

Gustavo Madeira

Curriculum Vitae

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Profile

I am a PhD in Physics, with emphasis on Position Astronomy and Celestial Mechanics, and currently hold a Post-doctoral Researcher position at the Institut de Physique du Globe de Paris (IPGP), France. My research covers the formation of satellites, physics of planetary rings, circumplanetary disks, and the dynamic evolution of small bodies in the Solar System. I use numerical simulations and analytical development in orbital dynamics, with a focus on connecting both.

Research Topics

- **Satellite formation:** accretion in circumplanetary disks and rings, pebble accretion, gas-driven migration, tides, and ring torques.
- **Giant impacts:** formation of the Moon, formation of Phobos and Deimos.
- **Composition:** composition of the Moon, exoplanets' atmosphere.
- **Small bodies:** formation of binary systems, rings, and dynamics around small bodies.
- **Perturbations on small bodies:** solar radiation, plasma drag, Lorentz forces, tides, and Yarkovsky effect.
- **Ring dynamics:** stability and formation of planetary rings and arcs.
- **Small impacts:** dust production due to meteoroid impacts.

Academic Background

2019–2023 **PhD in Physics**, São Paulo State University, UNESP, Brazil.

Title: Exploring models of formation and dynamic evolution of satellites and rings of the Solar System

Advisor: Silvia Maria Giulietti Winter

Co-advisor: André Izidoro Ferreira da Costa

Abroad Internship (2021–2022): Institut de Physique du Globe de Paris, France

Supervision: Sébastien Charnoz

Scholarship: São Paulo Research Foundation (FAPESP)

2016–2019 **Master's in Physics**, São Paulo State University, UNESP, Brazil.

Title: Study of the orbital evolution of particles in corotation and Lindblad resonance under the influence of co-orbital satellites: application to planetary arcs

Advisor: Silvia Maria Giulietti Winter

Scholarship: São Paulo Research Foundation (FAPESP)

2012–2016 **Bachelor in Physics**, São Paulo State University, UNESP, Brazil.

Title: Dynamics of micrometric particles in Saturn's G ring arc

Advisor: Silvia Maria Giulietti Winter

Scholarship: São Paulo Research Foundation (FAPESP)

Postdoctoral

2023-2025 **Institut de Physique du Globe de Paris**, France.

Project: Modeling of volatile loss from the Moon

Funding: European Research Council (ERC)

Supervisor: Frederic Moynier

Involvement in Space Missions

2023- **HERA Mission**, European Space Agency (ESA), member of the Dynamics team (Working Group 3).

2023 **DART Mission**, National Aeronautics and Space Administration (NASA), member of the Investigation team.

Teaching Experience

2019 **Substitute Professor**, Differential and Integral Calculus, 4 hours per week, 1 semester.

2019 **Substitute Professor**, Mathematics applied to materials engineering, 3 hours per week, 1 semester.

Complementary Formation

2023 **COSPAR Capacity Building Workshop Planetary Sciences Data Analysis**, 70 hours, Committee on Space Research, COSPAR, Chile.

2019 **XXIV Special Courses Cycle**, 24 hours, National Observatory, ON, Brazil.

2018 **Third Astrobiology School at National Observatory**, 30 hours, National Observatory, ON, Brazil.

2017 **XXI Special Courses Cycle**, 24 hours, National Observatory, ON, Brazil.

Fundings

2023–2025 **Modeling of volatile loss from the Moon**.

Funding: European Research Council (ERC)

Process: METAL 101001282

2021–2022 **Tidal evolution of Mars' moons: satellite destruction and fall onto Mars and its implications for the MMX/JAXA mission**.

Funding: São Paulo Research Foundation (FAPESP)

Process: 2021/07181-7

2019–2019 **Supervised Teaching Internship**.

Funding: Guaratinguetá School of Engineering (FEG)

- 2019–2022 **Scenarios for the formation of Neptune's arcs and the large satellites of the gas giants.**
 Funding: São Paulo Research Foundation (FAPESP)
 Process: 2018/23568-6
- 2017–2019 **Study of the orbital evolution of particles in Lindblad and corotation resonance under the influence of co-orbital satellites: application to planetary arcs.**
 Funding: São Paulo Research Foundation (FAPESP)
 Process: 2016/24488-0
- 2013–2016 **Study of the electromagnetic force effect on small planetary ring particles.**
 Funding: São Paulo Research Foundation (FAPESP)
 Process: 2013/05803-4

Honours

- 2017 **Academic Excellence Award**, *Guaratinguetá School of Engineering (FEG)*, for my research work during my bachelor's degree in Physics.

Bibliometric data

H=5, 74 citations (Source: Google Scholar), 15 articles in international peer reviewed journals, 9 articles as first author.

Publications

- Madeira, G., Charnoz, S., Rambaux, N., & Robutel, P. (2024). Long-term dust dynamics in the Didymos and Dimorphos system: Production, stability, and transport. *Icarus*, 115997.
- Madeira, G., & Charnoz, S. (2024). Revisiting Dimorphos formation: A pyramidal regime perspective and application to Dinkinesh's satellite. *Icarus*, 115871.
- Giulietti Winter, S., Madeira, G., Ribeiro, T., Winter, O. C., Barbosa, G. O., & Borderes-Motta, G. (2023). The stability around Chariklo and the confinement of its rings. *Astronomy & Astrophysics*, 679, A62.
- Ribeiro, T., Winter, O. C., Madeira, G., & Giulietti Winter, S. M. (2023). Dynamics around non-spherical symmetric bodies: II. The case of a prolate body. *Monthly Notices of the Royal Astronomical Society*, 525(1), 44–56.
- Madeira, G., Charnoz, S., & Hyodo, R. (2023). Dynamical origin of Dimorphos from fast spinning Didymos. *Icarus*, 394, 115428.
- Madeira, G., Charnoz, S., Zhang, Y., Hyodo, R., Michel, P., Genda, H., & Winter, S. G. (2023). Exploring the recycling model of Phobos formation: rubble-pile satellites. *The Astronomical Journal*, 165(4), 161.
- Madeira, G., & Giulietti Winter, S. M. (2022). Numerical analysis of processes for the formation of moonlets confining the arcs of Neptune. *Monthly Notices of the Royal Astronomical Society*, 513(1), 297–309.
- Hyodo, R., Genda, H., Sekiguchi, R., Madeira, G., & Charnoz, S. (2022). Challenges in Forming Phobos and Deimos Directly from a Splitting of an Ancestral Single Moon. *The Planetary Science Journal*, 3(8), 204.
- Madeira, G., Giulietti Winter, S. M., Ribeiro, T., & Winter, O. C. (2022). Dynamics around non-spherical symmetric bodies—I. The case of a spherical body with mass anomaly. *Monthly Notices of the Royal Astronomical Society*, 510(1), 1450–1469.

- Muñoz-Gutiérrez, M. A., Granados Contreras, A. P., Madeira, G., A'Hearn, J. A., & Giulietti Winter, S. (2022). Long-term dynamical evolution of Pallene (Saturn XXXIII) and its diffuse, dusty ring. *Monthly Notices of the Royal Astronomical Society*, 511(3), 4202-4222.
- Madeira, G., Izidoro, A., & Giulietti Winter, S. M. (2021). Building the Galilean moons system via pebble accretion and migration: a primordial resonant chain. *Monthly Notices of the Royal Astronomical Society*, 504(2), 1854-1872.
- Gaslac Gallardo, D. M., Giulietti Winter, S. M., Madeira, G., & Muñoz-Gutiérrez, M. A. (2020). Analysing the region of the rings and small satellites of Neptune. *Astrophysics and Space Science*, 365(1), 5.
- Madeira, G., & Giulietti Winter, S. M. (2020). Effects of immersed moonlets in the ring arc particles of Saturn. *The European Physical Journal Special Topics*, 229(8), 1527-1543.
- Giulietti Winter, S. M., Madeira, G., & Sfair, R. (2020). Neptune's ring arcs confined by coorbital satellites: dust orbital evolution through solar radiation. *Monthly Notices of the Royal Astronomical Society*, 496(1), 590-597.
- Madeira, G., Sfair, R., Mourão, D. C., & Giulietti Winter, S. M. (2018). Production and fate of the G ring arc particles due to Aegaeon (Saturn LIII). *Monthly Notices of the Royal Astronomical Society*, 475(4), 5474-5479.

Journal Reviewer

2023– **The European Physical Journal Special Topics**.

2022– **Monthly Notices of the Royal Astronomical Society**.

Media Presence

Comments

- The new missions of NASA and the European Space Agency to Jupiter. *Revista Veja*. 2023.

Interviews

- Who is the Brazilian scientist who made a discovery about an asteroid and was involved in NASA missions. *Jornal Estado de São Paulo*. 2023
- Research solves the enigma of the shape of the asteroid targeted in the first planetary defense experiment. *Jornal da UNESP*. 2023
- Article proposes a new hypothesis for the origin of the Galilean moons. *Jornal da UNESP*. 2021.