

PERSONAL INFORMATION

Family and First name : **Soffi, Livia** (ORCID :<http://orcid.org/0000-0003-2532-9876>)
 Citizenship : Italian
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 Spoken Languages : Italian, English and French

EDUCATION

01/2015 **PhD** in Physics at Sapienza, University of Rome (Italy) under supervision of Prof. S. Rahatlou and Prof. D. del Re
09/2011 **Master degree** in Nuclear and Subnuclear physics at the Physics Department of Sapienza, University of Rome (Italy), (110/110 cum laude, excellent profile¹)
07/2009 **Bachelor degree** in Astro-physics at the Physics Department of Sapienza, University of Rome (Italy), (110/110 cum laude, excellent profile)

CURRENT WORKING POSITION

Since 10/2019 **Permanent research position** at the National Institute for Nuclear Physics (INFN) Rome (Italy)

PREVIOUS WORKING POSITIONS

02/2019-09/2019 **Fixed term research position** type A (RTdA), at the Physics Department of Sapienza, University of Rome (Italy)
02/2015-01/2019 **Postdoctoral Research Fellow**, Cornell University (US)
07/2013-06/2014 **CERN INFN Associate**, CERN, Geneva (CH)

SCIENTIFIC QUALIFICATIONS

2017 **National Scientific Qualification (ASN)**, Academic Field : 02/A1 Experimental physics of fundamental interactions, Associated Professor Level

MAJOR COLLABORATIONS

Since 2010 Member of the *Compact Muon Solenoid (CMS)* collaboration at CERN / Switzerland

RESEARCH ACTIVITIES AT CMS

Contributions to physics analyses

Since 2018 Search for **non conventional signatures** with delayed leptons, photons and jets with the **new CMS MIP timing detector** for High Luminosity LHC.
2017-2019 Search for **new physics with displaced photons** in the final state at 13 TeV.
2015-2018 Search for **dark-matter** particles produced in association with hadronic jets and/or an Higgs Boson.
2013-2017 Search for **heavy resonances decaying in two photons** at 8 and 13 TeV
2012-2014 Study of the **interference effect in the standard model** $H \rightarrow \gamma\gamma$ signal with the non resonant $\gamma\gamma$ background.
2011-2013 Search for new physics in final states with **delayed photons and missing energy with novel experimental techniques at 8 TeV.**

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

Contributions to the detector

Since 2018	Characterization of LYSO :Ce crystals and tests of crystals radiation resistance for the novel CMS MIP timing detector for High Luminosity LHC.
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.
Since 2011	Measurement of CMS ECAL time resolution using electrons and jets.
2011-2015	In-situ calibration of CMS ECAL calorimeter . Energy resolution and of photon identification in presence of multiple interactions in the event.
2011-2015	ECAL detector expert on call

SCIENTIFIC RESPONSIBILITIES

Since 2021	Future Timing and Long Lived Particles Sub Group Convener : Coordinator of all the activities in CMS related to the usage of timing in preparation for Run 3 and High Luminosity LHC (Roughly 30 people).
2018-2020	E/Gamma Group Convener : Coordinator of all the activities in CMS related to the usage of electrons and photons (Roughly 40 people).
2017-2018	E/Gamma Identification Sub Group Convener : Responsible of development, implementation and test of electrons and photons identification tools at CMS (Roughly 7-10 people).
2015-2016	LHC Higgs Cross Section Sub Group Convener : Responsible of the studies related to the interference effect in the $H \rightarrow \gamma\gamma$ channel at CMS.
2014-2018	Exotica Photon Contact : Person in charge for the review of all analyses that use photons in the Exotica Physics Analysis Group at CMS.

REVIEW COMMITTEES

Since 2015	Member and chair of the internal Analysis Review Committees of the CMS Collaboration : Responsible and coordinator of the scrutiny of public results of the CMS collaboration.
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TEACHING RESPONSABILITIES AT SAPIENZA UNIVERSITY

Since 2019	Lecturer, Course of "Laboratorio di Calcolo" - Sapienza, University of Rome (Italy)
Since 2019	Co-lecturer, Course of Classical Mechanics - Sapienza, University of Rome (Italy) with Prof. E. Longo
2013-2014	Teaching assistant, Course of Nuclear and Particle Physics - Sapienza, University of Rome (Italy) with Prof. E. Longo

OTHER TEACHING EXPERIENCES

Since 2019	Lecturer at OLIFIS - Teacher of Modern Physics to students participating to international Olympic games of physics. [link]
2013-2014	Teaching assistant at COURSERA : <i>La visione del mondo e della Meccanica Quantistica</i> with Prof. C. Cosmelli [link]
2018	Lecturer at 7th NCP School on LHC Physics - Islamabad (Pakistan)
Since 2017	Lecturer at CMSPOS CMS Physics Objects School - Europe

SUPERVISION OF UNDER-GRADUATE and PhD STUDENTS

Since 2021	Supervised undergraduate student from Sapienza, University of Rome (Italy).
2018-2020	Co-supervised two PhD students from Notre-Dame University (US), and SINP (India).
2015-2018	Supervised two PhD students from Cornell University (US). Coordinator of PhD and master students activities at Cornell.
2012-2016	Co-supervised three under-graduate students from Sapienza, University of Rome (Italy)

OUTREACH ACTIVITIES

- Since 2021 **Responsible and coordinator of HEPscape** - High Energy Physics Escape Room project supported by the INFN CC3M presented at European research Night in Rome and Science Festival in Genova [\[link\]](#)
- Since 2020 **Responsible and coordinator of FISICAST** - Program consisting in podcasts to explain everyday life observations related to physics. [\[link\]](#)
- Since 2020 **Tutor at LAB2GO** - Program for upgrading high school laboratories with the help of qualified researchers from university [\[link\]](#)
- Since 2019 **Co-organizer of International Day of Women and girls in Science** - Program introducing girls at high school level to the field of research in physics and STEM [\[link1\]](#) [\[link2\]](#)
- Since 2019 **Co-organizer of "European Research Night"** - Physics Department, Sapienza, University of Rome (Italy)
- 2019 **Lecturer at "Camminiamo nella Luce"** - Sapienza, University of Rome (Italy)
- Since 2017 **Co-coordinator of ESADE-CERN : Thinking the Unknown Program**, with 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)

INTERNATIONAL CONFERENCES TALKS

- 09/2021 *BSM Physics Prospects (Experimental Vision)*, PANIC 2021, Virtual Conference
- 09/2021 *CMS Status Report*, 147th LHCC Open Session, Virtual (CERN)
- 07/2020 *CMS electron and photon performance at Run 2 and prospects for Run 3*, ICHEP 2020, Virtual Conference
- 01/2020 *Exotic Searches at CMS*, COMPOSE-IT 2020, Perugia, (Italy)
- 05/2019 *CMS Phase-2 MIP timing detector*, Fifth Workshop of the LHC LLP Community, CERN, Switzerland (CH)
- 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)

NATIONAL CONFERENCES TALKS

- 10/2019 *Ricerche di Stati Esotici e Prospettive per il Run 3*, CMS ITALY 2019, Bari (Italy)
- 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)

SEMINARS

- 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 physics in final states with leptons and photons at CMS, LPCC Seminar, CERN, Geneva (Switzerland)*

FELLOWSHIPS and AWARDS

- 09/2019** Selected among the 10 finalists for the *Giovedì Scienza Prize* dedicated to scientists under 35 years in Italy.
- 07/2019** P.I. of the *PICO* Project presented for ERC-2020-STG retained at step 1 (B1) and rejected at step 2 (B2).
- 03/2016** **INFN Marcello Conversi Prize** : best PhD dissertation in collider physics by the Italian National Institut of Nuclear Physics (INFN)
- 2013-2014** **CERN-INFN Fellowship** : Grant to spend one year at CERN to pursue research activity (INFN)
- 2013** **Laura Bassi Prize** : Prize for graduated students in particle physics given by the Italian Society of Physics (SIF)
- 2013** **Best talk** given in the PhD session at Incontri di Fisica delle Alte Energie, Cagliari (Italy)
- 2009** **ARAP Prize** : Award for undergraduate students in particle physics from Associazione Romana di Astro-Particelle, Rome (Italy)

SHORT SUMMARY 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](#) to mitigate the worsening of the identification efficiencies in the event of multiple interactions at CMS detector at LHC. The number of multiple interactions being proportional to the increasing instantaneous luminosity of the LHC, this tool has been one of the key ingredient for the [discovery of the Higgs boson](#) in his decay into two photons in 2012. Nowadays it is of paramount importance for all the searches at CMS which consider final states with electrons or photons (roughly 50% of all the analyses at CMS).
- In the context of the standard model Higgs boson investigation, i developped 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.
- Performed as main author the [first search for heavy wide resonances in the di-photon decay channel](#) 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](#), observed also by the ATLAS experiment. 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](#).
- Part of the team responsible for testing and [characterization of a prototype for a sampling calorimeter](#), 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.
- Introduced the very first search at LHC which probed the existence of [Dark Matter](#) produced in [association with an Higgs boson decaying to two photons](#), two b quarks or [two taus](#). Actively worked also on searches for [dark matter production in association with an hadronic jet](#).
- 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 a student on a [similar search with Run 2 data](#). 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. The results I obtained at Run 1 and Run 2 served to target the performance for the upgraded CMS at HL-LHC.
- In this context I am now working on the project of a new dedicated MIP timing detector which CMS is planning to build for HL-LHC and that will be also used to identify secondary vertex decays of long-lived particles with a global timing resolution of the order of 30 ps. The HL-LHC sensitivity projections I obtained on [searches for delayed photons](#) and [delayed jets](#) 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 produced in the proton-proton collisions.

SUMMARY OF SCIENTIFIC ACHIEVEMENTS ²

- Total number of publications : 888
- Total Citations :39679
- Average Citations per product : 44.68
- Hirsh (H) index : 91
- Normalized H index ³ : 9.1
- Total Impact Factor : 4590
- Mean Impact Factor : 5.169

2. From Web Of Science, database recognized for the "abilitazione scientifica nazionale"

3. H index versus/divided by the academic seniority

PUBLICATIONS

I am co-author of [926 published papers](#) in the domain of particle physics. Of these I gave a major contribution to 20 papers [[Link 1](#), [Link 2](#), [Link 3](#), [Link 4](#), [Link 5](#), [Link 6](#)]. This list includes the following 12 papers in which I have been the main author.

N.	Ref.	Title	Role	IF	Citations	
					WoS	Insp.
1	JHEP 03 (2020) 025 doi link	<i>Search for dark matter particles produced in association with a Higgs boson in proton-proton collisions at $\sqrt{s} = 13$ TeV</i>	Main author.	3.95	0	7
2	J. Phys. G 47 (2020) doi link	<i>Searching for Long-Lived Particles beyond the Standard Model at the Large Hadron Collider</i>	Main author of section 5.1.3	3.53	0	104
3	Phys. Rev. D 100 (2019) 11, 112003 doi link	<i>Search for long-lived particles using delayed photons in proton-proton collisions at $\sqrt{s} = 13$ TeV</i>	Main author and supervisor of PhD student	4.83	2	4
4	JHEP 10 (2017) 180 doi link	<i>Search for associated production of dark matter with a Higgs boson decaying to $b\bar{b}$ or $\gamma\gamma$ at $\sqrt{s} = 13$ TeV</i>	Main author.	3.91	19	65
5	Phys. Lett. B 767 (2017) doi link	<i>Search for high-mass diphoton resonances in proton-proton collisions at 13 TeV and combination with 8 TeV search</i>	Main author.	4.25	71	124
6	JHEP 07 (2017) doi link	<i>Search for dark matter produced with an energetic jet or a hadronically decaying W or Z boson at $\sqrt{s} = 13$ TeV</i>	Main author.	3.91	71	141
7	Phys. Rev. Lett. 117 (2016) doi link	<i>Search for resonant production of high-mass photon pairs in proton-proton collisions at $\sqrt{s} = 8$ and 13 TeV</i>	Main author.	8.62	37	165
8	Eur. Phys. J. Plus 131 (2016) doi link	<i>Search for new exotic particles decaying to photons with the CMS experiment at the LHC</i>	Main and only author. Paper published as a recognition of the INFN Conversi Prize.	1.97	0	1
9	Nucl. Inst. Meth. A 804 (2015) doi link	<i>Performance of a tungsten-cerium fluoride sampling calorimeter in high-energy electron beam tests</i>	Member of the test beam team and analyzer.	1.52	3	4
10	Phys. Lett. B 750 (2015) doi link	<i>Search for Diphoton Resonances in the Mass Range from 150 to 850 GeV in pp Collisions at $\sqrt{s} = 8$ TeV</i>	Main Analyzer. Topic of PhD thesis (awarded with INFN M. Conversi Prize 2015)	4.78	121	174
11	JINST 10 (2015) 08, P08010 doi link	<i>Performance of Photon Reconstruction and Identification with the CMS Detector in Proton-Proton Collisions at $\sqrt{s} = 8$ TeV</i>	Main Analyzer. Work realized in collaboration with PhD supervisors	1.45	141	380
12	Phys. Lett. B 722 (2013) doi link	<i>Search for long-lived particles in events with photons and missing energy in proton-proton collisions at $\sqrt{s} = 7$ TeV</i>	Main Analyzer. Work realized in collaboration with PhD supervisors	6.02	18	53