



# Francesco Amadori

**Nationality:** Italian **Date of birth:** 25/11/1997 **Gender:** Male

☎ **Phone number:** (+39) 3386536117

✉ **Email address:** [francesco.a97.ing@outlook.it](mailto:francesco.a97.ing@outlook.it)

✉ **Email address:** [francesco.amadori@pec.francescoamadoriastronomy.com](mailto:francesco.amadori@pec.francescoamadoriastronomy.com)

## OBJECTIVE

---

### Job objective

My goal is to work as a software analyst and developer in a scientific field primarily oriented toward astrobiology, astronomy, aerospace, and space technology.

I would like to work in exoplanet research, mainly using spectroscopy to identify key chemical features.

## EDUCATION AND TRAINING

---

### Astrophysics and Cosmology

*University of Padua - UNIPD* [ 2023 – Current ]

City: Padua

Country: Italy

Website: <https://astrophysics-and-cosmology.dfa.unipd.it/>

### Bachelor degree in Astronomy

*ALMA MATER STUDIORUM - UNIBO* [ 08/2020 – 18/07/2023 ]

City: Bologna

Country: Italy

Website: <https://corsi.unibo.it/laurea/Astronomia>

Field(s) of study: Astronomy, Astrophysics

Final grade: Graduated with 97/110.

Thesis: Pipeline per la caratterizzazione di atmosfere esoplanetarie con spettroscopia ad alta risoluzione: dall'acquisizione degli spettri al retrieval dei parametri atmosferici

### Bachelor degree in Computer Sciences and Engineering

*ALMA MATER STUDIORUM - UNIBO* [ 08/2016 – 10/2019 ]

Address: Cesena's Campus, Cesena (Italy)

Website: <https://corsi.unibo.it/laurea/IngegneriaScienzeInformatiche>

Field(s) of study: Software Engineering

Final grade: Graduated with 94/110.

Thesis: ANALISI, PROGETTAZIONE E SVILUPPO DI SOFTWARE PLC PER L'AUTOMAZIONE INDUSTRIALE

### High School - Scientific lyceum

*Scientific lyceum Augusto Righi* [ 08/2011 – 07/2016 ]

City: Cesena

Country: Italy

Website: <https://www.liceorighicesena.edu.it/>

## WORK EXPERIENCE

---

### Software and Scientific Analyst

**INAF (National Institute of Astrophysics)** [ 10/2021 – Current ]

City: Turin (TO)

Country: Italy

Collaboration with the Exoplanet group at INAF-OATo finalized the development of various software concerning the classification and study of exoplanets.

The principal projects are here enounced:

- The complete conversion of an IDL code in Python that calculates atmosphere models of exoplanets, generating transmission and emission spectra of the exoplanets (both for clear and cloudy planets), using the radiative transfer of the involved/theoretical molecules. Once the models are created, they are conveyed to the real exoplanets spectra (obtained using the data collected during the observations) to see which describes the reality better. The key of the conversion is that Python allows code parallelization to reduce significantly the execution of the algorithm. Once I completed the optimization and parallelization process, I developed a GUI called GUIBRUSH®, which stands for: *Graphics User Interface for Bayesian Retrieval Using Spectroscopy at High Resolution*, that supports the user during the complete execution of different retrievals. It also gives the chance to show the results of an ongoing run used to check the progress;
- [pyExoRaMa](#): this tool is the Python version of the software originally developed with Mathematica by [Dr. Zeng Li](#). The code represents a helpful tool for visualizing and manipulating data related to extrasolar planets and their host stars in a multi-dimensional parameter space. Its versatility enables statistical studies based on the large and constantly increasing number of detected exoplanets. It can be used to identify possible interdependence among several physical parameters and to compare observables with theoretical models describing the exoplanet composition and structure. This transposition to Python presents some new features with respect to the original version, and due to the popularity of this programming language in the astrophysics community, the tool is made accessible to a larger number of users interested in exoplanet studies.

### Software and Scientific Analyst

**INAF (National Institute of Astrophysics)** [ 01/02/2023 – Current ]

City: Turin

Country: Italy

Fellowship for the "Development of Space Meteorology tools for automatic recognition of solar flares and prediction of their eventual arrival time to Earth".

The fellowship is aimed at developing tools that enable:

- the automatic real-time identification of solar flares (CMEs) from the analysis of coronagraphic images provided by space missions (such as SOHO, STEREO, Solar Orbiter);
- the automatic determination of the main kinematic parameters of the eruption (velocity, acceleration, angular extent, mass, propagation direction);
- the automatic reconstruction by ballistic "back-mapping" methods of the structure of the pre-eruption interplanetary medium from 0.1 to 1.1 AU from measurements acquired in situ;
- the automatic reconstruction of the propagation of the eruption front by a "drag-based" model;
- the automatic prediction of the eventual arrival time of the eruption to Earth.

Also, I pursued my activities on CORMAG and PROBA-3 missions.

**SWESNET:** <https://swesnet.busoc.be/>

## **Software and Scientific Analyst**

**INAF (National Institute of Astrophysics)** [ 01/07/2022 – 31/01/2023 ]

City: Turin (TO)

Country: Italy

Renewal of the "Software development for the in-flight control of solar space instrumentation and for the validation of their scientific data, with applications to Metis-Solar Orbiter" fellowship.

## **Software and Scientific Analyst**

**INAF (National Institute of Astrophysics)** [ 01/07/2021 – 30/06/2022 ]

City: Turin (TO)

Country: Italy

Fellowship for the "Software development for the in-flight control of solar space instrumentation and for the validation of their scientific data, with applications to Metis-Solar Orbiter".

The fellowship tasks concern the three projects on which I have already worked:

- The METIS solar telescope, which is mounted on the SOLAR ORBITER probe. I am upgrading the "PDOR/IOR to TCL converter" developed in the previous fellowship.
- The PROBA-3 mission, where I am still working on the simulator that I have developed in the previous months. I am officially in charge of the in-flight software management regarding the SPS system.
- The CORMAG project, which my tasks remain the same discussed previously.

During the fellowship, I also contributed to other scientific and IT sub-projects:

- The analysis and development of the OPSE (Occulter Position SENSors) system algorithm and software in Matlab. The OPSE is a system of three LEDs positioned on the opposite-Sun surface of the external occulter of the space Coronagraph ASPIICS on board of the PROBA-3 ESA mission. The analysis of the OPSE spot geometry is one of the metrology tools used to realize the formation flying of the two spacecraft forming PROBA-3. Based on the dispositions of those LEDs, it is possible to reconstruct the necessary operation to realign the two spacecraft.
- The development of a python software that analyzes fits images obtained during the calibration of the ASPIICS coronagraph systems. This software reads the images headers to obtain important information used to select only those that respect some constraints chosen by the user. Once the files are selected, the requested information is printed in a CSV file that can be used for future analysis.

## **Software analysts**

**INAF (National Institute of Astrophysics)** [ 01/09/2020 – 30/06/2021 ]

City: Turin (TO)

Country: Italy

Collaboration with INAF-OATo (National Institute of Astrophysics - Astrophysical Observatory of Turin) to finalize part of the activity started during the fellowship obtained in the previous period (see below). Contribution to the development of the pointing, thermal, and communication software for the CORMAG coronagraph being installed on a stratospheric balloon to observe the Solar Corona from the high atmosphere. Part of this collaboration is focused on the development of the application for the communication between the balloon and the ground station.

**CORMAG:**

<https://www.oato.inaf.it/progetti/hemera/?portfolioCats=87%2C88>

## Software analysts

**INAF (National Institute of Astrophysics)** [ 01/05/2020 – 31/08/2020 ]

City: Turin (TO)

Country: Italy

Fellowship for the "Analysis and validation of the software for the metrological system of Shadow Positioning Sensors (SPS) of ASPIICS coronagraph for the PROBA-3 mission and for the development of the validation SW of the Metis/Solar Orbiter instrument operation".

Fellowship tasks:

- The first part of the fellowship was focused on the development and testing of a software application to simulate the metrology performance of the Shadow Position Sensor (SPS) for the PROBA-3 formation flying mission. The SPS consists of a set of eight photodiodes mounted around the ASPIICS coronagraph's entrance pupil in order to monitor the symmetry of the penumbra projected by the external occulter with respect to the line of sight of the telescope. The code has been developed in Matlab language by implementing new routines and translating and debugging some existent IDL codes. The final objective was to realize an end-to-end simulator that, starting from the modeling and encoding of the penumbra profile and accounting of the SPS expected performance, returns the absolute and relative position measurement of the formation. The documentation describing the application has been produced, as well, for being used by the international team involved in the project (Centre Spatial de Liege, European Space Agency, Science Operation Centre for the PROBA-3 mission);
- The second part of the fellowship was focused on the development of a GUI, written in PYTHON language, to convert some operation command sequences (for example starting of the photo acquisition, the setting of parameters, etc) from a PDOR or IOR format to a TCL file. These files will be loaded by the on-ground support instrumentation to test the command sequences being fed to the METIS Coronagraph onboard the NASA/ESA Solar Orbiter mission.

The work done in the frame of this fellowship allowed me to apply my IT competencies to the astronomic/astrophysics field giving me a precious opportunity to experience high-level work organization for space projects. Moreover, I accessed a lot of teachings in software development for space technology applications.

The fact that I developed software being used by engineers and scientists in an international framework represents a high achievement for me.

Besides, I learned many new things about maths, physics, and IT thanks to the teamwork I was involved in, and about the usage of new programming languages (such as Matlab) to build software modules for high-level problem-solving objectives.

**ASPIICS/PROBA-3:**

<https://www.oato.inaf.it/progetti/proba3/?lang=en>

**METIS/SOLAR ORBITER:**

<https://www.oato.inaf.it/progetti/solar-orbiter-metis/>

## Analyst and developer of industrial machines (PLC)

**Denken Italia** [ 23/06/2019 – 12/03/2020 ]

City: Mercato Saraceno

Country: Italy

Tasks:

- Draw UML schemes that describe the machine station life cycle and develop relative code;
- Identify and apply software design methodologies for managing the software development process;
- Identify the reusability, reliability, interoperability, maintainability requirements to guarantee the quality of the software product.

This experience helped me to improve my teamwork attitude, to get a more efficient organization of my task-oriented work time, to extend my knowledge in the field of automation.

Main improvements in software development competencies:

- PLC programming using the AWL;
- C# and SQL for data analysis.

## Software analysts

**CTM: Club Tecnica e Motori** [ 31/01/2019 – 08/06/2019 ]

City: Bologna (BO)

Country: Italy

Trainee using LabView to realize control strategies for Formula SAE vehicle.

University internship (150 hours):

- Formula SAE CPU optimization;
- Study MATLAB algorithms and partial conversion in VI LabView;
- Creation of bin-CSV file converter using LabView, adapted to the complete machine management cluster;
- Logger modifications for data storage and saving.

Involvement in a team for the implementation and analysis of strategies aimed at reducing CPU consumption due to sensors and their data processing.

## LANGUAGE SKILLS

---

Mother tongue(s): **Italian**

**Other language(s):**

**English**

**LISTENING B2 READING B2 WRITING B2**

**SPOKEN PRODUCTION B1**

**SPOKEN INTERACTION B1**

**Spanish**

**LISTENING A1 READING A1 WRITING A1**

**SPOKEN PRODUCTION A1**

**SPOKEN INTERACTION A1**

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

## DIGITAL SKILLS

---

Matlab/Octave (90/100) / Python (90/100) / C++ (85/100) / C (80/100) / Linux (80/100) / Web Development (75/100) / LabView (70/100) / SQL (70/100) / Java (70/100) / Git (70/100) / Office (65/100) / C# (65/100) / PLC/AWL (65/100) / Assembly/AWL (50/100) / IDL (45/100)

## ACHIVEMENTS

---

**IT competencies (ordered by descending skills):**

- **Matlab/Octave (90/100):** Used to improve an end-to-end simulator for the Formation Flying (FF) algorithm of the PROBA-3 mission. I developed this simulator in the framework of the fellowship obtained at the Astrophysical Observatory of Turin from 01/05/2020 to 30/08/2020. I am also using Matlab for improving the FF algorithm.
- **Python (90/100):** Used to create a converter from PDOR and IOR files (used for sending commands to the METIS coronagraph) to TCL files (used to test the commands in the ground instrumentation). I also used it to create the [pyExoRaMA](#) tools.
- **C++ (85/100):** I am using the C++ language in my University Collaboration for the CBL and MOKA libraries.
- **C (80/100):** I am using the C language for the CORMAG mission. I used it a lot in the University courses.
- **Linux (80/100):** I learned how to use Linux in my University courses. I am still using it as the main Operation System.

- **Web Development (75/100):** I learned how to develop websites in my University courses. I created my website (<https://www.francescoamadoriastronomy.com/>) and I did some projects.
- **LabView (70/100):** I used it in my University Internship, in particular for the Engine Management for the formula SAE machine.
- **SQL (70/100):** I used it a lot in my past experiences with Denken Italia, to manage the product information and production of the various automated prototypes.
- **Java (70/100):** I created a 2-D game at the University in Java. It was a group project where we developed a portable application.
- **Git (70/100):** I use it since my first year at the Computer Science University.
- **Office (65/100):** I have used Office's application (Word, PowerPoint, Excel, etc) in all my work experiences.
- **C# (65/100):** I used it during my past experiences with Denken Italia.
- **PLC/AWL (65/100):** I used it a lot in my past experiences with Denken Italia.
- **Assembly/AWL (50/100):** I used it during my past experiences with Denken Italia and at the University.
- **IDL (45/100):** I learned some basic commands of IDL during my experience at INAF.

## **Manager of the CORMAG's pointing and tracking software in Timmins (Canada) for the second flight**

[ 30/07/2023 – 17/08/2023 ]

## **Secondary Observer GAPS at La Palma (Canary Islands)**

[ 17/12/2022 – 26/12/2022 ]

I have been selected as a secondary observer to participate and contribute to the observations of the [GASP](#) program. GAPS (an acronym for Global Architecture of Planetary Systems) is a long-term program for the comprehensive characterization of the architectural properties of planetary systems as a function of host star characteristics (mass, metallicity, environment). This experience will help me become a primary observer in the future.

## **Manager of the CORMAG's pointing and tracking software in Timmins (Canada)**

[ 03/08/2022 – 21/08/2022 ]

As the developer of the pointing and tracking software for the CORMAG project, I went to Canada to attend the launch of the HEMERA balloon, where the coronagraph was mounted on.

## **Speaker at the International Conference on Space Optics 2020**

[ 31/03/2021 ]

Presentation of the poster named "Formation Flying performances simulator for the Shadow Position Sensors of the ESA/PROBA-3 mission" at the International Conference on Space Optics 2020.

## **APIICS calibration in OPSys (ALTEC)**

[ 19/09/2021 – 30/09/2021 ]

I participated at the "Coronagraph System on-ground and in-orbit characterization and calibration", in particular for what concerned the SPS system (both HW and SW). It consisted of the radiometric and stability calibration and the validation of the SPS algorithms.

## **Meetings between ESA and INAF**

[ 30/04/2020 – Current ]

During my fellowship at INAF-OATo, I attended some meetings between ESA, CSL, and INAF for the PROBA-3 and SOLAR ORBITER missions, contributing to the preparation of discussion material and presentations.

## **GENERAL SKILLS**

---

### **General skills**

**Autonomy:** 9/10

**Flexibility/Adaptability:** 9/10

**Organization and planning skills:** 8/10

**Lifelong learning:** 10/10

**Information management:** 9/10

**Communication skills:** 8/10

**Teamwork:** 9/10

**Self-confidence:** 9/10

**Stress resistance:** 9/10

**Precision/Details Attention:** 8/10

**Achieve goals:** 9/10

**Initiative:** 10/10

**Problem Solving:** 9/10

**Leadership:** 8/10

## **CERTIFICATION AND COURSES**

---

### **English B2**

University Certification

### **Python**

Udemy Certification

## **PROJECTS**

---

### **CosmoBolognaLib and MOKA research projects at the University of Bologna**

[ 07/01/2021 – 31/12/2021 ]

I began an unpaid and unofficial collaborative project with two professors of the University of Bologna which I am conducting in my free time. The collaboration involves Dr. Marulli Federico of the University of Bologna and Dr. Giocoli Carlo of the INAF of Bologna and concerns four interesting cosmological sub-projects, in particular, three of them treat the CosmoBolognaLib (CBL) libraries and the last one treats the MOKA software:

- Project 1 (CBL): the scope of this project is to fix some C++ files of the CBL libraries, in order to split them into class files and to make their execution more efficient;
- Project 2 (CBL): the scope of this project is to create a GUI application to run and execute the CBL libraries;
- Project 3 (CBL): the scope of this project is to create a website to run and execute online the CBL libraries;
- Project 4 (MOKA): the scope of this project is to fix some C++ files of the MOKA software, in order to split them into class files and to make their execution more efficient. Once this part will be completed, the next step will be to integrate the MOKA software in the CBL libraries.



## PUBLICATIONS

---

### [Prediction Capability of Geomagnetic Events from Solar Wind Data using Neural Networks](#)

[2023]

Daniele Telloni; Maurizio Lo Schiavo; Enrico Magli; Silvano Fineschi; Sabrina Guastavino; Gianalfredo Nicolini; Roberto Susino; Silvio Giordano; **Francesco Amadori**; Valentina Candiani, Anna Maria Massone, Michele Piana, "*Prediction Capability of Geomagnetic Events from Solar Wind Data using Neural Networks*", 2023, <https://doi.org/10.3847/1538-4357/acdeea>

### [The GAPS Programme at TNG. XXXIII. HARPS-N detects multiple atomic species in emission from the dayside of KELT-20b](#)

[2022]

F. Borsa, P. Giacobbe, A. S. Bonomo, M. Brogi, L. Pino, L. Fossati, A. F. Lanza, V. Nascimbeni, A. Sozzetti, **F. Amadori**, S. Benatti, K. Biazzo, A. Bignamini, W. Boschin, R. Claudi, R. Cosentino, E. Covino, S. Desidera, A. F. M. Fiorenzano, G. Guilluy, A. Harutyunyan, A. Maggio, J. Maldonado, L. Mancini, G. Micela, E. Molinari, M. Molinaro, I. Pagano, M. Pedani, G. Piotto, E. Poretti, M. Rainer, G. Scandariato, H. Stoev, "*The GAPS Programme at TNG. XXXIII. HARPS-N detects multiple atomic species in emission from the dayside of KELT-20b*", *Astronomy & Astrophysics*, 2022, <https://doi.org/10.1051/0004-6361/202142768>

### [PyExoRaMa: An Interactive Tool in Python to Investigate the Radius–Mass Diagram for Exoplanets](#)

[2022]

**Francesco Amadori**, Mario Damasso, Li Zeng, Alessandro Sozzetti, "*PyExoRaMa: An Interactive Tool in Python to Investigate the Radius–Mass Diagram for Exoplanets*", *Research Notes of the AAS*, Volume 6, Number 2, <https://doi.org/10.3847/2515-5172/ac52f2>

### [CorMag – coronal magnetograph for the stratospheric Hemera mission](#)

[2022]

Silvano Fineschi, Gerardo Capobianco, Luca Zangrilli, Donata Bonino, Federico Landini, Davide Loreggia, Maurizio Pancrazzi, Roberto Susino, Alessandro Bemporad, Valeria Caracci, **Francesco Amadori**, Salvatore Caschera, "*CorMag – coronal magnetograph for the stratospheric Hemera mission*", *SPIE Digital Library*, 2022, <https://doi.org/10.1117/12.2630866>

### [Formation Flying performances simulator for the Shadow Position Sensors of the ESA/PROBA-3 mission](#)

[2021]

CAPOBIANCO Gerardo, **AMADORI Francesco**, FINESCHI Silvano, BEMPORAD Alessandro, CASTI Marta, LOREGGIA Davide, NOCE Vladimiro, PANCRAZZI Maurizio, LANDINI Federico, THIZY Cedric, ROUGEOT Raphael, GALANO Damien, VERSLUYS Jorg, "*Formation Flying performances simulator for the Shadow Position Sensors of the ESA/PROBA-3 mission*", *Proceedings of the International Conference on Space Optics (ICSO 2020)*, <https://doi.org/10.1117/12.2600310>



## Laboratory testbed for the calibration and the validation of the Shadow Position Sensor subsystem of the PROBA3 ESA mission

[2021]

Davide LOREGGIA, Luca ZANGRILLI, Gerardo CAPOBIANCO, Giuseppe MASSONE, Massimiliano BELLUSO, Silvano FINESCHI, **Francesco AMADORI**, Vladimiro NOCE, Alessandro BEMPORAD, Marta CASTI, Gianalfredo NICOLINI, Federico LANDINI, Marco ROMOLI, Maurizio PANCRAZZI, "*Laboratory testbed for the calibration and the validation of the Shadow Position Sensor subsystem of the PROBA3 ESA mission*", Proceedings of the International Conference on Space Optics (ICSO 2020), <https://doi.org/10.1117/12.2600312>

## The Coronal Magnetograph CorMag Mission for the Stratospheric Hemera Mission

[2021]

Silvano FINESCHI, Luca ZANGRILLI, Gerardo CAPOBIANCO, Federico LANDINI, Alessandro LIBERATORE, Giuseppe MASSONE, Maurizio PANCRAZZI, Roberto SUSINO, **Francesco AMADORI**, Marco ROMOLI, "*The Coronal Magnetograph CorMag Mission for the Stratospheric Hemera Mission*", Proceedings of the International Conference on Space Optics (ICSO 2020), <https://doi.org/10.1117/12.2599647>

## End-to-end numerical simulator of the Shadow Position Sensor (SPS) metrology subsystem of the PROBA-3 ESA mission

[2020]

**F. Amadori**, G. Capobianco, D. Loreggia, M. Casti, A. Bemporad, S. Fineschi, V. Noce, L. Zangrilli, M. Belluso, M. Pancrazzi, "*End-to-end numerical simulator of the Shadow Position Sensor (SPS) metrology subsystem of the PROBA-3 ESA mission*", INAF Technical report, INAF, 2020, pp.1-184, <https://openaccess.inaf.it/handle/20.500.12386/28811>

## **CODE PUBLICATIONS**

---

### **pyExoRaMa: an interactive tool to investigate the radius-mass diagram for exoplanets (SW)**

[ 24/01/2022 ]

- **Author:** Francesco Amadori
- **Co-authors:** Mario Damasso, Li Zeng, Sozzetti Alessandro
- **Title:** pyExoRaMa: an interactive tool to investigate the radius-mass diagram for exoplanets (SW)
- **SW Info:** Zenodo, January 25, 2022
- **DOI:** [10.5281/zenodo.5899601](https://doi.org/10.5281/zenodo.5899601)
- **GitHub:** <https://github.com/francescoa97outlook/pyExoRaMa>
- **ASCL:** <http://ascl.net/code/v/3171>
- **EMAC-NASA:** [https://emac.gsfc.nasa.gov?related\\_resource=cdf88fcb-529a-4c21-aaea-79034a660f0a](https://emac.gsfc.nasa.gov?related_resource=cdf88fcb-529a-4c21-aaea-79034a660f0a)

Link: [10.5281/zenodo.5899601](https://doi.org/10.5281/zenodo.5899601)

## **CONTACT AND PERSONAL SECTION**

---

### **Full Contact Information**

- **Email:** francesco.a97.ing@outlook.it
- **PEC:** francesco.amadori@pec.francescoamadoriastronomy.com
- **Phone:** +39 3386536117
- **Site:** <https://www.francescoamadoriastronomy.com/>
- **Linkedin:** [www.linkedin.com/in/francescoamadori-42a773160](https://www.linkedin.com/in/francescoamadori-42a773160)

## General Information

- **Date of Birth:** 26/11/1997
- **Birthplace:** Borgosesia (VC)
- **Gender:** Male
- **Nationality:** Italian
- **Driving license:** B
- **ORCID:** [0000-0003-1316-1033](https://orcid.org/0000-0003-1316-1033)
- **I am available to travel and off-site work.**

## Hobbies and Interest

- Traveling
- Developing new codes
- Study new IT environments applied in the astronomy field
- Astronomy and telescope observation
- Astrobiology and life in other planets
- Paleontology
- Film and TV series

## Affiliation and Collaboration

- **Unibo** - Alma Mater Studiorum (2016 - Current)
- **INAF-OATo** - National Institute of Astrophysics - Astrophysical Observatory of Turin (2020 - Current)
- **GAPS** - Global Architecture of Planetary Systems (2022 - Current)