

# Marios Mattheakis (Matthaiakis)

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## Professional & Research Experience

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**Harvard University**, John A. Paulson School of Engineering and Applied Sciences

- 2018– **Research Associate, Machine Learning and Modeling:** Developed physics-informed neural network (NN) differential equations solvers. Applied Transfer Learning for one-shot discovery of accurate solutions. Designed NNs with embedded principles and integrators to forecast dynamics and discover physics from data. Developed recurrent NNs (echo-state reservoir computing, LSTM) to forecast spatiotemporal dynamics of chaotic autonomous systems.
- 2015–18 **Postdoctoral Fellow, Computational Applied Physics.** Advisor: Prof. Efthimios Kaxiras. Computational materials and heterostructures, metamaterials, light-matter interaction, plasmons, nanophotonics, complex systems, stochastic flows. Modeling optical excitations in 2D quantum materials and twisted heterostructures. Developed a method for nanoscale imaging.

## Education

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**University of Crete**, Department of Physics. Advisor: Prof. Giorgos Tsironis.

- 2014 **Ph.D. in Physics.** Computational electromagnetism, nonlinear and chaotic dynamics, stochastic flows, nanophotonics, plasmons, extreme events in complex spatiotemporal systems.
- 2012 **M. Sc., Computational Physics.** Nonlinear waves in random systems, chaotic dynamics.
- 2010 **B. Sc., Physics.** Numerical methods for electromagnetism and metamaterials.

## Teaching Experience, Leadership, & Professional Activities

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**Education activity** at Harvard Institute for Applied Computational Science

- 2018-22 Instructor in graduate courses for Data Science and Machine learning. Instructed students in advanced topics of deep learning, developed curriculum, leading computational Labs, managed teaching assistants, supervised 12 students in deep-learning research projects.
- 2020-21 Co-organizer of Machine Learning and Data Science workshops

**Conferences, colloquiums, and public speaking:** 13 invited presentations on machine learning topics. 20 conference presentations on machine learning, computational modeling, and applied physics.

**Peer-Reviewer** on top-rated journals and conferences including NeurIPS, AISTATS, Nature Comm, PRL.

## Technical Skills

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**Programming languages:** Python, MATLAB, MATHEMATICA, Fortran, C, Java, UNIX,

**Deep learning and computational packages:** PyTorch, TensorFlow, Keras, COMSOL

## Selected Publications and pre-prints: [Google Scholar Profile]

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1. Mattheakis, et al., *Hamiltonian neural networks for solving differential equations*, arXiv, (2020)
2. Mattheakis, et al., *Reservoir Computing for Solving Ordinary Differential Equations*, arXiv (2021)
3. Jin, Mattheakis, Protopapas, *Physics-Informed Neural Networks for Quantum Eigenvalue Problems*, JCNN at IEEE WCCI (2022)
4. Bhattacharya, Mattheakis, Protopapas, *Encoding Involutory Invariance in Neural Networks*, JCNN at IEEE WCCI (2022)
5. Desai, Mattheakis et al., *One-Shot Transfer Learning of Physics-Informed Neural Networks*, arXiv (2021)
6. Desai, Mattheakis, Roberts, *Variational Integrator Graph Networks for Learning Energy Conserving Dynamical Systems*, Phys. Rev. E (2021)
7. Desai, Mattheakis et al., *Port-Hamiltonian Neural Networks for Learning Explicit Time-Dependent Dynamical Systems*, Phys. Rev. E, (2021)
8. Jin, Mattheakis, Protopapas, *Unsupervised neural networks for quantum eigenvalue problems*, NeurIPS Workshop (2020)
9. Neofotistos, Mattheakis, et al. *Machine learning with observers predicts complex spatio-temporal behavior*, Front. Phys. - Quantum Computing, (2019)
10. Luo, Engelke, Mattheakis, et al., *In-situ nanoscale imaging of moiré superlattices in twisted van der Waals heterostructures*, Nature Communication (2020)

Link for an extended curriculum vitae and a full list of publications.