

Anna Maria Gargiulo

ABOUT ME: I am a Postdoctoral researcher at the Department of Mechanical and Aerospace Engineering (DIMA), Sapienza University of Rome, where I received my Ph.D. in Aeronautical and Space Engineering in 2025. As a member of the SPRING Lab, my research focuses on optical navigation for rovers and deep space probes, AI-assisted characterization of geological features on planetary surfaces, and investigation of planetary interiors. I am also a Postdoctoral Affiliate with the Gravity/Radio Science (G/RS) Team of NASA's Europa Clipper mission. During my participation in the JPL Visiting Student Research Program (JVS RP) in the final year of my PhD, under the supervision of Dr. Bhaskaran and Dr. Bradley, I focused on AI strategies to support optical data processing for the orbit determination of deep space probes. This collaboration resulted in a conference paper at the AAS/AIAA Astrodynamics Specialist Conference 2025 (Gargiulo et al 2025).

WORK EXPERIENCE

Department of Mechanical and Aerospace Engineering, Sapienza University of Rome – Rome, Italy

City: Rome | **Country:** Italy

Research Fellow

[10/12/2024 – Current]

Current research topics:

- Developing a Markov Chain Monte Carlo (MCMC)-based inference framework to retrieve the likely interior structure of rocky planets, such as Venus, by combining geophysical constraints with compositional modelling;
- Designing a navigation strategy that fuses optical-based direction of motion (DoM) measurements with radio tracking data to enhance orbit determination accuracy.
- Investigating AI-assisted techniques for the automated characterization of geological features on planetary surfaces, with applications in autonomous navigation and surface mapping.

EDUCATION AND TRAINING

[01/11/2021 – 31/01/2025; Defence date: 27/05/2025]

Ph.D. in Aeronautics and Space Engineering - Sapienza University of Rome

City: Rome | **Country:** Italy | **Thesis:** Geophysical investigations of celestial bodies' atmosphere, surface and interior through Bayesian and ML-based techniques (Advisor: Prof. Maria Marsella)

[08/03/2021 – 02/03/2022]

Master in Satellites Systems and Services - Sapienza University of Rome

City: Rome | **Country:** Italy | **Final grade:** Cum Laude | **Thesis:** Multi Modal Cooperative PVT Solution Supporting Lunar User Assets Guidance and Navigation (Advisors: Prof. Paolo Gaudenzi, Eng. Giuseppe Tomasicchio)

[09/2018 – 23/10/2020]

M. Sc. in Aeronautical and Space Engineering - Sapienza University of Rome

City: Rome | **Country:** Italy | **Final grade:** Cum Laude | **Thesis:** Safe Navigation on Planetary Surfaces (Advisor: Prof. Antonio Genova)

[09/2015 – 24/07/2018]

B. Sc. In Aerospace Engineering - Sapienza University of Rome

City: Rome | **Country:** Italy | **Final grade:** Cum Laude | **Thesis:** Aeroelastic and Command Reversal Study of an Arrow Wing Aircraft (Advisor: Prof. Paolo Gasbarri)

LANGUAGE SKILLS

Mother tongue(s): Italian

Other language(s):

English: LISTENING C2; READING C2; WRITING C2; SPOKEN PRODUCTION C2; SPOKEN INTERACTION C2.

French: LISTENING A1; READING A2; WRITING A1; SPOKEN PRODUCTION A1; SPOKEN INTERACTION A1.

Levels: A1 and A2: Basic user; B1 and B2: Independent user; C1 and C2: Proficient user

SKILLS

Software: Microsoft Office / AGIs STK(Systems Tool Kit) / GMAT / ArcGIS, ESRI, QGIS, EPANET, Google Earth Pro / ENVI / Blender / MSC PATRAN/NASTRAN / IDM-CIC / SNAP.

Libraries/Frameworks: Gazebo (Robotics simulator) / ROS2 / OpenCV / SHTools / Pytorch, Tensorflow / PyALMA / Pandas / NASA-MONTE / NASA Ames Stereo Pipeline (ASP) / USGS ISIS / SPICE NAIF.

Programming Languages: MATLAB / C++ / Python (computer programming) / Linux/Unix Scripting.

Organizational/Managerial skills: Team working, Problem-solving, Goal-oriented, Willingness to learn.

RESEARCH AND INTERNSHIP EXPERIENCE

[05/08/2024 – 06/12/2024]

Visiting Student at NASA Jet Propulsion Laboratory (JPL)

Research activity “Spacecraft's Orbit determination through AI-based Direction of Motion Measurement” at NASA Jet Propulsion Laboratory, Pasadena, CA, US, under the JPL Visiting Student Research Program (JVS RP)

- Mentors: Dr. Shyam Bhaskaran and Dr. Nick Bradley.
- Developed an AI-assisted framework to process image pairs and identify matching landmarks using deep learning pretrained models such as SuperPoint and SuperGlue.
- Designed a validation procedure to assess matching accuracy in synthetic environments.
- Implemented a pipeline to evaluate the spacecraft's direction of motion (DoM) from tracked image features, following the method presented in Christian J. et al. 2021.
- Developed an estimation strategy to integrate the DoM observables into a navigation framework for posterior trajectory reconstruction (batch LS filter), including the computation of required partial derivatives for state estimation.
- Validated the proposed navigation strategy in orbital scenarios around the Moon and Vesta, demonstrating its potential as an alternative optical navigation (OpNav) technique during acquisition gaps of radio tracking data.

[07/2023]

Visiting Student at Cornell University

Research activities at Cornell University, Ithaca, NY, US, as part of the research project “Sensor Data Fusion Techniques for Geophysical Investigations and Precise Orbit Determination of Interplanetary Spacecraft” in collaboration between the research groups of Prof. Antonio Genova at the University of Rome, Sapienza, and Prof. Jonathan I. Lunine, David C. Duncan Professor in Physical Sciences at Cornell University and director of the Cornell Center for Astrophysics and Planetary Science (CCAPS).

[22/07/2021 – 31/12/2021]

Internship at Telespazio S.p.a.

Research activity focused on the analysis of multi-modal Cooperative PVT & COMMS solutions for Lunar/planetary surface user segment in the framework of the ESA's Moonlight program, carried out as part of the second-level Master's program in Satellites Systems and Services at the Concurrent & Collaborative Design Facility (C2DF) at Telespazio S.p.a. Rome, Italy, under the mentorship of Eng. Giuseppe Tomasicchio.

HONOURS AND AWARDS

- 2022 Best Student Presentation Award at the virtual NAVITEC 2022 Conference within the track "Navigation in space and science".
- 2019-2020 Excellence Path in Space and Astronautical Engineering Sapienza University of Rome.
- 2017-2018 Excellence Path in Aerospace Engineering Sapienza University of Rome.

ACADEMIC ROLES/ACTIVITIES/MEMBERSHIP

[2025 – Current] **EUROPLANET SOCIETY Membership**

[2025 – Current] **American Institute of Aeronautics and Astronautics (AIAA) Membership**

[2025 – Current] **Postdoc affiliate with the Gravity/Radio Science team of NASA's Europa Clipper mission.**

[2025 – Current] **Subject Expert (Cultore della Materia)**

- Supported exam sessions for the Space Exploration Systems (BSc) and Space Robotic Systems (MSc) courses.
- Mentored BSc and MSc theses in Aerospace Engineering.

[2022 – Current] **American Geophysical Union (AGU) Associate Membership**

[2022 – Current] **Member of the SPRING (SPace Robotics INvestigation Group) research group led by Prof. Antonio Genova.**

[2015 – Current] **Member of the SIGMA Group - Liceo Scientifico Statale Teresa Gullace, Rome.**

[2015 – 2016] **Taught the preparation course for the Archimedes Games - Liceo Scientifico Statale Teresa Gullace, Rome.**

PUBLICATIONS

Journal Articles

[2025]

Neural Network-Aided Optical Navigation for Precise Lunar Descent Operations

(doi.org/10.3390/aerospace12030195)

Authors: Andolfo, S., Genova, A., Buonomo, F. V., Gargiulo, A. M., El Awag, M., Federici, P., Teodori, R., La Grassa, R., Re, C., & Cremonese, G. | Journal Name: Aerospace | Volume, Issue and Pages: Vol 12, p195

Real-time onboard orbit propagator for planetary missions

Authors: T. Torrini, A. Genova, S. Andolfo, A. M. Gargiulo, P. Federici, R. Teodori and M. Ciambellini | Journal Name: Astrodynamics (in press)

[2024]

Water ice concentration and distribution in the Martian south polar layered deposits constrained by the lateral variations of their bulk density (doi.org/10.1016/j.icarus.2024.116025)

Authors: Genova, A., Petricca, F., Andolfo, S., Gargiulo, A.M., Sulcanese, D., Mitri, G., Chiarolanza, G. | Journal Name: Icarus | Volume, Issue and Pages: vol 414, p 116025 | Publisher: Elsevier

Gravity Investigation to Characterize Enceladus's Ocean and Interior (doi.org/10.3847/PSJ/ad16df)

Authors: Genova, A., Parisi, M., Gargiulo, A.M., Petricca, F., Andolfo, S., Torrini, T., Del Vecchio, E., Glein, C.R., Cable, M.L., Phillips, C.B., Bradley, N.E., Restrepo, R.L., Mages, D.M., Babuscia, A. and Lunine, J.I | Journal Name: PSJ | Volume, Issue and Pages: Vol.5, p.40

Joint determination of Venus gravity and atmospheric density through EnVision radio science investigation (doi.org/10.1016/j.actaastro.2023.12.010)

Authors: Gargiulo, A.M., Genova, A., Petricca, F., Del Vecchio, E., Andolfo, S., Torrini, T., A., Rosenblatt, P., Lebonnois, S., Marty, J.C., Doumulin, C. | Journal Name: Acta Astronautica | Volume, Issue and Pages: Vol 215, p 725-738 | Publisher: Elsevier

First Analysis of BepiColombo Radio Science and Accelerometer Data Acquired During Venus and Mercury Flybys (doi.org/10.1109/TAES.2024.3381582)

Authors: Del Vecchio, E., Gargiulo, A.M., Petricca, F., Genova, A., Andolfo, S., Cappuccio, P., De Filippis, U., Lefevre, C., Lucente, M., Magnifico, C., Santoli, F., Iess, L., Benedetto, C., Benkhoff, J. | Journal Name: IEEE Transactions on Aerospace and Electronic Systems | Volume, Issue and Pages: Vol. 60, Issue 4, p 5604 - 5612

[2021]

Model-Based Slippage Estimation to Enhance Planetary Rover Localization with Wheel Odometry (doi.org/10.3390/app11125490)

Authors: Gargiulo, A.M., di Stefano, I., Genova, A. | Journal Name: Applied Sciences | Volume, Issue and Pages: Vol 11, p 5490

Conference Proceedings

[2025]

Direction of Motion-based Optical Navigation Using Deep Learning: Methods and Results from Dawn at Vesta

Authors: Gargiulo, A.M., Bhaskaran, S., Bradley, N., Vaughan, A.T., Lubey, D.P., Mages, D.M., Andolfo, S., Torrini, T., and Genova, A. | Journal Name: 2025 AAS/AIAA Astrodynamics Specialist Conference

An AI-assisted Vision-based Navigation Approach for Pinpoint Lunar Landing: Development, Validation and Testing

Authors: Andolfo, S., El Awag, M., Buonomo, F.V., Gargiulo, A.M., Cavalieri, L., and Genova A. | Journal Name: 2025 AAS/AIAA Astrodynamics Specialist Conference

EnVision Radio Science and Altimetric Data Processing for Orbit Determination

Authors: Torrini, T., Genova, A., Andolfo, S., Gargiulo, A.M., Rosenblatt, P., et al. | Journal Name: 2025 IEEE Aerospace Conference ([10.1109/AERO63441.2025.11068487](#))

[2024]

Sensor Data Fusion for Precise Orbit Determination of Interplanetary Spacecraft

Authors: Genova, A., Andolfo, S., Ciambellini, M., Federici, P., Teodori, R., Torrini, T., Zavoli, A., Del Vecchio, E., Gargiulo, A.M., Petricca, F., De Matteis, G., and Cottini V. | Journal Name: 2024 IEEE 1st International Conference on Space Robotics (iSpaRo) ([10.1109/iSpaRo60631.2024.10688208](#))

Optical and radio data fusion for spacecraft navigation and geophysical investigations

Authors: Ciambellini, M., Andolfo, S., Del Vecchio, E., Genova, A., Gargiulo, A.M., et al. | Journal Name: 75th International Astronautical Congress (IAC) ([10.52202/078368-0130](#))

[2022]

Semi-Autonomous Guidance, Navigation and Control System for Planetary Rovers

Authors: Andolfo, S., Del Vecchio, E., Gargiulo, A.M., Petricca, F., and Genova, A. | Journal Name: 73rd International Astronautical Congress (IAC) 2022.

Lunar Surface exploration based on LCNS orbiters and Onboard Sensor observables

Authors: Tomasicchio, G., Gargiulo, A.M., Genova, A., Marsella, M., Andolfo, S., Del Vecchio, E., Petricca, F., Rodriguez, F., Albanese, C. | Journal Name: 73rd International Astronautical Congress (IAC) 2022

Accurate Lunar Surface PNT based on LCNS Orbiter Sources and Onboard Sensor Fusion

Authors: Tomasicchio, G., Albanese, C., Rodriguez, F., Spazzacampagna, L., Gargiulo A.M., Gaudenzi, P., Genova, A., Giordano, P., Zoccarato, P., Swinden, R., Ventura-Traveset, J. | Journal Name: NAVITEC 2022

[2021]

Numerical Simulations for Planetary Rovers Safe Navigation and LIDAR Based Localization

Authors: Gargiulo, A.M., di Stefano, I., Genova, A. | Journal Name: IEEE 8th International Workshop on Metrology for AeroSpace (MetroAeroSpace), 2021 | Volume, Issue and Pages: p 418-423
([10.1109/MetroAeroSpace51421.2021.9511774](#))

CONFERENCES AND SEMINARS

[23/10/2025] Nantes, France

Seminar at Nantes University

- Gargiulo, A.M., Genova, A., Ciambellini, M., Torrini, T., Rosenblatt, P., Tobie, G., and Dumoulin C. "Constraining Venus' interior structure using existing geophysical observations and implications for EnVision", hosted at Nantes University.

[07/09/2025 – 12/09/2025] Helsinki, Finland

EPSC-DPS Joint meeting 2025

- Gargiulo, A.M., Genova, A., Ciambellini, M., Torrini, T., Tobie, G., Rosenblatt, P., and Dumoulin C (2025) "Inferring Venus interior structure based on present geophysical constraints"

[25/08/2025 – 28/08/2025] Eugene, OR, US (Online participation)

Europa Clipper PSG-15 Meeting

[03/02/2025 – 07/02/2025] Pescara, Italy

Congresso Nazionale di Scienze Planetarie

- Gargiulo, A.M., Genova, A., Ciambellini, M., Torrini, T., Cottini, V. (2025) "Inferring Venus interior structure based on present and expected geophysical constraints"

[07/10/2024 – 11/10/2024] Cocoa Beach, FL, US

Europa Clipper PSG-14 Meeting

[14/04/2024 – 19/04/2024] Vienna, Austria

European Geoscience Union (EGU) General Assembly 2024

- Gargiulo, A. M., Genova, A., Petricca F., Del Vecchio, E., Andolfo, S., Torrini, T., A., Rosenblatt, P., Lebonnois, S., Marty, J.C., Doumulin, C. (2024). “Estimation of Venus' atmospheric density through EnVision precise orbit determination”

[11/12/2023 – 15/12/2023] San Francisco, CA, US

AGU Fall Meeting 2023

- Gargiulo, A. M., Genova, A., Petricca F., Del Vecchio, E., Andolfo, S., Torrini, T., A., Rosenblatt, P., Lebonnois, S., Marty, J.C., Doumulin, C. (2023). “Joint Determination of Venus Gravity and Atmospheric Density through EnVision Radio Science Investigation”.
- Gargiulo, A.M., Guerrero Tello, J.F., Marsella, M., Coltelli, M., Genova, A. (2023). “A Deep-Learning Approach for the Detection and Mapping of Volcanic and Tectonic Features on Mars”.
- Genova, A., Parisi, M., Gargiulo, A.M., Petricca, F., Andolfo, S., Del Vecchio, E., Torrini, T., Glein, C.R., Cable, M.L., Phillips, C.B., Bradley, N.E., Restrepo, R.L., Babuscia, A., Mages, D.M., and Lunine, J.I. (2023). “Gravity Investigation of a Mission Concept to constrain Enceladus' Internal Structure”.
- Del Vecchio, E., Gargiulo, A. M., Petricca, F., Genova, A., Andolfo, S., Cappuccio, P., Iess, L., Lefevre, C., Lucente, M., Magnafico, C., De Filippis, U., Santoli, F., Benkhoff, J. (2023). “First Analysis of BepiColombo Radio Science and Accelerometer Data Acquired During Venus and Mercury Flybys”.

[24/10/2023 – 26/10/2023] Marseille, France

Workshop on the Origins and Habitability of Galilean Moons

- Genova, A., Petricca, F., Gargiulo, A.M. (2023). “A Bayesian Inference Framework to Determine the Internal Structure of Icy Moons with Geophysical Constraints”.

[08/05/2023 – 11/05/2023] Berlin, Germany

2023 EnVision Workshop

- Gargiulo, A.M., Petricca, F., Genova, A., Rosenblatt, P., Doumulin, C., Marty, J.C., Lebonnois, S. (2023). “Atmospheric Drag Effects on the Precise Orbit Determination of the EnVision Spacecraft”.

[12/12/2022 – 16/12/2022] Chicago, IL, US

AGU Fall Meeting 2022

- Gargiulo, A.M., Guerrero Tello, J.F., Moriero, I., Coltelli, M., Marsella, M., Genova, A. (2022). “Artificial Intelligence Techniques applied to Remote Sensing data for Volcano-Tectonic Features Extraction”.
- Gargiulo, A.M., Marsella, M., Genova, A., Coltelli, M. (2022). “Detection of Geological Features on Terrestrial Planets by using Machine Learning”.
- Rosenblatt, P., Genova, A., Petricca, F., Gargiulo, A.M., Dumoulin, C., Tobie, G., Marty, J.C., Lebonnois, S. (2022). “Improving Venus' static and time-variable gravity field with the EnVision Radio Science Experiment”.

[23/05/2022 – 27/05/2022] Vienna, Austria

European Geoscience Union (EGU) General Assembly 2022

- Gargiulo, A.M., Marsella, M., Coltelli, M., Genova, A. (2022). “An approach for volcano-tectonic features extraction using optical and radar remote sensing data”.

[19/04/2021 – 30/04/2021] Online

European Geoscience Union (EGU) General Assembly 2021

- Andolfo, S., Gargiulo, A.M., Di Stefano, I., Petricca, F., and Genova, A. (2021). “Safe navigation and visual odometry-based localization for planetary exploration rovers”.

PROJECTS

[02/2021 – 07/2021]

Research Activity: AVUM Multi-purpose Module Structure Concept Design

Contributed to the research activity coordinated by Prof. Paolo Gaudenzi dedicated to the completion of Task 9/WP9: AVUM Multipurpose Module Structure Concept Design (ESA Work Package STS-DVL ESA Work Order STS-DVI) included in the Technical Support Activities for VEGA-C, VEGA- E and P- 120C Work Order 3.

Rome 24/11/2025