

Vinícius Bastos Marcos

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Profile

I hold a Bachelor's degree in Computational Physics from the São Carlos Institute of Physics (IFSC-USP), where I conducted research on electromagnetic simulations using the Finite-Difference Time-Domain (FDTD) method to investigate the optical properties of plasmonic structures, supported by a FAPESP scholarship. Currently, I am a direct-entry PhD student in Experimental and Theoretical Physics at IFSC-USP, also funded by FAPESP.

My research focuses on the investigation of matter structures and metasurfaces through the integration of numerical modeling with artificial intelligence techniques, particularly Deep Neural Networks (DNNs) and Physics-Informed Neural Networks (PINNs). My goal is to apply machine learning to the inverse design of nanophotonic devices, exploring phenomena such as strong light-matter coupling, polariton formation, and optical interactions in two-dimensional (2D) materials.

My academic interests include computational physics, plasmonics, nanophotonics, and quantum optics, with an emphasis on the use of computational methods and machine learning. I aim to contribute to the advancement of emerging optical technologies and to strengthen the interface between machine learning and fundamental physics.

Education

University of São Paulo, PhD in Experimental and Theoretical Physics Feb 2025 - present

- Subject: Inverse Design and Optimization of Nanophotonic Devices for Integrated Photonics and Quantum Technologies
- GPA: 4.0/4.0 (A)

University of São Paulo, Bachelor of Science in Computational Physics Mar 2021 – Dec 2024

- GPA: 3.5/4.0
- Coursework: Data Science, High Performance Programming, Quantum Information, Data Structures, Linear Algebra, Computational Physics, Numerical Analysis, Calculus, Experimental Physics

Publications

Tunable Periodicity in Metal Nanogratings for Optimized Plasmon-Enhanced Upconversion Luminescence in Er³⁺/Yb³⁺ Co-doped PGG Glasses Dec 2024

J.F.M. dos Santos, *V.B. Marcos*, L.R.P. Kassab, E. Marega Jr.

10.1016/j.jlumin.2024.121020

Scholarships and Prizes

Inverse Design and Optimization of Nanophotonic Devices for Integrated Photonics and Quantum Technologies, Doctorate (Direct) FAPESP Scholarship; Process: 2025/10637-3 Nov 2025 - present

- Advisor: Prof. Dr. Euclides Marega Junior
- Nanoplasmonics Group, CePOF, São Carlos Institute of Physics, University of São Paulo
- Awarded the PhD scholarship based on academic merit and the strength of this research proposal.
- Currently developing a research project focused on the investigation of matter structures and metasurfaces through the integration of numerical modeling with artificial intelligence techniques, particularly Deep Neural Networks (DNNs) and Physics-Informed Neural Networks (PINNs). The main goal is to apply machine learning to the inverse design of nanophotonic devices, exploring phenomena such as strong light-matter coupling, polariton formation, and optical interactions in two-dimensional (2D) materials.

Machine Learning-Assisted Design of Plasmonic Metasurfaces, CAPES PROEX Master's Scholarship; Process: 88887.116494/2025-00 Feb 2025 - Oct 2025

- Advisor: Prof. Dr. Euclides Marega Junior
- Nanoplasmonics Group, CePOF, São Carlos Institute of Physics, University of São Paulo

- Awarded the Master's scholarship based on academic merit.
- Currently developing a research project focused on creating an advanced framework for designing nanophotonic metasurfaces by integrating Finite-Difference Time-Domain (FDTD) simulations with machine learning. The goal is to significantly accelerate the design of novel, high-performance optical components for applications in quantum communication, sensing, and integrated photonics.

Study of the Optical Properties of Plasmonic Structures Using Numerical Simulation, FAPESP Undergraduate Research Fellow Scholarship; Process: 2023/05726-1

Jan 2024 - Dec 2024

- Advisor: Prof. Dr. Euclides Marega Junior
- Nanoplasmonics Group, CePOF, São Carlos Institute of Physics, University of São Paulo
- The presented project aims to systematically study the optical properties of metallic nanostructures composed of a set of metallic slits whose lateral dimensions are smaller than the wavelength of the incident radiation. These nanostructures are fabricated on a metallic film deposited on a dielectric substrate. The study will be conducted through numerical simulations using the Finite-Difference Time-Domain (FDTD) method. From this study, properties will be determined such as: i) extraordinary optical transmission spectrum; ii) reflectance spectrum and determination of resonances; iii) profiles of the evanescent field formed at the dielectric-metal interface. Such studies will be used in the fabrication of nanostructures for investigating the interaction of surface plasmon-polaritons with quantum emitters.

Study of the Optical Properties of Plasmonic Structures Using Numerical Simulation, CNPq-PIBIC Undergraduate Research Fellow Scholarship; Project: 2023-2454

Sep 2023 - Dec 2023

- Advisor: Prof. Dr. Euclides Marega Junior
- Nanoplasmonics Group, CePOF, São Carlos Institute of Physics, University of São Paulo
- The project was interrupted to be continued under a FAPESP scholarship.

CNPq Scholarship - National Institutes of Science and Technology Program; Undergraduate Research Fellow, Process: 117506/2022-2.

Sep 2022 - Aug 2023

- Advisor: Prof. Dr. Euclides Marega Junior
- Nanoplasmonics Group, CePOF, São Carlos Institute of Physics, University of São Paulo
- The project itself served as a starting point for the subsequent project. In it, I studied and became familiar with the concepts of Plasmonics, Nanophotonics, and simulation using the FDTD method, simulating some initial and simpler examples. CNPq Scholarship - National Institutes of Science and Technology Program; Process: 117506/2022-2. The project itself served as a starting point for the subsequent project. In it, I studied and became familiar with the concepts of Plasmonics, Nanophotonics, and simulation using the FDTD method, simulating some initial and simpler examples.

National Science Olympics, Gold Medal

2019

Mathematical Kangaroo Brazil, Merit Medal

2019

Academic Events: Participations and Presentations

B-RMS 2025 (Congress)

2025

Poster Presentation: "Machine Learning-Optimized Plasmonic Metasurfaces for Tailored Light-Matter Interactions at the Nanoscale", *V.B. Marcos, J.F.M. dos Santos, E. Marega Jr.*

32nd SIICUSP and SIFSC 14 (Congress)

2024

Poster Presentation: "Extraordinary Optical Transmission in Periodic Plasmonic Gratings: A Finite-Difference Time-Domain Approach", *V.B. Marcos, J.F.M. dos Santos, E. Marega Jr.*

B-RMS 2024 (Congress)

2024

Poster Presentation: "Study of the Optical Properties of Plasmonic Structures Using Numerical Simulation", *V.B. Marcos, J.F.M. dos Santos, E. Marega Jr.*

32nd annual International Laser Physics Workshop (Congress)

2024

I International Symposium for Undergraduate Students in Photonics (ISUSP) (Symposium)

2024

Poster Presentation: "Study of the Optical Properties of Plasmonic Structures Using Numerical Simulation",
V.B. Marcos, J.F.M. dos Santos, E. Marega Jr.

SiRFoton (Symposium) 2024
IFGW 2024 Summer School (Summer School) 2024
SIFSC 13 (Congress) 2023

Poster Presentation: "Estudo das Propriedades Ópticas de Estruturas Plasmônicas Usando Simulação Numérica",
V.B. Marcos, J.F.M. dos Santos, E. Marega Jr.

Teaching Assistant

7600112 - Physics A for Environmental Engineering April 2022 - Jul 2022

I worked as a teaching assistant for the course 7600112 - Physics A for Environmental Engineering, offered in the Environmental Engineering Bachelor's program (EESC-USP). My responsibilities included grading extra exercises, addressing student questions online, and preparing and conducting tutoring sessions, aligned with the content taught by the professor in class.

Relevant Courses

Computational infrastructure for AI and container usability: an introduction to HPC cluster initiatives - ICMC-USP (2025)

Machine Learning 2025 - DATA (ICMC-USP)

Four Methods to Numerically Solve the Time-Independent Schrödinger Equation - SBF minicourses

An Introduction to Artificial Intelligence in Physics - SBF minicourses

Technologies

Programming Languages: Python, Julia, Fortran, C, Octave

Technologies: Pytorch, LaTeX, LUMERICAL, MEEP, Blender, Canva, Basic Excel, Kdenlive

Languages

Portuguese - native

English - bilingual proficiency

Community Engagement Projects

Optica Student Chapter Member April 2024 - present

Engaging in chapter activities including technical seminars, professional networking events, and science outreach initiatives to advance my knowledge and connections in the optics and photonics community.

Social Media Manager and Designer of Nanoplasmonics IFSC-USP Oct 2023 - present

- I manage the online presence of the Nanoplasmonics Group, creating engaging content that highlights our latest research, publications, and events. I design posts and templates for Instagram to promote our work, share newly published studies, and showcase the group's research scope. Additionally, I coordinate event dissemination, ensuring our scientific contributions reach a broader audience through visually appealing and well-structured content. Through strategic content planning, I enhance the group's visibility, foster collaboration, and promote our research in plasmonics, nanophotonics, and advanced materials.

- Linktree link.

Mentor, Academic Guidance I and II - Computational Physics Mar 2024 - Dec 2024

- Selected to mentor a group of first-year students in the Computational Physics program as part of the Academic Guidance I and II courses (7600011/7600012).
- Provided guidance on academic planning, course selection, study strategies, and integration into the university environment.

Student Representative, Undergraduate Studies Council (CoG-USP) Aug 2023 - Jul 2024

- Elected to represent the students on the university's central council responsible for the academic governance of

all undergraduate programs across USP's 8 campuses.

- Deliberated and voted on strategic university-wide policies, including curriculum creation and reform, academic regulations, and standards for admission and evaluation.
- Directly engaged in policy debates and strategic planning with University Deans (Pró-Reitores), faculty leaders, and representatives from all of USP's academic institutes and faculties.
- Held the unique position of being the sole student representative for all USP campuses outside the capital (the "interior").

Student Representative, Library and Information Services (SBI-IFSC-USP)

Aug 2023 - Jul 2024

Elected by my peers to act as the primary liaison between the student body and library

Secretary, CEFiSC (Physics Academic Center)

Nov 2022 - Mar 2024

- Acted as the designated substitute for the President and co-managed the organization's strategic planning.
- Elected to the board as part of the "1905" slate. Elected in a landslide victory, securing a clear and powerful mandate from the student body.
- Managed internal operations and represented the student body's interests to the faculty.

Director of USP Central Student Union (DCE Livre "Alexandre Vannucchi Leme")

Mar 2022 - Jul 2022

- Part of the "Nossa Voz" elected slate.
- Acted as the official representative and key organizer for the DCE on the São Carlos campus.
- Led local campaigns, mobilized the student community, and served as the primary liaison between the central board in the capital and the students in São Carlos.