Federica Tarsitano Curriculum Vitae

Postdoctoral researcher at ETH Zürich
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Employment

06.2025 - Ongoing	Postdoctoral Researcher ETH Zürich, Institute of Particle Physics and Astrophysics
03.2022 - 06.2025	Postdoctoral Researcher, University of Geneva, Department of Astronomy
09.2021 - 02.2022	Research Assistant ETH Zürich - Institute for Particle Physics and Astrophysics (IPA)

Education

2015 - 2021	PhD in Physics ETH Zürich - Institute for Particle Physics and Astrophysics (IPA) Thesis: *Galaxy morphology and cosmological predictions for wide-field survey analyses*. Advisors: Prof. A. Refregier, Prof. A. Amara
12.2019	Visiting student at Stanford University
03 - 07.2017	Internship in nuclear and particle physics, ETH Zürich (IPA)
2009 - 2014	Master Degree in Nuclear, Subnuclear and Biomedical Physics University of Turin, Italy Final marks: 110/110 Magna Cum Laude and Honourable Mention. Thesis: *Study of the noise in the Electromagnetic Calorimeter and Analysis of the Invariant Mass spectrum of Y(ns)gamma in the CMS experiment at LHC.*
2013 - 2014	CERN Summer student - CERN, Geneva, Switzerland
2009	High school Diploma, Liceo Classico C. Cavour, Turin, Italy Final marks: 100/100

Mentoring

2024	Supervisor of Dóra Takács' Semester Project *Dual and Binary supermassive black holes in the Euclid Survey.*
2024	Co-supervisor of Otilia Manasoiu's Master Thesis: *The growth of galaxies and their dark matter haloes across cosmic time.*
2020	Silvan Fishbacher's Semester Project: *Constraining Cosmological Parameters with PyCosmo using KiDS+VIKING-450.*

2020	Paul Moser Röggla's Bachelor Thesis: *The effect of Intrinsic Alignment on cosmological parameter constraints.*
2019	Beatrice Moser's Master Thesis, *Neutrino Cosmology.*
2019	Imelda Romero's Semester Project, *Testing PyCosmo on JupyterHub.*
2018	Ralf Aeberhard's Semester Project, *Semesterproject in Cosmology.*

Teaching

Physics III	Fall Semester 2020
Astrophysics II	Spring Semesters 2018, 2019, 2020
Statistical Methods in Astrophysics	Fall Semester 2018
Astrophysics I	Fall Semester 2018
Physics II	Spring Semester 2016
Physics I	Fall Semester 2015, 2016

Conferences and Seminars

- Third HSC medium band workshop, 6-8 August 2025, University of Nagoya, Japan: **Co-leader of a new HSC MB survey and co-chair of the workshop:** https://sites.google.com/view/hsc-mb-survey3/
- Cosmic Cartography with Roman, 14-18 July 2025, STScI Baltimore - **Selected talk:** *Dual AGN and the status of photo-z: synergies across Euclid, Roman and a new HSC medium band survey*
- ESLAB/EC meeting, Leiden, 24-28 April 2025 - **Invited plenary talk:** *Euclid Quick Data Release (Q1): First study of red quasars selection*
- Second HSC medium band workshop, 27-28 November 2024, University of Nagoya, Japan: **Co-leader of a new HSC MB survey and co-chair of the workshop** *https://sites.google.com/view/hsc-mb-workshop/home*
- Euclid Collaboration Meeting, Rome, June 2024 - **Invited plenary talk:** *Euclid OU-PHZ:* https://youtu.be/7lxD48__iiU?si=uiIAw4m2KLaQzD6e&t=2985
- *OU-PHZ workshop in Garching, Münich, May 2024*
- *AGN workshop* in Bologna, February 2024 - **Selected Talk:** *AGN-host decomposition with Euclid first light*
- *First* HSC medium band workshop, University of Nagoya, Japan, August-September 2023. **Invited talk:** *Accurate SED Reconstruction in the Euclid Survey*
- **Invited Seminar** at the University of Nagoya, Japan, August 2023
- **Invited Seminar** at the University of Turin, Italy, July 2023
- Euclid Collaboration Meetings, Copenhagen, June 2023 and Oslo, June 2022
- Kinetic Field Theory (*KFT*) Workshop, March 2022, Heidelberg
  Invited talk: *KFT in PyCosmo*
- Scipy 2020, online conference
- Python in Astronomy, April 2020
  Selected talk: *Cosmological predictions with PyCosmo*

- Cosmology on Safari, South Africa, March 2019 - **Selected talk:** *Cosmological observables with PyCosmo*
- Cosmo-18, Daejeon, South Korea, August 2019 - **Selected poster:** *Precision cosmology with PyCosmo*
- Dark Energy Survey (DES) Collaboration Meeting, Penn State University, June 2019
- DES Collaboration Meeting, Michigan and Stanford Universities, May 2015, 2016

Referee for MNRAS and A&A.

Post-graduate training

April 2021	Django Girls workshop, CERN, Geneva
January 2020	Deep learning meets (Astro)Physics, workshop on Tensor Flow 2.0
Fall 2019	Advanced Machine Learning lectures, ETH Zürich
June 2019	AICosmo2019, Ascona
February 2019	Machine Learning for High Energy Physics, University of Zürich
September 2016	C++ workshop CSCS Supercomputing Centre, Lugano
Aug/Sept. 2016	Observer for DES at Blanco Telescope, Cerro Tololo CTIO, Chile

LANGUAGES

Italian	English	French	German
Native speaker	Proficient user	Intermediate user	Basic user

HOBBIES AND INTERESTS

I play the piano, which I learnt as an autodidact, and sport activities (swimming, biking and martial arts). I like doing scientific outreach and teaching. I enjoy literature, too. I can translate Latin and ancient Greek and I like learning new languages.

Outreach and awards

Science Comics: I wrote two comic books to teach math and physics **[1]**, and I preparing a new story describing the Universe at different scales, as seen by the Euclid telescope, using my own illustrations and the original Euclid ERO images. The project is currently underway within the domain of the Euclid Consortium, in collaboration with Prof. Valeria Pettorino and Prof. Jean Charles Cuillandre.

I made comics for *Treffpunkt Science City*, a public science program by ETH Zürich **[2].**

Other outreach events: I contributed to *Scientifica*, a biennial scientific outreach event organised by ETH Zürich and the University of Zürich, which welcomes more than 25000 visitors every year.

Guest at the Swiss Radio-television: I am often invited to the Swiss Radio television program *Millevoci*, to discuss topics related to space missions, cosmology and astrophysics, together with the journalist Nicola Colotti and internationally recognised scientists **[3].**

Awards: On a personal note, my very first mission was witnessing the launch of the space shuttle STS-120 in Cape Canaveral, Florida, after winning an ESA science competition **[4].**

[1] Preview of science comic books: https://www.federicatarsitano.com/outreach-and-awards .
[2] Comics for Treffpunkt Science City: https://static.wixstatic.com/media/dd2a18_c7a3ecb9737b4a10ba8343e61b2c85dc~mv2.jpg .
[3] F. Tarsitano, N. Colotti, *Euclid e le sue prime immagini dell'Universo*, RSI, 2023: https://www.rsi.ch/info/scienza-e-tecnologia/Euclid-e-le-sue-prime-immagini-dell'Universo--1988018.html .
[4] Article on national newspaper La Stampa: https://www.federicatarsitano.com/_files/ugd/dd2a18_d92dd0178bf74bb1b823ed9378480deb.pdf?index=true .

List of Federica Tarsitano's publications - DSTrain MSCA Postdoctoral Fellowship in Computational and Natural Sciences at University of Oslo

Highlighted publications

1. Euclid Collaboration, **Tarsitano+2025,** ***First study of red quasars in Euclid Q1.*** *This work will be part of A&A Special Issue Euclid Quick Data Release (Q1), publicly presented in March 2025 by the European Space Agency.* Using Euclid Q1, I developed a selection method based on machine learning and multidimensional colour analysis, identifying over 150000 candidate red quasars. Compared to VISTA+DECAm based colour selection criteria, Euclid's superior depth, resolution, and optical-to-NIR coverage improves the identification of the reddest, most obscured sources. This approach, refined through probabilistic Random Forest classification and UMAP, achieves 98% completeness and 88% purity. Notably, Euclid's exquisite resolution in the I_E filter unveils the presence of dual AGN systems and lensed sources. This work provides a first census of candidate red quasars in Euclid and sets the groundwork for future studies in the Euclid Wide Survey (EWS), including spectra and host morphology.

2. **Tarsitano+ in prep.,** ***Accurate SED Reconstruction for Euclid PSF: testing novel Subaru medium-band filters.*** This work focuses on the reconstruction of galaxy spectral energy distributions (SED) — key for modelling the Euclid chromatic point spread function — using a combined physics and machine learning-based method. I also discuss the accuracy gained through the combination of Euclid photometry with a new sets of medium-band filters, sampling the I_E band. I co-lead this survey in collaborations with Japanese institutions. Information is reported here: https://sites.google.com/view/hsc-mb-workshop/home .

3. **Tarsitano+2021,** ***Image feature extraction and galaxy classification: a novel and efficient approach with automated machine learning***, *MNRAS, Volume 511, Issue 3, pp.3330-3338.* In this work, which is a follow-up of Tarsitano+2018, I proposed a novel method combining feature engineering and boosted Random Forest to classify the Dark Energy Survey (DES) galaxy population into early-type and late-type, and simultaneously identify sub-structural features such as bars, clumps and shell-like structures. The analysis offers a baseline for future studies aiming at identifying morphological traits that are typically found in galaxy mergers and can guide the quest for potential hosts of gravitational wave (GW) events.

4. **Tarsitano+2018,** ***A catalogue of structural and morphological measurements for DES Y1***, *MNRAS, Volume 481, Issue 2, p.2018-2040.* In this work I led the creation of the largest galaxy structural catalogue existed since then, and I established my expertise in developing pipelines and algorithms to extract morphological information from galaxy images, validating the measurements through ad-hoc simulations and delivering science-driven interpretation of the results. This earned me the promotion to DES builder member, under the approval of the DES Management Committee and the DES appointed director, Prof. Richard Kron.

5. Palmese+2017, ***Evidence for Dynamically Driven Formation of the GW170817 Neutron Star Binary in NGC 4993***, *The Astrophysical Journal Letters, Volume 849, Issue 2, article id. L34, 8 pp. (2017).* In this work, I performed a multi-wavelength morphological analysis of NGC 4993, the host galaxy of the GW event detected in 2017 by LIGO/Virgo. I found increasing Sérsic index from the blue to red DES bands, orientation twists, and a shell-like structure in the residuals. My analysis suggest the presence of two overlapping stellar populations with different orientations — likely the result of a past minor merger. This interpretation aligns with simulations showing shell structures in post-merger galaxies, and with the co-authors'

spectroscopic analyses that reveal no signs of recent star formation. The collected evidences support the scenario where the merger triggered gravitational instabilities that led to the coalescence of the neutron star binary. Beyond marking the dawn of multi-messenger astronomy, NGC 4993 illustrates how galaxy structure offers unique insights into physical and dynamical processes at play.

Other publications

- **Tarsitano+ in prep.,** ***AGN-host decomposition with Euclid first light***, featuring a novel method for studying AGN-host galaxy with the Euclid Early Release Observations. Featured in Cuillandre+ 2024, *Euclid: Early Release Observations – Overview of the Perseus cluster and analysis of its luminosity and stellar mass functions*, A&A Special issue *Euclid on Sky*.
- Euclid Collaboration, Tucci+2025, *Photometric redshifts and physical properties of galaxies through the PHZ processing function*, *A&A Special Issue Euclid Quick Data Release (Q1).*
- Euclid Collaboration, Quilley+2025, *Exploring galaxy morphology across cosmic time through Sersic fits*, *A&A Special Issue Euclid Quick Data Release (Q1).*
- Euclid Collaboration, Matamoro Zatarain+2025, *The active galaxies of Euclid*, *A&A Special Issue Euclid Quick Data Release (Q1).*
- Euclid Collaboration, Bisigello+2025, *Extending the quest for little red dots to z<4* , *A&A Special Issue Euclid Quick Data Release (Q1).*
- *Cuillandre+2024, Euclid: Early Release Observations -- Programme overview and pipeline for compact- and diffuse-emission photometry, arXiv:2405.13496.*
- Atek+2024, *Euclid: Early Release Observations -- A preview of the Euclid era through a galaxy cluster magnifying lens*, A&A Special issue *Euclid on Sky*.
- Bigwood+2024, *Weak lensing combined with the kinetic Sunyaev-Zel'dovich effect: a study of baryonic feedback*, MNRAS, Volume 534, Issue 1, pp.655-682.
- McCullough+2024, *Dark Energy Survey Year 3: Blue Shear*, arXiv:2410.22272.
- Ting Tan+2023, *Assessing theoretical uncertainties for cosmological constraints from weak lensing surveys*, MNRAS.
- Moser+2022, *Symbolic implementation of extensions of the PyCosmo Boltzmann solver*, Astronomy and Computing, Volume 40, article id. 100603.
- **Tarsitano+2021,** *Predicting Cosmological Observables with PyCosmo*, *Astronomy and Computing, Volume 36, article id. 100484.*
- Sgier+2021, *Combined 13×2-point analysis of the Cosmic Microwave Background and Large-Scale Structure: implications for the S8-tension and neutrino mass constraints*, arXiv:2110.03815.
- Vega-Ferrero+2021, Pushing automated morphological classifications to their limits with the Dark Energy Survey, MNRAS, Volume 506, Issue 2, pp.1927-1943.
- Hartley+2021, *Dark Energy Survey Year 3 Results: Deep Field Optical + Near-Infrared Images and Catalogue*, MNRAS, Volume 509, Issue 3, pp.3547-3579.
- MacCrann N+2021, DES Y3 results: *Dark Energy Survey Y3 results: blending shear and redshift biases in image simulations*, MNRAS, Volume 509, Issue 3, pp.3371-3394.
- Kacprzak, T.+2020, *Monte Carlo Control Loops for cosmic shear cosmology with DES Year 1*, Physical Review D, Volume 101, Issue 8, article id.082003.

I am member of the Euclid Collaboration, MOONS, SkyPy, Dark Energy Survey, LSST Desk.