
PERSONAL INFORMATION

Family and First name : **Soffi, Livia**
ORCID :<http://orcid.org/0000-0003-2532-987>
Date of birth : 20/08/1987
Nationality : Italian
Spoken Languages : Italian, English and French

EDUCATION

01/2015 **PhD** in Physics - "*Search for new physics with photons at LHC*" - Sapienza, University of Rome (Italy)
09/2011 **Master degree** in Nuclear and Subnuclear Physics - Sapienza University, (110/110 cum laude, excellent profile¹)
07/2009 **Bachelor degree** in Astro-Physics - Sapienza, University, (110/110 cum laude, excellent profile)

APPOINTMENTS

Since 6/2023 **Permanent Senior research position** - National Institute for Nuclear Physics (INFN) Rome (Italy)
10/2019-5/2023 **Permanent research position** - INFN Rome (Italy)
02/2019-09/2019 **Fixed term research position** - Sapienza, University
02/2015-01/2019 **Postdoctoral Research Fellow** - Cornell University (US)

SCIENTIFIC QUALIFICATIONS

2017 **National Scientific Qualification (ASN)**, academic field : 02/A1 experimental physics of fundamental interactions, associated professor level in Italy

REVIEWING ACTIVITIES

Since 2025 **Austrian Science Fund** - external referee
Since 2023 **Physics Letters B** - Referee of pre-prints in the field "Beyond the Standard Model Physics at colliders"
Since 2022 **JHEP (Journal of High Energy Physics)** - Referee of pre-prints in the field "Beyond the Standard Model Physics at colliders"
Since 2022 **Nature Scientific Reports** - Guest editor of the "Scientific Reports : Neutrinos and other elementary particles" collection
Since 2022 **Regular Fondecyt National Projects Competition** - external referee
Since 2021 **ERC starting grant**, external referee - Panel PE2_2
Since 2016 **CMS Experiment review committee** - member and chair, 9 papers reviewed.

SCIENTIFIC SOCIETY MEMBERSHIPS

Since 2023 **SIF** (Società Italiana di Fisica), scientific member
Since 2021 **AIF** (Associazione Insegnamento della Fisica), scientific member
Since 2010 **CERN** (European Laboratory for Particle Physics), scientific associate
Since 2010 **CMS** (Compact Muon Solenoid) collaboration at CERN, scientific member

FELLOWSHIPS and GRANTS

2023 P.I. of the **PINCH Project** presented for PRIN 2022 call : ranked as **19th over 114 selected projects and financed for two years (300k€)**.
2021 P.I. of the **PINCH Project** presented for ERC-2022-STG retained at step 2 (A grade) but not financed.
2019 P.I. of the **PICO Project** presented for ERC-2020-STG retained at step 1 and rejected at step 2 (B grade).
2013-2014 **CERN-INFN Fellowship** : INFN Grant to spend one year at CERN for research activity during PhD

1. Special program of lectures and seminars dedicated to students with the highest academic records

RESEARCH ACTIVITIES at CMS Experiment ²

Contributions to physics

Since 2025	Search for Heavy Stable Charged Particles w/ Run 3 data and projections at High Luminosity LHC (HL-LHC).
Since 2023	Search for light resonances in di-electrons final state w/ Run 3 data and novel parking strategy.
Since 2020	Search for multiquark resonances (tetraquarks) in B hadrons decays with Run 2 and Run 3 data.
Since 2018	Search for non conventional signatures at HL-LHC with delayed objects including leptons, photons and jets with the new CMS MIP timing detector (MTD). See : 10.22323/1.414.0688 , CERN-CMS-DP-2022-025 , CERN-LHCC-2019-003 , arXiv:1812.07831
2015-2018	Search for dark-matter particles produced in association with hadronic jets and/or an Higgs Boson. See : arXiv:1810.00196 , arXiv:1908.01713 , arXiv:1806.04771 , CMS-CR-2017-130 , arXiv:1703.052361 , arXiv:1712.02345
2013-2017	Search for heavy resonances decaying in two photons at 8 and 13 TeV. See : arXiv:1809.00327 , doi:10.1140/epjp/i2016-16283-3 , CERN-THESIS-2015-466 , arXiv:1506.02301 , arXiv:1606.04093 , arXiv:1609.02507 ,
2012-2014	Study of the interference effect in the standard model $H \rightarrow \gamma\gamma$ signal with the non resonant $\gamma\gamma$ background. arXiv:1407.0558 , arXiv:1610.07922
Since 2011	Search for new physics with delayed photons in the final state with novel experimental techniques at 8 TeV and at 13 TeV. See : arXiv:1906.06441 , doi.org/10.1051/epjconf/20136017006 , arXiv:1212.1838 , arXiv:1903.04497

Contributions to the detector

Since 2025	Assembly of detector modules and trays for the barrel section (BTL) of the MTD.
Since 2018	Characterization of LYSO :Ce crystals for the MTD and tests of crystals radiation resistance for HL-LHC. See arXiv:2205.14890 , arXiv:2104.07786
2015-2017	Jet reconstruction performance with the upgraded tracker detector in the very forward region of CMS after the Long Shut Down 2 at CMS.
Since 2014	Shift Leader at CMS Experiment Site, Point 5 of the LHC
2013-2014	Beam test for a tungsten-cerium fluoride sampling calorimeter for High Luminosity LHC. doi: 10.1109/NSSMIC.2015.7581770 doi:10.1088/1748-0221/10/07/P07002 doi:10.1016/j.nima.2015.09.052 arXiv:1506.02604
Since 2012	Study of electrons and photons performance with the ECAL detector including energy and time calibration and triggering and identification strategies since Run 1. See : arXiv:2012.06888 , arXiv:1810.00196 , doi:10.22323/1.390.0780 , arXiv:1803.11133 , arXiv:1502.02702 , doi:10.1393/ncc/i2014-11685-6 , arXiv:1810.00196 , arXiv:1810.00196 ,
2011-2015	ECAL detector expert on call

RESEARCH MANAGEMENT RESPONSIBILITIES

2. See detailed description of my research activity at the end of this document

Since 2025	LHC BSM Working Group Convener : Coordinator and and leadeare of a collaborative research group focused on exploring physics beyond the Standard Model, bringing together theorists and experimentalists across the LHC community [link] . Responsible of setting the scientific agenda, prioritizing key analyses and fostering innovation in search strategies, while overseeing the progress of working group activities, including publications, public results, and internal reports. Facilitating communication and collaboration within the group, mentoring early-career researchers, and ensuring the exchange of ideas across experiments and institutions. Additionally, representing the working group in LHC-wide and international forums, advocating for the group's research priorities.
2022-2024	EXOTICA Group Convener : Coordinator and responsible of all the activities in CMS related to the searches for new physics (excluded SUSY). Level-2 position coordinating the largest Physics Analysis Group in CMS (~ 200 people). There are currently $O(100)$ analyses underway, exploiting both LHC Run 2 and Run 3 data and exploring the existence of new physics in fields ranging from the dark sector, to leptoquarks, new resonances and extradimensions. I directly coordinate 8 sub-conveners responsible for the EXOTICA sub-groups and 15 contacts. In 2022, the group coordinated by me published 12 journal articles and produced 13 new results [link] shown at major international conferences such as Moriond2022, LHCP2022 and ICHEP2022.
2021-2022	Future Long Lived and Timing Convener : Coordinator of all the activities in CMS related to the usage of timing at HL-LHC. I have developed algorithms to extract, from the reconstruction of the signals in CMS, the time measured by the CMS sub-detectors and to calculate variables capable of discriminating signals with characteristic temporal structures (e.g. slow particles). Level-3 position (~ 10 people)
2018-2020	E/Gamma Group Convener : Coordinator and responsible of all the activities in CMS related to the usage of electrons and photons (roughly 50% of all physics analyses in CMS). Level-2 position (~ 60 people). I responded directly to the Physics Coordination of CMS and co-coordinated all activities related to the reconstruction, identification and triggering of electrons and photons in CMS. I had primary responsibility for the quality and precision of the energy measurement of electrons and photons, as well as the calculation of correction factors between data and simulation and the performance of the triggers. I directly coordinated 6 sub-conveners responsible for the E/Gamma sub-groups. Over the two years I also coordinated and acted as main editor of the first publication of electron and photon performances with all the data collected by CMS in Run2 [arXiv:2012.06888] .
2017-2018	E/Gamma Identification Sub Group Convener : Responsible and main author of development, implementation and test of electrons and photons identification tools at CMS. Level-3 position (~ 10 people)
2015-2016	LHC Higgs Cross Section Sub Group Convener : Main developer of the studies related to the interference effect in the $H \rightarrow \gamma\gamma$ channel at CMS. Level-3 position (~ 5 people)
2014-2018	Exotica and B-physics Electron/Photon Contact : Person in charge for the review of all analyses that use photons in the Exotica and B-hadrons Physics Analysis Groups at CMS.

AWARDS

2024	Premio per la Comunicazione Scientifica : best outreach project in physics
2016	INFN Marcello Conversi Prize : best PhD thesis in collider physics
2013	Laura Bassi Prize : best graduated student by Italian Society of Physics
2013	Best talk in PhD session at IFAE, Cagliari (Italy)
2009	ARAP Prize : best undergraduate student in particle physics from Roman Association for Astroparticles

ORGANIZATION OF SCIENTIFIC CONFERENCES

2024	[CMS Italy Meeting] - Rome, October 2024 : member of the local organizing committee
2024	[Standard Model at the LHC] - Rome, May 2024 : member of the local organizing committee
2023	[CMS Exotica Workshop] - Rome, Dec 2023 : coordinator of the local organizing committee
2023	[IFAE2023 Conference] - Catania, May 2023 : convener of the searches plenary session
2023	[Moriond EW 2023 Conference] - La Thuile, Mar 2023 : chair of Dark Matter plenary session
2022	[LHCP2022 Conference] - Taipei May 2022 : convener of BSM parallel session
2022	[CMS ECAL Days Workshop] - Rome, Oct 2023 : Member of the local organizing committee
2011-2012	[CMS Exotica Workshop] - Rome Nov 2021/22 : Member of the local organizing committee

SUPERVISION OF UNDER-GRADUATE and PhD STUDENTS

Since 2021	Supervising undergraduate and PhD students from Sapienza, University of Rome (Italy) : Lisa Fantini (2021), Chiara Basile (2022), Noemi Palmeri (2023), Elena De Santis (2024), Tiziano Pauletto (2024), Simone Tranfo (2025). The work produced by these students under my supervision can be found [here] .
2018-2021	Co-supervised two PhD students from Notre-Dame University (US) (Dr. Ryan Kim (2019)), and SINP (India) (Dr. Debabrata Bhowmik (2018)).
2015-2019	Director of PhD activities within CMS group - Cornell University (US) : responsabile and coordinator of the research activities of all the PhD students within the group (roughly 5-6 students per year).
2015-2019	Supervised two PhD students from Cornell University (US) : Dr. Kevin McDermott (2018) and Dr. Margaret Zientek (2018).
2012-2016	Co-supervised three under-graduate students from Sapienza, University of Rome (Italy)

TEACHING EXPERIENCES

Undergraduate

2019-2023	Lecturer, Course of Computing Methods - Sapienza, University of Rome (Italy), ~100 students per year [link]
2019-2023	Co-lecturer, Course of Classical Mechanics - Sapienza, University of Rome (Italy), ~80 students per year [link]
2019-2022	Teaching assistant, Course of Nuclear and Particle Physics Laboratory - Sapienza, University of Rome (Italy) with Prof. G. Cavoto, ~5 students [link]
2013-2014	Teaching assistant, Course of Nuclear and Particle Physics - Sapienza, University of Rome (Italy) with Prof. E. Longo, ~80 students [link]

Lectures at graduate and summer schools and high schools

Since 2020	Lecturer at OLIFIS - Teacher of Modern Physics to students participating to international games of physics. [link]
2018	Lecturer at 7th NCP School on LHC Physics - Islamabad (Pakistan)
2017	Lecturer at CMSPOS CMS Physics Objects School - Bari (Italy)
2013-2014	Teaching assistant at COURSERA : La visione del mondo e della Meccanica Quantistica with Prof. C. Cosmelli [link]

OUTREACH AND DISSEMINATION

Since 2021	Responsible and coordinator of HEPscape! - The first high energy physics escape room activity realized in Italy with the support of INFN. [link] O(2000) visitors per year.
Since 2021	Supervisor of Outreach projects from PhD students - Supervisor of two projects (3k EUR in 2021 and 6.5 kEUR in 2022) dedicated to outreach activities targeting elementary and middle schools students with disabilities and hearing-impaired. [link]
Since 2021	Responsible and co-coordinator of INFN Rome socials - Mostly focus on INF Rome Facebook page [link]
Since 2021	Speaker at Art&Science - Program that promotes the connections between the arts and science through seminars from experts in the schools [link] O(60) students per year.
Since 2020	Responsible and coordinator of FISICAST - Program consisting in podcasts to explain everyday life observations related to physics. [link]
Since 2020	Speaker at INFN Kids - Program that promotes the INFN research activities among elementary schools students [link]
2020-2021	Tutor at LAB2GO - Program for upgrading high school laboratories with the help of qualified researchers from university [link]
Since 2019	Responsible and coordinator of International Masterclass - Reference person from INFN and IPPOG in Rome. I coordinate two events per year for high schools in Lazio Region in Italy. [link] O(200) students per year.
Since 2019	Main organizer of International Day of Women and Girls in Science - Program for introducing girls at high school level to the field of research in physics and STEM [link1] [link2] O(100) students per year.
Since 2019	Co-organizer of "European Research Night" - Physics Department, Sapienza, University of Rome (Italy) and INFN [link] O(1000) students per year.
2019	Selected among the 10 finalists for the <i>Giovedì Scienza Prize</i> dedicated to scientists under 35 years in Italy.
2019	Lecturer at "Camminiamo nella Luce" - Sapienza, University of Rome (Italy)
Since 2017	Co-coordinator of ESADE-CERN : Thinking the Unknown Program , under Dr. Markus Nordberg, Head of Resources Development Unit at CERN [link]
Since 2015	Responsible and coordinator of "A volte ritornano" - Serie of seminars of ex-students, now researchers in physics, from Liceo Scientifico Paolo Ruffini, Viterbo (Italy) [link]
Since 2013	CMS outreach activities (visits, masterclasses for students, virtual events)

SELECTED INTERNATIONAL CONFERENCES TALKS

- 12/2025** *BSM physics from CMS and prospects*, WHEPP2025 , Hyderabad (India)
5/2025 *Beyond standard model searches : current status and prospects from the experiment side*, CorfuFA 2025 , Corfu (Greece)
12/2024 *New particle searches at LHC (non-susy)*, Discrete 2024 , Ljubana (Slovenia)
7/2024 *Experimental overview of BSM searches (including resonant HH production)*, ICHEP 2024 , Praga (Czech Republic)
6/2024 *New ideas for measurements and searches at the HL-LHC*, LHCP 2024 , Boston (US)
07/2022 *Physics opportunities with a MIP Timing Detector in CMS at HL-LHC*, ICHEP 2022 , Bologna (Italy)
03/2022 *HEPscape : High Energy Physics escape room*, INTED 2022 , Virtual World
11/2021 *HEPscape : High Energy Physics escape room*, AIF 2021 , Roma
09/2021 *Prospects for BSM at LHC*, PANIC 2021 , Virtual World
09/2021 *CMS status report*, LHCC147 : 147th LHCC Meeting , Virtual World
07/2020 *CMS electron and photon performance at Run 2 and prospects for Run 3*, ICHEP 2020, Virtual World
07/2018 *Search for non conventional signatures at CMS*, SUSY 2018, Barcelona, (Spain)
04/2018 *HL-LHC studies of the potential for fast timing for BSM searches*, HL/HE LHC Meeting, Fermilab (US) (Invited)
12/2017 *CMS Summary*, LHC Dark Matter WG public meeting, CERN Geneva (Switzerland) (Invited)
05/2017 *BSM physics with photons*, Photon17, CERN Geneva (Switzerland)
03/2017 *Search for Dark Matter and unusual signatures at LHC*, Rencontres de Moriond, La Thuile (Italy)
05/2016 *Is there a $X(750)$ signal ?*, Rencontres de Blois, Blois (France)
09/2015 *Search for New Physics at the LHC*, COSMO 2015, Warsaw (Poland)
07/2014 *Search for Beyond the Standard Model Higgs*, Higgs Hunting 2014, Orsay (France)
05/2013 *Searches for Long-Lived Particles*, LHCP 2013, Barcelona (Spain)

SELECTED SEMINARS AND COLLOQUIA

- 01/2020** *Exotic Searches at CMS*, COMPOSE-IT 2020, Perugia, (Italy)
10/2019 *Ricerche di Stati Esotici : Prospettive per Run 3*, CMS ITALY 2019, Bari (Italy)
05/2019 *CMS Phase-2 MIP timing detector*, 5th Workshop - LHC LLP Comm. (CERN)
09/2017 *Search for Dark Matter and unusual signatures with photons at CMS*, Harvard University, MIT, Princeton University, Cornell University (US)
07/2016 *Chasing Dark-Matter at the LHC*, Sapienza, University of Rome (Italy)
03/2016 *Search for BSM with leptons and photons at CMS*, LPCC Seminar (CERN)
04/2013 *Use of ECAL time in physics analysis at CMS*, IFAE 2013, Cagliari (Italy)
09/2011 *Ricerca di SUSY con energia trasversa mancante e fotoni di alta energia a LHC*, XCVII SIF Congress, L'Aquila University, L'Aquila (Italy)

PUBLICATIONS

I am co-author of [more than 1000 published papers in Web Of Science \(WoS\) database](#) in the domain of particle physics. The list below includes 12 papers in which I have been the main author or I gave a major contribution. The number of citations shown and the impact factor (IF) are taken from WoS database. At the end of this document a brief description of my research activity with reference to these papers when appropriate is reported.

N.	Title	Reference	DOI	IF	#cit.
1	"Comparative characterization study of LYSO :Ce crystals for timing applications"	JINST 17 08 (2022)	10.1088/1748-0221/17/08/P08028	1.3	22
2	"Electron and photon reconstruction and identification with the CMS experiment at the CERN LHC"	JINST 16 05 (2021)	10.1088/1748-0221/16/05/P05014	1.4	58
3	"Searching for long-lived particles beyond the Standard Model at the Large Hadron Collider"	J. Phys. G 47 09 (2020)	10.1088/1361-6471/ab4574	5.09	123
4	"Search for dark matter particles produced in association with a Higgs boson in proton-proton collisions at $\sqrt{s} = 13$ TeV"	JHEP 03 (2020)	10.1007/JHEP03(2020)025	7.9	13
5	"Search for long-lived particles using delayed photons in proton-proton collisions at $\sqrt{s} = 13$ TeV"	Phys. Rev. D 100 (2019)	10.1103/PhysRevD.100.112003	9.62	12
6	"Search for new physics in final states with an energetic jet or a hadronically decaying W or Z boson and transverse momentum imbalance at $\sqrt{s}=13$ TeV"	Phys. Rev. D 97 9 (2018)	10.1103/PhysRevD.97.092005	8.71	120
7	"Search for dark matter produced in association with a Higgs boson decaying to $\gamma\gamma$ or $\tau\tau$ at $\sqrt{s} = 13$ TeV"	JHEP 09 (2018)	10.1007/JHEP09(2018)046	8.70	7
8	"Search for high-mass diphoton resonances in proton-proton collisions at 13 TeV and combination with 8 TeV search"	Phys. Lett. B 767 (2017)	10.1016/j.physletb.2017.01.027	4.25	79
9	Search for Resonant Production of High-Mass Photon Pairs in Proton-Proton Collisions at $\sqrt{s} = 8$ and 13 TeV"	Phys. Rev. Lett. 117 (2016)	10.1103/PhysRevLett.117.051802	8.25	41
10	"Search for new exotic particles decaying to photons with the CMS experiment at the LHC"	Eur. Phys. J. Plus 131 (2016)	10.1140/epjp/i2016-16283-3	1.96	1
11	"Performance of photon reconstruction and identification with the CMS detector in proton-proton collisions at $\sqrt{s} = 8$ TeV"	JINST 10 08 (2015)	10.1088/1748-0221/10/08/P08010	1.31	173
12	"Performance of a tungsten—cerium fluoride sampling calorimeter in high-energy electron beam tests"	Nucl. Instrum. Meth. A 804 79 (2015)	10.1016/j.nima.2015.09.055	1.4	3

WORLDWIDE ACCEPTED ESTEEM INDICATORS

Web of Science : Total **publications** : **1070**. Total **citing articles** : **18329**. Total **citations** : **47985** (44.85 on average). **H-index** : **100**.

HIGHLIGHTS OF ORIGINAL RESEARCH CONTRIBUTIONS

I contributed to high energy physics research within the CMS collaboration at CERN with new ideas and developments. Here a few highlights :

- Development of [electrons and photons identification strategies](#)[11] to mitigate the worsening of identification efficiencies in the event of multiple interactions at CMS detector at LHC. This tool has been one of the ingredient for the [discovery of the Higgs boson](#) in its decay into two photons in 2012. My continuous interest in electromagnetic objects at CMS allowed me to cover firstly the position of E/gamma identification convener (Level 3) and then the prestigious position of E/gamma convener at CMS (level 2). During my mandate I have been the main author and coordinator of the [first CMS physics object paper with full Run 2 data discussing electrons and photons performances](#)[2]. In the context of the standard model Higgs boson investigation, I developed a study of the [interference effect between the \$H \rightarrow \gamma\gamma\$ signal and the non resonant \$\gamma\gamma\$ background](#). The Higgs boson mass shift due to this interference can be exploited to constraint the Higgs boson width.
- I performed as main author the [first search for heavy wide resonances in the di-photon decay channel](#)[10] at LHC, producing [model independent bounds](#) on a resonant production of new particles in the mass range between 150 and 850 GeV at 8 TeV. I co-authored a similar search at 13 TeV which reported, back in 2015, an [interesting fluctuation of events around a di-photon mass of 750 GeV](#)[9], observed also by the ATLAS experiment and published on Physical Review Letters. I had the responsibility of the statistical combination of the 13 TeV and the 8 TeV results, which eventually explained the observed excess as a [pure statistical fluctuation of the data](#)[8].
- I have been part of the team responsible for the testing and the characterization of a prototype [for a sampling calorimeter](#)[12], to be built for the High Luminosity LHC (HL-LHC), made out of cerium fluoride crystals interleaved with tungsten plates, and read out by wavelength-shifting fibres.
- I contributed to the CMS search for [Dark Matter](#) produced in [association with a jet](#)[6]. I introduced the very first search for Dark Matter produced in association with an [with an Higgs boson](#)[4] decaying to two photons, two b quarks or [two taus](#)[7].
- I pioneered, in collaboration with PhD supervisors, the [use of the time of arrival of the photons](#) on the electromagnetic calorimeter of CMS (ECAL) as a novel technique to identify, for the very first time at colliders, [delayed photons produced in the decay of long-lived particles](#). This work laid the basis for the development of new experimental techniques which exploit the ECAL time measurement to identify a potential non standard model signal in the detector. I supervised two PhD students on a [similar search with Run 2 data](#)[5]. With my work, I introduced the usage of ECAL timing to detect delayed signal at CMS, and I contributed to the exportation of this method to detect also delayed jets. My expertise in non conventional signatures boosted my interest in new physics searches at CMS bringing me to cover the role of EXOTICA convener at CMS (level 2 position) starting in 2022. Covering this role I expanded my expertise to searches with hadronic and non hadronic final states and heavy objects.
- New phenomena with long-lived particles decaying to delayed objects are also of great interest in preparation of the HL-LHC physics program in the next 5 years. In this context I am now collaborating to the project of a new dedicated 30 ps resolution MIP timing detector (MTD) that CMS is planning to build for HL-LHC. The HL-LHC sensitivity projections I obtained on [searches for delayed photons and delayed jets](#)[3] with timing measurement in the MTD, have been a key ingredient to support the MTD project and its approval from the LHC committee in Sept. 2019. My main involvement now consists in design novel approaches in the investigation of physics beyond the SM [exploiting timing information to reconstruct and identify final states with long-lived particles](#). For this reason I served as convener of the physics group : Future Long Lived and Timing. I indeed co-coordinated the usage of timing information from all CMS subdetectors at Run 3 and its [projections and opportunities for HL-LHC](#). I work actively on the [characterization of the MTD](#) [1] units prototypes made of LYSO :Ce crystals, within the efforts of the CMS Rome group, who has a leading role in the units production.
- I recently won a research grant (PRIN2022, Prot. 2022NYSEMR) with a budget of roughly 300k€, to set up a team of people working, for the next two years on new physics searches with non conventional techniques, as a testing ground for the deployment of the MTD detector in few year from now. We will perform Run 3 data based searches and projection at HL-LHC using timing information from CMS sub-detectors to explore new physics with a non main-stream approach.