Andrea Francesco Maria Enia

Date of birth: 4 Oct 1990 | **Nationality:** Italian | **Gender:** Male |

Email address: andrea.enia@unibo.it | **GitHub:** https://github.com/AndreaEnia |

WORK EXPERIENCE

1 JUL 2022 – CURRENT

RESEARCH FELLOW UNIVERSITÀ DEGLI STUDI DI BOLOGNA

Winner of a 24 months research fellowship (*assegno di ricerca*) on PRIN/MIUR and ASI funds, *"Constraining the evolution of galaxy physical properties with machine learning in EUCLID from photometry and spectroscopy"*, under the supervision of Dr. Lucia Pozzetti, Dr. Micol Bolzonella and Dr. Margherita Talia. I joined the Euclid consortium, in the Organizational Unit for Photometric Redshifts (OU-PHZ), the Science Working Groups on Galaxy Evolution and AGN (SWG-GAE) and the Local Universe (SWG-LU). During the fellowship, I am testing, exploring, and developing Machine/Deep Learning models to derive galaxies' physical properties from the broadband Euclid photometry and infer their Posterior Distribution Function in a flexible and memory-efficient way. All these results will be part of an Euclid pre-launch key paper (KP-GEV-1, Enia et al., in prep).

Address Via Piero Gobetti 93/2 | **Website** https://fisica-astronomia.unibo.it/it/index.html

13 SEP 2021 – 30 JUN 2022 Casalecchio di Reno, Italy

DATA SCIENTIST CINECA

Data Scientist at the High Performance Computing Dept. in Cineca, the Italian centre for calculus. As part of the Data Analytics team, I was involved in Machine Learning and Deep Learning projects within the HPC framework, helping winners of the Italian SuperComputing Resource Allocation - ISCRA running their codes efficiently on HPC, assisting external partners (companies or academies) within the EUHubs4Data project, and developing Proof of Concept projects for public and private entities.

Address Via Magnanelli, 6/3, Casalecchio di Reno, Italy | **Website** https://www.hpc.cineca.it/

1 JUN 2020 – 12 SEP 2021 Bologna, Italy

RESEARCH FELLOW UNIVERSITÀ DEGLI STUDI DI BOLOGNA

12 months research fellowship (*assegno di ricerca*) on PRIN/MIUR funds, as part of the project *"Constraining galaxy evolution with infrared and sub-mm/radio observations"*, under the supervision of Prof. Andrea Cimatti, Prof. Francesca Pozzi and Dr. Margherita Talia. The fellowship's main goal was to derive the cosmic star formation rate density history from a radio sample in GOODS-N, focusing in particular on objects undetectable in the near-IR (*H*-dark). The results have been published in Enia et al., 2022.

Address Via Piero Gobetti 93/2, Bologna, Italy | **Website** https://fisica-astronomia.unibo.it/it/index.html

1 OCT 2019 – 31 MAR 2020 Padova, Italy

RESEARCH GRANTS UNIVERSITÀ DEGLI STUDI DI PADOVA

Two three months grants (borsa di studio) on ASI fundings *"DustPedia: resolved star-formation from multiwavelength photometric analysis"* within the DustPedia collaboration, an UE funded project aimed at building an archive of all the Herschel observed local galaxies to study interstellar dust properties, under the supervision of Prof. Giulia Rodighiero and Prof. Alberto Franceschini. The grants were finalised at studying resolved star formation processes in nearby galaxies from multiwavelength observations (Enia et al., 2020, Morselli et al., 2020, 2021). As part of this project, I developed a code (*In Rainbows*, available on GitHub) to manage all the various processes, from data pre-reduction to noise estimation, from pixel by-pixel photometry (or custom apertures) to SED fitting, to data visualisation.

Address Vicolo dell'Osservatorio 3, Padova, Italia, Padova, Italy | **Website** https://www.dfa.unipd.it/

1 OCT 2018 – 30 SEP 2019 Padova, Italy

RESEARCH FELLOW UNIVERSITÀ DEGLI STUDI DI PADOVA

12 months research fellowship on STARS funds *"Formation and evolution of distant galaxies observed with gravitational lensing"*, under the supervision of prof. Giulia Rodighiero. A natural continuation of the PhD, the fellowship was aimed at concluding the open-source Python code for gravitational lens modelling from interferometric observation (Enia et al., 2018), whose know-how has been carried to the PyAutoLens collaboration, another open-source code (Nightingale et al., 2018, 2021).

Address Vicolo dell'Osservatorio 3, Padova, Italia, Padova, Italy | **Website** https://www.dfa.unipd.it/

EDUCATION AND TRAINING

1 OCT 2015 – 5 MAR 2019 Padova, Italy

PHD IN ASTRONOMY Università degli Studi di Padova

Thesis: *Zoom-in on the dust-obscured phase of galaxy formation with gravitational lenses* (link)
Supervisors: Prof. Alberto Franceschini (Università di Padova), Prof. Mattia Negrello (Cardiff University).
External Advisors: Prof. Stephen Serjeant (Open University), Dr. Neal Jackson (Manchester University)

Address Vicolo dell'Osservatorio, 3, Padova, Italy | **Final grade** Graduated with Honorable Mention

13 MAR 2018 – 9 APR 2018 Padova, Italy

TRAINING COURSES FOR THE ACHIEVEMENT OF 24 ECTS Università degli Studi di Padova

Exams:

- Elementi di didattica e pedagogia inclusiva per la scuola secondaria
- Metodi e strumenti della didattica della Fisica
- Metodologie e tecnologie didattiche per l'insegnamento della Matematica nella scuola secondaria
- Psicologia dell'apprendimento strategico e motivato

Address Via VIII Febbraio, 2, Padova, Italy

1 OCT 2012 – 26 JUN 2015 Padova, Italy

MASTER'S DEGREE IN ASTRONOMY Università degli Studi di Padova

Thesis: *Source reconstruction of sub-mm selected gravitationally lensed galaxies* (link)
Supervisors: Prof. Alberto Franceschini (UniPD), Dott. Mattia Negrello (Cardiff University)

Address Vicolo dell'Osservatorio, 3, Padova, Italy | **Final grade** 110/110L

1 OCT 2008 – 12 OCT 2012 Padova, Italy

BACHELOR'S DEGREE IN ASTRONOMY Università degli Studi di Padova

Thesis: *L'effetto Sunyaev-Zel'dovich*
Supervisor: Prof. Alberto Franceschini

Address Vicolo dell'Osservatorio, 3, Padova, Italy | **Final grade** 104/110

DIGITAL SKILLS

Linguaggi di programmazione

Python (advanced) | IDL (advanced) | R (advanced) | C++ (basics) | Fortran77 (basics)

Frameworks

Conda | Python Libraries (numpy, scipy, matplotlib, seaborn, scikit-learn, pandas, astropy) | Experience in HPC environments, SLURM | Horovod | Keras | TensorFlow | Git Github | Jupyter Notebook | Jupyter Lab

Sistemi Operativi

Mac Os X | Linux (Ubuntu, Debian) | Windows

Varie

Microsoft Office | Smart working platforms | Slack | Suite Google Drive

LANGUAGE SKILLS

Mother tongue(s): **ITALIANO**

Other language(s):

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken production	Spoken interaction	
INGLESE	C2	C2	C2	C2	C2
PORTOGHESE	A2	B1	A1	A1	A1
SPAGNOLO	B2	B2	A2	A2	A2

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

ADDITIONAL INFORMATION

COURSES

PhD Schools

- *2nd ASTERICS-OBELICS International School on Advanced Software Programming for Astrophysics and Astroparticle Physics*, LAPP, Annecy, France, June, 4-8, 2018
- *5th International Young Astronomer School on Scientific exploitation of the Gaia data*, Paris, France, February, 26 - March, 02, 2018
- *International Max Planck Research School for Astronomy & Astrophysics on Astro-statistics & Data Mining*, Heidelberg, Germany, September, 12-16, 2016
- *Astrophysical Probes of Fundamental Physics*, Ferrara, Italy, September, 5-9, 2016

PhD Courses

- Galaxy Formation and Evolution (Dr Poggianti)
- Scientific Projects Management (Dr Farinato)
- Astronomical Sites Characterization (Prof. Ortolani)
- Adaptive Optics (Dr Farinato)
- Machine Learning (Dr. Pasquato)
- Paper Writing (Prof Sneden)
- Statistical Methods in Astrophysics (Prof Sheth)
- Multimessenger Astrophysics (Dr Ciolfi)

PUBLICATIONS

As first Author

Enia et al., 2022, "*A New Estimate of the Cosmic Star Formation Density from a Radio-selected Sample, and the Contribution of H-dark Galaxies at $z \geq 3$*" (ApJ)
https://ui.adsabs.harvard.edu/abs/2022ApJ...927..204E/abstract
DOI: 10.3847/1538-4357/ac51ca

Enia et al., 2020, "*A panchromatic spatially-resolved analysis of nearby galaxies - I. Sub-kpc scale Main Sequence in grand-design spirals*" (MNRAS)
http://adsabs.harvard.edu/abs/2020MNRAS.493.4107E
DOI: 10.1093/mnras/staa433

Enia et al., 2018, "*The Herschel-ATLAS: magnifications and physical sizes of 500-μm-selected strongly lensed galaxies*" (MNRAS)
http://adsabs.harvard.edu/abs/2018MNRAS.475.3467E
DOI: 10.1093/mnras/sty021

Others relevant publications

Giulietti et al. 2022, *The far-infrared/radio correlation for a sample of strongly lensed dusty star-forming galaxies detected by Herschel* (MNRAS)
https://ui.adsabs.harvard.edu/abs/2022MNRAS.511.1408G

DOI: 10.1093/mnras/stac145

Nightingale et al., 2021, *PyAutoLens: Open-Source Strong Gravitational Lensing* (JOSS)
https://ui.adsabs.harvard.edu/abs/2021JOSS....6.2825N
DOI: 10.21105/joss.02825

Morselli et al., 2021, *Redshift evolution of the H2/H I mass ratio in galaxies* (MNRASL)
https://ui.adsabs.harvard.edu/abs/2021MNRAS.502L..85M/abstract
DOI: 10.1093/mnrasl/slab007

Morselli et al., 2020, *A panchromatic spatially resolved analysis of nearby galaxies - II The main sequence - gas relation at sub-kpc scale in grand-design spirals* (MNRAS)
http://adsabs.harvard.edu/abs/2020MNRAS.496.4606M
DOI: 10.1093/mnras/staa1811

Rodighiero et al., 2019, *Active Galactic Nuclei in Dusty Starbursts at z = 2: Feedback Still to Kick in* (ApJL)
https://ui.adsabs.harvard.edu/abs/2019ApJ...877L..38R/abstract
DOI: 10.3847/2041-8213/ab222e

Zurlo et al., 2018, *The gravitational mass of Proxima Centauri measured with SPHERE from a microlensing event* (MNRAS)
https://ui.adsabs.harvard.edu/abs/2018MNRAS.480..236Z/abstract
DOI: 10.1093/mnras/sty1805

Massardi et al., 2018, *Chandra and ALMA observations of the nuclear activity in two strongly lensed star-forming galaxies* (A&A)
http://adsabs.harvard.edu/abs/2018A%26A...610A..53M
DOI: 10.1051/0004-6361/201731751

APPROVED PROPOSALS AND FUNDED PROJECTS

2022

Co-I of ALMA Cycle 9 programs:

1. **2022.1.00971**, *"Feebdack or mergers? Detailed characterisation of an exceptional molecular gas ejection at z=1.4"*, PI: Annagrazia Puglisi
2. **2022.1.00224**, *" The Home Straight - Completing the CO Redshifts of Herschel's Brightest SMGs"*, PI: Tom Bakx
3. **2022.1.00432**, *"ANGELS: A New high-z submm Galaxy Efficient Line Survey in bands 3 through 8"*, PI: Tom Bakx

Co-I of NOEMA Project **W22DX**, "*The obscured Universe at z~6 on the way to JWST*", PI: Margherita Talia, Matthieu Bethermin

2021

Co-I of ALMA Cycle 8 programs:

1. **2021.2.00059**, "*Feeding BEARS At Cosmic Noon*", PI: Stephen Serjeant
2. **2021.2.00036**, "*Water BEARS*", PI: Stephen Serjeant
3. **2021.2.00052** "*The Home Straight - CO Redshifts of Herschel's Brightest SMGs*", PI: Tom Bakx
4. **2021.1.01628** "*85 birds -- 1 stone: The most efficient line survey of SMGs in Bands 3 through 8*", PI: Tom Bakx

Co-I of NOEMA Project **W21EG**, "*Shedding light on the obscured Universe at z~7*", PI: Margherita Talia, Matthieu Bethermin

2020

Co-I of VLA proposal **VLA/20A-264 "***Constraining the Upper Mass Tail of the IMF in young high-z starbursts*", PI: Giulia Rodighiero

Co-I of NOEMA Project **S20BQ**, "*A systematic search for ultra-bright strongly lensed galaxies in the Planck all-sky survey*", PI: Mattia Negrello

2019

Co-I of ALMA Cycle 7 programs:
1. **2019.2.00155**, "*The home stretch: Completing the redshift catalogue of a large flux-limited high-redshift Herschel sample*", PI: Tom Bakx
2. **2019.1.01477**, "*A comprehensive ALMA Redshift Survey of the Brightest Herschel Galaxies*", PI: Sheona Urquhart

Co-I of NOEMA Project **W19CL**, "*A titanic wind destroying the interstellar medium of a massive starburst galaxy at z=1.4?*", PI: Annagrazia Puglisi

2018

Co-I of ALMA Cycle 7 programs:
1. **2018.1.00804**, "*Redshifts of bright Herschel gravitational lenses*", PI: Stephen Serjeant
2. **2018.1.01152**, "*Extreme feedback in a cool core cluster at z=0.2*", PI: Giulia Rodighiero

Co-I of the "*Budget Integrato per la Ricerca Interdipartimentale - BIRD*", Università di Padova, "*The baryon cycle in galaxies: gas, dust and SFR interplay revealed by the Atacama Large Millimeter Array*", PI: Paolo Cassata

2017

Co-I of ALMA Cycle 5 program **2017.1.00027**, "*Unveiling the Galaxy Formation Sequence*", PI: Steve Eales
Co-I Hubble Space Telescope Cycle 25 program **ID 15242,** "*SNAPshot observations of the largest sample of lensed candidates in the Equatorial and Southern Sky identified with Herschel*", PI: Lucia Marchetti

2016

Co-I of SMA program **2016B-S003,** "*SMA imaging of Herschel-ATLAS candidate lensed galaxies*", PI: Mattia Negrello

CONFERENCES AND SEMINARS

Talks *"Euclid OU-PHZ meeting"*, (22-23 Sep 2022) in Geneva (Switzerland)
Contributed talk: *"Characterizing the evolution of galaxy physical properties relation with machine learning"*

"Galaxies & AGN with the first Euclid data and beyond", (14-16 Sep 2022) in Naples (Italy)
Contributed talk: *"Characterizing the evolution of galaxy physical properties relation with machine learning"*

"EAS-2021 (virtual), SS26a : Towards a Complete Census of Star-Formation in the Early Universe", (2 Jul 2021) in Leiden (Netherlands)
Contributed talk: *"Weighting the contribution of radio-selected H-dark galaxies to the cosmic SFRD at redshift 3 in GOODS-N"*

"*The Art of Measuring Galaxy Physical Properties*", (18-22 Nov 2019) in Milan (Italy)
Winner of 5 minutes session poster: "*A panchromatic definition of the kpc-scale relation between stellar mass and star formation in local grand-design spirals from Dustpedia*"

"*Views on the Interstellar Medium in galaxies in the ALMA era*", (2- 6 Sep 2019) in Bologna (Italy)
Contributed talk (on behalf of Aris Amvrosiadis): "*The nature of the strongly lensed SMG J091043.0- 000322*"

"*The Universe as a Telescope: probing the cosmos at all scales with strong lensing*", (3-7 Sep 2018) in Milan (Italy)
Contributed talk: "*Zoom-in on the dust-obscured phase of galaxy formation with gravitational lenses*"

"*IV Workshop on millimeter-submillimeter Astronomy in Italy*" , (7- 10 Feb 2017) at ALMA Regional Center, IRA, Bologna (Italy)
Contributed talk: "*Herschel-ATLAS: a reassessment of the size and magnification of a sample of 500 micrometer-selected strongly lensed galaxies*"

Seminars *"Gravitational Lensing"*, (20-21 Mar 2023) in Padova (Italy)
Cycle of two lessons (4 hours total) for the Observational Cosmology course at the Master's Degree in Astrophysics and Cosmology

ORGANISATIONAL SKILLS

Team working and problem solving Excellent teamwork skills gained from participation in several multinational collaborations spanning multiple disciplinary areas, allowing me to acquire abilities of flexibility and adaptation to the needs of the group and the goals set. I've always addressed problems with an analytical mindset and a character distinguished by logic, as well as optimal lateral thinking skills, which I honed during my PhD.

COMMUNICATION AND INTERPERSONAL SKILLS

Written and oral Author of 21 peer-reviewed scientific publications in leading international journals, such as the Journal of Open Source Software, Monthly Notices of the Royal Astronomical Society (IF: 5.235), Astronomy & Astrophysics (IF: 5.636), The Astrophysical Journal (IF: 5.745) and Nature Astronomy (IF: 11.518).

Served as a referee for the Astrophysical Journal (ApJ), providing feedback to authors on manuscripts.

Speaker at several international scientific conferences, with written and oral presentations (posters) aimed at illustrating the scientific results obtained, as well as at dissemination meetings, with participation in consecutive editions of the Researchers' Night.

PROFESSIONAL SKILLS

Data Analysis and Computing

Excellent professional knowledge of data analysis, from initial data approaches (and data crunching) to all the various analysis processes. The experience gained during the courses of study and the PhD is articulated in excellent statistical knowledge (frequentist and especially Bayesian), construction and testing of multivariable models, and subsequent data-fitting, particularly with MonteCarlo methods (MonteCarlo Markov Chain or Multimodal Nested Sampling Algorithms), and data visualisation for specialised publications and scientific and/or outreach conferences.

Excellent knowledge of Python (acquired during the PhD), R (acquired at Cineca) and IDL (acquired during the Master thesis), as well as related analysis and visualisation libraries such as NumPy, SciPy, Astropy, photutils, Pandas, scikit-learn, matplotlib, and seaborn.

Good knowledge of parallel computing protocols such as MPI, OpenMPI and Horovod, as well as the Bash environment, with the ability to write scripts for the automation of processes outside Python as required for my programs (i.e. SED-fitting with magphys) and SLURM scripts for HPC machines. Good knowledge of GPUs architecture (Volta NVIDIA GPUs) and distributed calculus over multiple GPUs either in a single computing node and in multiple nodes.

Astronomy Softwares

Starting from my Master's thesis until my PhD, as well as during my Post-doc years, I have gained an excellent knowledge of softwares for astronomical data analysis: TRACTOR, SEXTRACTOR and PyBDSF for source extraction; GALFIT and CASA for morphological analysis; magphys, sed3fit and bagpipes for spectral energy distribution fitting; DS9, Aladin, CASA and topcat for data analysis and visualisation. For some of them I wrote my personal libraries for optimal data I/O, available on GitHub.

I also contributed to the writing of PyAutoLens (Nightingale et al., 2018, 2021), an open-source code for lens modelling of gravitationally lensed galaxies, thanks to to my expertise in interferometric data management (Enia et al., 2018) and visualisation of results on an adaptive Voronoi grid (Enia et al., 2018, Massardi et al., 2018).

As part of the study of star formation processes within DustPedia, I wrote a code, used in three publications on the topic (Enia et al., 2020, Morselli et al., 2020, 2021), to read and reduce the data, measure the flux over apertures of the user's choice at different wavelengths, fitting the spectral energy distribution, and extract the results.

Machine Learning and Deep Learning

Excellent knowledge of gradient boosting algorithms (XGBoost, Catboost, LightBoost, AdaBoost), supervised machine learning models for classification and regression problems, as well as unsupervised machine learning models for anomaly analysis and clustering problems, and related frameworks e.g. the Python scikit-learn library, used extensively e.g. during PhD to develop lens modelling software for interferometric images (Enia et al. 2018), as part of the DustPedia project to identify clusters of pixels separated from the Galactic main core (Enia et al. 2018, 2020, Morselli et al., 2020), within OU-PHZ in the Euclid collaboration as a benchmark to output multivariate posterior distribution functions of parameters from random forests.

All those knowledges have deepened in the time spent as Data Scientist at Cineca, as applying ML techniques is the core business of the Data Analytics group, along with working with DL frameworks (TensorFlow and Keras) in building Convolutional Neural Networks for regression and classification problems.

SCIENTIFIC MEMBERSHIPS

Euclid

From July 2022 I am a member of the Euclid consortium, active in the Organization Unit on Photometric Redshifts (OU-PHZ) and the Science Working Groups on AGN & Galaxy Evolution (SWG-GAE) and Local Universe (SWG-LU).

H-ATLAS

In September 2015 I became a member of the Herschel Astrophysical Terahertz Large Area Survey (H-ATLAS) collaboration.

TEACHING ACTIVITY

2023 – CURRENT
Teaching Tutor at Bologna University

Winner of the Teaching Tutor call for the "*Ottica Astronomica*" course at the University of Bologna's Bachelor's Degree in Astronomy. The primary responsibilities included supporting the teacher in laboratory classes, correcting and evaluating student reports, and administering exams (both written and oral).

2021 – 2022
Cineca Academy

Cineca offers a variety of courses through their Academy (https://learn.cineca.it/) and EuHubs4Data (https://euhubs4data.eu/courses/), either for public or private entities (e.g. Universities, corporations). I am passionate about teaching, and I have taught a number of Machine Learning and Deep Learning classes so far:

- **Data Science and Deep Learning with Python** and **Data Science with R** provided by Cineca Academy within EuHubs4Data
- **Data Science and Deep Learning with R** for *Istituto Nazionale di Oceanografia e di Geofisica Sperimentale di Trieste* (OGS) and *Future Earth, Climate Change and Societal Challenge* PhD course at Unibo
- **Big Data Lab** for Bologna Business School (BBS)

2017 – CURRENT
Assistant Teacher at Padova University

Winner for four years in a row of the Assistant Teaching call for the "*Sperimentazioni di Fisica I, modulo B*" course at the University of Padova's Bachelor's Degree in Astronomy. The primary responsibilities included supporting the teacher in laboratory classes, correcting and evaluating student reports, and administering exams (both written and oral, in person and online after the pandemic).

During these years, I subbed the principal teacher for courses in the Bachelor's Degree Cosmology course and the Master's Degree General Astrophysics course (Gravitational Lensing module).
In Spring 2023 I held a 4 hours seminar in Gravitational Lensing for the Observational Cosmology course at the Master's Degree in Astrophysics and Cosmology.

Thesis co-supervision

I co-supervised the following theses:

Bachelor's:
1. *Ricostruzione di sorgenti gravitazionalmente lensate con PyAutoLens*, A.A. 2019/2020, University of Padova, Candidate B. Munari
2. *Lensing gravitazionale e supernovae ad alto redshift: vincoli ai parametri cosmologici*, A.A. 2019/2020, University of Padova, Candidate M. Scialpi

Master's:
1. *Spatially resolved scaling relations in nearby galaxies: stellar Mass assembly constraints from their star formation histories*, A.A. 2020/2021, University of Padova, Candidate C. Lofaro, currently PhD student at the University of Crete
2. *The impact of bars on quenching galaxies across cosmic times: constraints from a nearby spatially resolved analysis*, A.A. 2021/2022, University of Padova, Candidate L. Scaloni, currently PhD student at University of Bologna

THIRD MISSION AND DISSEMINATION

2017 – 2018

European Researcher's Night

Two presentations for the cycle "La giovane astronomia" at the 2017/2018 Researcher's Night, at the Physics and Astronomy Dept., University of Padova.

Link https://edu.inaf.it/events/venetonight-2017-alla-specola-di-padova/

Le informazioni contenute nel presente "curriculum vitae et studiorum" sono rese sotto la personale responsabilità del sottoscritto, ai sensi degli articoli 46 e 47 del Decreto del Presidente della Repubblica 28 dicembre 2000, numero 445, e successive modifiche ed integrazioni, consapevole della responsabilità penale prevista dall'articolo 76 del medesimo Decreto per le ipotesi di falsità in atti e dichiarazioni mendaci