Alejandro José Florido Tomé

Theoretical Physicist & Mathematician

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About Me

Theoretical physicist and mathematician with a solid background in computational methods. My research focuses on tackling complex problems in mathematical physics using both analytical and numerical techniques, particularly in quantum cosmology and compact astrophysical objects. With strong programming skills and a multidisciplinary background, I connect abstract theory with real-world applications by building innovative computational tools for astrophysics. My work reflects a high degree of versatility across mathematics, physics and data science.

Research Profile

- Quantum gravity and singularity resolution
- Numerical relativity and compact objects
- Mathematical physics (Wheeler-DeWitt formalism)
- Boson stars as dark matter candidates

Research and Professional Experience

03/26–Present **PhD Researcher in Physics & Mathematics**, *Universidad de Granada*, Spain
- Advancing knowledge of stellar interiors using ML and Bayesian inference to relate physical and asteroseismological parameters, exploiting the large amounts of spatial and ground-based data available now and in the future.

10/25–Present **Data Engineer & Researcher (PLATO Mission – ESA)**, *Universidad de Granada*, Spain
- **Scientific Pipeline Development:** Data pipeline engineering to transform raw telemetry into stellar oscillation frequencies for asteroseismology analysis (PLATO space mission).
- **Full-Stack & DevOps:** Management of the web infrastructure of the project using Symfony (backend) and React (frontend); optimization of Apache servers and management of MariaDB databases.
- **Cybersecurity and Hardening:** Ensuring server security by implementing iptables policies, Fail2Ban, SSH hardening, and SSL certificate management.
- **Scientific Computing:** Deployment of interactive data visualization tools using R/Python (Quranto) on servers; use of HPC resources (HAYDN cluster) for massive processing.

Feb 2026 – Present **Digital Content Creator**, *Nexus Cosmicus*, Remote
- Creating high-quality science popularization content combining physics, mathematics and technology
- Writing articles and producing multimedia content for a broad audience

Aug 2025 – Present **STEM Content Creator & Science Communicator**, *El Prisico*, Spain
- Bringing physics, mathematics and technology to the general public in an attractive, rigorous and well-founded way
- Python, Google Colab and 3 additional skills applied

07–08/25 **AI Data Engineer (Astronomical Operations)**, *CEFCA*, Spain
- I started developing the AI agent OPTIMIA for the Javalambre Astrophysical Observatory.
- I created REST APIs connecting SQL databases with LLM systems.

02–05/25 **Geospatial Data Analyst**, *EGEMAP*, Spain
- I designed a temporal database for geomatic projects, see `https://egemap.eu/project/beca-leonardo/`
- I developed analysis pipelines using Python/JavaScript.

11/23–06/24 **Numerical Relativity Researcher**, *Universidad de Valencia*, Spain
- I investigated the Chern-Pontryagin scalar in binary black hole mergers using numerical relativity.
- I analyzed gravitational wave modes (l,m) for asymmetry indicators.
- I developed correlation maps for parameters such as spin, recoil velocity, and luminosity.

04–05/24 **Erasmus Researcher**, *Sapienza Università di Roma*, Italy
- I studied boson stars with potential $V \propto |\phi|^6$ under the supervision of Dr. Massimo Vaglio and Prof. Paolo Pani.
- I implemented a dimensionless formalism for the Einstein-Klein-Gordon system in Mathematica.
- I analyzed stability criteria for higher-order self-interaction terms.

07/23 **Materials Science Researcher**, *Universidad de Granada*, Spain
- I performed X-ray diffraction analysis of MOF crystals.

09/21–06/22 **Theoretical Gravity Researcher**, *Universidad de Córdoba*, Spain
- I developed a weak-field approximation framework for gravitational wave generation.
- I implemented numerical solutions to the linearized Einstein equations.
- I conducted an independent study on the applications of differential geometry in GR.

International Stays

- **Research Collaboration - ISI** — Athena Research and Innovation Information Technologies, Patras, Grecia (1 month), August 2026–September 2026
- **Erasmus Internship** — Sapienza Universita di Roma, Roma, Italia (2 months), April 2024–June 2024

Scientific Output

Published

Camino Mesa, C. C., García Hernández, A., Suárez, J. C., Mirouh, G. M., **Florido-Tomé, A.**, & Godoy-Rivera, D. (2026). A catalogue of A-F variable stars within PLATO's first field of view, LOPS2. Astronomy & Astrophysics, 714, A318. https://doi.org/10.1051/0004-6361/202661071 — `https://doi.org/10.1051/0004-6361/202661071`

Rodrigo-Comino, J., Jódar-Abellán, **A., Florido-Tomé**, et al (2026). Spatial Variability and Magnitude of Soil Erosion in Vineyards Across Spain: Insights from Standardized ISUM Measurements. Hydrology, 13(9), 251. https://doi.org/10.3390/hydrology13090251 — `https://doi.org/10.3390/hydrology13090251`

Camino Mesa, C. C., García Hernández, A., Suárez, J. C., Mirouh, G., **Florido Tomé, A. J.**, & Godoy-Rivera, D. (2026, July 13). The potential of SPATO: Survey of PLATO A-Type stars Oscillation frequencies. Zenodo. 10th TESS/17th Kepler Asteroseismic Science Consortium Workshop (TASC10/KASC17), Aarhus, Denmark. https://doi.org/10.5281/zenodo.21334086 — `https://zenodo.org/records/21334086`

Leong, S. H. W., Tomé, A. F., Bustillo, J. C., del Río, A., & Sanchis-Gual, N. (2025). Gravitational-wave signatures of the mirror asymmetry in binary black hole mergers: Measurability and correlation to gravitational-wave recoil. Physical Review D, 112, 084078. https://doi.org/10.1103/1nnp-w5w4 — `https://doi.org/10.1103/1nnp-w5w4`

Conference Participation

10/26 **Invited talk; Local Organising Committee (LOC):** *Asteroseismic study of intermediate-mass stars using space data and machine-learning tools.* 13th Iberian Meeting on Asteroseismology, Universidad de Granada.

07/26 **Poster; Volunteer:** *What makes a HADS star? Data-driven study of the HADS phenomenon.* Juan Carlos Suárez, **Alejandro J. Florido**, Sebastiano de Franciscis, Elham Ziaali XVII Reunión Científica de la Sociedad Española de Astronomía, Sociedad Española de Astronomía.

02/26 **Oral presentation:** *The potential of SPATO: Survey of PLATO A-Type stars Oscillation frequencies.* (Presented by C. C. Camino Mesa). C. C. Camino Mesa, A. García Hernández, J. C. Suárez, G. M. Mirouh, **A. Florido-Tomé**. TASC10/KASC17, Aarhus, Denmark.

07/25 **Poster:** *Mapping Soil Erosion in Vineyards to create the first national database: The ISUM Web-Based Approach.* **A. Florido-Tomé**, J. Rodrigo-Comino TERRAenVISION, Granada.

05/25 **Oral presentation:** *Dynamical formation of multi-state boson stars.* **A. Florido-Tomé**, N. Sanchis-Gual NewFunFiCO Meeting, University of Valencia.

Conferences Attended

2026
- **MSAP5 Validation Workshop** : LIRA-Paris Observatory, April 2026
- **EDUCADO–MWGaiaDN Training School on Astro-AI and Machine Learning** : Universiteit Gent, March 2026

2025
- **12th Iberian Meeting on Asteroseismology** : Instituto de Astrofísica e Ciências do Espaço, U. Porto — Luso, Portugal, November 2025
- **Gravitational Wave Open Data Workshop 2025** : GWOSC, May 2025

2023
- **FIRST EUCAPT SCHOOL: Cosmology** : Universidad de Valencia, September 2023

Awards & Grants

Extra Grants & Awards

2024
- **Full Scholarship — The Laplacian and Beyond: Celebrating Luis Caffarelli's Mathematics** : Universidad Internacional Menéndez Pelayo, Santander
- **Partial Traveltalent Scholarship — Professional Development Programme** : Edinburgh, UK

Media Appearances

TVE Aragón (2025) *TV interview about AI and astronomical data processing work at CEFCA and the Javalambre Astrophysical Observatory (OAJ). Featured for the development of the OPTIMIA AI agent.*

Diario de Teruel (2025) *Front page appearance (Issue 27,222, August 19) for the development of the OPTIMIA AI agent for telescope operations at the Javalambre Astrophysical Observatory.*

Software and Projects

OPTIMIA AI Agent (tool). For: CEFCA / Javalambre Observatory. Natural language to SQL AI assistant. Allows modifying observatory databases via chat using Flowise, with zero code involved. Deployed for astronomical operations. *Let observatory staff update their databases just by chatting, without writing SQL.* youtube.com

GIA Web Portal (website). For: Iberian Asteroseismology Group (GIA). Design and development of the formal platform for the Iberian asteroseismology community. A vital forum for researchers to coordinate missions and share funding opportunities. *Give the community one official place to coordinate missions and share funding opportunities.* gia.ugr.es

National Soil Erosion Map (website). For: Leonardo Grant / EGEMAP. Interactive Web GIS platform visualizing soil erosion across various vineyards in Spain. Highlights the severe deterioration of fertile land through interactive geospatial data. *Make the deterioration of fertile land visible and explorable through geospatial data.* egemap.eu

Cante de las Estrellas (website). For: University of Granada. Have you ever wondered what the Sun sounds like? Or different stars in the sky? On this website, we teach you in an educational, simple way, and what relationship it has with the interior of stars and the mysteries it holds... *Understanding stellar physics in an attractive and original way* cantedelasestrellas.ugr.es

SPATO Database (website). For: University of Granada. Survey of PLATO A-Type stars Oscillation frequencies. Explore, filter, and cross-match data from TESS, Gaia DR3, and Open Clusters. stellar.ugr.es

Star Evolution Group (website). For: University of Granada. From the pulsations of δ Scuti and γ Doradus stars to the structure of their interiors: we use asteroseismology, space photometry and stellar modelling to understand how stars live and evolve. stellar.ugr.es

ASC 2027 (website). For: University of Granada. Over the last two decades, asteroseismology has revolutionized our ability to describe stars, ushering in a revolution in stellar physics and beyond. Ahead lies a bright future, with the PLATO, Roman and Earth2.0 missions building upon the discoveries of MOST, CoRoT, Kepler and TESS. Equally, this first installment of the new Asteroseismic Science Consortium conference series will continue the efforts of the KASC/TASC series in building a community of observers, theoreticians, and everyone in between to tackle the ongoing challenges in stellar physics: angular momentum transport processes, magnetic fields and activity, binary interactions, and many more across the entire HR diagram. cadiz-meeting2027.ugr.es

Education

03/26–Present **PhD in Physics & Mathematics**, *Universidad de Granada*, Spain

09/24–07/25 **MSc Interuniversity Mathematics**, *Universidad de Granada*, Spain
- **Master's thesis:** *Wheeler-DeWitt Equation & WKB Method in Quantum Cosmology: 9.8/10*
  - Derived quantum FLRW cosmology from first principles
  - Resolved the initial singularity using WKB wavefunctions
  - Classified allowed/forbidden quantum states of the universe
- **Courses:** Riemannian Geometry, Lie Groups, PDEs (Finite Elements), Mathematical Modelling

09/23–09/24 **MSc Advanced Physics**, *Universidad de Valencia*, Spain
- **Master's thesis:** *Dynamical Formation and Stability of Multi-State Boson Stars: 9.5/10*
  - Numerically solved the Einstein-Klein-Gordon system
  - Demonstrated stable multi-state configurations
  - Fitted rotation curves to galactic observations
- **Specialisation:** QFT, Renormalisation, Stellar Astrophysics, Observational Techniques

09/22–06/23 **SICUE Exchange**, *Universidad de Granada*, Spain
- **Key courses:** General Relativity, Cosmology, Electrodynamics

09/19–09/23 **BSc Physics**, *Universidad de Córdoba*, Spain
- **Bachelor's thesis:** *Gravitational Waves: Theory & Simulations: Honours (Matrícula de Honor)*
  - Derived wave equations from the weak-field approximation
  - Computed radiated power for binary systems
- **Core training:** Advanced Quantum Mechanics, Statistical Physics, Computational Methods

Teaching

- **Fundamentos matemáticos de la Relatividad Numérica** (Instructor) — udemy (online, 1 h), 09/26
- **Introduction to Numerical Relativity** (Instructor) — Udemy (online, 1 h), 08/26
- **Introducción a la Relatividad Numérica** (Instructor) — Udemy (online, 1 h), 08/26
- **Desarrollo inicial de la web del grupo GARANAT** (Director) — Atlántida CIPED, Granada, España (in person), 02/26–05/26

Accreditations and Courses

Accreditations and Certifications

10/26 **Certificado de Asistencia al Curso de Iniciación al Desarrollo con IA**, *BIG school*

12/24 **C1 - Certificate in Advanced English**, *Cambridge English*

12/24 **Information Technology Specialist - Cibersecurity**, *Pearson VUE*

11/24 **Cisco Certified Support Technician Cybersecurity**, *Cisco Systems, Inc.*

Professional Courses

10/26 **VIII Seminario de Análisis Geométrico UJA**, *Universidad de Jaén*, 10 h

07/26 **Training Course on Cibersecurity**, *European Institute of Innovation & Technology*, 75 h

05/26 **Divulgación científica**, *UNIVERSIDAD DE GRANADA*, 20 h

04/26 **Internet of Things (EIT)**, *European Institute of Innovation & Technology*, 75 h

04/26 **Big Data (EIT)**, *European Institute of Innovation & Technology*, 75 h

04/26 **Curso de Ciberseguridad y Hacking Ético**, *BIG school*, 6 h

01/26 **Creatividad, integridad y comunicación en ciencia**, *UNIVERSIDAD DE GRANADA*, 23 h

01/26 **El primer autovalor del laplaciano de una subvariedad espacial compacta del espaciotiempo de Lorentz-Minkowski de dimensión arbitraria y aplicaciones a desigualdades geométricas Riemannianas**, *UNIVERSIDAD DE GRANADA*, 12 h

07/25 **INTELIGENCIA ARTIFICIAL APLICADA A LA INGENIERÍA: DEL MACHINE LEARNING AL CHATGPT**, *aprendeal*, 150 h

06/25 **The Data Science Course: Complete Data Science Bootcamp 2025**, *365 Careers*, 32 h

02/25 **Geo Web App Building with OS Tools**, *UNIVERSITY OF TWENTE*, 40 h

02/25 **Introduction to machine learning for earth observation**, *eo-college*

01/25 **Ciencia de Datos a través del Big Data**, *Cátedra ENIA: Inteligencia Artificial, Ética, Responsable y de Propósito General (IAFER)*, 20 h

01/25 **Modelos Matemáticos en la Ciencia y la Naturaleza**, *UNIVERSIDAD DE GRANADA*, 45 h

11/24 **Introduction to Cibersecurity**, *Cisco Networking Academy*

10/24 **Quantum Gravity: from Gravitational Waves to Gravitons**, *Udemy*, 6 h

10/24 **Mathematical Intuition behind String Theory**, *Udemy*, 6 h

10/24 **Curso Power BI - Análisis de Datos y Business Intelligence**, *Udemy*, 22 h

08/24 **English Language Course**, *The Language Institute Edinburgh*, 15 h

06/24 **Administración de empresas**, *Udemy*, 5 h

06/24 **SQL - Curso completo de Bases de Datos - de 0 a Avanzado**, *Udemy*, 21 h

05/23 **Mathematical predictions of General Relativity**, *Udemy*, 5 h

05/23 **Tablas Dinámicas: Análisis de datos en Microsoft Excel**, *Udemy*, 11 h

05/23 **Python TOTAL - Programador Avanzado en 16 días**, *Udemy*, 30 h

Technical Skills

Programming Languages

Advanced
- **Python**: NumPy, SciPy, SymPy, TensorFlow, PyTorch, Pandas, Scikit-learn, Matplotlib, Seaborn, SQLAlchemy, SMTP/IMAP protocols (automation), Flask (APIs)
- **Web & Backend**: Symfony (PHP), React (JavaScript), Apache HTTPd, REST APIs, TypeScript
- **Mathematica**: symbolic computation, numerical analysis, visualisation
- **LaTeX**: advanced document preparation (including Beamer, TikZ)
- **Fortran**: numerical relativity codes

Intermediate
- **Databases**: SQL (PostgreSQL), MariaDB
- **Scientific**: R (statistical analysis), Quarto (interactive reports)
- **Java**: algorithm implementation
- **Containerisation**: Docker, Ollama (LLM deployment)

Scientific Software

Physics: SAOImageDS9 (astronomical data visualisation), Stellarium (observation planning)

Mathematics: FreeFEM (finite element methods), FEniCS/PETSc (PDE solvers), wxMaxima (symbolic computation)

Data Analysis & Visualisation

Power BI (dashboards), Gnuplot (scientific plots), Google Colab (cloud computing), MATLAB (numerical analysis)

Office & Productivity

Office 365 (advanced Excel formulas, VBA macros), Overleaf (collaborative LaTeX), Git/GitHub (version control)

Systems Administration & DevOps

Experience deploying and maintaining Linux servers (CentOS/RHEL):

- Installing and compiling Python from source, resolving dependencies (`sqlite-devel`, `ncurses-devel`, `readline-devel`, etc.)
- Configuring web services with Apache and PHP-FPM, including SSL/HTTPS.
- Automating CRON tasks for periodic maintenance and data processing.

Linux security & hardening:

- Network security with `iptables` and firewall configuration.
- Intrusion prevention with `fail2ban` and custom jail policies.
- SSH hardening and user permission management (`sudo`, `pam_wheel.so` policies).
- Linux lover: Rufus for bootable USB drives; dual boots to run Windows and Linux on the same computer.

Languages

- **Spanish**: Native
- **English**: C1 Advanced
- **Italian**: B1 Intermediate
- **French**: A2 Basic
- **German**: A2 Basic
- **Greek**: A2