



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

DIFA Summer School 2026

Physics for a better planet III edition

**Summer school on modeling and
data analysis for applied physics**

Daniel Remondini

Nico Curti, Leonardo Conti, Chiara Malvaso,
Mattia Ricchi, Simone Santoro, Maria Chiara
Stellato, Tommaso Giacometti

WELCOME!



DIFA Summer school – 22-26 June 2026

Monday 22 afternoon – Friday 26 morning

Invited speakers (Mon (Tue), Fri):

JRC, UniPD, DIMEC, U Oxford, HERA, TIM

Tue-Thu:

morning lectures

afternoon hands-on computational labs

Thursday evening networking event:

social dinner!

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

INFN
BOLOGNA

DEPARTMENT
OF PHYSICS AND ASTRONOMY
"AUGUSTO RIGHI"

1st Modeling and Data Analysis for Applied Physics

PHYSICS

FOR A BETTER PLANET

3rd edition

22/26 JUNE 2026

**ACCELERATORS
AI
BIOINFORMATICS
CLIMATE
GEOPHYSICS
HEALTH
MATERIALS
SOCIETY**

REGISTRATION DEADLINE May 30th

**In English
Up to 50 participants
No participation fee
Coffee breaks provided**

ORGANIZATION COMMITTEE:
Daniel Remondini, Mariachiara Stellato, Mattia Ricchi, Chiara Malvaso, Simone Santoro, Leonardo Conti, Tommaso Giacometti

INVITED SPEAKERS:
Lapo Boschi, Department of Geosciences, University of Padova
Filippo Pirani, Department of Medical and Surgical Sciences, University of Bologna
Camilla Marella, Medical Physics Unit, Azienda Unità Sanitaria Locale – IRCCS di Reggio Emilia
Matteo Berni, Medical Technology Laboratory, IRCCS – Istituto Ortopedico Rizzoli
Simone Fantoni, Medical Technology Laboratory, IRCCS – Istituto Ortopedico Rizzoli
Camilla Scapicchio, National Institute for Nuclear Physics, INFN Pisa
Fabio Monforti, Joint Research Centre – European Commission
Francesco Avolio, Hera Bologna s.r.l.
Davide Micheli, TIM, Wireless Access Engineering Department
Adrien Hallou, Kennedy Institute, University of Oxford

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Challenges for ApplPhys researchers

1. Controlled Nuclear Fusion & New-generation fission

Challenges: plasma confinement and stability, neutron-resistant materials, tritium breeding, scaling, **monitoring & sensing**.

2. Quantum Technologies

Challenges: fault-tolerant quantum computing, scalable qubits, **quantum communication networks**, and practical quantum sensing.

3. Energy Storage

Challenges: solid-state batteries, sodium-ion technologies, fast charging, and **grid-scale energy storage & distribution management**.

4. Advanced Semiconductor Physics

Challenges: post-silicon electronics, spintronics, **neuromorphic computing**, and low-power devices.



Challenges for ApplPhys researchers

5. Photonics and Optical Computing

Challenges: integrated photonic circuits, optical logic, and **energy-efficient information processing**.

6. Superconductivity

Challenge: room-temperature superconductivity, **AI-driven novel materials**.

7. Climate Physics and Carbon Removal

Challenges: accurate **climate prediction**, carbon capture, and **understanding aerosol-cloud interactions**.

8. New Materials

Challenges: scalable production of graphene and other 2D materials, programmable metamaterials, and **AI-designed materials**.



Challenges for ApplPhys researchers

9. Medical Physics

Challenges: advanced **imaging**, proton **therapy** & ion-beam treatments, and **personalized medicine (diagnosis, therapeutical protocols)**, **AI-driven analysis of proteins, drug & multi-omics data**.

10. Water and Environmental Technologies

Challenges: low-energy desalination, atmospheric water harvesting, and advanced purification systems, **global management (resources, fluxes, sites)**.

11. Complex Systems and Networks

Challenges: power-grid stability, **transportation networks, social networks**, internet resilience, and **epidemic modeling**.



WHAT
WILL I DO
WHEN I WILL
BE **BIG**?



Opportunities for ApplPhys researchers: academics



1. Computational Physics Researcher

Research in complex systems, statistical physics, network science, dynamical systems, and nonlinear phenomena (biology, medicine, society, economics, policy).

2. Data Analytics in Physics Research

Applications in climate modeling, plasma physics, astrophysics, materials science, biophysics, medicine.

3. Computational Biology and Systems Biology

Gene regulation, immune system & complex diseases, protein interaction & metabolic biochemical reaction networks, epidemiology, drug discovery and repurposing, multi-modal data integration, synthetic data generation.



Opportunities for ApplPhys researchers: academics



4. AI for Science Research

Physics-informed neural networks, surrogate modeling & digital twins, symbolic regression, and AI-assisted scientific discovery (embedding & representation).

5. Network Science Research

Study of social, transportation, financial and biological networks.

6. Quantitative Social Science

Research on information/opinion diffusion, online marketing strategies, mobility patterns, collective behavior (e.g. road traffic, public events).



Opportunities for ApplPhys researchers: industry



7. Data Scientist

Predictive modeling, forecasting, optimization, and analytics in finance (quantitative analyst), insurance, telecommunications, energy, and e-commerce.

8. Machine Learning Engineer

Development and deployment of machine learning systems, recommendation engines, and predictive maintenance. Research on novel AI algorithms, explainable AI, scientific AI, and foundation models.

9. Complex Systems Analyst

Modeling and optimization of infrastructures, transportation systems, energy grids, and logistics networks.



Opportunities for ApplPhys researchers: industry



10. Operations Research Scientist

Optimization and simulation for supply chains, manufacturing, and transportation.

11. Climate and Environmental Data Scientist

Climate risk analysis, sustainability modeling, weather prediction, and energy transition studies.

12. Telecommunications and Network Analytics Specialist

Analysis and optimization of communication and internet infrastructures, networks of robotic agents (swarms)



Opportunities for ApplPhys researchers: industry



13. Cybersecurity Analytics Specialist

Graph analytics, anomaly detection, fraud detection, and threat propagation modeling.

14. Digital Twin Engineer

Creation of digital replicas of physical systems for smart cities, manufacturing, and energy applications.

15. Industrial R&D Research Scientist

Research positions in technology companies and industrial laboratories focusing on AI, optimization, simulation, and production chains.



Conclusions

Applied physicists have to opportunity to acquire a very versatile background:

useful in academics

useful in industry R&D

New opportunities can be created by combining different disciplines and approaches

We hope this school will provide hints for you!



ENJOY!

