Curriculum Vitae
and Publication List

Dr. Federica Tarsitano
Postdoctoral Researcher
ETH Zürich Alumni
Université de Genève, Switzerland

Federica Tarsitano

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I am a post-doctoral researcher at the University of Geneva, and **leader of the Morphology AGN working group in the ESA Euclid collaboration.** As part of the **Euclid Early Release Observations Team**, I am working on the very first images from the Euclid telescope, analysing the properties of AGN host galaxies in the Perseus Cluster, with a special focus on novel approaches to study **dual and binary supermassive black holes.** I am also **co-leading the design of a survey** using a new set of medium-band filters of the **Subaru telescope.**

During my **education and research** I applied mathematical modelling, data analysis and code development **in the fields of Particle Physics, Astronomy and Cosmology**, using data from the Dark Energy Survey and the CMS experiment at CERN. **With my work I contributed to the study of NGC 4993, the host galaxy of the GW170817 gravitational wave event.** I also developed a new method for automated classification of astronomical images, and validated it in collaboration with the Swiss startup *Modulos AI.*

I am active in the field of **educational technology**, where I design and promote multidisciplinary science learning projects that integrate fundamental science, computer science, computer vision and AI. My **EduGame project** was shortlisted by the **ETH AI Center.** As a spin-off of that project, I recently published **comic books to teach math and physics, and I am currently working on a comic series for ESA Euclid.** As part of my **outreach** activities, I often participate in the **Swiss Radio television program Millevoci** to discuss topics related to space missions, Cosmology and Astrophysics.

OUTREACH AND AWARDS

23/10/2007: Winner of a scientific competition organised by La Stampa, ESA and Thales Alenia Space. I attended the launch of the shuttle Discovery of the STS-120 space mission in Cape Canaveral, Florida.

01/2024 - Ongoing: Publication of science comics to teach math an physics. Link1 - Link2 .

11/2023: Guest in the Swiss radio television program Millevoci, leading the discussion on Euclid. Article and program here: *Euclid e le sue prime immagini dell'Universo* .

2022: Comics poster for the *Treffpunkt* outreach event in Zürich.

03/2018: Guest in Millevoci: *From the beginning to the end of the Universe*.

2017 - 2019: *Scientifica* outreach event in Zürich.

RESEARCH POSITIONS
Postdoctoral Researcher
University of Geneva | March 2022 - Present
- Contribution to the Euclid operational units, exploring both physics and AI-driven methods to compute galaxy photometric redshifts. **Publications:** Tarsitano et al., in prep., *Accurate flux reconstruction of galaxy SEDs in the Euclid survey.*
- Leading the Morphology AGN working group in the ESA Euclid collaboration. The **publication** will be showcased in the ESA Press Release scheduled for March 2025: Tarsitano et al., in prep., *A red quasar view of Euclid.*
- Analysis of the AGN host-galaxies in the Euclid Early Release Observations, with particular focus on the Perseus Cluster. Development of a new software, **GingaFit** (https://github.com/AstroFederica/GingaFit/tree/main), devoted to AGN-host decomposition and the detection of dual and binary supermassive back holes. Preliminary results were presented in the publication by Cuillandre et al., 2024, *Euclid: Early Release Observations – Overview of the Perseus cluster and analysis of its luminosity and stellar mass functions*, showcased in the ESA Euclid Press release on May 2024. **Publications:** the full analysis will be presented in *AGN-host decomposition with Euclid first light*, Tarsitano et al., in prep.
- Co-leading the design of an HSC medium-band survey, in collaboration with Japanese institutions. Website here.

Research Assistant
ETH Zürich | September 2021 - February 2022

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CONFERENCES AND SEMINARS

Second HSC medium band workshop, 27-28 November 2024, University of Nagoya, Japan, **Co-chair in organising the workshop.**

Euclid Collaboration Meeting, Rome, June 2024 - **Invited** to give the plenary talk *Euclid OU-PHZ*, available on a dedicated Youtube channel. Link here.

OU-PHZ workshop in Múnich-Garching, May 2024

AGN workshop in Bologna, February 2024 - **Selected Talk**

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 Meeting, Copenhagen, June 2023
Euclid Collaboration Meeting, Oslo, June 2022 (online)

KFT Workshop, March 2022, Heidelberg - **Invited** to give a talk about *KFT in PyCosmo*.

Scipy 2020, online conference

Selected talk for Python in Astronomy, April 2020

Cosmology on Safari, South Africa, March 2019 - **Selected talk**

Cosmo-18, Daejeon, South Korea, August 2019 - **Selected poster**

DES Collaboration Meeting, Penn State University, June 2019
DES Collaboration Meeting, Stanford University, May 2016
DES Collaboration Meeting, University of Michigan, May 2015

DES Thought of the Day

EDUCATION - DOCTORAL STUDIES
Research in Cosmology and Astrophysics
ETH Zürich, IPA | July 2017 - July 2021
Publications: Tarsitano et al., 2021, *Image feature extraction and galaxy classification: a novel and efficient approach with automated machine learning*. A new method for galaxy morphological classification, consisting in feature-extraction via isophotal analysis of the galaxy-light distribution. Features are organised as 1D sequences, including enough information to successfully distinguish between early-type and late-type galaxies, and processed through *Modulos AutoML* to perform automated model selection and training. Dimensionality reduction implies faster data manipulation and less computational cost, without significant loss in accuracy. This method can be used to detect contaminating sources and for deblending, as well as for astronomical spectroscopy.

Leading the development of a novel project called PyCosmo, an interactive Python-based framework providing analytical and numerical predictions for cosmological quantities. It is publicly available online on the platform **PyCosmoHub**, https://pycosmohub.com/hub/login. PyCosmoHub is useful both for educational and research purposes.
Publications: Tarsitano et al, 2021, *Predicting Cosmological Observables with PyCosmo*, Astronomy and Computing. Additional developments currently focus on the implementation of new theoretical models to compute cosmological observables, in particular of the Kinetic Field Theory (KFT), as described in Bartelmann et al., 2019.

Internship in nuclear and particle physics
ETH Zürich, IPA | March 2017 - June 2017
Contribution to the project presented in Kasieczka et al., 2017, within the CERN-CMS group at ETH Zürich. The goal was to test the usage of deep learning techniques in Particle Physics analyses, focusing on the classification of reconstructed jet images from the LHC by comparing a deep-learning-based top tagger to the QCD-based top taggers.

Research in Astrophysics
Institute for Astronomy, ETH Zürich | March 2015 - February 2017
Leading the creation of a catalogue of structural properties of galaxies for the Dark Energy Survey (DES) collaboration. With more than 150 million of galaxies made available to the astronomical community, it represents the biggest structural catalogue to date.

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POST-GRADUATE TRAINING

April 2021 Django Girls workshop, CERN, Geneva.

January 2020 Deep learning meets (Astro)Physics, workshop on Tensor Flow 2.0

Visiting student at Stanford University, December 2019

Fall 2019 Advanced Machine Learning lectures, ETH Zurich

June 2019 AICosmo2019, Ascona

February 2019 Machine Learning for High Energy Physics, University of Zurich

September 2016 C++ workshop CSCS Supercomputing Centre, Lugano

August/September 2016 Observer for DES at Blanco Telescope, Cerro Tololo CTIO, Chile.

BUILDER MEMBER OF THE DES COLLABORATION

ACADEMIC REVIEWER

TECHNICAL SKILLS
- Python, C++, HTML
- Wolfram Mathematica
- Big Data, Parallel Computing
- Machine Learning, AI
- Tensorflow
- Statistics, Bayesian statistics
- Edutech

LANGUAGES
- Italian: native speaker
- English: proficient user
- French: intermediate user
- German: 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.

Publications: Tarsitano et al, 2018, *A catalogue of structural and morphological measurements for DES Y1*, Monthly Notices of the Royal Astronomical Society. This work contributed to the study of the host galaxy of the GW170817 gravitational wave event, which was included in media coverage and a press release. **Information can be found** here.

EDUCATION - GRADUATE STUDIES
Master Degree in Nuclear, Subnuclear and Biomedical Physics
University of Turin, Italy | 2009 - 2014
Final grades: 110/110 Magna Cum Laude and Honorable 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, CERN.
CERN Summer Student | 06/2013 - 07/2014
Measurement of the radiation damage of the CMS calorimeter and calibration of its crystals. Study of the decay of particles containing a beauty quark.

EDUCATION - UNDERGRADUATE STUDIES
High School Diploma | 2009
Liceo Classico C. Cavour, Turin, Italy - Final marks: 100/100

TEACHING AND MENTORING
Mentoring | University of Geneva
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.*
Mentoring | ETH Zürich
2020 Silvan Fishbacher's Semester Project, *Constraining Cosmological Parameters with PyCosmo using the KiDS+VIKING-450 Data Release.*
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 Assistant | ETH Zürich
- 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

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Member of the Euclid Collaboration, SkyPy, Dark Energy Survey, LSST Desk.

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PUBLICATIONS

Tarsitano et al., in prep., *Accurate flux reconstruction of galaxy SEDs in the Euclid survey.*

Tarsitano et al., in prep., *A red quasar view of Euclid,* as part of the papers exploiting the potential of the Euclid first data release, which will be presented to the public by ESA in March 2025.

Tarsitano et al., in prep., *AGN-host decomposition with Euclid first light*, featuring a novel method for studying AGN-host galaxy with the Euclid Early Release Observations.

Cuillandre, J-C et al., 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*.

Atek et al, 2024, *Euclid: Early Release Observations -- A preview of the Euclid era through a galaxy cluster magnifying lens*, A&A Special issue *Euclid on Sky*.

Ting Tan et al, 2023, *Assessing theoretical uncertainties for cosmological constraints from weak lensing surveys*, MNRAS.

Tarsitano et al., 2021, *Image feature extraction and galaxy classification: a novel and efficient approach with automated machine learning*, Monthly Notices of the Royal Astronomical Society (MNRAS).

Tarsitano et al, 2021, *Predicting Cosmological Observables with PyCosmo*, Astronomy and Computing.

Sgier et al., 2021, *Combined 13×2-point analysis of the Cosmic Microwave Background and Large-Scale Structure: implications for the S8-tension and neutrino mass constraints*, MNRAS.

Kacprzak, T. et al., 2020, *Monte Carlo Control Loops for cosmic shear cosmology with DES Year 1*, Physical Review D.

Vega-Ferrero et al., 2021, Pushing automated morphological classifications to their limits with the Dark Energy Survey, MNRAS.

Hartley W. et al., 2021, *Dark Energy Survey Year 3 Results: Deep Field Optical + Near-Infrared Images and Catalogue*, MNRAS.

MacCrann N., et al., 2021, DES Y3 results: *Dark Energy Survey Y3 results: blending shear and redshift biases in image simulations*, MNRAS.

Tarsitano et al, 2018, *A catalogue of structural and morphological measurements for DES Y1*, Monthly Notices of the Royal Astronomical Society.

Palmese, A. et al., 2017, *Evidence for Dynamically Driven Formation of the GW170817 Neutron Star Binary in NGC 4993*, The Astrophysical Journal Letters.