rodì Milici(ME), Italia  
Phone +39 3478544657  
Email carmelofilippo26@hotmail.com, carmelofilippo.munafò@unime.it  
ORCID 0000-0003-3611-0941

### EDUCATION

- 01 Nov 2021 - 31 Oct 2024 **Winner of a PhD scholarship in Mathematics and Computational Sciences, 37th Cycle, Joint program of the Universities of Catania, Messina and Palermo**, administrative office: University of Palermo, Department of Mathematics and Computer Science, Via Archirafi 34, Palermo (PA), Italy.
- Sep 2018 - 22 Oct 2020 **Master's Degree in Mathematics**, Università degli Studi di Torino, Italy (Department of mathematics, via Carlo Alberto 10, Torino), with a thesis in mathematical physics entitled *Un'applicazione dell'equazione del calore alla saldatura sequenziale*, advisor Prof. Paolo Cermelli and Dottor Roberto Sofia, final grade 110/110 cum laude and mention.
- Sep 2015 - 25 Jul 2018 **Bachelor's Degree in Mathematics**, Università degli Studi di Messina, Italy (Department MIFT, "Polo Papardo", Viale Ferdinando Stagno d'Alcontres, 31, Messina), with a thesis in Rational Mechanics entitled *Dinamica del volo: modellizzazione di un quadricottero*, advisor Prof. Annunziata Palumbo, final grade 110/110 cum laude.

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2010–2015 **Scientific High School Diploma (Italy)**, *I.I.S. Liceo Medi*, Via degli studi 74, Barcellona P.G.(ME), Italy, final grade 100/100.

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## PROFESSIONAL EXPERIENCE

- Nov 2021 - Oct 2024 **PhD Student**, *Joint program of the Universities of Catania, Palermo and Messina*, Italy, advisor Prof. Patrizia Rogolino.
- 25 Sep 2023 - 22 Dec 2023 **Visiting Researcher**, *Budapest*, Hungary.  
BME University, Department of Energy Engineering, Faculty of Mechanical Engineering, guest of Prof. Róbert Kóvác
- 12 Apr 2023 - 12 May 2023 **Visiting Researcher**, *Budapest*, Hungary.  
BME University, Department of Energy Engineering, Faculty of Mechanical Engineering, guest of Prof. Róbert Kóvác
- 14 Oct 2020 - 12 Jun 2021 **Teacher**, *Acqui Terme*, Alessandria, Italy.  
Mathematics Teacher (A026) at the Scientific High School of the G. Parodi Institute in Acqui Terme, Via A. De Gasperi 66, Italy.
- 18 May 2020 - 11 Sep 2020 **Stage**, *Santena*, Turin, Italy.  
6-month internship at AMADA INNOVATIVE SOFTWARE EUROPE S.R.L., Via Giovanni Agnelli 15, 10026, Santena (TO), Italy. Supervisor: Dr. Roberto Sofia, co-supervisor of the thesis work carried out at the company on a research topic proposed by the company related to heat propagation during a laser welding process.
- 2015 **Tirocinio**, *Barcelona P.G.*, Messina, Italy.  
Internship at the Scientific High School of I.I.S. Liceo E. Medi in Barcelona P.G., Via degli Studi 74, Barcellona P.G. (ME), Italy, as a Mathematics and Physics teacher. Under the guidance of tenured teacher Maria Imbesi.

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## OPEN DAY

- 15-16 May 2024 **Open Day**, *Messina*.  
Organization of a stand during the Open Day at the Papardo Campus of the University of Messina, Italy.
- 11 Apr 2024 **University Open Day**, *Barcelona P.G.*, Messina, Italy.  
Presentation of the seminar "Predator-Prey Model" during the university Open Day at school Liceo Medi of Barcellona P.G.
- 09 Feb 2024 **STEM Day**, *Messina*.  
Presentation of the workshop "Giocando con i fluidi" during the STEM Day at University of Messina.
- 16-17 May 2023 **Open Day**, *Messina*.  
Organization of a stand during the Open Day at the Papardo Campus of the University of Messina.
- 31 Mar 2023 **Open Day**, *Messina*.  
Presentation of the workshop "Giocando con i fluidi" during the Open Day at the Bisazza Institute.
- 27 Apr 2022 **Mathematics Day**, *Messina*.  
Presentation of the workshop "Superfici minime e bolle di sapone" and the workshop "Giocando con i fluidi" during Mathematics Day at University of Messina.

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## TEACHING EXPERIENCE

- Feb 2024 - May 2024 **Lecturer (Didattica Integratica)**, *Messina*, Italy.  
Lectures for the course *Rational Mechanics*, A.A. 2023-2024, Università degli studi di Messina, Italy.
- 2023 **Teaching Assistant**, *Messina*, Italy.  
Tutor for the course of *Rational Mechanics*, Università degli studi di Messina, Department MIFT, Prof. Annunziata Palumbo, with a duration of 40 hours.
- 2022 **Teaching Assistant**, *Messina*, Italy.  
Tutor for the course of *Rational Mechanics*, Università degli studi di Messina, Department MIFT, Prof. Annunziata Palumbo, with a duration of 30 hours.
- 2021 **Teaching Assistant**, *Torino*, Italy.  
Tutor for the course of *Istituzioni di Analisi numerica*, Università degli studi di Torino, Department of mathematics 'Giuseppe Peano', Prof. Alessandra De Rossi and Prof. Roberto Cavoretto, with a duration of 30 hours.
- 2020 **Teaching Assistant**, *Torino*, Italy.  
Tutor for *excellence courses in Algebra and Differential Equation Models*, Università degli studi di Torino, Department of mathematics 'Giuseppe Peano', Prof. Lea Terracini and Prof. Isabella Cravero, with a duration of 20 hours.
- 2020 **Teaching Assistant**, *Torino*, Italy.  
Tutor for the course *Matematica 2*, Università degli studi di Torino, Department of Chemistry, Prof. Reto Buzano and Prof. Alberto Raffero, with a duration of 40 hours divided into two courses of 20 hours each.
- 23 Jul 2020 **Didactics training programm (Percorso Formativo 24 CFU)**, *con riconoscimento crediti*, Università degli studi di Torino, four courses with final exams on pedagogy, psychology and didactics of Mathematics..

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## RESEARCH INTEREST

Non-equilibrium thermodynamics  
Non-Fourier heat propagation (Maxwell-Cattaneo-Vernotte, Guyer-Krumhansl).  
Heat propagation in biological tissues.  
Heat propagation during a laser welding process.  
Reaction-diffusion systems: Turing patterns, Hopf bifurcation.  
Kinetic models applied to epidemiology, ecology...

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## SCHOOLS, CONFERENCES, AND WORKSHOPS

- 02-14 Sep 2024 XLIX Summer School on Mathematical Physics, Ravello, Italy.  
10-12 Jul 2024 GIMC-SIMAI YOUNG 2024, Napoli, Italy.  
04-05 Jul 2024 Phonon Hydrodynamics in solids and superfluids (PhHydro 2024), Palermo, Italy.

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- 02 Jul 2024 New Horizons in Science: Research and teaching, Messina, Italy.
- 23-29 Jun 2024 ECMI Modelling Week 2024, Catania, Italy.
- 21 Jun 2024 New trends in Biomathematics: Applications in Oncology and Immunology, Reggio Calabria, Italy.
- 02-08 Feb 2024 Summer School on Methods and Models of Kinetic Theory (MMKT), Pesaro, Italy.
- 15 Mar 2024 Heart beats in Continuum Mechanics, Torino, Italy.
- 22-23 Feb 2024 Applied Mathematics Seminars, Messina, Italy.
- 12-17 Jun 2023 JETC, Joint European Thermodynamics Conference, Salerno, Italy.
- 05-09 Jun 2023 WASCOM XXII, Bari, Italy.
- 04-16 Sep 2023 XLVIII Summer School on Mathematical Physics, Ravello, Italy.
- 14 Gen 2023 Seminario Prof. A. Coclite "Un approccio dynamic-Immersed boundary per l'interazione fluido-struttura in biologia", Università degli studi di Messina, Italy.
- 06-07 Dec 2022 From Kinetic Theory to Data Science and Related Topics, Pavia, Italy.
- 12-24 Sep 2022 XLVII Summer School on Mathematical Physics, Ravello, Italy.
- 23-24 Jun 2022 Non-Equilibrium Thermodynamics, Continuum Physics and Applied Perspectives, Messina, Italy
- 13-17 Jun 2022 MPDEE 2022, Torino, Italy.
- 06-10 Jun 2022 WASCOM XXI, Catania, Italy.
- 21 Apr 2022 One-day workshop on Continuum Mechanics, Salerno (SA), Italy.
- 10-12 Nov 2021 Approximation: Theory, Methods and Applications (ATMA), Reggio Calabria, Italy.
- 06-15 Sep 2021 XLVI Summer School on Mathematical Physics, Ravello, Italy.

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## MEMBER OF THE ORGANIZING COMMITTEE

- 23-24 Jun 2022 Non-Equilibrium Thermodynamics, Continuum Physics and Applied Perspectives, Messina (ME), Italia.
- 12 Jun 2024 BioKioWorkshop, Messina (ME), Italia.

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## PARTICIPATION IN THE ACTIVITIES OF A RESEARCH GROUP

- Gen 2023 - Dec 2023 Participation of GNFM Young Project 2023: 'PDE Systems for the Interaction between Epidemics, Individual Behaviors, and Mobility Patterns' CUP-E53C22001930001.

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## SCIENTIFIC COMMUNICATIONS

- 13 Sep 2024 "Kinetic model for interacting systems: classical, non conservative and future problems", XLIX Summer School, Ravello, Italy.

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- 05 Sep 2024 "Non-linear Non-Fourier heat propagation", XLIX Summer School, Ravello, Italy.
- 11 Jul 2024 "A kinetic framework under the action of an external force field: analysis and application in epidemiology", GIMC-SIMAI YOUNG 2024, Napoli, Italy.
- 04 Jul 2024 "Investigating the whirling heat current density in the Guyer–Krumhansl equation", PhHydro 2024, Palermo, Italy.
- 29 Jun 2024 "Mathematical Modelling of Immigration Ethnic Enclave Formation versus Cultural Integration", ECMI Modelling week, Catania, Italy.
- 22 Feb 2024 "Turing patterns in an epidemic model with information-dependent vaccination", Applied Mathematics Seminars, Messina, Italy.
- 26 Oct 2023 "Numerical solutions of heat pulse experiment under Guyer-Krumhansl heat conduction in two dimensions", Budapest, Italy.
- 13 Sep 2023 "Non-linear thermal analysis of two-dimensions material with memory", XLVIII Summer School, Ravello, Italy.
- 17 Jun 2023 "Non-linear Ballistic heat conduction in one dimension", JETC, Salerno, Italy.
- 07 Jun 2023 "A conservative kinetic model with the external actions and its application in epidemiology", WASCOM XXII, Bari, Italy.
- 20 Apr 2023 "Non-linear non-Fourier heat conduction in one/two dimensions medium", Budapest, Italy.
- 15 Sep 2022 "Analysis of non-linear non-Fourier heat transport in two dimensions", XLVII Summer School, Ravello, Italy.
- 24 Jun 2022 "Analysis of non-linear non-Fourier heat transport in two Dimensions", Non-Equilibrium Thermodynamics, Continuum Physics and Applied Perspectives, Messina, Italy.
- 15 Jun 2022 "A reaction-diffusion model of crimo–taxis in a street", MPDEE 2022, Torino, Italy.
- 08 Jun 2022 "Analysis of non-linear non-Fourier heat transport in two Dimensions", WASCOM XXI, Catania, Italy.
- 21 Apr 2022 "Dissipation principle and different thermodynamic theories in continuum physics", One-day workshop on Continuum Mechanics, Salerno, Italy.
- 10 Sep 2021 "An application of heat equation (sequential welding)", XLVI Summer School, Ravello, Italy.

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## POSTER

- 06 Jun 2024 "A kinetic framework under the action of an external force field: analysis and application in epidemiology", MMKT, Pesaro, Italy.
- 02 Jul 2024 "Nonlinear thermal analysis of two-dimensional materials with memory", New Horizons in Science: Research and teaching, Accademia peloritana dei pericolanti, Messina, Italy

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## ACTIVITY AS SUPERVISOR/CO-SUPERVISOR FOR THE PREPARATION OF DEGREE THESIS

- 2024 Modellizzazione delle interazioni tra cellule tumorali, immunitarie e citochine, A.A. 2023–2024, master's thesis.
- 2024 Crescita e diffusione di cellule tumorali e interazione con il sistema immunitario, A.A. 2023–2024, master's thesis.
- 2024 Equazioni differenziali con ritardo per un modello preda-predatore, A.A. 2023–2024, tmaster's thesis.
- 2023 Su un Modello della Febbre Gialla con Migrazione, A.A. 2022–2023, master's thesis.
- 2023 Su un modello per la previsione delle attività criminali, A.A. 2022–2023, master's thesis.
- 2022 Analisi di Turing per un modello S-I con coefficiente di trasmissione non costante, A.A. 2021–2022, master's thesis.
- 2021 Analisi di un modello spazialmente distribuito: ruolo del fattore di paura delle prede, A.A. 2020–2021, master's thesis.

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## PUBLICATIONS AND PREPRINTS

- ✓ **G. Gorgone, G. Guglielmo, C.F. Munafò**, *Operatorial formulation of crimo-taxis phenomena in a street* manuscript, 2024.
- ✓ **R. Della Marca, C.F. Munafò, A. d'Onofrio, R. Travaglini**, *Spatio-temporal chaos induced by all-ages vaccine hesitation in SIR model* manuscript, 2024.
- ✓ **A. Sellitto, C.F. Munafò, P. Rogolino**, *Heat transfer at nano-scale and boundary conditions: A comparison between the Guyer-Krumhansl model and the Thermomass theory* submitted on International Journal of Thermal Science, 2024.
- ✓ **C.F. Munafò**, *Analysis of nonlinear Guyer-Krumhansl heat equation* submitted on International Journal of Engineering Science, 2024.
- ✓ **M. Menale, C.F. Munafò, F. Oliveri**, *A nonconservative kinetic framework with logistic growth for modeling the coexistence in a multi-species ecological system* submitted on The European Physical Journal Plus, 2024.
- ✓ **M. Szücs, C.F. Munafò, R. Kovács**, *Investigating the whirling heat current density in the Guyer-Krumhansl equation*, arXiv preprint, 2024. [arxiv.org/abs/2405.09199](https://arxiv.org/abs/2405.09199)
- ✓ **C.F. Munafò, P. Rogolino, D. Jou**, *Comparison of two nonlinear formulations of the Maxwell-Cattaneo equation in heat pulse transmission*, Applied Mathematical Modelling, pp. 115684, 2024. <https://doi.org/10.1016/j.apm.2024.115684>

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- ✓ **M. Gorgone, C.F. Munafò, A. Palumbo, P. Rogolino**, *A thermodynamical suspension model for blood*, *Meccanica*, pp. 1–13, 2024. [link.springer.com/article/10.1007/s11012-024-01859-2](https://link.springer.com/article/10.1007/s11012-024-01859-2)
- ✓ **C. Godano, C.F. Munafò, F. Oliveri**, *The birth of a volcano: a nonlinear convective model for rock melting at the asthenosphere - lithosphere boundary*, *Applications in Engineering Science*, 18, pp. 100179, 2024. [doi.org/10.1016/j.apples.2024.100179](https://doi.org/10.1016/j.apples.2024.100179)
- ✓ **G. Infrerra, C.F. Munafò, F. Oliveri, P. Rogolino**, *Reaction-diffusion models of crimo-taxis in a street*, *Applied Mathematics and Computation*, 467, pp. 128504, 2024. [doi.org/10.1016/j.amc.2023.128504](https://doi.org/10.1016/j.amc.2023.128504)
- ✓ **C.F. Munafò, P. Rogolino, R. Kóvác**, *Nonlinear thermal analysis of two-dimensional materials with memory*, *International Journal of Heat and Mass Transfer*, 219, pp. 124847, 2024. [doi.org/10.1016/j.ijheatmasstransfer.2023.124847](https://doi.org/10.1016/j.ijheatmasstransfer.2023.124847)
- ✓ **M. Menale, C.F. Munafò**, *A kinetic framework under the action of an external force field: Analysis and application in epidemiology*, *Chaos, Solitons & Fractals*, 174, pp. 113801, 2023. [doi.org/10.1016/j.chaos.2023.113801](https://doi.org/10.1016/j.chaos.2023.113801)
- ✓ **C.F. Munafò, A. Palumbo, M. Versaci**, *An inhomogeneous model for laser welding of industrial interest*, *Mathematics*, 11(15), pp. 3357, 2023. [doi.org/10.3390/math11153357](https://doi.org/10.3390/math11153357)
- ✓ **C.F. Munafò, P. Rogolino**, *Analysis of a Hyperbolic Heat Transfer Model in Blood-perfused Biological Tissues with Laser Heating*, *Journal of Applied and Computational Mechanics*, 8(4), pp. 1398–1406, 2022. [doi.org/10.22055/jacm.2022.40152.3528](https://doi.org/10.22055/jacm.2022.40152.3528)

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## SCIENTIFIC COLLABORATIONS

- Prof. **P. Rogolino**, University of Messina, Department MIFT.
- Prof. **F. Oliveri**, University of Messina, Department MIFT.
- Prof. **A. Palumbo**, University of Messina, Department MIFT.
- Prof. **D. Jou Mirabent**, Autonomous University of Barcelona.
- Prof. **R. Kóvác**, BME University, Department of Energy Engineering, Faculty of Mechanical Engineering, and Wigner Research Centre for Physics, Institute for Particle and Nuclear Physics.
- Prof. **M. Szücs**, BME University, Department of Energy Engineering, Faculty of Mechanical Engineering.
- Prof. **A. Sellitto**, University of Salerno, Department of Industrial Engineering.
- Prof. **M. Versaci**, University “Mediterranea” of Reggio Calabria, Department DICEAM.

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- Prof. **C. Godano**, University of Campania “Luigi Vanvitelli”, Caserta, Department of Mathematics and Physics, and INGV - Osservatorio Vesuviano, Napoli.
- Dott. **M. Menale**, University of Naples “Federico II”, Department of Mathematics and Applications “R. Caccioppoli”.
- Dott. **M. Gorgone**, University of Messina, Department MIFT.
- Dott. **G. Inferrera**, University of Messina, Department MIFT.
- Dott. **R. Della Marca**, University of Naples "Federico II", Department of Mathematics and Applications.
- Dott. **R. Travaglini**, University of Parma, Department of Mathematical, Physical and Computer Sciences.
- Prof. **A. d’Onofrio**, University of Trieste, Department of Mathematics, Informatics and Geosciences.

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## TECHNICAL SKILLS

Programming **C++**, **Fortran**, **Python**  
 Scientific **Matlab**, **Mathematica**, **Maple**, **GeoGebra**.  
 OS Microsoft Windows, Linux/Unix.  
 Typography **Office**, **L<sup>A</sup>T<sub>E</sub>X**.


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## LANGUAGES

**Italian** (native), **English**.

The undersigned, aware of the provisions of Articles 75 and 76 of Presidential Decree No. 445 of December 28, 2000, regarding the criminal liability for false statements, and the revocation of any benefits obtained on the basis of untruthful declarations, hereby declares, under their personal responsibility, that all information contained in the Curriculum Vitae is truthful. Furthermore, the undersigned authorizes the processing and publication of personal data contained in the CV in accordance with Legislative Decree No. 196 of June 30, 2003, "Personal Data Protection Code" and the General Data Protection Regulation (EU Regulation 2016/679).

Messina, 20/09/2024

**The declarant**  
 Carmelo Filippo Munafo  


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