Giuliano Gustavino

RTDA Sapienza Università di Roma

N. publications (scopus): 913 h-index (scopus): 95

Work experience

◦ RTDA - funded by *Young Researcher* grant	Sapienza Università di Roma	2025 - today
◦ Assegno di Ricerca - *Seal of SapiExcellence* grant	Sapienza Università di Roma	2024 - 2025
◦ Assegno di Ricerca - Senior Fascia 3	INFN Sezione di Roma	2024 - 2024
◦ Senior Research Fellow	CERN	2021 - 2023
◦ Post-Doctoral Fellow	University of Oklahoma	2017 - 2021

Education

◦ PhD in Physics	Excellent	Sapienza Università di Roma	2013 - 2017
◦ MSc degree in Physics	110 cum laude	Sapienza Università di Roma	2011 - 2013
◦ BSc degree in Physics	110 cum laude	Università degli studi dell'Aquila	2008 - 2011

Grants & fellowships

◦ Project: "*AnomalousJetTagger*"			
• Young researchers	208 k€	Ministero dell'Università e della Ricerca	2024
• Seal of SapiExcellence	50 k€	Sapienza Università di Roma	2024
◦ Cooperation Associate position	48 kCHF	CERN and INFN	2016
◦ Summer student	3.3 kCHF	MEG experiment	2012
◦ Extreme Energy Events	600 €	CERN and INFN	2005

Awards & acknowledgements

◦ Seal of Excellence, '*DarkJetTracking*' - Horizon Europe MSCA		2025
◦ "Ettore Pancini" prize - Società Italiana di Fisica *for fundamental contributions to new physics searches in ATLAS and the development of a displaced track reconstruction algorithm, advancing the search for long-lived particles.*	5 k€	2024
◦ Seal of Excellence, '*AnomalousJetTagger*' - Horizon Europe MSCA		2024
◦ ATLAS Outstanding Achievement Award *for developing and integrating the large radius tracking into ATLAS' standard reconstruction*		2022
◦ Abilitazione Scientifica Nazionale, ASN - II Fascia		2020
◦ Springer PhD Thesis Award, Published on Springer [1]	500 €	2017
◦ "Pietro Blaserna" prize - Società Italiana di Fisica	1 k€	2015
◦ "Wanted The Best" prize - Sapienza Università di Roma	3.3 k€	2012
◦ "Prize of excellence in Physics" - Società Italiana di Fisica	1.7 k€	2010

Coordination roles & selected responsibilities

◦ Prompt BSM LHC working group convener		2025 - today
◦ Jet and Dark Matter ATLAS subgroup convener (~120 members, ~20 analyses)		2020 - 2022
◦ Analysis contact	• Run 3 emerging jet search (~20 members)	2022 - today
	• Run 2 legacy H → inv combination (~30 members) [2]	2021 - 2023
	• Run 2 legacy monojet search (~20 members) [3]	2017 - 2022
◦ High Level Trigger expert on-call of tracking, *b*-jet, muon and *B*-physics HLT triggers		2016 - today
◦ Tracking Liaison of the Exotics physics group		2019 - 2022

Editorial activities

◦ Papers editor	• Run 3 emerging jet search	2025 - today
	• MALTA telescope [4]	2022 - 2023
	• Large radius tracks reconstruction [5]	2022 - 2023
◦ Pub-notes editor	Monojet perspectives at HL-LHC [6] and LLP recast [7]	2018, 2021
◦ Journals Reviewer	• *Journal of High Energy Physics (JHEP)*	2024
	• *Nuovo Cimento C - SIF proceedings*	2022
◦ Editorial Board member	Dark photons [8] vector-like quarks [9] mono-photon [10] searches	2018 - 2024

Research activity

Over the past few years, I gained an extensive overview of the physics programme at collider experiments, with a main focus on searching for beyond the Standard Model (BSM) Higgs decays, dark matter (DM) and long-lived particles (LLPs). I developed tracking reconstruction algorithms and hardware technologies outside ATLAS.

Data analysis in ATLAS - I led the first study of the tensorial spin-0 structure of the decay amplitude of the Higgs in the $h \to ZZ^* \to 4l$ channel. The results based on the Run 1 data provided the most stringent results of the **spin-CP Higgs properties** [11], confirming the SM expectations. I also provided the sensitivity projections for HL-LHC [12]. I was the main analyser (MA) of all the **mono-jet** searches based on Run 2 data [13, 14, 3], serving as the analysis contact (AC) for the legacy Run 2 analysis and producing the inputs for the European Strategy [15]. This is the most sensitive channel for a wide range of models predicting 'invisible' particles in the final state. As a convener of the **Jet and Dark Matter** subgroup, I deepened and expanded the DM investigation, reviewing and approving 10 analyses now public. I served as the AC of the legacy combination of searches for **Higgs to invisible** decays [2], setting the most stringent limit to date on such a branching ratio, and contributed to several DM and dark sector combinations [16, 17, 7]. To widen the search for DM and NP, I led searches for hidden sectors foreseeing BSM Higgs decays in **LLP** within the ATLAS ID. At first, exploiting the performance of b–tagging algorithm [18], and then, designing a novel analysis strategy focused on reconstructing large radius tracks (LRT) and displaced vertices [19, 20], I filled a gap in the proper lifetime of NP candidates still unexplored. In the last years, I expanded my focus on **dark QCD** scenarios and led the first searches for semi-visible jets in ATLAS [21]. I am the analysis coordinator for the emerging jet search based on initial Run 3 data and I am developing a new model-agnostic search strategy using **anomaly detection** techniques to tag anomalous jet using track information.

Collaborations outside ATLAS - I am a long-term member of the **DM and LLP LHC working groups** (WGs), composed of theoretical and experimental physicists, to establish guidelines and benchmark signals for searches performed at LHC experiments [22, 23, 24]. I participated into the Snowmass Energy Frontier effort to define a guideline for future perspectives of DM and dark shower searches [25, 26]. I am now the convener of the novel **Prompt BSM LHC WG** aiming at harmonising the LHC search programme which complements the DM and LLP signatures and including scenarios such as leptoquarks, vector-like fermions, supersymmetry, anomaly detection.
I played a key role as a MA in measuring the cosmic muon flux with the Cosmic Ray Cube detector at Mt. Soratte. The project combines outreach activities with the scientific purpose of providing the **mountain tomography** [27].

Algorithms development - I developed the novel **LRT reconstruction** algorithm, for which I was awarded the '*ATLAS Outstanding Achievement Award*' and the '*Pancini*' prize. It allowed for reducing fake displaced tracks by a factor of 20 with respect to the past. This impacted dramatically the CPU time and disk-space consumption allowing its integration into the standard ATLAS online and offline reconstruction chains for the first time [5], a game changer for the next generation of LLP searches. I also characterised the secondary vertex reconstruction algorithm [28] to detect the LLP decay products. Currently, I am developing an innovative **Level-0 muon trigger** algorithm for HL-LHC, employing a GNN integrated on FPGAs to further expand the ATLAS upgrade programme.

Hardware & Detectors - I joined the MATHUSLA experiment project, a detector proposal to broaden the exploration of LLPs at HL-LHC, characterising a variety of SiPMs coupled to scintillators. I played a key role in the MALTA project characterising **radiation-hard monolithic pixels sensors**, initially designed for the ATLAS ITk upgrade and future collider applications [29]. I also estimated the resolution of the MALTA telescope based on six chips permanently installed at SPS at CERN and used by several ATLAS upgrade projects [4].

Contributions at conferences & workshops, and seminars

I had about 15 (4) **oral presentations** at international (national) conferences/workshops, including 1 invited talk, and 4 talks invited by the ATLAS speakers committee. I also contributed to 4 **poster** sessions
As a member of the *scientific committee*, I **organised and chaired** 4 sessions at international workshops.
I gave 3 **seminars** and I am a co-organiser of the Young@INFN seminar series for young researchers at Sapienza.

Supervision, Referee & Teaching activities

◦ Student supervision	3 PhD, 4 MSc, 3 BSc	CERN, University of Oklahoma, Sapienza Università di Roma	
◦ Teaching	Electromagnetism	Sapienza Università di Roma	2025
◦ Lectures	Searching for Dark	CERN - ATLAS lecture series	2024
◦ External referee	Phd thesis	IFAE, Barcelona	2022

Outreach

◦ Art & science	Seminar	2025
◦ Stage d'observation	Tutor for a week of a secondary school student	2021
◦ Physics Briefings editor	"Chasing the invisible" [30], "Jetting into the dark side" [31]	2017, 2020