Juan Pablo Solís Ruiz

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PROFILE

Engineering Physics graduate with a strong focus on fusion and plasma physics, numerical modelling and scientific computing. Experienced in developing original physics simulation codes (PIC, MHD, two-fluid, Grad–Shafranov) and custom Geant4 frameworks. Highly motivated to pursue graduate studies in fusion science, combining solid theoretical training with hands-on computational and engineering skills.

EDUCATION

Tecnológico de Monterrey, Monterrey, Mexico — Jun 2025
B.S. in Engineering Physics (Ingeniería Física Industrial)
GPA: 92.29 / 100 — Academic Talent Scholarship (2021–2025)

ONLINE COURSES & CERTIFICATIONS

PlasmaApplicationX: Plasma Physics – Applications, EPFLx / edX — 2025
Ecole Polytechnique Fédérale de Lausanne – Verified Certificate.
Topics: space and astrophysical plasmas; industrial and medical plasma applications; thermonuclear fusion physics including power balance and magnetic confinement devices (tokamaks and stellarators).

PlasmaIntroductionX: Plasma Physics – Introduction, EPFLx / edX — 2025
Ecole Polytechnique Fédérale de Lausanne – Verified Certificate.
Topics: Debye shielding and plasma parameters; single-particle motion in electromagnetic fields; kinetic and fluid descriptions (Vlasov, two-fluid, MHD); equilibrium and stability; MHD waves and basic numerical modelling exercises.

Complete Guide to C++ Programming Foundations, LinkedIn Learning — 2025
Certificate of completion. Topics: C++ fundamentals for scientific and engineering applications (types, pointers, references, control flow, functions, classes and introductory use of the STL).

Lean Six Sigma White Belt – Certification — 2023

RESEARCH & PROJECTS IN FUSION AND PLASMA PHYSICS

STAR-like Spherical Tokamak Equilibrium (FreeGSNKE)

- Built a STAR-like spherical tokamak model in FreeGSNKE, including vessel geometry and PF/CS coil set.
- Ran PF/CS current scans with a misfit-based optimisation to obtain a low-aspect-ratio, highly elongated bean-shaped equilibrium with positive triangularity.
- Computed MHD diagnostics (separatrix geometry, $q(\psi)$, pressure, β_p, toroidal current density, magnetic shear) and generated a quasi-static ramp-up animation.
- *Tools:* Python, NumPy, Matplotlib, FreeGSNKE.

PIC Simulation of Two-Stream Instability

- Implemented a 1D electrostatic Particle-In-Cell (PIC) code including charge deposition, field solver and particle pusher for periodic plasmas.
- Reproduced the exponential growth phase of the two-stream instability and compared numerical growth rates with analytical theory.
- Produced phase-space plots and field evolution diagnostics to study nonlinear saturation.
- *Tools:* Python, NumPy, SciPy, Matplotlib.

Two-Fluid Plasma Wave Simulation (1D/2D)

- Developed a two-fluid plasma framework with separate ion and electron dynamics coupled to Maxwell-type field equations.
- Validated dispersion relations for several plasma wave branches (R/L, O/X, electrostatic modes) against theoretical predictions.
- Designed a modular structure allowing 1D/2D setups, boundary conditions and parameter scans.
- *Tools:* Python, NumPy, SciPy, Matplotlib.

Z-Pinch MHD Stability Simulation

- Implemented a resistive-MHD solver to model the time evolution of an axial Z-pinch.
- Reproduced characteristic sausage and kink instabilities under different current and pressure profiles.
- Built a modular codebase prepared for future extensions (additional physics, higher-dimensional geometries).
- *Tools:* Python, NumPy, SciPy, Matplotlib.

OTHER SCIENTIFIC & ENGINEERING PROJECTS

Geant4 Simulation Framework for Customizable Radiography Imaging

- Constructed a reusable Geant4 framework for X-ray radiography and tomography of arbitrary samples.
- Implemented flexible geometry, source and detector configurations to support different experimental scenarios.

ComSatsP4 – Bidirectional S-Band Communications System for a CubeSat

- Co-designed a bidirectional communication system between a climate observation CubeSat and a ground station, integrating a fractal patch antenna for the satellite, a directional ground antenna and an S-band link prototype.
- Implemented a communications stack inspired by the CCSDS space packet protocol, including packetisation, sequence control and basic error detection for image and diagnostic data.
- Prototyped and validated the link using commercial hardware (Raspberry Pi, nRF24L01-based transceivers and custom PCB antennas), debugging packet fragmentation issues and demonstrating reliable image transmission in realistic lab conditions.

EXPERIENCE

Volunteer – **GeoStats**, Monterrey, Mexico — Aug 2023 – Aug 2024

- Mapped femicides in Nuevo León using GIS tools and contributed to a predictive model for the metropolitan area of Monterrey.
- Helped identify support networks and areas of social backwardness to assist social organizations.

Peer Tutor – **Calentando Ideas**, Monterrey, Mexico — Feb 2023 – Jun 2023

- Provided physics tutoring and mentoring for high-school students facing academic difficulties.
- Helped students prepare for quizzes and exams, improving their performance and confidence.

AWARDS & HONOURS

Academic Talent Scholarship, Tecnológico de Monterrey — 2021–2025
First Place – Quantum Hackathon 2023, Tecnológico de Monterrey
3rd Place – Expo Ingenierías FI2025, "Physical Prototype Development" category — 2025

TECHNICAL SKILLS

Programming & Scientific Computing:
Python, MATLAB, Julia, C++; data science libraries (NumPy, SciPy, Pandas, Matplotlib); optimisation and scientific simulation workflows.

Simulation & Modelling:
Geant4; custom PIC/MHD/two-fluid plasma codes; numerical methods for ODEs and PDEs; Fourier and spectral techniques.

RF, Antennas & Experimental Skills:
Basic RF link design; patch/fractal antenna design on FR4 (KiCad); S-band CubeSat communications prototype; optical laboratory techniques (interferometry, diffraction, spectroscopy); basic electronics and instrumentation.

Data Science & Analysis:
Statistical modelling, basic machine learning (regression, classification), data visualisation and exploratory data analysis.

LANGUAGES

Spanish – Native (C2)
English – Advanced (C1, TOEFL iBT 98)
German – Elementary (A2)