Pierluigi Monaco, Ph.D.

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Employment History

2016 – present	**Associate Professor**, University of Trieste.
1999 – 2016	**Researcher**, University of Trieste.
1997 – 1999	**Marie Curie Research Training Grant**, University of Cambridge, supervisor *Prof. George Efstathiou*.

Education

1993 – 1997	**Ph.D. in Astronomy,** Università degli Studi di Trieste, Thesis title: *The cosmological mass function*, Supervisor: *Prof. Fabio Mardirossian*.
1994 – 1995	**Servizio civile** (compulsory, 1 year).
1987 – 1992	**Degree in physics,** Università degli Studi di Trieste, Thesis title: *Effetti d'ambiente sulle galassie del superammasso locale*, Supervisor: *Prof. Giuliano Giuricin*.

Longer-term (up to one-month) visits

2014	**Institute of Astronomy,** Cambridge, UK Collaborator: *Debora Sijacki*.
2008	**Centre de Physique Teorique,** Marseille, France Collaborator: *Christian Marinoni*.
2005	**Institute for Computational Cosmology,** Durham, UK Collaborator: *Tom Theuns*.
2002	**European Southern Observatory,** Garching, Germany Collaborator: *Palle Möller*.
1996	**Theoretical Astrophysics Center,** Copenhagen, Denmark Collaborator: *Paolo Catelan*.

Short term visits and **seminars** in [Germany] Frankfurt, Heidelberg, Bonn, Garching (MPA and ESO), [UK] Cambridge, Durham, Edinburgh, Cardiff, Oxford, Portsmouth, London (UCL), [Canada] Toronto, Waterloo, [France] Marseille, [India] Pune, [Italy] Trieste, Padova, Bologna, Torino, Firenze, Roma, Milano, Palermo.

Teaching and mentoring experience

Teaching duties

from 2016	Cosmology I, master degree in physics
from 2017	Fisica Generale II, bachelor degree in electronic engineering

Teaching and mentoring experience (continued)

2002–2016	
and from 2023	Introduzione all'astrofisica, bachelor degree in physics
2016–2023	Galaxy Formation, PhD program in physics
2018–2021	Radiative processes, master degree in physics
2016–2018	Theoretical astrophysics, master degree in physics
2000/2001	Stellar physics, master degree in physics

Teaching outside University of Trieste

2016/2017	**Contract professor at Lublijana University**, for the course of Extragalactic Astrophysics.
2000 to 2002	**Non-linear Evolution of Perturbations** for PhD students at **SISSA**, Trieste.

Publications

Textbook	**Introduzione all'Astrofisica**, P. Monaco, 2011, edited by Aracne, ISBN 978-88-255-3800-7.

Management

Since 2015	Member of *Commissione didattica* for the curriculum of Astrophysics and Cosmology, that includes mentoring of master students on the choice of their *piano di studi*, and management of the didactical offer of *Laurea Magistrale*.

Mentoring

PhD students:	Giuliano Taffoni (at SISSA), Fabio Fontanot (Tacchini prize), Francesco Saitta, David Goz, Manuel Colavincenzo, Chiara Moretti, Eduardo Quintana Miranda, Jasbir Singh, Vieri Cammelli, Jacopo Salvalaggio, Marius Daniel Lepinzan (still a student).
Master students:	Christian Marinoni (co-supervisor), Gabriele Cescutti, Fabio Fontanot, Gisella De Rosa, David Goz, Massimo Viola, Agnese Fabris, Barbara Lo Faro, Luca Alberto Rizzo, Simone Mozzon, Maria Carla Calcioni, Giordano Teza, Matteo Udina, Giosué Gambardella, Marina Galvagni, Nicola Cantarutti.
Tesine triennali:	Alexandro Saro, Gisella De Rosa, Barbara Lo Faro, Angela Montanaro, Maria Berti, Giulia Sokolic, Gaia Bilosi, Valeria Costa, Luisa Maria Serrano, Gaia Ferri, Agnese Fabris, Andrea Chiappo, Bartolomeo Saviano, Luca Alberto Rizzo, Sergio Vesnaver, Michela Sfreddo, Alberto Monte, Alessandro Vigliano, Ivan Zebochin, Matteo Porru, Claudia Botondi.
PhD reviewer	for University of Padova, Durham, Barcelona (UNAM and Universitat de Barcelona), Roma Tor Vergata, Pune.

Main scientific projects

Scientific interests

Cosmology: based on my PhD thesis on the cosmological mass function, I developed with Tom Theuns the `Pinocchio` approximate code for the fast generation of dark matter halo catalogs. With George Efstathiou I worked on the reconstruction the initial conditions of our local Universe. Later, I restarted the development of `Pinocchio` and joined the Euclid Consortium. My contribution to Euclid: (1) creating the simulated galaxy catalogs needed to compute the error on cosmological parameters; (2) studying the systematic error coming from data analysis. `Pinocchio` has become a science case for ICSC-Spoke 3.

Galaxy formation: starting from the halo merger trees produced by `Pinocchio` and from my works on stellar feedback, I developed `Morgana`, a semi-analytic model of galaxy formation, that was compared to observations in several papers. We were the first to connect the evolution of the most massive galaxies to the production of the intra-cluster light component. With Gabriella De Lucia and Rachel Somerville we made one of the first comprehensive comparisons of different semi-analytical models, showing how we were not reproducing galaxy "downsizing" trends.

N-body simulations: with Giuseppe Murante we wrote the `MUPPI` sub-resolution physics module of `Gadget3`, to taking into account the multi-phase nature of the gas below the resolution limit when including star formation and feedback. With this code we participated to the Aquila comparison project, and in 2015 produced one of the first simulated spiral galaxy that does not suffer by catastrophic loss of angular momentum.

The seeds of supermassive black holes: with Jonathan Tan, and using very high resolution `Pinocchio` simulations, we investigated how the physics of the formation of the first supermassive black holes can be tested with observations. This has triggered an observational effort to quantify the number density of black holes exploiting their variability, lead by Matthew Hayes.

Extragalactic astronomy: since my undergraduate thesis I participated to several projects of extragalactic astronomy, reported in the publication list; an example is the interpretation of data from Emanuele Daddi's group as two parallel Kennicutt relations for normal and starburst galaxies.

Codes

`Pinocchio` I am the main developer and maintainer of *PINpointing Orbit Crossing Collapsed HIerarchical Objects*, that is being used by several groups in the world. Its latest version 5.1, in C, is publicly available on github (`https://github.com/pigimonaco/Pinocchio`) under GNU-GPL license, and has been used to produce 3500 + 1000 simulated Euclid spectroscopic skies.

`Morgana` I was the main developer of the *MOdel for the Rise of GAlaxies aNd Agn*, a non-public semi-analytic fortran code of galaxy formation.

`MUPPI` I was one of the main developers of *MUlti-Phase Particle Integrator*, developed in `Gadget3` in C and later ported to `OpenGadget3`.

Collaborations and leadership

Projects

I list here my responsibilities in the two big projects I am participating to, **Euclid Consortium** and **Italian Center for SuperComputing** (ICSC, Spoke 3 – Astrophysics & Cosmos Observations). I have been part of other collaboration, including **GOODS** (Great Observatories Origins Deep Survey) and **Hydrosim**, the Trieste – LMU network on hydro simulations.

Euclid

Lead of the **Galaxy Clustering Science Working Group**.

Lead of a **Data Release 1 Key Project** on galaxy clustering validation tests and systematic errors.

Lead of a **Preparation Key Project** on galaxy clustering observational systematics; nine papers are in preparation within this Key projects, of which one has already been submitted to the Euclid Consortium Editorial Board (ECEB) for internal review.

Former lead of the Observational Systematics **Work Package** within Galaxy Clustering Science Working Group.

Former lead of two **Processing Functions** for estimating the covariance matrix of clustering measurements (OU-LE3, CM-2PCF-GC and CM-PK-GC).

Up to now, **lead author** of nine Euclid papers that have been published in the arXiv or in a journal.

In preparation: **corresponding author** of two papers: "Simulating thousands of Euclid spectroscopic skies", sent to the ECEB for the first screening, and "Controlling data systematics in the Euclid spectroscopic galaxy sample: fluctuations of survey depth" to be sent to the ECEB very soon.

Presently, co-author of other 58 preparation and 33 Q1 Euclid papers that have at least a preprint (these numbers are changing fast).

ICSC Spoke 3

Former lead of Work Package 2 - Design of innovative Algorithms, Methodologies, Codes toward Exascale and beyond.

Proponent of a Key Science Project - EuMocks.

Conferences and workshops

Selected talks

2003 Lecture at International School on Galaxy Formation, Allahabad (India).

2007 Lecture at Novicosmo school, Novigrad (Croatia).

2013 Lecture at PhD School of Astronomy Francesco Lucchin, Asiago (Italy).

Invited review at European Week of Astronomy and Space Science, Symposium "The co-evolution of Black Holes and Galaxies", Turku (Finland).

2015 Invited talk at "The Many Pathways to Galaxy Growth", Prato (Italy).

Invited review at European Week of Astronomy and Space Science, Symposium "What happened to the gas? Understanding the evolution of galaxies", Tenerife (Spain).

2016 Invited talk at SIGRAV 2016 XXII Conference, "A Century of General Relativity", Cefalù (Italy).

2017 Invited talk at "Frontiers of astrophysical modeling", Leuven (Belgium).

Conferences and workshops (continued)

	Invitation to MIAPP workshop, "In & Out: What rules the galaxy baryon cycle", Garching (Germany).
2018	Invited talk at "Simulated skies for new-generation spectroscopic surveys", ESAC Madrid (Spain).
	Keynote Speaker at "Universum", Bologna (italy).
2019	Invited review at "Cosmology - The next decade", Bangalore (India).
2020	Lecture at Euclid advanced school "The science of future cosmological surveys", supposed to be in Les Houches (France), and held in remote.
2022	Lecture at Euclid Advanced school 2022, Les Houces (France).
2023	Invited talk at "New Strategies for Extracting Cosmology From Future Galaxy Surveys", Sesto (Italy).

Organization of conferences and workshops

2010	Third workshop of the Italian Astrobiology Society, “When Darwin meet Copernicus”, Duino (Italy), member of LOC.
2012	"Active Galactic Nuclei 10" conference, Rome (Italy), member of SOC.
2014	"Active Galactic Nuclei 11" conference, Trieste (Italy), chair of SOC.
2015	Sexten Center of Astrophysics workshop: "Cosmological simulations: from galaxies to large scales", Sesto (Italy), co-chair of SOC.
2023	Organizer of two focus weeks (2023 and 2024) at the Institute for the Fundamental Physics of the Universe, Trieste (Italy), for Euclid’s Observational Systematics Work Package.
	"XVth School of Cosmology", Cargese (France), member of SOC.
2024	Sexten Center of Astrophysics workshop: "New Strategies for Extracting Cosmology From Future Galaxy Surveys - 2nd edition", Sesto (Italy), member of SOC.
	Sexten Center of Astrophysics conference: "The origin and evolution of supermassive black holes", Sesto (Italy), co-chair SOC. We were honoured by the participation of Nobel laureate Prof. Reinhard Genzel.

Bibliometry (NASA ADS)

Total papers:	223
Refereed papers:	162
Total citations:	8577
Normalized citations:	1454
First-author papers:	48
First-author citations:	1338
h-index:	50
m-index:	1.5

Miscellanea

Peer review	Referee for the journals *Monthly Notices of the Royal Astronomical Society*, *The Astrophysical Journal*, *Astronomy & Astrophysics*, *Physical Review D* and others.
Grants	Evaluator of grant proposals for the Georgian, Austrian, Israel national science funds.
Italy	Participant to the Albo dei Revisori of italian MIUR, evalutator of FIRB, SIR and Rita Levi Montalcini projects.
Computing	Computing time grants at CINECA/ISCRA B, PRACE (preparatory access) and ICSC, for more than 20 million core hours.
	Evaluator of ISCRA computing time requests for CINECA.
Affiliations	Istituto Nazionale di Astrofisica (INAF),
	Istituto Nazionale di Fisica Nucleare (INFN),
	Institute for the Fundamental Physics of the Universe,
	International Astronomical Union.

Outreach and *Terza missione*

	Several public lectures, stages and conferences at schools of all levels. Participation to the *Progetto Lauree Scientifiche* at the University of Trieste. Participation to several editions of *Notte dei ricercatori* and *Pint of science*. Public lectures at *ScienzArteAmbiente – Elementa* (Pordenone, 2011), *Certamen Lucretianum Naoniense* (Pordenone, 2012), *M'illumino di meno* (Monfalcone, 2014), *Udinestate* (Udine, 2014), *Scienza e storia dell'acqua* (Trieste, 2014), *Stelle, Galassie e Buchi neri* (Monfalcone, 2018), *Uno sguardo rivolto alle stelle, tra scienza arte e musica* (Gradisca D'Isonzo, 2024); for the *Circolo Culturale Astronomico* of Farra d'Isonzo (2014 and 2018), for Rotary Club Monfalcone, for the Sexten Center for Astrophysics (Sesto, 2015).
2007	Author of an outreach article on the journal *L'Astronomia* titled *La Formazione delle Galassie*.
2008 – 2010	Organizer of and speaker at the *Vagabondi del Cosmo* series of public conferences in Trieste and Monfalcone.
2005 – 2010	Collaboration with the online journal Ulisse (SISSA) for science outreach.
2009	*La scienza della street dance*, invited activity for the 10 year anniversary of *Immaginario Scientifico* of Trieste.
	Live interview at Rai Radio 3 on *Vagabondi del cosmo*.
2014	Press release of INAF-OATs and Trieste University, *Grandi progressi per le galassie in scatola*. Full-page article on Giornale di Sicilia.
2018	Live interview at the local TV network *Retequattro* on the topic *In viaggio con le galassie*.
2021	Interview on *Il Piccolo* local newspaper.
2022	Lecture at "Il cosmo e Margherita", in honour of Margherita Hack (Gradisca d'Isonzo, 2022).
2023	Public lecture for the titling of the local library of Staranzano (the town where I live) to Margherita Hack.
2024	Interview for the *Fisicaffè* podcast (video on youtube).