# CURRICULUM VITAE MARIO EDOARDO BERTAINA

## Posizione attuale

Da giugno 2015 **Professore Associato** Settore Concorsuale **02/A1**, Settore scientifico disciplinare **FIS/01** presso il Dipartimento di Fisica, Università degli Studi di Torino.
Abilitazione Scientifica Nazionale a ricoprire il ruolo di Professore di I fascia nel s.c. **02/A1** (validità dal 10/09/2019 al 10/09/2029).

## Curriculum Scientifico e Accademico

Ottobre 2009 - Giugno 2015 **Ricercatore confermato** (FIS/01) presso il Dipartimento di Fisica, Università di Torino.

Ottobre 2006 - Ottobre 2009 **Ricercatore non confermato** (FIS/01) presso il Dipartimento di Fisica Generale, Università di Torino.

Aprile 2005 - Settembre 2006: **Assegno di ricerca** presso il Computational Astrophysics Laboratory, RIKEN (Giappone). Programma di ricerca: *Elaborazione di sistemi di trigger per esperimenti di fisica cosmica dallo spazio sensibili alla luce di fluorescenza emessa dagli sciami in atmosfera, con particolare riferimento all' esperimento JEM-EUSO*. Responsabile Scientifico: Prof. T. Ebisuzaki.

Aprile 2003 - Marzo 2005: **Borsa di studio post-dottorato** della Japan Society for Promotion of Science presso il Image Information Unit, RIKEN (Giappone). Programma di ricerca: *sviluppo e caratterizzazione di fotomoltiplicatori e di spostatori di lunghezza d'onda finalizzata ad esperimenti di fisica cosmica dallo spazio e di ottica neutronica*. Responsabile scientifico: Dott. H. Shimizu.

Settembre 2002 - Settembre 2006: **Cattedra di Fisica** (CL.A038) in qualità di insegnante di ruolo presso l'Istituto d'Istruzione Superiore "Vallauri" - Fossano (in aspettativa per motivi di ricerca da Aprile 2003 a Settembre 2006).

Settembre 2001 - Agosto 2002: **Cattedra di Fisica** (CL.A038) in qualità di insegnante di ruolo presso Istituto Professionale Statale per l'Industria e l'Artigianato di Cuneo, per superamento del concorso ordinario del 2000.

Agosto 2000 - Luglio 2002: **Assegno di ricerca** presso l'Università di Torino presso il Dipartimento di Fisica Generale "A. Avogadro". Programma di ricerca: *Studio della propagazione dei raggi cosmici in atmosfera sia in relazione agli effetti atmosferici che alla fisica dei primari.* Responsabile scientifico: Prof. G. Navarra. Nel periodo Settembre 2000 - Maggio 2001, svolgo la mia attività di ricerca in modo continuativo presso il Institut für Kernphysik del Forschunszentrum Karlsruhe (Germania).

Luglio 1999 - Luglio 2000: **Borsa di studio** del Consiglio Nazionale delle Ricerche presso l'Istituto di Cosmo-geofisica di Torino. Programma di ricerca: *Studio di Sciami Atmosferici Estesi (EAS) attraverso l' osservazione di luce Cerenkov emessa in EAS in correlazione con i $\mu$ di alta energia in sciami osservati a grande profondità*. Responsabile scientifico: Prof. G. Navarra.

Ottobre 1998 - Luglio 1999: **Cattedra di Matematica Applicata** (CL.A048) presso l'I.T.C.G. "Baruffi" - Mondovì e **Cattedra di Fisica** (Cl.A038) I.T. Geometri - Cuneo in qualità di insegnante supplente temporaneo. **Commissario di Fisica** presso VIII Commissione IPSAA Sc. coord. di Ormea per gli esami di Stato.

Settembre 1998 - Ottobre 1998: **Attività di ricerca e presa dati esperimento E941** presso il Alternating Gradient Synchroton del Brookhaven National Laboratory (AGS-BNL), New York (USA), finalizzato allo studio del nuclear stopping in collisioni protone-nucleo. Responsabile scientifico: Prof. H.Z. Huang del Department of Physics, University of California, Los Angeles (USA).

Settembre 1997 - Agosto 1998: **Borsa di studio** del Consiglio Nazionale delle Ricerche "NATO CNR Advanced Fellowship Programme" presso il Laboratory for Nuclear Science del Massachussetts Institute of Technology, Cambridge (US). Programma di ricerca: *Studio del flusso di $\mu$ prompt con l'esperimento LVD al Gran Sasso e ricerca di positive charged strangelets con l'esperimento E864.*

1996-1997: **Borsa di Studio art. 50** presso il Dipartimento di Fisica Generale dell' Università di Torino per il supporto didattico nell'area di Fisica - sottoarea Esperimentazioni della Facoltà di Scienze M.F.N..

1994 - 1997: **Dottorato di Ricerca** in Geofisica IX ciclo (Consorzio tra le Università di Genova, Modena e Torino) presso il Dipartimento di Fisica Generale "A. Avogadro". Titolo della Tesi: *Studio di variazioni di temperatura in bassa stratosfera (50-200mb) attraverso il flusso di muoni atmosferici.* Responsabile scientifico: Prof. G. Navarra; Relatore della Tesi: Prof. L. Briatore. Il titolo di Dottore di ricerca in Geofisica è stato conseguito il 8 luglio 1997 presso l'Università di Napoli.

9 Luglio 1993: Conseguimento della **Laurea in Fisica** presso l'Università di Torino con votazione 110/110 lode, discutendo una tesi di laurea dal titolo *Il calorimetro adronico di EAS-TOP: dati preliminari sulla componente adronica in atmosfera.* Relatori della Tesi: Prof. G. Navarra e Prof. O. Saavedra.

## ATTIVITÁ DI RICERCA E PUBBLICAZIONI SCIENTIFICHE

L'attività di ricerca svolta dalla tesi di laurea ad oggi è stata condotta prevalentemente nel campo della fisica cosmica partecipando agli esperimenti: EAS-TOP, LVD, KASCADE-Grande, LOPES, CROME, Programma JEM-EUSO, Pierre Auger Observatory, NUSES.

Accanto a questa attività mi sono occupato anche di fisica nucleare e sub-nucleare (esperimenti E-864 e E-941 a Brookhaven National Laboratory); di sviluppo di rivelatori per fisica astro-particellare e loro applicazione per es. nel contesto di rivelazione e bonifica di detriti spaziali; di planetologia, in particolare studio di meteore e fireball (progetto PRISMA), di ricerca di strange quark matter (progetto DIMS) e di correlazioni tra radiazione e particelle di alta energia in temporali, fulmini e gamma-ray flash terrestri (progetto GAMMA-FLASH).
La produzione scientifica (fonte: www.webofknowledge.com), consiste di **356 lavori scientifici** con **7687 citazioni (6540 senza self-citations)** ed un **h-index** pari a **39** alla data del **09 Marzo 2023**. La lista completa delle pubblicazioni è in allegato alla presente.

### SELEZIONE PUBBLICAZIONI SCIENTIFICHE DI RILIEVO

Le pubblicazioni sono state scelte individuando per ciascun progetto o attività di ricerca quelle che hanno avuto un contributo personale più significativo e caratterizzanti il percorso scientifico negli anni.

EAS-TOP:

**- P1** "Measurement of the cosmic ray hadron spectrum up to 30 TeV at mountain altitude: the primary proton spectrum", M. Aglietta et al. (Collaborazione EAS-TOP), Astroparticle Physics, 19 (2003) 329-338.

**WOS:000182857300002, 32 citazioni** (2003, IF=4.0, ASTRONOMY & ASTROPHYSICS Q1=6/42)

**- P2** "The cosmic ray proton, helium and CNO fluxes in the 100 TeV energy region from TeV muons and EAS atmospheric Cherenkov light observations of MACRO and EAS-TOP", M. Aglietta et al. (Collaborazioni EAS-TOP & MACRO), Astroparticle Physics, 21 (2004) 223-240.
**WOS:000221970300001, 36 citazioni** (2004, IF=3.6, ASTRONOMY & ASTROPHYSICS Q1=11/45)

LVD:

**- P3** "Upper limit on the prompt muon flux derived from the LVD underground experiment", M. Aglietta et al. (Collaborazione LVD), Physical Review D, Vol. 60 (1999) 112001.
**WOS:000084138100008, 30 citazioni** (1999, IF=3.7, PHYSICS, PARTICLES & FIELD, Q1=4/18)

KASCADE-Grande:

**- P4** "The spectrum of high-energy cosmic rays measured with KASCADE-Grande", W.D. Apel et al. (Collaborazione KASCADE-Grande), Astroparticle Physics, 36 (2012) 183-194.
**WOS:000309787000022, 117 citazioni** (2012, IF=4.8, ASTRONOMY & ASTROPHYSICS Q1=13/56)

**- P5** "Kneelike Structure in the Spectrum of the Heavy Component of Cosmic Rays Observed with KASCADE-Grande", W.D.Apel et al. (Collaborazione KASCADE-Grande), Physical Review Letters, 107 (2011) 171104.
**WOS:000296984700004, 133 citazioni** (2011, IF=7.4, PHYSICS, MULTIDISCIPLINARY Q1=5/84)

**- P6** "Ankle-like feature in the energy spectrum of light elements of cosmic rays observed with KASCADE-Grande", W.D. Apel et al. (Collaborazione KASCADE-Grande), Physical Review D, 87 (2013) 081101(R).
**WOS:000318185000001, 93 citazioni** (2013, IF=4.9, ASTRONOMY & ASTROPHYSICS Q1=12/59)

LOPES:

**- P7** "Detection and imaging of atmospheric radio flashes from cosmic ray air showers", H. Falcke et al. (LOPES Collaboration), Nature (19 May 2005), 435 (2005) 313-316.
**WOS:000229185000038, 300 citazioni** (2005, IF=29.3, MULTIDISCIPLINARY SCIENCES Q1=2/48)

ARTICOLI DI REVIEW:

**- P8** "Cosmic rays from the knee to the ankle", M. Bertaina, Comptes Rendus Physique, 15 (2014) 300-308.
**WOS:000339145400002, 5 citazioni** (2020, IF=3.8, PHYSICS, MULTIDISCIPLINARY Q1=21/86)

**- P12** "Ultra high energy cosmic rays The intersection of the Cosmic and Energy Frontiers", A. Coleman et al., Astroparticle Physics, 147 (2023) 102794.

Pierre Auger Observatory:

**- P9** "Combined fit of spectrum and composition data as measured by the Pierre Auger Observatory", A. Aab

et al. (Collaborazione Auger), Journal of Cosmology and Astroparticle Physics, Issue 04, (2017) 038.
**WOS:000401806200038, 91 citazioni** (2017, IF=5.1, ASTRONOMY & ASTROPHYSICS Q1=13/66)

**- P10** "Measurement of the cosmic-ray energy spectrum above $2.5\times10^{18}$ eV using the Pierre Auger Observatory", A. Aab et al. (Collaborazione Auger), Physical Review D 102, Issue 06, (2020) 062005.
**WOS:000569631500001, 17 citazioni** (2020, IF=5.3, ASTRONOMY & ASTROPHYSICS Q1=15/68)

JEM-EUSO:

**- P11** "An evaluation of the exposure in nadir observation of the JEM-EUSO mission", J.H. Adams Jr. et al. (Collaborazione JEM-EUSO), Astroparticle Physics, 44 (2013) 76-90.
**WOS:000318322100009, 88 citazioni** (2013, IF=4.5, ASTRONOMY & ASTROPHYSICS Q1=14/59)

**- P13** "A Review of the EUSO-Balloon Pathfinder for the JEM-EUSO Program", J.H. Adams Jr. et al. (Collaborazione JEM-EUSO), Space Science Reviews, 218/1 (2022) article 3.
**WOS:000749525700001, 0 citazioni** (2020, IF=8.0, ASTRONOMY & ASTROPHYSICS Q1=7/68)

**- P14** "Performance and science reach of the Probe of Extreme Multimessenger Astrophysics for ultrahigh-energy particles", L. Anchordoqui et al., Physical Review D, 101/2 (2020) 023012.
**WOS:000509499300001, 14 citazioni** (2020, IF=5.3, ASTRONOMY & ASTROPHYSICS Q1=15/68)

**- P15** "Mini-EUSO Mission to study Earth UV emissions on board the ISS", S. Bacholle et al., Astrophysical Journal Supplement Series, 253, Issue 2 (2021) 36.
**WOS:000629941500001, 7 citazioni** (2020, IF=8.1, ASTRONOMY & ASTROPHYSICS Q1=6/68)

SVILUPPO DI RIVELATORI E LOGICHE DI TRIGGER:

**- P16** "Cosmic ray oriented performance studies for the JEM-EUSO first level trigger", G. Abdellaoui et al. (Collaborazione JEM-EUSO), Nuclear Instruments and Methods in Physics Research A, 866 (2017) 150-163.
**WOS:000407863700020, 12 citazioni** (2017, IF=1.3, INSTRUMENTS & INSTRUMENTATIONS Q3=41/61)

# Curriculum vitae STEFANIA BUFALINO

**Present position**: From 2018 I am Associate Professor (L. 240/10) at the Department of Applied Science and Technology (DISAT) of the Politecnico of Turin.

**Publication Score**
Co-author of 380 publications, with h-index: 70 (Scopus),
More than 12 thousand citations (Scopus).

**Curriculum studiorum**
- 2004 Master Degree in Physics, Catania University (110/110 cum laude)
- 2007 Ph.D. in Physics at the Department of Experimental Physics, Turin.
- 2008-2010 Post-doc research fellow at the Department of Experimental Physics, Turin.
- 2010-2014 Post-doc research fellow at INFN, Turin. From July 2012 based at CERN with an Associate position at the CERN Physics department
- July 2014 - May 2015: Project Associate Position at CERN
- July 2012 - May 2015 I was based at CERN as a member of the CERN Physics Department
- June 2015 (for 6 months): Marie Curie Research Fellow at the Physics Department of the Turin University
- December 2015 (three years position): Researcher (art. 24 c.3-b L. 240/10) at the Department of Applied Science and Technology of the Politecnico of Turin

**Grant**
- June 2015: I obtained a Marie Curie Research Fellow at the Physics Department of the Turin University (agreement "Marie Skłodowska-Curie No 609402-2020 researchers: TraintoMove (T2M)"). Title of the project: "Design of high-performance vertexing and tracking algorithms optimized for large data throughput."

**Recent responsibilities:**
- Sep. 2020-present: convener of the ALICE 3 Timing Layers Working Group. The group, composed by ~30 members from 6 institutions, is dedicated to the R&D of silicon sensors with excellent timing resolution to build the ALICE 3 timing layers. ALICE 3 is a new experiment which has been proposed to run in 2030 at the LHC.
- 2017- 2019: convener of the Light Flavour Physics Working Group (PWG-LF) of the ALICE experiment at the LHC. The PWG-LF group is composed by ~120 members from 20 institutions.
- 2017-2019: member of the Physics Board of the ALICE experiment

**Titles, awards and selected past responsibilities**
-2013-2017: Convener of the Physics Analysis Group “Nuclei and Exotica” of the ALICE experiment. The group is composed by ~50 members from 10 institutions and it is dedicated to the study of anti-nuclei, anti-hypernuclei and exotic baryon states.
- 2015-2016: Shift leader System Run Coordinator
- 2014 -2019: Deputy System Run Coordinator of the Silicon Drift Detector (SDD) of the ALICE Inner Tracking System (ITS).
- 2013 – 2015: System Run Coordinator of the ALICE ITS (~20 people to coordinate).
- November 2012: Period Run Coordinator of the ALICE experiment (~ 80 people to coordinate).
- 2012-2014: expert on call in charge of the maintenance and operations of the ALICE SDD.
- 2008 Special Prize "Antonio Garbasso" of the Italian Physics Society (SIF) given to young researchers for the scientific results achieved after their Master Degree

**RESEARCH ACTIVITY**
**Synopsis of activities**

I have been working in the field of experimental nuclear and particle physics since my Ph.D.; specifically, my work focuses on data analysis and Monte-Carlo simulation and for a large fraction of my research work I have been very active in detectors commissioning and operations. I have been a member of three collaborations, based in Europe and Japan, where I reached leadership positions thus coordinating several international research groups dedicated to data analysis, detectors operation and R&D.
-FINUDA and SKS Collaboration
During the Ph.D. period and until 2010 I carried out my research activity in the FINUDA experiment installed in one of the two interaction regions of the DANE (e+e-) collider at the Laboratori Nazionali di Frascati. The experiment was devoted to the search of the Lambda hypernuclei.
My Ph.D. thesis was focused on the study of the hypernuclei production and decay. I was responsible for the analysis of the weak decay of Lambda hypernuclei. I am the corresponding author of all the FINUDA publications regarding the hypernuclear Non Mesonic Weak Decay.
From 2008 to 2011 I was also a member of the SKS (Superconducting Kaon Spectrometer) Collaboration and I participated in two experiments dedicated to hypernuclear physics and carried out at the Japan Proton Accelerator Research Complex (J-PARC) in Tokai. I spent several months at J-PARC and at the Tohoku University (Sendai) for the test of the HyperPure Germanium (HPGe) detectors. I was also involved in the commissioning of the drift chambers installed along the beam line to be used in both experiments

**- ALICE experiment**
In 2010 I joined the ALICE Collaboration and since the beginning the focus of my research activity has been on data analysis and Monte Carlo simulation for the study of anti-nuclei and hypernuclei production at the LHC. I served on committees to prepare ALICE publications (3 paper committees), to review paper drafts (3 internal review committees) on the aforementioned subjects and to prepare internal notes describing the analyses results before their presentation at conferences and their publication (5 internal analysis notes).
I was also deeply involved in the study of the performance of the new ALICE Inner Tracking System (ITS2, now in the commissioning phase) in terms of particle identification for different physics channels. The results I achieved are shown in dedicated chapters of the ITS Conceptual Design Report (CERN-LHCC-2012-013 (LHCC-P-005)) and the ITS Technical Design Report (J. Phys. G 41 (2014) 087002). Thanks to the experience gained in the development of vertexing and tracking code for large data throughput, in 2015 I obtained a Marie Curie fellowship for the design and optimization of vertexing and tracking algorithms on parallel architectures like the GPUs.
When I was based at CERN (2012-2015) I devoted a sizable part of my work to the commissioning and operations of the ITS and of the ALICE experiment. I served as on call expert and deputy System Run Coordinator (SRC) of the SDD, as SRC of the ITS, and then as Period Run Coordinator of the whole experiment.
At the beginning of 2019 I participated in the preparation of the expression of interest (available at https://arxiv.org/abs/1902.01211) for a next-generation heavy-ion experiment at the LHC, called ALICE 3. A key element of the proposed experiment is a Time Of Flight detector (timing layers) made of silicon sensors with an excellent timing resolution (~20 ps) to separate electrons from hadrons at low momentum. This year, new working groups have been created to handle different aspects of the project and since September 2020 I am one of the three conveners of the timing layers working group.

**Presentation at conferences**
I delivered more then 40 talks, and these include 11 invited contributions and 6 plenary invited talks. Among these:
- Plenary talk at the XI International Conference on Hypernuclear and Strange Particle Physics (HYP2012, October 2012-Barcelona, Spain).
- Invited talk at The 21th Anniversary International Workshop on Vertex Detectors (VERTEX2012,

September 2012, Jeju-Korea).
- Invited talk at the Conference on Advanced Studies Institute Symmetries and Spin" (Prague, July 2013).
- Talk at the 14th ICATPP Conference on Astroparticle, Particle, Space Physics, Detectors for physics Application (Como, Italy -September 2013).
- Plenary talk at the "Fourth annual Conference on Large Hadron Collider Physics", (LHCP 2016 in Sweden)
- Plenary talk at the XXVIIth International Conference on Ultra-relativistic Nucleus-Nucleus Collisions (QM2018, Venice, Italy - May 2018).
- Plenary talk at the 22nd Particles and Nuclei International Conference (PANIC 2021, Portugal (online))

**Training of young researchers**
-supervisor of 8 Ph.D. students in Physics at the Politecnico of Turin
-supervisor of 1 Ph.D. student in electrical, electronics and communications engineering at the Politecnico of Turin
-supervisor of 1 Ph.D. student in Technologies and methods in higher education at the University of Palermo Politecnico of Turin
-co-supervisor of 4 Ph.D. students in Physics at the Turin University
-supervisor of 2 Bachelor students in computing engineering and 1 bachelor student in Electronics engineering at the Politecnico of Turin
-co-supervisor of about 10 Bachelor and Master students in Physics at the Physics Department of the Turin University
Additionally, during the period I was based at CERN I supervised, for about one year, 2 PhD students and one post-doc fellow.

**Workshop/conferences organization**
- Organizer of 3 international "EMMI Workshop on anti-matter, hyper-matter and exotica production at the LHC", supported by the ExtreMe Matter Institute (EMMI, Darmstadt, Germany) and held at CERN in 2015, in Turin in 2017 and in Wraclow in 2019. For each workshop I obtained a funding of about 18 kEU.
- October 2017: I was one of the 3 conveners of the "Soft observables physics" session of the Workshop "Secondo incontro sulla fisica con ioni pesanti a LHC" held at the Turin University
- member of the Local Organizing Committee (LOC) of the 2018 European Nuclear Physics Conference (Bologna, Italy)
- member of the LOC of the 27th International Conference on Ultrarelativistic Nucleus-Nucleus Collisions (2018 in Venice, Italy).
- I was one of the 3 organizers of the "Workshop on Heavy ion physics" at the 8th International Conference on New Frontiers in Physics" (2019, Crete).
- November 2021: I am one of the 3 conveners of the "Global observables physics" session of the Workshop "Terzo incontro sulla fisica con ioni pesanti a LHC" which will be held at the Padua University.

**Activity as refereee**
Reviewer of the following international peer-reviewed journals:
- Nature Physics
- Advances in High Energy Physics
- Nuclear Physics A
- The European Physical Journal A
- The European Physical Journal Plus

**Other activities**
- 2018 to present: member of the Faculty Board of the Doctoral School for the PhD programme in Physics at the Politecnico of Turin.
- 2018 to present: member of the Focus Group of the Politecnico of Turin for the implementation

of the principles of the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers.
- 2016 to present: organizer of the annual visit at CERN dedicated to the students of the Young Talent project of the Politecnico of Turin
- 2012-2016 Expert guide for the visit at the ALICE experiment
- 2011 and 2013: International Masterclasses at CERN

Torino, 10/03/2023 Stefania Bufalino

# SIMONA GIORDANENGO

## PERSONAL INFORMATION

Email
Year of birth
Nationality
Web page

ORCID

## EDUCATION

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|---|---|
| 2010 | PhD in Physics, University of Torino, Physics Department, Italy |
| 2002 | Physics academic degree, University of Torino, Physics Department, Italy |

## CURRENT and PREVIOUS POSITIONS

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|---|---|
| 2018-present | Researcher at Istituto Nazionale di Fisica Nucleare, Division of Torino, Italy |
| 2016 – 2018 | Researcher (non-permanent position)<br>Istituto Nazionale di Fisica Nucleare, Division of Torino, Italy |
| 2014 – 2015 | Grant for Young Researcher<br>Istituto Nazionale di Fisica Nucleare, Division of Torino, Italy |
| 2005 – 2013 | Researcher (non-permanent position)<br>Istituto Nazionale di Fisica Nucleare, Division of Torino, Italy |
| 2002 – 2004 | Post-degree fellowship, IBA Company |

## TRACK RECORD

My research activities are focused in physics for medical applications and started in 2002 with my M. Sc. Thesis in the medical physics group of the INFN and University of Torino. Detectors and new technologies for beam monitoring and treatment optimization in particle therapy have been my core research topic.

**2002-2004 Post-degree fellowship for testing 2D detectors for radiotherapy**

- Tests of two prototypes of pixel ionization chamber: one at GSI, Darmstadt for beam monitoring in particle therapy and a 2D dosimeter for conventional radiotherapy in 9 different Italian hospitals. **Spokesperson** for the results of the extended group at the biennial meeting of the Medical Association of Italian Medical Physics.

**2004-2006 Research position to work on the EU FP6 Integrated Project MAESTRO.**

- Industrialization and Technological Transfer of the 2D dosimeter prototypes by the Belgian company Ion Beam Application, which marketed MatriXX and StarTrack dosimeters.

**2006-2007 Research position to develop beam monitors for particle therapy.**

- Development and characterization of a beam monitor for the Italian curative proton beam (CATANA), and a different prototype for the French Centre de Protonterapie d'Orsay (CPO).

**2007-2010 PhD on "design, implementation and test of the Fast Control of the Dose Delivery System for the Italian Centro Nazionale di Adroterapia Oncologica (CNAO)".**

- Design, development, construction and commissioning of the Dose Delivery System (DDS) for Centro Nazionale di Adroterapia Oncologica (CNAO) in Pavia.
- Leader of beam tests at PSI: organization and training of PhD student to perform data taking and analysis. Relevant publications: Giordanengo S et al. *Design and characterization of the*

*beam monitor detectors of the Italian National Center of Oncological Hadron-therapy (CNAO)* NIM A698 (2013);
- **Invited talk** on "The CNAO system to monitor and control hadron beams for therapy" at "Whorkshop on Advanced Hadrontherapy" IEEE NSS-MIC Conference (2009)
- Study and definition of the scanning magnet and power supply specifications for the CNAO active scanning beam delivery. **National Instruments prize** "Nicola Chiari" for the best Application of Measurement and Automation.
- Relevant publication: Giordanengo S et al. *Performances of the scanning system for the CNAO center of oncological hadron therapy* Nuclear Instruments and Methods A 613 (2010).

**2011-2012 CNAO Dose Delivery System commissioning and clinical start-up.**
- Commissioning and clinical start-up of the CNAO DDS
- Main publications: Giordanengo S et al *The CNAO Dose Delivery System for ion pencil beam scanning radiotherapy*, Med Phy 42, 263 (2015); Giordanengo **S** and Donetti M, *Dose Delivery Concept and Instrumentation*, CERN-2017-004-SP, Yellow Report Vol 1/2017;

**2012-2013 DDS technological and knowhow transfer.**
- Responsible granted with the contract between INFN, CNAO and MedAustron to provide for the Austrian centre for Ion Beam Therapy (MedAustron) a DDS based on the CNAO Dose Delivery System.

**2014-2016 PI of the RIDOS project (2 years INFN Grant for Young researcher).**
- Responsible of the RIDOS (Real-time Ion DOse planning and delivery System) project which develop a fast, GPU-based, dose calculation and integration into the CNAO dose delivery system. Main publication: Giordanengo S et al. *RIDOS: A new system for online computation of the delivered dose distributions in scanning ion beam therapy*, Physica Medica, 60, (2019).

**2017-2021 Advanced silicon detectors for new beam monitors in particle therapy**
- Innovative thin silicon detector, frontend readout, dedicated ASIC and DAQ for next generation of beam monitoring system in particle therapy. Main publications: Vignati A, Giordanengo S et al. *A new detector for the beam energy measurement in proton therapy: a feasibility study,* Phys. Med. Biol. 65 (2020); 2 review papers: Giordanengo S, et al. A *Review of technologies and procedures of clinical dosimetry for scanned ion beam radiotherapy* Physica Medica European Journal of Medical Physics (2017) 43; Giordanengo S and Palmans H *Dose detectors, sensors, and their applications* Medical Physics 45(11), (2018)

**2022- Present**

- Scientific responsible of the work package devoted to the development of new detectors and frontend readout for single ion tracking to develop an advanced dose delivery system for ion gantry within the INFN SIG project.
- New beam monitors for FLASH therapy within the INFN FRIDA project.
- Thin silicon sensors for Extreme Fluences within the AIDAinnova project.

## VISITING

2009 *Visiting scientist at the Paul Scherrer Institute (PSI), Switzerland.*
- T**hree months at PSI** with European avant-garde experts in proton therapy. Leader in the start-up of the on-line beam position strip monitor used in the new PSI treatment beam line (Gantry 2) which was in the commissioning phase.
- Test and characterization of the CNAO beam monitors with PSI clinical proton beam.

## TENDER

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| 2016 | Art. 36 INFN – Tender TO/R3/522 |
| 2013 | Abilitazione Scientifica Nazionale (ASN), Settore concorsuale 02/B3 - Seconda Fascia - MIUR. Validity 18/12/2014 -18/12/2020. |
| 2013 | Grant for Young Researcher INFN – CSN5, Call n. 15766/2013. |

## AWARDS

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|---|---|
| 2015 | Guglielmo Marconi Prize for *Technological Transfer of the Società italiana di Fisica*, Roma, Italy |
| 2014&2009 | Nicola Chiari Prize of National Instruments for *the best Application of Measurement and Automation*, Italy. |
| 2010 | INFN Francesco Resmini Prize, for *the best PhD thesis in the field of Physics of accelerators and new technologies*, Italy. |

## FUNDS and GRANTS

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|---|---|
| 2014 – 2015 | INFN Grant for Young Researcher for the RIDOS project |
| 2004 – 2012 | Grants for the construction of the Dose Delivery System for CNAO |

## INSTITUTIONAL RESPONSIBILITIES

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|---|---|
| 2022-Present | Local coordinator of the INFN National Scientific Committee 5 (CSN5) |
| 2021-Present | Member of the evaluation committee for the INFN AdR. |
| 2019-Present | Responsabile Unico Procedimento (RUP) for INFN purchase orders |
| 2019 – 2020 | Member of the evaluation committee for the Award "Anna Piccotti" for the best Master Thesis on Particle Detector at the INFN of Torino, Italy. |

## EDUCATION and SUPERVISION OF STUDENTS

## INVITED LECTURES and SEMINARS

| | |
|---|---|
| 2023 | *Detector development for novel technologies,* invited lecture at the 3rd RAPTOR School for PhDs and Early Stage Researchers, Ascona, Switzerland |
| 2022-2023 | *Applicazioni di Fisica in Medicina:Adroterapia*, Politecnico di Torino |
| 2022 | *Nuove tecnologie per il monitoraggio di fasci terapeutici di protoni e ioni carbonio*, Seminario presso il CNAO, Pavia |
| 2020 | *New Detectors for Beam Monitoring in Particle Therapy*, XXIX Giornate di Studio sui Rivelatori 2020, Cogne, Italy |
| 2018 | *New online beam monitor detectors* – ENLIGHT annual meeting – London, UK. |
| 2017 | *Online dose calculation using GPUs,* Workshop on Innovative Delivery Systems in Particle Therapy (EuCARD2), Torino, Italy |
| 2016 | *Treatment Planning Simulations in Hadrontherapy with GPUs* - INFN Mini-workshop of the "Commissione Calcolo e Reti" – Trento, Italy |
| 2015 | *Dose Delivery Instrumentation*; "CERN Accelerator School on Accelerators for Medical Application", Wien, Austria |
| 2015 | *Advanced Dose Delivery System for Hadrontherapy* - China-Italy Science Technology & Innovation Week – MIUR-MAEC, Beijing, Tianjin, Shanghai, – China |
| 2013 | *Two Years of Protons and Carbon Ions Treatments at CNAO* Workshop on New technologies in Hadron Therapy - IEEE NSS-MIC-RTSD, Seoul – Corea |
| 2011 | *Adroterapia a CNAO*, "XXII Giornate di studio sui rivelatori 2012", Torino, Italy |

## OUTREACH

| | |
|---|---|
| 2022-2023 | Coordinator of the *Masterclass in Particle Therapy* for students in Torino. |
| 2021-2022 | *European Night of Researcher* in Torino with a "*Experience with sounds and waves*" for kids and "*Escape room of medical physics"*. |
| 2020 | Lectures on "*Quando la fisica fa bene alla salute: dalla ricerca di base agli strumenti per la diagnosi e la cura in medicina*", Campus MFS, for secondary school, Bardonecchia. |
| 2018 – 2020 | Member of the Torino committee for the "*Art&Science across Italy*" project for scientific dissemination to secondary school students. |
| 2019 | Scientific guide for the "*Uomo virtuale*" exhibition in Torino. |
| 2017 | Invited speaker at the "*GiovedìScienze*" event in Torino for the general public, talk title "*Che la forza dell'adroterapia sia con noi*". |

## MEMBERSHIPS OF SCIENTIFIC SOCIETIES

| | |
|---|---|
| 2004 - present | Member of the Particle Therapy Co-Operative Group (PTCOG) |
| 2008 - present | Member of the European Network for Light ion Hadron Therapy (ENLIGHT*)* |
| 2014 - present | Associated Member of the Associazione Italiana di Fisica Medica (AIFM) |
| 2013 – 2014 | Associated Member of the European Society foRadiotherapy and Oncology (ESTRO) |

## MAJOR COLLABORATIONS

| | |
|---|---|
| 2004 - present | Italian National Center of Honcological Hadrontherapy (CNAO), Pavia, Italy. |
| 2004 – 2008 & 2021 | GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany |
| 2005 – 2007 | Centre de Protontherapie d'Orsay (CPO), Orsay, France |
| 2007 – 2010 | Paul Scherrer Institute (PSI), Villigen, Swietzerland |

## REVIEWING ACTIVITIES

| | |
|---|---|
| Reviewer for: | Physics in Medicine and Biology; Nuclear Instruments and Methods A; Medical Physics; Int. J. of Medical Physics Research and Practice; Physica Medica – European Journal of Medical Physics (EJMP); Frontiers in Physics; Applied Science; Life. |
| 2020-Present | *Editorial Board Member for Applied Science* |
| 2021-2022 | Guest Editor for the special issue *on "Detectors for medical physics" of Applied Science - https://www.mdpi.com/si/82644* |

## PUBBLICATIONS (ORCID: 0000-0001-6347-1182)

Co-author of more than 80 publications on peer-reviewed international journals, more than 900 citations by 650 documents, H-index 18 and more than 280 Co-authors (by Scopus).

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Torino, 09/03/2023 Simona Giordanengo

- **10 PUBLICATIONS with main contribution**

1. Giordanengo S, et al. Fluence Beam Monitor for High-Intensity Particle Beams Based on a Multi-Gap Ionization Chamber and a Method for Ion Recombination Correction, Appl. Sci. 12(23), (2022)
2. Fausti F, Olave J, Giordanengo S, et al. *A single ion discriminator ASIC prototype for particle therapy applications* Nuclear Instruments and Methods in Physics Research A 985 164666 (2021)
3. Vignati A, Giordanengo S, et al. *A new detector for the beam energy measurement in proton therapy: a feasibility study* Phys. Med. Biol. 65 215030 (2020)
4. Vignati A, et al. *Accuracy assessment of the CNAO Dose Delivery System in the initial period of clinical activity and impact of later improvements on delivered dose distributions* Medical Physics*:* early view as of January 23 (2020)
5. Giordanengo S et al. *RIDOS: A new system for online computation of the delivered dose distributions in scanning ion beam therapy,* Physica Medica 60, 139-149 (2019)
6. Fausti F, Mazza G, Giordanengo S, et al. *Single Event Upset tests and failure rate estimation for a front-end ASIC adopted in high-flux-particle therapy applications,* Nuclear Instruments and Methods in Physics Research A 918 54–59 (2019)
7. Giordanengo S and Palmans H *Dose detectors, sensors, and their applications* Medical Physics 45(11), (2018)
8. Giordanengo S and Donetti M, *Dose Delivery Concept and Instrumentation* CERN-2017-004-SP, Yellow Report Vol 1/ (2017)
9. Giordanengo S, Manganaro L and Vignati A, *Review of technologies and procedures of clinical dosimetry for scanned ion beam radiotherapy* Physica Medica European Journal of Medical Physics 43 (2017)
10. Giordanengo S et al. *The CNAO Dose Delivery System for ion pencil beam scanning radiotherapy* Medical Physics 42, 263 (2015)

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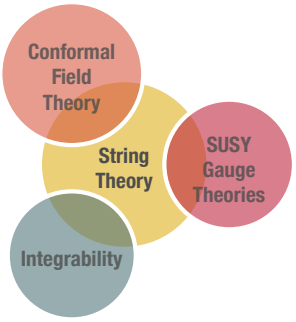
Torino, 09/03/2023 Simona Giordanengo




# DomenicoOrlando

Primo Ricercatore at INFN

## Affiliations

| | | |
|---|---|---|
| | **INFN – Torino division** | primo ricercatore (associate professor) |
| | **Albert Einstein Center for Fundamental Physics – University of Bern** | member |
| | **Kavli IPMU – University of Tokyo** | affiliate member |

## Previous Appointments

| | | |
|---|---|---|
| 2015–2017 | **University of Bern** | postdoc and lecturer |
| 2013–2015 | **École Normale Supérieure (Paris)** | junior research associate |
| 2011–2013 | **CERN** | fellow |
| 2008–2011 | **IPMU (Tokyo)** | project researcher |
| 2007–2008 | **Université de Neuchâtel** | postdoc |
| 2006–2007 | **Università di Milano Bicocca** | postdoc |

## Education

| | | |
|---|---|---|
| 2002–2006 | **PhD in String theory**<br>String Theory: Exact Solutions, Marginal Deformations and Hyperbolic Spaces | École Polytechnique (Paris) |
| 2006 | **Marie Curie Predoc** | Vrije Universiteit Brussel |
| 2001–2002 | **Diplôme d'études approfondies**<br>First year undergraduate study | École Normale Supérieure (Paris) |
| 1995–2002 | **Master's degree in Nuclear Engineering** | Politecnico di Milano |

## Professional qualifications

| | | |
|---|---|---|
| 2015 | **Abilitazione scientifica nazionale** | Italy |
| 2013 | **Qualification aux fonctions de maitre de conférences** | France |

## Grants and Honors

| | | |
|---|---|---|
| 2020 | **co-PI for the INFN Grant "Gauge Theories, Supergravity and String Theory"** | INFN |
| 2018 | **INFN Grant "Strongly coupled CFTs at large quantum number"** | INFN |
| 2011 | **CERN fellowship** | CERN |
| 2006 | **Marie Curie Predoc fellowship** | VUB |
| 2002 | **PhD fellowship Bourse Monge** | École Polytechnique |

## Service to the profession

2022–present **Editor**
Frontiers in Physics

2015–2017 **Editor**
Advances in Mathematical Physics

2005-present **Referee**
Classical and Quantum Gravity; JHEP; Journal of Physics A; Letters in Mathematical Physics; Mathematical Reviews; Physics Letters; Sci|Post; The European Physical Journal; International Journal of Theoretical Physics; German Academic Exchange Service (DAAD); National Research, Development and Innovation Office of Hungary; Alexander von Humboldt Foundation; Austrian Science Fund.

Jun 2022 **Organizer** Diablerets (Switzerland)
SwissMaP workshop Large charge aux Diablerets

Aug 2021 **Organizer** IPMU of the University of Tokyo
Focus Week on Quantum Mechanical Systems at Large Quantum Number

May 2021 **Organizer** Galileo Galilei Institute
New Frontiers in Theoretical Physics: Cortona Young

May 2020 **Organizer** Galileo Galilei Institute
New Frontiers in Theoretical Physics: Cortona Young

Mar 2020 **Organizer** `https://web.infn.it/strings`
Italian String web seminar

Nov 2019 **Organizer** Galileo Galilei Institute
Workshop: Integrable effective field theories and their holographic descriptions

Sep 2019 **Jury member** Università di Torino
Molinari prize for Master's thesis in theoretical physics

Aug 2019 **Organizer** SCGP Stony Brook
Program: Quantum-Mechanical Systems at Large Quantum Number

Jul 2018 **Organizer** Bern
The second international conference on Supersymmetric theories, dualities and deformations

| | | |
|---|---|---|
| Jul 2016 | **Organizer**<br>The first international conference on Supersymmetric theories, dualities and deformations | Bern |
| 2011–2013 | **Organizer**<br>CERN-TH string seminars | CERN |
| May 2009 | **Organizer**<br>focus week: New invariants and wall crossing | IPMU |
| Jan 2008 | **Organizer**<br>RTN Winter School: Strings, supergravity and gauge theories | CERN |
| Oct 2006 | **Scientific secretary**<br>conference: 30 Years of supergravity | Paris |
| Oct 2006 | **Scientific secretary**<br>conference: Journée Joël Scherk | Paris |

## Teaching

| | | |
|---|---|---|
| 2019-2022 | **Introduction to Superstrings**<br>Solvay Doctoral School | CERN, Geneva, Paris |
| Nov 2019 | **Conformal field theories**<br>Nordic Winter School in Theoretical Physics | University of Southern Denmark |
| 2016–2017 | **Introduction to statistical field theory**<br>Master's degree course | University of Bern |
| 2015–2022 | **Advanced concepts of theoretical physics**<br>Master's degree course | University of Bern |
| 2010–2011 | **Lectures on the Bethe Ansatz**<br>Graduate course | University of Tokyo |
| 2016–2019 | **phd coadvisor** | university of bern |
| 2015–2018 | **phd coadvisor** | university of bern |

# Marco Taoso

## Contact details

Address

## Employment history

Dec 2017 - present: **Staff researcher**, *Istituto Nazionale di Fisica Nucleare*, Sezione di Torino (Italy).

Nov 2015 - Dec 2017: **Postdoctoral researcher**, *Instituto de Física Teórica*, CSIC, Universidad Autónoma de Madrid (Spain).

Jan 2013 - Oct 2015: **Postdoctoral researcher**, *Institut de Physique Théorique*, CEA-Saclay (France).

Nov 2011 - Dec 2012: **Institute of Particle Physics Postdoctoral Research Fellow**, *University of British Columbia and TRIUMF laboratory*, Vancouver (Canada).

Oct 2009 - Oct 2011: **Postdoctoral researcher**, *Astroparticle and High Energy group*, IFIC-CSIC Valencia (Spain).

## Education

Jan 2006 - Apr 2009: **PhD in Theoretical Physics**, *University of Padova (Italy) and Université Paris Diderot (France)*, Thesis title: "Particle Dark Matter and Astrophysical constraints", Supervisors: Prof. Antonio Masiero, Prof. Gianfranco Bertone.
Enrolled in the "International Doctorate on AstroParticle Physics" (IDAPP) programme. Participation in the IDAPP training programme leads to a double doctoral degree according to the rules of the certification of Doctora Europaeus.

2000 - 2005: **Laurea Degree in Theoretical Physics**, *University of Padova (Italy)*, Thesis title: "The generation of the baryonic asymmetry in the Universe in the presence of a magnetic field", Supervisors: Prof. Sabino Matarrese, Prof. Antonio Riotto.

May 2009 - Sept 2009: Visitor at CERN Theory-Division.

Aug 2007: Visiting student at the California Institute of Technology, Theoretical Astrophysics group.

Oct 2007 - Dec 2008: Visiting student at the Institut d'Astrophysique de Paris (France).

## Research interests

Astroparticle Physics, Physics Beyond the Standard Model, Dark Matter, Cosmology and Theoretical Astrophysics.

## Refereee

**Referee for**: Journal of High Energy Physics (JHEP), Physics Review D, Journal of Cosmology and Astroparticle Physics (JCAP), Physics Review Letters, Astronomy and Astrophysics Letters, Physics Letters B, European Physical Journal C, Advances in High Energy Physics, Monthly Notices of the Royal Astronomical Society, Galaxies.

## Conference and meetings organization

08-10 Sept 2021 **Workshop From Darklight to Dark Matter**, *Barolo (Italy)*. https://agenda.infn.it/event/21257/

09-11 June 2021 **Workshop Cortona Young: New Frontier in Theoretical Physics**, *Online*. https://www.ggi.infn.it/showevent.pl?id=404

27-29 May 2020 **Workshop Cortona Young: New Frontier in Theoretical Physics**, *Online*. https://www.ggi.infn.it/showevent.pl?id=377

Nov 2016 **IBS-Multidark workshop on dark matter**, *Durham (UK)*. https://conference.ippp.dur.ac.uk/event/555/

Sept 2014 **Workshop "Dark Matter numerical simulations"**, *IPhT-Saclay, Paris (France)*.

Dec 2013 **Workshop "Amsterdam-Paris-Stockholm"**, *Paris December*. https://indico.cern.ch/event/270855/

Sept 2013 **Workshop "Dark Matter at accelerators"**, *IPhT-Saclay (France)*.

## Coordinator of research projects

31/08/2019 - present **"The Dark Universe: A Synergic Multimessenger Approach"**, PRIN_2017X7X85K, funded by MIUR. PI of the project: Nicolao Fornengo. I am the coordinator of INFN unit of the project. Budget of the unit: €158k.

10/12/2018 - 31/12/2021 **"Looking into the dark – LINDARK"**, Individual grant. Project funded by INFN. Budget: €20k.

## Lectures

2023 **PhD course on Dark Matter and Inflation**, University of Torino.

2021 **PhD course on Dark Matter**, University of Torino.

2019 **PhD course on Dark Matter**, University of Torino.

## Tutoring of students and young researchers

Oct 2020 - Oct 2022

Oct 2013 - March 2014

Oct 2009 - Oct 2011

## Participation in evaluation activities and scientific charges

2023 - present **Local coordinator** of the INFN Consortium for AstroParticle Theory (TAsP) research network in Torino, https://web.infn.it/CSN4/index.php/it/17-esperimenti/190-tasp-home

2022 - present **Representative** of the Torino group in the European Consortium for AstroParticle Theory (EuCAPT) and member of the EuCAPT Symposium Task Force. https://www.eucapt.org

2021 - present **Co-Organiser of the Theory Colloquia** at the Physics Department of Torino. http://colloquia.to.infn.it/

8 Oct 2021 **Member of the PhD jury** of the doctoral thesis presented by Mario Reig Lopez, Universitat de València (Spain).

2021 **Member of the selection commitee** for a faculty permanent position (Maître de Conférences) at LAPTh Université Savoie Mont Blanc (France).

2021-2022 **Member of the selection commitee** for the INFN *Molinari prize 2020 and 2021* for the best doctoral thesis in theoretical physics (University of Torino).

2020 **Referee of the PhD thesis**

2019 **Member of the selection commitee** for the INFN *Fubini prize 2018* for the best doctoral thesis in theoretical physics (national level).

10 Apr 20218 **Member of the PhD jury** of the doctoral thesis presented by Marta Perego, Université Paris-Saclay (France).

22 May 2020 - 22 May 2029 **National Scientific Qualification from the Italian Ministry of University and Research to function as associate in Italian Universities** *in the area of "Theoretical physics of fundamental interactions".* https://asn18.cineca.it/pubblico/miur/esito-abilitato/02%252FA2/2/4

## Seminars and Conference Talks

| | |
|---|---|
| 03 March 2023 | *Seminar at Helsinki Institute of Physics*, Finland. https://www.hip.fi/cosmoseminars/ |
| 17-28 Oct 2022 | *Beyond the Standard Models: Particle Physics Meets Cosmology*, Madrid, Spain. **Invited speaker.** https://indico.ift.uam-csic.es/event/12/ |
| 8-12 Aug 2022 | *TeVPA 2022*, Kingston, Canada. https://indico.cern.ch/event/1082486/ |
| 26 May 2022 | *Seminar at University of Pisa*, Italy. |
| 10 Nov 2021 | *Seminar at University of Padova*, Italy. |
| 18-20 Oct 2021 | *MULTIDARK Consolider Workshop*, Huelva, Spain. https://workshops.ift.uam-csic.es/multidark18 |
| 23 Sept 2021 | *Workshop Cosmology and dark matter*, **Invited speaker**, Torino, Italy. https://agenda.infn.it/event/28019/ |
| 30 Aug - 3 Sept 2021 | *TAUP 2021*, online conference. https://congresos.adeituv.es/TAUP2021/ |
| 12 - 23 Jul 2021 | *ICRC 2021*, online conference, **Invited rapporteur plenary speaker**. https://icrc2021.desy.de/ |
| 28 Apr 2021 | *UC Irvine*, online talk. |
| 18 Oct 2019 | *Seminar at IFUNAM*, Mexico City, Mexico. |
| 9 - 13 Sept 2019 | *TAUP 2019*, Toyama, Japan. http://taup2019.icrr.u-tokyo.ac.jp/ |
| 8 - 10 April 2019 | *IFAE 2019*, **Invited speaker**, Naples, Italy. https://agenda.infn.it/event/17945/ |
| 24 Jul 2018 | *Seminar at IFIC*, Valencia, Spain. |
| 25-29 Jun 2018 | *Dark Side of the Universe*, Annecy, France. https://indico.in2p3.fr/event/14719/ |
| 16 Feb 2018 | *Seminar at IFIC*, Valencia, Spain. |
| 24-26 May 2017 | *MULTIDARK Consolider Workshop*, UAM, Madrid, Spain. https://workshops.ift.uam-csic.es/multidark14 |
| 10-12 May 2017 | *South American Dark Matter workshop*, ICTP-SAIFR, **Invited speaker**, San Paolo, Brazil. https://www.ictp-saifr.org/sao-paulo-dark-matter-workshop/ |
| 08 May 2017 | *Seminar at ICTP San Paolo*, Brazil. |
| 09 March 2017 | *Seminar at University of Torino*, Italy. |
| 30 Nov 2016 | *Seminar at University of Padova*, Italy |
| 21-25 Nov 2016 | *IBS-Multidark-IPP workshop*, Durham, UK. https://conference.ippp.dur.ac.uk/event/555/ |
| 10-16 Jul 2016 | *PASCOS 2016*, Quy-Nhon, Vietnam. https://indico.cern.ch/event/452998/ |
| 22-28 May 2016 | *Frontier Objects in Astrophysics and Particle Physics*, **Invited plenary speaker**, Sicily, Italy. http://www.lnf.infn.it/conference/vulcano2016/ |
| 23-28 Nov 2015 | *IBS-MULTIDARK Workshop*, UAM Madrid, Spain. https://workshops.ift.uam-csic.es/IBSmultidark |
| 15 Oct 2015 | *Seminar at LPT Orsay*, Paris, France. |
| 7-11 Sept 2015 | *TAUP 2015*, Torino, Italy. http://taup2015.to.infn.it/ |

16-20 Mar 2015 *Effective Theories and Dark Matter Workshop*, Mainz, Germany.
https://indico.mitp.uni-mainz.de/event/25/

4 March 2015 *Seminar at SISSA*, Trieste, Italy.

15-16 Jan 2015 *Rencontres de Physique des Particules*, Paris, France.
https://indico.in2p3.fr/event/10699/

11-13 Dec 2014 *GDR Terascale*, **Invited plenary speaker**, Heidelberg, Germany.
https://indico.in2p3.fr/event/10186/

17-21 Nov 2014 *Dark Side of the Universe*, Cape Town, South Africa.
http://www.acgc.uct.ac.za/dsu2014

29 Sept-01 Oct 2014 *APS workshop*, Amsterdam, Netherlands.
https://indico.cern.ch/event/331892/

22-26 Sept 2014 *Physics Challenges in the face of LHC-14*, Madrid, Spain.
https://workshops.ift.uam-csic.es/faceLHC14

23-28 Jun 2014 *TeVa/IDM 2014*, Amsterdam, Netherlands.
https://indico.cern.ch/event/278032/

Apr 2014 *Seminar at LAPTh*, Annecy, France.

16-21 Sept 2013 *WIN 2013*, **Invited speaker**, Natal, Brasil.
http://hep.if.usp.br/WIN13/

12-31 May 2013 *Hunting for Dark Matter workshop*, **Invited speaker**, Santa Barbara, USA.
https://www.kitp.ucsb.edu/activities/dmatter13

25-27 March 2013 *APS workshop*, Stockholm, Sweden.

Feb 2013 *Seminar at Institut d'Astrophysique de Paris*, Paris, France.

Jan 2013 *Seminar at IPhT-Saclay*, Paris, France.

8-10 Oct 2012 *Physun 2012*, **Invited speaker** LNGS, Italy.
https://agenda.infn.it/event/5284/

23-27 Jul 2012 *Identification of Dark Matter*, **Invited plenary speaker**, Chicago, USA.
https://kicp-workshops.uchicago.edu/IDM2012/

3-8 Jun 2012 *PASCOS 2012*, Merida, Mexico.
https://indico.nucleares.unam.mx/event/621/

Nov 2011 *Seminar at TRIUMF Laboratory*, Vancouver, Canada.

5-9 Sept 2011 *TAUP 2011*, Munich, Germany.
http://www.taup-conference.to.infn.it/taup2011.html

11-14 Jul 2011 *FLASY 2011*, Valencia, Spain.
http://ific.uv.es/~flasy2011/

4-6 Apr 2011 *MULTIDARK Workshop*, IFT UAM/CSIC Madrid, Spain.
www2.ift.uam-csic.es/iftworkshops/index.php?id=12

15-16 Nov 2010 *MULTIDARK Workshop*, CETA-CIEMAT, Trujillo, Spain.
www2.ift.uam-csic.es/iftworkshops/index.php?id=11

26-30 Jul 2010 *Indentification of Dark Matter*, Montpellier, France.
https://indico.in2p3.fr/event/1565/

19-23 Jul 2010 *Pascos 2010*, Valencia, Spain.

28-30 Jun 2010 *MULTIDARK workshop*, Santander, Spain.
www2.ift.uam-csic.es/iftworkshops/index.php?id=10

1-5 Mar 2010 *Multi3 workshop*, Padova, Italy.
https://userswww.pd.infn.it/~mdoro/Multi-cube/Homepage.html

25-27 Jan 2010 *MULTIDARK workshop*, UAM Madrid, Spain.
www2.ift.uam-csic.es/iftworkshops/index.php?id=3

Jun 2009 *Seminar at Observatory of Geneva*, Switzerland.

May 2009 *Seminar at CERN TH-Division*, Geneva, Switzerland.

March 2009 *Seminar at University of Padova*, Italy.

March 2009 *Seminar at IFIC*, Valencia, Spain.

7-11 Sept 2009 *Cosmo 09*, CERN, Geneva, Switzerland.
https://indico.cern.ch/event/46758/

9-10 Jun 2008 *IDAPP meeting*, Paris, France.

18-22 Aug 2008 *Identification of Dark Matter*, Stockholm, Sweden.

3-4 May 2007 *IDAPP meeting*, Ferrara, Italy.

27-31 Aug 2007 *TeV Particle Astrophysics*, Venice, Italy.
https://www2.pd.infn.it/TeV/index.html

12-13 May 2006 *IDAPP meeting*, Ferrara, Italy.

## Publications


[1] A. Caputo, M. Negro, M. Regis and M. Taoso, **Dark Matter prospects with COSI: ALPs, PBHs and sub-GeV Dark Matter**, JCAP 02 (2023) 006, [arXiv:2210.09310 [hep-ph]].

[2] D. Barducci, E. Bertuzzo, C. Toni and M. Taoso, **Probing right-handed neutrinos dipole operators**, Submitted to JHEP, [arXiv:2209.13469 [hep-ph]].

[3] J. Reynoso-Cordova, M. Regis and M. Taoso, **Upper limits on the dark matter content in globular clusters**, JCAP 10 (2022) 038, [arXiv:2203.13735 [astro-ph.GA]].

[4] E. Bertuzzo, A. Scaffidi and M. Taoso, **Searching for inelastic dark matter with future LHC experiments**, JHEP 08 (2022) 100, [arXiv:2201.12253 [hep-ph]].

[5] F. Riccardi, M. Taoso and A. Urbano, **Solving peak theory in the presence of local non-gaussianities**, JCAP 08 (2021) 060, [arXiv:2102.04084 [astro-ph.CO]].

[6] M. Taoso and A. Urbano, **Non-gaussianities for primordial black hole formation**, JCAP 08 (2021) 016, [arXiv:2102.03610 [astro-ph.CO]].

[7] A. Caputo, A. Vittino, N. Fornengo, M. Regis and M. Taoso, **Searching for axion-like particle decay in the near-infrared background: an updated analysis**, JCAP 05 (2021) 046, [arXiv:2012.09179 [astro-ph.CO]].

[8] E. Bertuzzo and M. Taoso, **Probing light dark scalars with future experiments**, JHEP 03 (2021) 272, [arXiv:2011.04735 [hep-ph]].

[9] M. Regis and M. Taoso and MUSE Collaboration, **Searching for light in the darkness: Bounds on ALP dark matter with the optical MUSE-faint survey**, Phys.Lett.B 814 (2021) 136075, [2009.01310 [astro-ph.CO]].

[10] G. Ballesteros, J. Rey, M. Taoso and A. Urbano, **Stochastic inflationary dynamics beyond slow-roll and consequences for primordial black hole formation**, JCAP 08 (2020) 043, [2006.14597 [astro-ph.CO]].

[11] G. Ballesteros, J. Rey, M. Taoso and A. Urbano, **Primordial black holes as dark matter and gravitational waves from single-field polynomial inflation**, JCAP 07 (2020) 025, [2001.08220 [astro-ph.CO]].

[12] A. Caputo, M. Regis and M. Taoso, **Searching for Sterile Neutrino with X-ray Intensity Mapping**, JCAP 03 (2020) 001, [1911.09120 [astro-ph.CO]].

[13] A. Caputo, M. Regis, M. Taoso and S.J. Witte, **Detecting the Stimulated Decay of Axions at RadioFrequencies**, JCAP 03 (2019) 027, [1811.08436 [hep-ph]].

[14] M. Cirelli, P. Panci, F. Sala, J. Silk, M. Taoso, and HESS Collaboration, **Searches for gamma-ray lines and 'pure WIMP' spectra from Dark Matter annihilations in dwarf galaxies with H.E.S.S**, JCAP 1811 (2018) 037, [1810.00995 [astro-ph.HE]]].

[15] G. Ballesteros, P. D. Serpico and M. Taoso, **On the merger rate of primordial black holes: effects of nearest neighbours distribution and clustering**, JCAP 10 (2018) 043, [1807.02084 [astro-ph.CO]].

[16] I. Baldes, M. Cirelli, P. Panci, K. Petraki, F. Sala and M. Taoso, **Asymmetric dark matter: residual annihilations and self-interactions**, SciPost Phys. 4 (2018) 6, 041, [1712.07489 [hep-ph]].

[17] G. Ballesteros and M. Taoso, **Primordial black hole dark matter from single field inflation**, Phys.Rev.D 97 (2018) 2, [1709.05565 [hep-ph]].

[18] D. Gaggero, D. Grasso, A. Marinelli, M. Taoso and A. Urbano, **Diffuse cosmic rays shining in the Galactic center: A novel interpretation of H.E.S.S. and Fermi-LAT $\gamma$-ray data**, Phys.Rev.Lett. 119 (2017) 3, 031101, [1702.01124 [astro-ph.HE]].

[19] M. Cirelli, P. Panci, K. Petraki, F. Sala and M. Taoso, **Dark Matter's secret liaisons: phenomenology of a dark U(1) sector with bound states**, JCAP 05 (2017), 036, [arXiv:1612.07295 [hep-ph]].

[20] M. Cirelli and M. Taoso, **Updated galactic radio constraints on Dark Matter**, JCAP 07 (2016), 041, [arXiv:1604.06267 [hep-ph]].

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## Other contributions

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## Conference Proceedings

[1] J. Singal et al., **The Second Radio Synchrotron Background Workshop: Conference Summary and Report**, [arXiv:2211.16547 [astro-ph.CO]].

[2] M. Taoso, **News on Dark Matter from ICRC 2021**, Contribution to ICRC 2021, PoS ICRC2021 (2021), 047.

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[9] M. Taoso, **Solar neutrinos constraints on light asymmetric dark matter**, Contribution to IDM 2010, PoS IDM2010 (2011), 038.

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[11] M. Taoso, G. Bertone, G. Meynet and S. Ekstrom, **WIMPs annihilations in Pop III stars**, Contribution to IDM 2008, PoS IDM2008 (2008), 076.

# Curriculum Vitæ of Daniele Trocino

## Personal data

| | |
|---|---|
| Full name | Daniele Trocino |

## Employment history

| | |
|---|---|
| May 2019–present | Staff researcher at Istituto Nazionale di Fisica Nucleare (INFN), Sezione di Torino, Italy |
| Apr 2017–Apr 2019 | Postdoctoral Researcher at Ghent University, Belgium |
| Feb 2011–Mar 2017 | Postdoctoral Research Associate at Northeastern University, Boston, United States |

## Education

| | |
|---|---|
| Jan 2011 | PhD in Physics, University of Turin, Italy<br>Title of dissertation: "Muon reconstruction and momentum scale calibration and their application to standard model Higgs searches with the CMS experiment" |
| Sep 2007 | Master's Degree in Particle Physics *cum laude*, University of Turin<br>Title of dissertation: "A study of high mass Higgs boson decay into two muons and two electrons with the CMS experiment" |
| Jul 2005 | Bachelor's Degree in Physics *cum laude*, University of Turin<br>Title of dissertation (in Italian): "Qualifica dei moduli a microstrip di silicio dei 'Tracker Inner Disks' dell'esperimento CMS" ("Quality certification of the silicon microstrip modules of the CMS Tracker Inner Disks") |

## Leadership and coordination experience

| | |
|---|---|
| Aug 2017–present | Muon-Object Coordinator within the CMS Exotica Physics Analysis Group (EXO PAG), responsible for ensuring a correct and coherent treatment of muons (triggering, identification, calibration, etc.) in all CMS exotics searches |
| Sep 2020–Aug 2022 | Co-convener of the muon reconstruction sub-group within the CMS Muon Physics Object Group (Muon POG), responsible for the development and maintenance of the CMS muon reconstruction algorithms and of all muon-related software |
| Nov 2018–Aug 2020 | Co-convener of the CMS Standard Model Physics–Multiboson subgroup, responsible for the standard model measurements and other studies involving the production of multiple electroweak bosons |
| Jul 2019 | Member of the Local Organizing Committee of the EPS–HEP Conference 2019, (Ghent, Belgium); co-responsible for the EPS–HEP 2019 outreach program; editor of the EPS–HEP 2019 daily newsletter |

| | |
|---|---|
| | `http://eps-hep2019.eu` |
| Jan 2014–Dec 2015 | Co-convener of the CMS Muon Physics Object Group (Muon POG), responsible for all the software- and physics-related aspects of muon detection in CMS: identification, trigger, measurement, calibration, performance validation, and usage in physics analysis |
| Jan 2012–Dec 2013 | Convener of the CMS Muon High-Level Trigger (HLT) group, responsible for the development, monitoring, and performance validation of muon triggers in CMS |
| Jan 2010–Dec 2013 | Responsible for muon tracking and triggering using the CMS muon spectrometer alone ("standalone muons") |
| Dec 2009–Dec 2010 | Responsible for the operation of the Front-End Drivers (FEDs) of the CMS Drift Tubes (DT) detector |

## Teaching and mentoring experience

| | |
|---|---|
| Feb 2023–present | Advisor of a postdoctoral researcher (*assegnista*), |
| 2011–present | Supervision of former and current students of Northeastern University Ghent Univer-sity (), and Torino University () in their analysis and detector projects and thesis preparation<br>Training of young reserchers () in their physics analysis, software development, and detector work; all of them are now pursuing successful careers in academia or industry |
| 2017–2019 | Teaching assistant for the course "Subatomic Physics II" (Ghent University, Department of Physics and Astronomy) |
| Sep 2017 | Instructor at the CMS Physics Object School (University of Bari, Italy) |

## Seminars and conference presentations

| | |
|---|---|
| 7 Sep 2023 | "Search for long-lived particles at ATLAS and CMS", plenary talk at the conference *Interplay between Particle and Astroparticle physics (IPA2022)*, Vienna, Austria |
| 8 Aug 2019 | "Heavy Neutral Lepton searches at CMS and ATLAS", invited plenary talk at the conference *15$^{th}$ Rencontres du Vietnam on 3 Neutrinos and Beyond*, Quy Nhon, Vietnam |
| 14 Feb 2019 | "Heavy Neutral Lepton searches at CMS", invited seminar at Université Catholique de Louvain, Belgium |
| 9 Mar 2017 | "Electroweak and QCD Physics at CMS" [23], plenary talk at the conference *La Thuile 2017*, 5–11 Mar 2017, La Thuile, Italy |

11 Jan 2017 "Dark matter and invisible Higgs searches in dilepton + MET channels at CMS", invited seminar at Ghent University, Ghent, Belgium

28 Jun 2016 "Non-hadronic searches for dark matter at CMS", plenary talk at the conference *Dark Matter 2016: From the smallest to the largest scales (DM 2016)*, 27 Jun–1 Jul 2016, Santander, Spain

9 Jan 2016 "Dark Matter Searches at CMS", talk at the $6^{th}$ *International Workshop on High Energy Physics in the LHC Era (HEP 2016)*, 6–12 Jan 2016, Valparaíso, Chile

4 Dec 2014 "Searches for dark matter at the LHC in mono-Z channels and in Higgs-portal models", invited seminar at the *Brown Astrophysics Seminar Series*, Brown University, Providence, United States

4 Jul 2014 "Searches for Invisible Decay Modes of the Higgs Boson with the CMS Detector" [24], talk at the $37^{th}$ *International Conference on High Energy Physics (ICHEP 2014)*, 2–9 Jul 2014, Valencia, Spain

17 Oct 2013 "The CMS High Level Trigger" [25], talk at the $20^{th}$ *International Conference on Computing in High Energy and Nuclear Physics (CHEP 2013)*, 14–18 Oct 2013, Amsterdam, The Netherlands

18 Jul 2013 "Definition and performance of muon physics objects at CMS" [26], poster at the *2013 European Physical Society Conference on High Energy Physics (EPS-HEP 2013)*, 18–24 Jul 2013, Stockholm, Sweden

23 Apr 2013 "Production of Multiple Electroweak Bosons at CMS" [27], talk at the *XXI International Workshop on Deep-Inelastic Scattering and Related Subjects (DIS 2013)*, 22–26 Apr 2013, Marseilles, France

9 Aug 2011 "A Search For The Higgs Boson In $H \to ZZ \to 2\ell 2\nu$ Mode" [28], talk at the *2011 Meeting of the Division of Particles and Fields of the American Physical Society (APS-DPF 2011)*, 9–13 Aug 2011, Providence, United States

10 Mar 2010 "Strategy for an early observation of the $ZZ^{(*)}$ di-boson production in four-lepton final states" [29], plenary talk at the *XLV Rencontres de Moriond on Electroweak Interactions and Unified Theories (Moriond EW 2010)*, 6–13 Mar 2010, La Thuile, Italy

2 Oct 2009 "The CMS Muon Reconstruction Software" [30], talk at the $8^{th}$ *International Conference on Computational Methods in Sciences and Engineering (ICCMSE 2009)*, 29 Sep–4 Oct 2009, Rhodes, Greece

29 Sep 2008 "Search for the SM Higgs Boson in $H \to ZZ^{(*)}$ in 4 leptons at CMS" [31], talk at the $4^{th}$ *Conference on Physics at LHC (PLHC 2008)*, 29 Sep–4 Oct 2008, Split, Croatia

23 Sep 2008 "Prestazioni del High Level Trigger di CMS per il canale $H \to ZZ^{(*)} \to 4\mu$", talk (in Italian) at the *XCIV Congresso Nazionale della Società Italiana di Fisica (SIF 2008)*, 22–27 Sep 2008, Genoa, Italy

## Summary of publications

I co-authored more than 1160 papers published on international peer-reviewed journals (courtesy of Scopus, www.scopus.com, and Web of Science, www.webofscience.com):

- citations: 50 484 (61 473 including self-citations)
- $h$-index: 111 (including self-citations)

A complete list of my publications can also be found at (courtesy of InSpire HEP):
`http://inspirehep.net/search?p=exactauthor%3AD.Trocino.1+collection%3APublished`

## Research activity

I conduct my research in Particle Physics in the Compact Muon Solenoid (CMS) experiment at CERN's Large Hadron Collider (LHC) in Geneva, Switzerland, with particular focus on the search for physics beyond the standard model (BSM) and on muon detection.

**Muon detection and reconstruction (2008–present).** It is one of the key aspects for CMS, as muons are involved in many physics studies. Muons in CMS are reconstructed using the muon spectrometer and the silicon tracker. Since 2008 I have conducted and coordinated the development of the algorithms for muon reconstruction and triggering in the spectrometer [1, 10, 14, 15, 25, 26, 30]. Since 2013 I have worked on the development of a new muon reconstruction algorithm in view of the High-Luminosity LHC run (HL-LHC) [18, 20]. This algorithm will extend the current CMS muon reconstruction coverage to higher pseudorapidity

I have covered major coordination roles in this field: responsible for muon reconstruction in the spectrometer (2010-13), Muon HLT convener (2012-13), Muon POG convener (2014-15), Muon-Object Coordinator for Exotica analyses (2017-present), muon reconstruction and muon software convener (2020-2022).

**Search for heavy sterile neutrinos (2017–present).** Since 2017 I have conducted a search for massive sterile neutrinos with 13 TeV CMS data, in final states with charged leptons and missing transverse energy (MET) [2]. This search targets hypothetical heavy Dirac or Majorana neutral leptons, produced via mixing with standard model (SM) neutrinos, in a very wide mass range (1 GeV–1.2 TeV) that exceeds any previous direct search

I am now coordinating the searches for *long-lived* sterile neutrinos, in channels with charged leptons and MET or with charged leptons and jets. For masses in the GeV range or for very small mixing parameters, such sterile neutrinos can decay far from the interaction point, even meters away. To tackle these signatures, I am developing dedicated techniques involving displaced leptons, displaced jets, and displaced vertices. In this effort, I am leading a team of scientists and students from several institutes (Ghent University, University of Antwerp, Université Catholique de Louvain, ETH Zürich, INFN).

**Endcap Timing Layer (2020–present).** The Endcap Timing Layer (ETL) is a new detector planned for the HL-LHC upgrade of CMS. Its design consists of a single layer of silicon sensors, based on low-gain avalanche diode (LGAD) technology, covering a surface of approximately 14 square meters in the forward rapidity region of CMS ("endcaps"). I work on the design, production, and assembly of the ETL modules at the Torino INFN laboratories.

**Muon trigger emulator (2019–present).** The Drift Tube (DT) and Resistive Plate Chamber (RPC) detectors cover the central rapidity region ("barrel") of the CMS muon spectrometer. I am currently responsible for the emulator of the TwinMux system, which combines DT and RPC trigger primitives to optimize the timing and bunch-crossing assignment of muon triggers.

**Diboson physics (2011–2020).** I coordinated the CMS analysis of the pp $\rightarrow$ ZZ process in final states with two charged leptons and two neutrinos [7, 23, 27] with data at 7 and 8 TeV (2011-2015). This study led to measurements of the ZZ production cross sections and set stringent limits on anomalous triple gauge couplings involving neutral bosons. I served as convener of the CMS Standard Model Physics–Multiboson group (2018-2020).

**BSM Higgs and dark matter searches (2012–2017).** In 2012 I proposed and started a search in CMS for invisibly decaying Higgs bosons produced in association with a Z boson, in final states with two charged leptons and MET [5, 8, 24]. Using 7, 8, and 13 TeV data I set upper limits on the invisible branching fraction of Higgs bosons in a wide mass range I then extended the search to possible dark matter (DM) candidates produced in association with a Z boson, in final states with charged leptons and MET [3, 4, 6, 19]. The 8 and 13 TeV CMS data allowed me to set upper limits on the DM production cross section at the LHC. These were then reinterpreted as limits on the DM-nucleon cross section, extending the existing results from DM direct-detection experiments.

**SM Higgs searches (2008–2012).** As a graduate student (2008-2011), my analysis activity was focused on the search for the SM Higgs boson in four-lepton final states [12, 22, 31, 32], which also constituted the main topic of my PhD thesis [33]. In 2011-2012 I worked on the search for the SM Higgs boson in final states with two charged leptons and two neutrinos [11, 28].

**Muon momentum calibration (2009–2011).** I worked on the development of the `MuScleFit` algorithm [10, 21, 33], which uses dimuon decays of well-known resonances ($J/\psi, \Upsilon, Z$) to calibrate the muon momentum scale and resolution. Using `MuScleFit`, I provided muon momentum corrections and related systematic uncertainties to several analyses [11, 12, 13]. To date, `MuScleFit` is still one of the main tools for muon momentum calibration in CMS.

**Cathode Strip Chambers (2011–2015).** The Cathode Strip Chambers (CSC) constitute one of the three sub-detectors of the CMS muon spectrometer, covering the forward rapidity region ("endcaps") [1, 9]. I served as CSC contact-person for HLT.

**Drift Tubes (2008–2010).** The Drift Tube (DT) chambers constitute one of the three sub-detectors of the CMS muon spectrometer, covering the central rapidity region ("barrel"). I worked on the calibration of the DT chambers with cosmic rays and collision data [9, 16, 17]. In 2009-2010 I was responsible for the operation of the DT Front-End Drivers (FEDs), the electronic boards that collect data from the DTs and send them to the central data acquisition system of CMS.

**Tracker Inner Disks (2005).** I worked on the integration and characterization of the silicon microstrip modules of the CMS Tracker Inner Disks (TID) at the INFN laboratories in Turin, Italy, as the main project for my Bachelor's Degree dissertation. I studied the channel noise performance in different operating conditions and at different stages of the module construction and assembly, and I defined standard protocols and criteria for their quality assurance.

## Other skills

| | |
|---|---|
| **Languages** | Italian (mother tongue), English, French, Dutch |
| **Operating systems** | Unix (Linux, OS X), Windows |
| **Programming/scripting** | Python, C/C++, HTML; Bourne shell, C shell |
| **Data-analysis programs** | ROOT, Mathematica |
| **Software versioning** | Git, CVS, SVN |

# References


[1] A. M. Sirunyan *et al.* [CMS Collaboration], "Performance of the CMS muon detector and muon reconstruction with proton-proton collisions at $\sqrt{s} = 13$ TeV," *JINST* **13**, no. 06, P06015 (2018)
doi:10.1088/1748-0221/13/06/P06015, arXiv:1804.04528 [physics.ins-det]

[2] A. M. Sirunyan *et al.* [CMS Collaboration], "Search for heavy neutral leptons in events with three charged leptons in proton-proton collisions at $\sqrt{s} = 13$ TeV", *Phys. Rev. Lett.* **120**, no. 22, 221801 (2018)
doi:10.1103/PhysRevLett.120.221801, arXiv:1802.02965 [hep-ex]

[3] A. M. Sirunyan *et al.* [CMS Collaboration], "Search for new physics in events with a leptonically decaying Z boson and a large transverse momentum imbalance in proton-proton collisions at $\sqrt{s} = 13$ TeV", *Eur. Phys. J. C* **78**, no. 4, 291 (2018)
doi:10.1140/epjc/s10052-018-5740-1, arXiv:1711.00431[hep-ex]

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doi:10.1007/JHEP03(2017)061, 10.1007/JHEP09(2017)106, 10.1007/JHEP01(2018)056
arXiv:1701.02042 [hep-ex]

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doi:10.1103/PhysRevD.93.052011, 10.1103/PhysRevD.97.099903,
arXiv:1511.09375 [hep-ex]

[7] V. Khachatryan *et al.* [CMS Collaboration], "Measurements of the ZZ production cross sections in the $2\ell 2\nu$ channel in proton-proton collisions at $\sqrt{s} = 7$ and 8 TeV and combined constraints on triple gauge couplings", *Eur. Phys. J. C* **75**, no. 10, 511 (2015)
doi:10.1140/epjc/s10052-015-3706-0, arXiv:1503.05467 [hep-ex]

[8] S. Chatrchyan *et al.* [CMS Collaboration], "Search for invisible decays of Higgs bosons in the vector boson fusion and associated ZH production modes", *Eur. Phys. J. C* **74**, no. 8, 2980 (2014). doi:10.1140/epjc/s10052-014-2980-6, arXiv:1404.1344 [hep-ex]

[9] S. Chatrchyan *et al.* [CMS Collaboration], "The performance of the CMS muon detector in proton-proton collisions at $\sqrt{s} = 7$ TeV at the LHC", *JINST* **8**, P11002 (2013) doi:10.1088/1748-0221/8/11/P11002, arXiv:1306.6905 [physics.ins-det]

[10] S. Chatrchyan *et al.* [CMS Collaboration], "Performance of CMS muon reconstruction in $pp$ collision events at $\sqrt{s} = 7$ TeV", *JINST* **7**, P10002 (2012) doi:10.1088/1748-0221/7/10/P10002, arXiv:1206.4071 [physics.ins-det]

[11] S. Chatrchyan *et al.* [CMS Collaboration], "Search for the standard model Higgs boson in the $H \to ZZ \to 2\ell 2\nu$ channel in $pp$ collisions at $\sqrt{s} = 7$ TeV", *JHEP* **1203**, 040 (2012) doi:10.1007/JHEP03(2012)040, arXiv:1202.3478 [hep-ex]

[12] S. Chatrchyan *et al.* [CMS Collaboration], "Search for the standard model Higgs boson in the decay channel $H \to ZZ \to 4l$ in $pp$ collisions at $\sqrt{s} = 7$ TeV", *Phys. Rev. Lett.* **108** (2012) 111804. doi:10.1103/PhysRevLett.108.111804, arXiv:1202.1997 [hep-ex]

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[14] V. Khachatryan *et al.* [CMS Collaboration], "Measurement of the charge ratio of atmospheric muons with the CMS detector", *Phys. Lett. B* **692**, 83 (2010) doi:10.1016/j.physletb.2010.07.033, arXiv:1005.5332 [hep-ex]

[15] S. Chatrchyan *et al.* [CMS Collaboration], "Performance of CMS Muon Reconstruction in Cosmic-Ray Events", *JINST* **5**, T03022 (2010) doi:10.1088/1748-0221/5/03/T03022, arXiv:0911.4994 [physics.ins-det]

[16] S. Chatrchyan *et al.* [CMS Collaboration], "Calibration of the CMS Drift Tube Chambers and Measurement of the Drift Velocity with Cosmic Rays", *JINST* **5**, T03016 (2010) doi:10.1088/1748-0221/5/03/T03016, arXiv:0911.4895 [physics.ins-det]

[17] G. Abbiendi, N. Amapane, C. Battilana, *et al.*, "Offline calibration procedure of the CMS drift tube detectors", *JINST* **4**, P05002 (2009). doi:10.1088/1748-0221/4/05/P05002

*Other reports and articles not on journal, CMS Physics Analysis Summaries*

[18] CMS Collaboration, "CMS Phase II Upgrade Scope Document", CERN-LHCC-2015-019, LHCC-G-165

[19] D. Abercrombie, N. Akchurin, E. Akilli, *et al.*, "Dark Matter Benchmark Models for Early LHC Run-2 Searches: Report of the ATLAS/CMS Dark Matter Forum", FERMILAB-PUB-15-282-CD, arXiv:1507.00966 [hep-ex]

[20] CMS Collaboration, "Technical Proposal for the Phase-II Upgrade of the Compact Muon Solenoid", ISBN 978-92-9083-417-5 (2015), CERN-LHCC-2015-10, LHCC-P-008

[21] CMS Collaboration, "Measurement of Momentum Scale and Resolution using Low-mass Resonances and Cosmic-Ray Muons", CMS-PAS-TRK-10-004

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