CURRICULUM VITAE

PERSONAL INFORMATION

Name	Riccardo Lasagni Manghi
Date of birth	08/06/1990
Citizenship	Italian
Address	via Tamagno 1, 42122, Reggio Emilia (RE), Italy
E-mail address	riccardo.lasagni@unibo.it

ACADEMIC STUDIES

2021 **PhD in Aerospace Science and Technology** (University of Bologna)

Thesis title: *Orbit Determination Techniques for Space Missions to Small Bodies*

Abstract: The PhD thesis focused on the development of accurate modelling tools to perform orbit determination in the proximity of asteroids and cometary bodies and on their application to the analysis of real data. The testcase for the validation of these tools was represented by the Rosetta mission, for which a re-analysis of the radiometric and astrometric data was performed, resulting in an accurate ephemeris reconstruction for the comet 67P Churyumov-Gerasimenko and in the estimation of its non-gravitational acceleration due to surface outgassing.

2016 **Master's degree in Aerospace Engineering** (108/110, University of Bologna)

Thesis: *Preliminary mission analysis and design for an AIM CubeSat opportunity payload*

2013 **Bachelor's degree in Astronomy** (109/110, University of Bologna)

Thesis: *The Virial theorem and its applications in astrophysics*

OTHER ACADEMIC EXPERIENCES

2019 **Alpbach Summer School** (ESA)

Took part in the 43rd edition of the Alpbach summer school, whose focus was on "Geophysics from space using micro- or nano-satellite constellations", and actively contributed to the preliminary design of the ORPHEUS mission.

2018 **Standardization training course** (ESA)

Took part in an intensive 4-day course held at ESA Academy's Training and Learning Facility in ESEC-Galaxia, Belgium, focused on the ECSS standards and their application to space-related projects.

2015 **BEXUS programme** (ESA, DLR, SNSB)

Took part in the Balloon Experiments for University Students (BEXUS) educational programme, contributing to the development of the A5-UNIBO experiment in quality of test and verification engineer. The experiment was launched from ESA's ground station in Kiruna (Sweden) as part of the BEXUS-18 campaign.

2014 **International Summer Space School** (Samara State University, RU)

Attended a series of courses, organized by the Aerospace Engineering department of the SSU, on topics related to small-satellite systems including: attitude control, guidance and navigation, remote sensing, tethered systems, and CAD modelling.

PREVIOUS WORKING POSITIONS

2021 - present **Post-Doctoral fellowship** (Radioscience and Planetary Exploration Laboratory[1])

The Post-Doc research activities are mostly focused on ESA's Near-Earth Object Modelling and Payloads for Protection (NEO-MAPP) project. Specifically, the candidate is involved in the Data Exploitation

[1] https://site.unibo.it/radioscience-and-planetary-exploration-lab/en

Working Group for which he is responsible of setting-up a dynamical environment and performing orbit determination simulations for the Hera mission, involving a mothercraft and two CubeSats orbiting the binary asteroid system Didymos.

2017 **Research fellowship** (Radioscience and Planetary Exploration Laboratory[1])

The candidate worked in the framework of the ESA project "Development of a Ground Tropospheric Media Calibration System for Accurate Ranging of Space Missions", acting as system engineer for the UNIBO team. He developed and tested a Python software tool for real-time monitoring and controlling of the media calibration system (TDCS) installed at the deep-space ground station in Malargue (Argentina), and performed an end-to-end testbed campaign to assess the TDCS performance using range and range-rate tracking data from the Gaia and BepiColombo missions.

JOB-RELATED EXPERIENCES

2021 - present **Remote Visiting Researcher at ESOC** (European Space Operations Center)

The candidate has been collaborating with the Flight Dynamics team at ESOC, under the supervision of Ruaraidh Mackenzie and Frank Budnik (OPS-GS), performing orbit determination and radio science analyses for the Hera mission using ESA's astrodynamics software GODOT.

2023 **HERA mission** (ESA)

Since 2023 he is a core group member of the HERA Dynamics Working Group (WG3), contributing to the mission development by assessing the sensitivity of the HERA orbit determination performance to the fidelity of the dynamical model.

2022 **Heavy-Metal mission proposal** (ESA, M7)

Contributed to the development of the Heavy-Metal mission proposal to the metallic-type asteroid 216/Kleopatra, assessing the performance of its radioscience experiment through a covariance analysis.

2019 **PROTEUS mission proposal** (NASA, Discovery program)

Contributed to the development of the PROTEUS mission proposal to the main-belt comets 238P and 288P, assessing the performance of its radioscience experiment through a covariance analysis.

2016 **DustCube mission proposal** (ESA, COPINS program)

Contributed to the development of the DustCube proposal to the binary asteroid system Didymos, performing a preliminary orbital analysis for a 3U CubeSat to be deployed by the Hera spacecraft (former AIM) and simulating the performance of its autonomous navigation filter based on optical data.

TEACHING ACTIVITIES

2020 - present The candidate has been involved in the teaching activities of the *Spacecraft Orbital Dynamics and Control* (1st year of the Master Degree in Aerospace Engineering of the University of Bologna), assisting the professor during the oral examinations, setting up training exercises in Python, and acting as co-supervisor for the final thesis of several students.

PERSONAL SKILLS

Native language **Italian**

Other languages

	Overall	Understanding	Speaking	Writing
English	Excellent	C1	C1	C1
French	Fair	B1	B1	A2

Soft skills Excellent relational and public-speaking skills; attitude to teamwork; good level of autonomy

Computer skills Advanced knowledge of: NASA/JPL MONTE, ESA GODOT, NAIF/Spice, Python, MATLAB®, Microsoft Windows, Linux, Microsoft Office.

Basic knowledge of: LaTeX, FORTRAN, Solid Works®, C++.

Hobbies Practices Historical European Martial Arts (HEMA) at agonistic level, speleology, skiing, and mountain trekking.

Volunteering Member of the *Rotary Club* of Reggio Emilia, and involved in scientific outreach activities through "*Minerva, Associazione di Divulgazione Scientifica*".

PUBLICATIONS

2023 Attree, N., Jorda, L., Groussin, O., Agarwal, J., Lasagni Manghi, R., Tortora, P., Zannoni, M., Marschall, R. (2023) "Activity distribution of comet 67P/Churyumov-Gerasimenko from combined measurements of non-gravitational forces and torques". A&A, 670, A170

2023 Lasagni Manghi, R., Bernacchia, D., Casajus, L. G., Zannoni, M., Tortora, P., Martellucci, A., et al. (2023). "Tropospheric Delay Calibration System performance during the first two BepiColombo solar conjunctions". Radio Science, 58, e2022RS007614.

2022 Lombardo, M.; Zannoni, M.; Gai, I.; Gomez Casajus, L.; Gramigna, E.; Manghi, R.L.; Tortora, P.; Di Tana, V.; Cotugno, B.; Simonetti, S.; Patruno, S.; Pirrotta, S. "Design and Analysis of the Cis-Lunar Navigation for the ArgoMoon CubeSat Mission". Aerospace 2022, 9, 659.

2021 Lasagni Manghi, Riccardo (2021) Orbit determination techniques for space missions to small bodies, [Dissertation thesis], Alma Mater Studiorum Università di Bologna. Dottorato di ricerca in Meccanica e scienze avanzate dell'ingegneria, 33 Ciclo. DOI 10.48676/unibo/amsdottorato/9867.

2021 Lasagni Manghi, R., Zannoni, M., Tortora, P., Martellucci, A., De Vicente, J., Villalvilla, J., et al. (2021). Performance characterization of ESA's Tropospheric Delay Calibration System for advanced Radio Science Experiments. Radio Science, 56, e2021RS007330.

2018 Perez, F., Modenini, D., Vázquez, A., Aguado, F., Tubío, R., Dolgos, G., et al. (2018). DustCube, a nanosatellite mission to binary asteroid 65803 Didymos as part of the ESA AIM mission. Advances in Space Research, 62(12), 3335-3356.

2018 Lasagni Manghi, R., Modenini, D., Zannoni, M., Tortora, P. (2018). Preliminary orbital analysis for a CubeSat mission to the Didymos binary asteroid system. Advances in Space Research, 62(8), 2290-2305.

2015 Amaya, J., Musset, S., Andersson, V., Diercke, A., Höller, C., Iliev, S., ... & Thonhofer, S. (2015). The PAC2MAN mission: a new tool to understand and predict solar energetic events. Journal of Space Weather and Space Climate, 5, A5

CONFERENCE PROCEEDINGS

2023 Tortora, P., Lasagni Manghi, R., Gramigna, E., Zannoni, M., Wahlund, J.-E., Bergman, J. (2023). Radio science investigations for the Heavy Metal mission to asteroid (216) Kleopatra. 33rd AAS/AIAA Space Flight Mechanics Meeting. Austin, TX.

2022 Gramigna, E., Johansen, J. G., Lasagni Manghi, R., Magalhães, J., Zannoni, M., et al. (2022). Hera Inter-Satellite link Doppler characterization for Didymos Gravity Science experiments. In 2022 IEEE 9th International Workshop on Metrology for AeroSpace, 430-435.

2019 Lasagni Manghi, R., Zannoni, M., Tortora, P., Modenini, D. "Measuring the Mass of a Main Belt Comet: PROTEUS Mission". 2019 IEEE 5th International Workshop on Metrology for AeroSpace.

2019 Lasagni Manghi, R., et al. "Tropospheric Delay Calibration System (TDCS): Design and Performances of a New Generation of Micro-Wave Radiometers For ESA Deep Space Ground Stations". 8th International Workshop on Tracking, Telemetry and Command Systems for Space Applications (TT&C), Darmstadt, Germany.

2018 Lasagni Manghi, R., Modenini, D., Zannoni, M., Tortora, P. "An autonomous optical navigation filter for a CubeSat mission to a binary asteroid system". 69th International Astronautical Congress, Bremen, Germany

2018 Modenini, D., Zannoni, M., Lasagni Manghi, R., Tortora, P. "An Analytical Approach to Autonomous Optical Navigation for a CubeSat Mission to a Binary Asteroid System". *Advances in the Astronautical Sciences*, 163, 139-149

Date: 04/11/2023 **Signature:**