ANASTASIOS BATATEGAS

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EDUCATION

National Technical University of Athens (NTUA) *October 2021 – Expected July 2027*
Diploma (Integrated Master's) in Applied Mathematical and Physical Sciences Current Grade: **9.46/10.00**
Direction: Applied Physics | *Specializations:* Theoretical & Computational Physics, Nuclear & Particle Physics
Selected Coursework: General Relativity & Cosmology, Theoretical Physics (QFT & Gauge Theories), Elementary Particles II, Quantum Mechanics II, Group Theory in Physics, Statistical Mechanics, Computational Physics II
Diploma Thesis: **Black Hole Perturbations & Gravitational Waves** *In Progress*
Supervisor: Prof. Alexandros A. Kehagias

- Analyzing linearized perturbations of black hole spacetimes via the Regge–Wheeler (axial) and Zerilli (polar) master equations, focusing on gravitational-wave ringdown and quasinormal modes.

National Technical University of Athens (NTUA) *October 2020 – September 2021*
School of Electrical & Computer Engineering (ECE)
Completed first-year coursework; voluntarily transferred to Applied Mathematical and Physical Sciences to focus exclusively on fundamental and mathematical physics.

3rd General Lyceum of Trikala "Odysseas Elytis" *September 2017 – June 2020*
High School Diploma Grade: **20.0/20.0 (Valedictorian)**

ACADEMIC PROJECTS & TERM PAPERS

SU(5) Grand Unified Theory (In Progress) *Fall 2026*
Course: Theoretical Physics

- Mapping Standard Model fermions to SU(5) irreps ($\overline{\mathbf{5}}, \mathbf{10}$) and computing one-loop β-functions for gauge couplings.
- Analyzing failures of minimal SU(5): coupling non-unification, proton decay (X, Y bosons), and doublet–triplet splitting.

Hamiltonian Chaos in Wave–Particle Dynamics *Spring 2025*
Course: Controlled Thermonuclear Fusion

- Analyzed a 1.5-DOF non-autonomous Hamiltonian system via fixed-point stability, separatrix bounds, and canonical perturbation theory in action–angle variables to derive the effective resonant Hamiltonian.
- Used Python (NumPy, SciPy, Matplotlib) to integrate the equations of motion and generate stroboscopic Poincaré sections, reproducing the transition from KAM tori and resonant islands to global chaos (Chirikov overlap).

Bateman Equations in Radioactive Series *Spring 2025*
Course: Nuclear Physics & Applications

- Derived closed-form solutions for n-step radioactive decay chains via mathematical induction and Laplace transforms, extending to arbitrary initial conditions and secular/transient equilibria.
- Surveyed numerical instabilities (catastrophic cancellation) in stiff decay chains and modern algorithmic solvers (matrix exponentials, Cauchy products, divided differences).

The Sudbury Neutrino Observatory (SNO): Oscillations & Analysis *Fall 2024*
Course: Detector & Accelerator Technology

- Reviewed the resolution of the Solar Neutrino Problem, detailing PMNS flavor mixing, vacuum oscillations, and the Mikheyev–Smirnov–Wolfenstein (MSW) matter resonance.
- Synthesized SNO Phases I–III and the maximum-likelihood separation of Charged-Current, Neutral-Current, and Elastic Scattering event distributions in heavy water (D_2O).

HONORS & AWARDS

SEEMOUS (South Eastern European Mathematical Olympiad for University Students) *2023*
Bronze Medal. Qualified in the Fall 2022 exams to represent NTUA and the Greek National Team in Struga, North Macedonia.

"Archimedes" Greek National Mathematical Olympiad *2020*
Silver Medal. Qualified as a Substitute Member of the Greek National Team for the 2020 International Mathematical Olympiad (IMO).

Greek National Physics Competition *2019*
2nd Prize of Excellence.

TEACHING EXPERIENCE

Independent Undergraduate Tutor (Mathematics & Physics) *2023 – 2026*
Provided structured one-on-one instruction in Mathematical Analysis, Ordinary & Partial Differential Equations, and General Physics to students from NTUA and other universities, guiding them to top examination grades (10/10).

TECHNICAL SKILLS & LANGUAGES

Programming: C/C++, Python (NumPy, SciPy, Matplotlib), MATLAB, Fortran, Bash
Operating Systems & Tools: Linux/Unix, Git, LaTeX
Languages: Greek (Native), English (Proficient – CEFR C2, Cambridge CPE)