

ALESSIO MARTINI

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Portfolio: alessiomartini.github.io | GitHub: github.com/alessiomartini | LinkedIn: [alessiomartini](https://www.linkedin.com/in/alessiomartini)

Theoretical physicist (MSc, University of Amsterdam, 2026) working with stochastic processes, fat-tailed statistics and real-world data, from Monte Carlo simulation to live data pipelines in Python. Interested in quantitative finance and in applying statistical physics to collective and social phenomena.

EDUCATION

Master of Science in Theoretical Physics | University of Amsterdam

Amsterdam, Netherlands

GPA: 8.76/10 · Thesis: 9.0/10

Sep 2024 – Jul 2026

- **Thesis:** *Continuous Non-Invertible Symmetries in the 3d Complex Scalar Boson* — Advisor: Diego Hofman. Generalized global symmetries of the 3d XY model and the abelian Higgs model, related by particle–vortex duality.
- **Relevant Courses:** Quantum Field Theory I–III & Advanced, String Theory I & II, Condensed Matter Theory Advanced, Topology in Physics, Differential Geometry and Algebraic Topology 1 (Mastermath), Non-equilibrium Statistical Physics, Hydrodynamics; *Exploring AI for (Quantum) Physics* (DRSTP).
- **Schools & Extra Courses:** Topological Order and Quantum Information, Lattice Gauge Theory (DRSTP); Generalised Symmetries in QFT and Gravity (Jena TPI School on QFT & Holography).

Bachelor of Science in Physics | University of Milano Bicocca

Milano, Italy

Final grade: 103/110

Oct 2020 – Nov 2023

- **Thesis:** *Anomalies in Quantum Mechanics* — Advisor: Noppadol Mekareeya. How quantization breaks the classical scale invariance of the attractive inverse-square potential, a solvable example of an anomaly.
- **Relevant Courses:** Computational Physics (Monte Carlo methods, numerical integration in C), Statistical Data Analysis (parameter estimation, hypothesis testing, error propagation), Mathematical Methods for Physics (complex & functional analysis), Quantum Mechanics, Classical Mechanics.

PROJECTS

Wikipedia Attention & ETF Volatility (Python, alternative data, in progress)

- Tests whether attention shocks in daily **Wikipedia pageviews** predict **next-day ETF realized volatility** (e.g. Nvidia → QQQ).
- Stationary, strictly lagged features (log returns, 5-day realized volatility, % change in pageviews at $t - 1$, $t - 2$) to rule out look-ahead; Ridge regression validated **walk-forward** (5-fold time-series split, scaler fitted per training fold).
- Next: a lags-only volatility baseline to isolate what attention adds.

The Real-Time Earth (Cloudflare Workers, GitHub Actions, in progress)

- Modular catalog of **live public data feeds** (Bitcoin trades, earthquakes, surface temperature, Wikipedia edits), with source timestamps and feed health; no interpolation or gap filling.
- Server-side proxy and relay keep API keys out of the browser; **GitHub Actions** check every candidate source (status, CORS) and test the deployed site in a real browser after each deploy and daily.

INDEPENDENT STUDY

Stochastic Modelling of Financial Time Series (Python, econophysics & non-eq. stat. mech.)

- **Fractional Brownian motion** via Cholesky factorization of the covariance kernel ($H = 0.1\text{--}0.9$), validating the variogram scaling $V(\tau) \propto \tau^{2H}$; **Ornstein-Uhlenbeck** mean reversion checked against closed-form theory.
- Monofractal moment ratios $M_q(\tau)/\sigma(\tau)^q$ matched to Gaussian constants within 0.1–0.2% ($q = 1\text{--}4$), then contrasted with a **Multifractal Random Walk**, the diagnostic for intermittent market returns.
- Overdamped **Langevin** dynamics: diffusion constant within 1% of theory; double-well first-passage times follow **Kramers' law**.
- Sums of **Pareto-tailed** variables ($\mu = 3$): data collapse at the predicted $\alpha = 1/2$, the fat-tail-to-Gaussian (**CLT**) crossover.

Markets from First Principles (Python, in progress)

- Learning site on finance & economics for a physicist: 8 tracks, 51 planned pages (23 written), 170 glossary entries; each page ends with a **real-data chart** naming its source and sample period.
- Python data pipeline refreshed daily by **GitHub Actions**, with fallback across data sources; live order-book page.

Lecture Notes & Reading (L^AT_EX, in progress)

- MIT 18.642 *Topics in Mathematics with Applications in Finance*: study notes with full derivations, exercises and historical asides.
- Perry Mehrling's *Economics of Money and Banking* (Columbia): one chapter per lecture across 22 lectures, linked to the exact moment in each video.
- Steve Brunton's *Data-Driven Dynamical Systems*: every point linked to the second of the video where it is said; the Matlab demos rewritten in Python.
- Reading: Benzaquen's *Modelling Financial Markets* (time-series analysis), Witten's *A Mini-Introduction to Information Theory*.

Big Picture (conceptual map, in progress)

- Conceptual map of physics, mathematics and the experiments behind them: each field states what it asks, what it has established, what it rests on and where it breaks; cross-field threads follow one idea (the action, universality) from field to field.

TECHNICAL & METHODOLOGICAL COMPETENCIES

- **Mathematics & Statistics:** Stochastic Processes & SDEs, Statistical Inference, Linear Algebra, Differential Geometry.
- **Computational Methods:** Monte Carlo Methods, High-Dimensional Numerical Integration, ODE Solvers (Runge-Kutta, Leap-frog), Root-Finding (Newton, Bisection).
- **Programming:** Python (NumPy, SciPy, Pandas, StatsModels, scikit-learn), C, C++ , SQL, Wolfram Mathematica, HTML/CSS.
- **Data & Tooling:** real-time public data feeds, Git, GitHub Actions, Cloudflare Workers.

PROFESSIONAL EXPERIENCE

Teaching Assistant & MSc Student Mentor | University of Amsterdam

Amsterdam, NL

MSc Quantum Field Theory I & II (Diego Hofman) · BSc Electrodynamics (Kareljan Schoutens)

Sep 2025 – Jun 2026

- Corrected two homework sets and the final exam across both QFT courses, for a cohort of ~90 students.
- Authored original session notes: worked exercises, theory summaries, and supplementary material proposed independently.
- Mentored incoming first-year MSc students through the program.

Additional Experience

Italy

Private Tutor, Advanced Mathematics & Physics (Aug 2022 – Jun 2024) · Lead Waiter, Caffè Mattà, Cremella (Jun 2020 – Feb 2022)

· Gymnastics & Calisthenics Instructor, Milano Gym Lab & ASD Sovico (Sep 2018 – Jun 2020)

MISCELLANEOUS

- **Puzzles & Competitions:** Jane Street Monthly Puzzles solver (August 2026).
- **Languages:** Italian (Mother Tongue), English (C1 Proficient User - IELTS Certification), Spanish (Elementary).
- **Volunteering & Interests:** Bartender & waiter, Downtown Hostel Bar (Copenhagen, 2022); Piano, Guitar, Clarinet; Artistic gymnastics, Krav Maga; Interested in every form of Art.