

# Giuseppe Puglisi, PhD

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## CONTACT INFORMATION

Researcher at Università degli studi di Catania  
via S. Sofia, 64  
Catania, IT, 95123

Citizenship: Italian, EU  
E-mail:  
giuseppe.puglisi@dfa.unict.it  
Webpage: <http://giuspugl.github.io>

## RESEARCH INTERESTS

**Cosmic Microwave Background** Data-analysis for CMB polarization. Map-making techniques, simulation of systematics, Galactic foreground separation, estimation of cosmological parameters.

**Large Scale Structures** Dark Energy equation of state, Neutrino Anomalies

**Modelling Galactic and Extragalactic Emission** Modelling the polarized emission coming from synchrotron, thermal dust, molecular line processes contaminating the CMB signal at large angular scales. Polarized Radio emission from Active Galactic Nuclei.

**Machine Learning in Data-analysis** Adopting Neural Networks to improve the modelling of Galactic Foregrounds. Unsupervised learning procedure to analyze our data by means of clustering techniques or manifold embedding.

### Developer of public packages

- ForeGround clusters ([fgcluster](#))
- Foreground Scale Extender ([ForSE](#))
- Python Sky model ([pysm](#))
- Python Inpainter for Cosmological and Astrophysical Sources ([PICASSO](#))
- Time Ordered Astrophysics Scalable Tools ([TOAST](#))
- Point Source ForeCast ([PS4C](#))
- COSmic Microwave linear Operator for MAP-making ([COSMOMAP](#))
- Monte-Carlo MOlecular Line Emission 3D ([MCMOLE3D](#))

## ACADEMIC APPOINTMENTS

### Researcher (RTDb) at Università degli studi di Catania,

- Period: November 2022 - October 2025
- Focus: Simulations for CMB polarization experiments

## RESEARCH EXPERIENCES

### Researcher (RTDa) at Università degli studi di Roma - Tor Vergata,

- Period: September 2021 - October 2022
- Referee: Prof. Nicola Vittorio
- Focus: Simulations for CMB polarization experiments

**Senior Postdoctoral Fellowship** University of California - Berkeley Berkeley Center for Cosmological Physics, (BCCP)

- Period: January 2020- August 2021
- Referee: Dr. Julian Borrill
- Focus: Data Analysis for future space satellite CMB polarization experiment

**Postdoctoral Fellowship** Kavli Institute of Particle Astrophysics and Cosmology (KIPAC) Stanford University

- Period: January 2018- December 2019
- Referee: Prof. Chao-Lin Kuo
- Focus: Systematics and Foreground simulations for CMB polarization experiment

**PhD in Astrophysics** 110/110 cum laude

International School for Advanced Studies - SISSA Trieste

- Period: November, 2013 - October, 2017
- Title: *B-mode Polarization Experiments for the Cosmic Microwave Background: Map-making and Foreground Modeling*
- Advisors: Prof. Carlo Baccigalupi (SISSA), Dr. Giulio Fabbian (IAP-Paris)
- Opponents: Prof. Paolo Natoli, Dr. Ingunn Wehus

### **Master's Degree in High Performance Computing**

Period: May 2015 - December, 16th 2016

Institutions: SISSA, ICTP

Project title: *Accelerating CMB Maps production with Deflation Preconditioners*

Advisors: Dr. Luca Heltai, Prof. Carlo Baccigalupi, Dr. Giulio Fabbian (SISSA)

### SCHOLARSHIPS AND AWARDS **Dean "Erasmus Traineeship Training PhD Students"**

AWARDS

Period: June 2016-September 2016

Institutions: AstroParticule et Cosmology (APC), Paris

Research field: Data-analysis for ground based CMB experiments

Focus: Noise estimation and mapmaking for Polarbear experiment

Supervisor: Dr. Radek Stompor

### **Undergrad scholarship**

Period: July 2013-November 2013

Institutions: [International School for Advanced Studies \(SISSA\)](#), Trieste

Research field: Forecast of polarized Galactic emission and parametric component separation for sub-orbital CMB experiments.

Supervisor: Prof. Carlo Baccigalupi

### TEACHING AND MENTORING

#### **CMB polarization Classes**

- PhD in Astrophysics joint program University of Rome - Sapienza and Tor Vergata  
Period: February 2023

#### **Radiative Processes Lectures**

- University of Rome - Tor Vergata  
Period: October-November 2022

#### **Relativity and Cosmology Lectures**

- University of Rome - Tor Vergata  
Period: April - May 2022

#### **Advanced Cosmology Lectures**

- University of Rome - Tor Vergata  
Period: Dec 2021

#### **PhD co-supervision**

- A. Carones (2021-now, Roma Tor Vergata), K. Cheung (2020-2021, UC Berkeley), E. Yang (2018-2020, Stanford), J. Kang (2018-2019, Stanford)

#### **Master MSc supervision**

- A. Annoni (2016, SISSA), L. Yang (2015, Beijing University), L. Siyu (2015, Beijing University)

#### **Summer Projects supervision**

- Xiran Bai (2018, University of Michigan)

### PROFESSIONAL ACTIVITIES

- Leader of Work Package on "*HPC codes enabling and optimization*", Spoke3 of the Italian Network *Centro Nazionale 1*
- Simulation Production Manager of the Litebird space mission 2022-present
- Source and Transients pipeline Leader for the Simons Observatory, 2021-present
- Member of Foreground and Systematics Litebird Joint Study Groups, 2018-present
- Member of Pan-Experiment Galactic Science group, 2021 - present
- Member of Simons Observatory Foreground and Galactic Science Working Groups, 2017-present
- Member of Low-ell Working group of CMB-Stage IV experiment, 2019-present
- Member of Polarbear and Simons Array Collaboration, 2014-present
- Member of Machine Learning applications on High Energy Physics at University of California, 2020-2021
- Referee for *JCAP*, 2020- present

- Referee for *Monthly Notices of the Royal Astronomical Society*, 2018 -present
- Referee for *Astronomy & Astrophysics*, 2019 - present
- Referee for *New Astronomy*, 2021 - present
- Referee for *Experimental Astronomy*, 2021 - present

#### BIBLIOMETRICS

- **Scopus Author ID:** 56924810000
- **ORCID:** 0000-0002-0689-4290
- **ResearcherID:** ABG-5313-2021
- **Publications:**
  - 55 papers published in major peer-reviewed journals
  - 20 conference proceedings
- **Total number of citations:** 1264
- **h-index:** 15
- **Presentations:**
  - 11 talks at conferences
  - 10 talks at department seminars
  - 5 posters at conferences

#### EDUCATION

**Course in Convolutional Neural Networks** - Coursera  
Certification Date Oct 2018, License 48PYEMPR4XB8

**Course in Machine Learning** - Stanford University  
Certification Date Sept 2018, License P3Q2PH3MYC2U

**Master in High Performance Computing** SISSA - ICTP

<http://www.mhpc.it>

Period: September 2014- May 2015

Thesis Defense: December, 16th 2016

**MSc in Physics, curriculum of Astrophysics, ("Laurea Magistrale")**, 110/110

Università degli Studi di Milano

Final GPA: **28.85/30** with 2 special mentions

18th October 2010 - 16th April 2013

**BSc in Physics, curriculum of General Physics**, 110/110 cum laude

Università degli studi di Catania

Final GPA: **28.8/30** with 4 special mentions

10th October 2007 - 18th November 2010

**Musical Studies Degree for Clarinet**, Final Score: 8/10

2003 - 2010 Istituto Musicale "V. Bellini" di Catania

#### SEMINARS AND INVITED TALKS

- Invited Talk, "Parametric component separation with clustering technique", *Galactic Science and CMB foregrounds*, Tenerife, Dec 2022
- Organizer and Chair of Workshop *Astrophysics with CMB-S4- Sources and Transients*, University of Urbana Champaign (Illinois), Jul 2022
- Talk, "Supervised and Unsupervised learning techniques on Galactic modelling", *Machine Learning for Astrophysics*, Catania, Jun 2022
- Talk, "Improved Foreground Removal for B-Modes Detection with Clustering Method", *From Planck to the Future of CMB*, Ferrara, May 2022
- Seminar, "Clustering methodologies with parametric fitting", Astrophysics Seminar, *University of Oxford*, Oct 2021,
- Seminar, "Challenges in future CMB polarization data", Astrophysics Seminar,

University of TorVergata - Rome, May 2021,

- Seminar, “Extending Galactic models for Cosmic Microwave Background emission with adversarial nets”, KICP Seminar, University of Chicago, January 2021,
- Seminar, “Extending Galactic models for Cosmic Microwave Background emission with adversarial nets”, International Physics Network, Machine learning and big data in Physics, January 2021, virtual event
- Seminar, “Extending Galactic foreground models for CMB with GANs”, University of California Berkeley, Cosmology and Machine Learning group meeting, December 2020
- Invited talk, “Optimizing the interplay of systematic effects and observing strategy in CMB space missions”, Workshop on CMB systematics, November 2020
- Seminar, “Inpainting Astrophysical emissions with neural networks”, CEA Paris, April, 2020, [link youtube](#)
- Invited talk, “Modeling high resolution Synchrotron emission with neural networks”, CMB-S4 LBNL meeting, April, 2020
- Invited talk, “Modeling Fractional polarization of point sources”, CMB-S4 LBNL meeting, April, 2020
- Seminar, “Hunting Primordial Gravitational waves in the Cosmic Microwave Background”, Università di Catania, EPS young minds meeting, June 2019
- Seminar, “CMB B-mode Polarization Experiments and Galactic Foreground Modelling”, Osservatorio INAF di Catania, June 2019
- Invited Talk, “B-mode forecasts from extra-galactic point sources”, In: CMB foreground B-mode studies, October 2018, Tenerife
- Invited Talk, “Building 3D Galactic models”, In: ASI Cosmos- Conference, April 18, 2018, SISSA Trieste
- Seminar, “Challenges in CMB B-mode data analysis: what’s next?”, Kavli Institute of Physics Astronomy and Cosmology - Stanford University, March 2018
- Seminar, “CMB B-mode Polarization Experiments and Galactic Foreground Modelling”, University of Bologna, Astrophysics Dept., Istituto di Fisica Cosmica (IASF) and Istituto di Radio Astronomia (IRA), October 2017

CONFERENCES AND  
SCHOOLS

- Member of Local Organizing Committee, LiteBIRD meeting October 2021
- Organizer panelist, “Deep Generative Models for Fundamental Physics” Workshop, March 2021
- Member of Local Organizing Committee, CMB-Stage4 Spring meeting 2021, March 2021
- Speaker, “Optimizing the interplay of systematic effects and observing strategy in CMB space missions”, 237th Meeting of American Astronomical Society, January 2021, Virtual meeting
- Chairman for Contributed talks on CMB session and for i-poster presentation on Dust, 237th Meeting of American Astronomical Society, January 2021, Virtual meeting
- Speaker for the Foreground Working group updates, Simons Observatory Global meeting, June 2020, Virtual meeting
- Speaker for the Optic and calibration systematic updates, Litebird Global meeting, June 2020, Virtual meeting
- Talk, “B-mode forecasts from extra-galactic radio sources”, ASI Cosmos- Conference, April 2018, SISSA Trieste
- Talk, “A 3D model for CO molecular line emission”, AstroTS Conference, September 2017, SISSA Trieste
- Talk, “Assessing Point Source emission in Polarbear 2nd season maps, Simons Array meeting, June 2017, Berkeley
- Talk, “Modeling CO line emission”, Simons Observatory meeting, October 2016, Princeton
- Talk, “New challenges in Cosmic Microwave Background studies”, Italian CMB-

	<p>day workshop, March 2016, Italian Space Agency (ASI) Rome</p> <ul style="list-style-type: none"> <li>• Talk, “Two-level preconditioned Conjugate gradient, a worked example”, <i>Workshop on High Performance Computing</i>, 24-26 February 2016, SISSA - Trieste</li> <li>• <i>First ICTP Advanced School on Cosmology</i>, May 2015, ICTP - Trieste</li> <li>• <i>PhD School of Astrophysics Francesco Lucchin</i>, September 2013, Gaeta - Italy</li> <li>• <i>New Light in Cosmology from the CMB School &amp; Workshop</i>, 22th July - 2nd August 2013, ICTP - Trieste</li> </ul>
CONFERENCE POSTERS	<ul style="list-style-type: none"> <li>• “Systematics simulations with TOAST”, <i>CMB-Stage 4 virtual meeting</i>, March 2021</li> <li>• “ Calibration, Beam and Cosmic ray Systematics simulations ”, <i>LiteBIRD virtual meeting</i>, February 2021</li> <li>• “Extending foreground emission with Neural Network”, <i>34th Conference on Neural Information Processing Systems</i>”, December 2020, Virtual meeting</li> <li>• “Making maps with Deflation preconditioner”, <i>CMB-Stage 4 meeting</i>, March 2019, Fermilab Chicago</li> <li>• “Mitigating Gain Systematics”, Litebird Collaboration Meeting, January 2019, ASI Rome</li> </ul>
LANGUAGES	<p>Italian <b>Native</b>  English <b>Fluent</b>  French <b>Good</b>  Spanish <b>Good</b></p>
COMPUTER SKILLS AND COMPETENCES	<ul style="list-style-type: none"> <li>• <b>Programming Languages:</b> C, C++, Fortran, Python, Julia, parallel computing (OpenMP, OpenMPI, CUDA), Mathematica, IDL, Bash scripting</li> <li>• <b>Operating systems:</b> LINUX, Macintosh, Windows</li> <li>• <b>Productivity applications:</b> Installation of Scientific libraries, T<sub>E</sub>X, Gnuplot, GIT</li> </ul>
INSTITUTIONAL RESPONSIBILITIES	<ul style="list-style-type: none"> <li>• PostDoc Representative in the KIPAC management committee, Stanford 2018-2020</li> <li>• Organizer of KIPAC Postdoc workshops and Astro-ph discussion, 2018-2019</li> <li>• Organizer, SISSA weekly Cosmology discussion, 2015-2017</li> <li>• 2014-2016: Student representative of the SISSA PhD courses in the council for Research Fundings of Friuli-Venezia-Giulia region</li> <li>• 2014-2016: Elected member of the SISSA student council as representative of the Astrophysics Sector</li> <li>• 2008-2010: Elected member, as student representative in the Physics Department Committee of the University of Catania (“Consiglio di Coordinamento Didattico”)</li> </ul>