



## Personal information

Surname(s) / First name(s)

Email(s)

Nationality(-ies)

Date of birth

**Tarantino Cecilia**

## Academic career

November 2014 – present

### Associate Professor in Theoretical Physics

Roma Tre University, Rome

University Researcher in Theoretical Physics

Roma Tre University, Rome

January 2007 – October 2014

Post-doc grant, for research activity in Theoretical Physics

Technische Universitaet Muenchen, Munich

November 2005 – December 2006

## Education and pre-doctoral positions

February 2006

Ph. D. in Theoretical Physics

Roma Tre University, Rome

Advisor: prof. Vittorio Lubicz

2002

INFN pre-doctoral fellow

Roma Tre University, Rome

April 2002

Laurea degree in Theoretical Physics (Summa cum Laude)

Roma Tre University, Rome

Advisor: prof. Vittorio Lubicz

## Awards

2006

Sergio Fubini 2006 prize, for three Ph. D. theses in Theoretical Physics

National Institute of Nuclear Physics (INFN) Theory Group

2005

Young Women in Physics 2005 prize, for young female researchers in Physics

Physics Department, Roma Tre University

2005

Best Ph. D. Seminar 2005 prize

Physics, Astronomy and Material Science Departments of the three Universities of Rome

2002

Antonio Stanghellini 2002 fellow for graduated students in Physics

Italian Physics Society (SIF)

2002

Galluzzi 2002 prize for Physics, for a graduated student in Physics

Roma Tre University

## Research activity

Research interests

**Flavor Physics, Lattice QCD**

## Synthetic description of the field

The study of the flavor sector of the Standard Model (SM) deals with fundamental questions which are still open in particle physics. Within the SM there is no explanation for the great hierarchy among different fermion masses, nor for the presence of three families, nor for the structures of the mixing matrices, which are very different between the quark sector (Cabibbo-Kobayashi-Maskawa matrix) and the lepton sector (Pontecorvo-Maki-Nakagawa-Sakata matrix). Moreover, the mixing among different flavors of quarks represents the only source of CP-violation in the Standard Model, an effect which has been proven to be too small, however, to explain the observed dominance of matter over anti-matter in the Universe. This observation provides therefore a strong hint for the existence of new sources of CP-violation beyond the SM. Research activities in Flavor Physics aims at clarifying these open questions by testing the SM itself with increasing accuracy and by searching New Physics (NP) effects through indirect searches, i.e. by looking at processes that are sensitive to virtual (loop) contributions of NP particles. In the last years a new era of exploration has started with the coming into operation of the Large Hadron Collider (LHC) at CERN. From the theory side, it will be crucial to keep pace with the experimental accuracy, with Lattice QCD simulations playing a fundamental role in the determination of the non-perturbative hadronic parameters, which often enclose the main source of theoretical uncertainty.

## Citations

My (about 50) published papers count about 4500 citations on the inSPIRE.net database. They include 4 famous (more than 250 citations) papers, 13 very well known (100-250 citations) papers and 11 well known (50-99 citations) papers.

## International scientific collaborations

**UTfit collaboration**, composed of Theorists and Experimentalists from various European nations, working at the determination of the parameters of the Cabibbo-Kobayashi-Maskawa matrix  
**European Twisted Mass collaboration (ETMC)**, composed of Lattice QCD experts from various European nations, working at the computation of quantities of interest for High Energy Physics

## Research programs

- 2010-2012 Participant in the **Prin 2008** research program on "Predictions and theoretical proposals for present and future experiments in particle physics"
- 2013-2016 Participant in the **Prin 2012** research program on "Symmetries, masses and mysteries: electroweak symmetry breaking, flavor mixing and CP-violation, dark matter in the LHC era"
- 2017-2020 Participant in the **Prin 2015** research program on "Search for the Fundamental Laws and Constituents"

## Invited talks at conferences and workshops

- June 2018 LHCP 2018, 6th Annual Large Hadron Collider Physics conference, Bologna
- May 2014 Planck 2014, 17th International Conference From the Planck Scale to the Electroweak Scale, Paris  
**plenary review talk**
- September 2013 SIF 2013, XCIX Congresso Nazionale della Società Italiana di Fisica, Trieste
- September 2013 WIN 2013, The XXIV Workshop on weak interactions and neutrinos, Natal (Brazil)  
**theory summary talk**
- July 2012 ICHEP'12, XXXVI International Conference on High Energy Physics, Melbourne (Australia)  
**plenary review talk**
- June 2012 Lattice 2012 The XXX International Symposium on Lattice Field Theory, Cairns (Australia)  
**plenary review talk**
- June 2012 International Collaboration Meeting "Super B IV", Isola d'Elba
- May 2012 The V International Workshop on Charm Physics, Honolulu (Hawaii)
- September 2011 The XV Workshop on Statistical Mechanics and nonperturbative Field Theory, Bari
- April 2011 Incontri sulla Fisica delle Alte Energie, IFAE 2011, Perugia
- October 2010 International Conference "Heavy Quarks and Leptons 2010", Frascati National Laboratories (LNF)
- October 2009  $V_{cb}$  Workshop, SLAC (USA)
- April 2009 Ringberg Workshop on New Physics, Flavors and Jets, Ringberg Castle, Rottach-Egern
- January 2008 V Workshop Italiano sulla Fisica p-p ad LHC, Perugia

May 2007	International Conference “Kaon’07”, Frascati National Laboratories (LNF)
April 2007	Incontri sulla Fisica delle Alte Energie, XVIII-IFAE, Napoli
December 2006	CKM 2006: Workshop on the Unitarity Triangle, Nagoya (Japan)
November 2006	International Workshop “Super B IV”, Villa Mondragone, Monte Porzio Catone
October 2006	International Conference “Heavy Quarks and Leptons 2006”, Munich
May 2006	Flavor in the LHC Era-3 <sup>rd</sup> Workshop on the Interplay of Flavor and Collider Physics, CERN Geneva
June 2005	Beauty 2005: 10 <sup>th</sup> International Conference on B-Physics at Hadron Machines, Assisi
April 2005	Workshop on Effective Field Theory, QCD and Heavy Hadrons, Seattle (USA)
March 2005	CKM 2005: Workshop on the Unitarity Triangle, San Diego (USA)
April 2004	Incontri sulla Fisica delle Alte Energie, XVI-IFAE, Torino
July 2003	International Europhysics Conference on High Energy Physics, EPS HEP 2003, Aachen
April 2002	Incontri sulla Fisica delle Alte Energie, XIV-IFAE, Parma

### Organization of scientific conferences, workshops and schools

September 2014	International Advisory Committee of the Doctoral School on Lattice Gauge Theories, Parma
June 2014	International Advisory Committee of the XXXII International Symposium on Lattice Field Theory, New York (USA)
April 2014	Convener of “Incontri di Fisica delle Alte Energie”, Gran Sasso National Laboratories
September 2013	Convener of the XXIV Workshop on weak interactions and neutrinos, Natal (Brazil)
July 2013	International Advisory Committee of the XXXI International Symposium on Lattice Field Theory, Mainz
July 2011	Convener of the International Europhysics Conference on High Energy Physics, Grenoble
June 2010	Local Organizing Committee of the XXVIII International Symposium on Lattice Field Theory, Cagliari
February 2010	Local Organizing Committee of the Galileo Galilei Institute (GGI) Workshop on “Indirect Searches for New Physics at the time of LHC”, Firenze
December 2009	Convener of the X SuperB Physics Workshop, Frascati National Laboratories (LNF)
April 2009	Convener of the VIII SuperB Physics Workshop, Warwick
September 2008	Convener of the V International Workshop on the CKM Unitarity Triangle, Roma

### Teaching

Lectures of Physics of Fundamental Interactions (master, 8 CFU), Roma Tre University  
 AY 2021/2022, 2020/2021, 2019/2020, 2018/2019, 2017/2018, 2016/2017, 2015/2016, 2013/2014, 2012/2013, 2011/2012

Lectures of Mathematical Methods for Optics (bachelor, 6 CFU), Roma Tre University  
 AY 2021/2022, 2020/2021, 2019/2020

Exercises of Quantum Mechanics (bachelor, 3 CFU), Roma Tre University  
 AY 2021/2022, 2020/2021, 2019/2020, 2018/2019, 2017/2018, 2016/2017, 2015/2016, 2013/2014, 2012/2013, 2011/2012, 2009/2010, 2008/2009, 2007/2008, 2004/2005, 2003/2004

Lectures of Quantum Mechanics (TFA and PAS for High School teachers), Roma Tre University  
 AY 2013/2014, 2012/2013

Lectures of Quantum Field Theory (master, 6 CFU), Roma Tre University  
 AY 2009/2010, 2007/2008

Exercises of Theoretical Physics (in English), Technische Universitaet Muenchen, Munich  
 AY 2006/2007, 2005/2006

Exercises of Statistical Mechanics (in English), Technische Universitaet Muenchen, Munich  
 AY 2005/2006

Lectures on Flavor Physics (ICTP Summer School on Particle Physics), Trieste, June 2011

## Supervision of theses

AY 2020/2021	Riccardo Azzali (master student in Physics, Roma Tre University) Title of the thesis: <i>Supersymmetry</i>
AY 2019/2020	Andrea Ricci (diploma student in Physics, Roma Tre University) Title of the thesis: <i>Quantum Theory of Diffusion</i>
AY 2019/2020	Marco Carducci (diploma student in Physics, Roma Tre University) Title of the thesis: <i>Study of a chain of harmonic oscillators</i>
AY 2018/2019	Silvia Peragallo (diploma student in Physics, Roma Tre University) Title of the thesis: <i>Applications of the time-dependent perturbation theory</i>
AY 2018/2019	Antonio Caporale (diploma student in Physics, Roma Tre University) Title of the thesis: <i>WKB method and application to the harmonic oscillator</i>
AY 2017/2018	Simone Romiti (master student in Physics, Roma Tre University) Title of the thesis: <i>Optimization techniques in the lattice calculation of the hadronic contribution to the muon anomaly</i>
AY 2016/2017	Fabio Grimaldi (diploma student in Physics, Roma Tre University) Title of the thesis: <i>Study of the WKB method and application to the alpha decay</i>
AY 2015/2016	Alessio Mattia Leonardi (diploma student in Physics, Roma Tre University) Title of the thesis: <i>Perturbation theory at high orders in quantum mechanics and its numerical applications</i>
AY 2013/2014	Matteo Stasi (diploma student in Physics, Roma Tre University) Title of the thesis: <i>WKB method for the semiclassical approximation and application to the tunnel diode</i>
AY 2013/2014	Daniele Carlotti (diploma student in Physics, Roma Tre University) Title of the thesis: <i>Isotropic harmonic oscillator in three dimensions</i>
AY 2012/2013	Elena La Preziosa (master student in Mathematics, Roma Tre University) Title of the thesis: <i>Variational method applied to hydrogen ion molecule</i>
AY 2011/2012	Paolo Lami (master student in Physics, Roma Tre University) Title of the thesis: <i>Determination of quark masses and decay constants from <math>N_f=2+1+1</math> Lattice QCD</i>
AY 2010/2011	Elisa Giunta (student in Mathematics, Roma Tre University) Title of the thesis: <i>WKB method: application to the double well potential</i>

## Activities of public dissemination of science

2011, 2012, 2014, 2016, 2017, 2021	Introductory lecture on Quantum Mechanics Masterclass in Particle Physics, INFN (Roma Tre Section) and Roma Tre University
2014	Presentation of the Department research activities based on numerical simulations Open Day, Mathematics and Physics Department, Roma Tre University

## Referee activities

2015 – present	Member of REPRISE (Register of Expert Peer Reviewers for Italian Scientific Evaluation)
2006 – present	Referee for journals: JHEP, European Physical Journal C, Nuclear Physics B, Physical Review D, Physical Review Letters, Physics Letters B
2013	Referee of the Ph. D. theses Title: Meson-antimeson oscillations in the SM and beyond from unquenched TM-Lattice QCD Student: Nuria Carrasco Vela (Valencia University) Title: Decays of the B-mesons to the first-orbitally excited $D^{**}$ mesons Student: Mariam Atoui (Particle Physics Laboratory, Clermont-Ferrand)
2008 – present	Referee of several diploma and master theses

## University/Department/INFN activities

2016 – 2021	<b>Member of the Roma Tre Evaluation Nucleus</b> (Evaluation of the University Quality in Teaching and Research)
2015 – 2017	<b>Member of the University Scientific Committee for the VQR</b> (Evaluation of Research Quality)
2013 – 2020	<b>National Coordinator of the INFN research line on Lattice QCD named LQCD123</b>
2016	Member of the Committee for the entrance examination to the Physics Ph.D.
2014	<b>Coordinator of PAS038</b> (course for the qualification of High School Physics teachers)
2015 – 2018	Member of the Physics Didactic Committee
2013 – present	Member of the Physics Doctoral School Committee
2013	Member of the Joint (professors-students) Committee of the Mathematics and Physics Department
2013 – 2014, 2018 – 2020	Member of the INFN (Roma Tre Section) Committee for postdoc fellowships in Theoretical Physics

## Publications

- C. Alexandrou *et al.* [Extended Twisted Mass],  
*Quark masses using twisted-mass fermion gauge ensembles*  
Phys. Rev. D **104** (2021) no.7, 074515, [arXiv:2104.13408 [hep-lat]].
- V. Lubicz *et al.* [ETM Collaboration],  
*Tensor form factor of  $D \rightarrow \pi(K)\ell\nu$  and  $D \rightarrow \pi(K)\ell\ell$  decays with  $N_f = 2 + 1 + 1$  twisted-mass fermions*  
Phys. Rev. D **98** (2018) no.1, 014516, [arXiv:1803.04807 [hep-lat]].
- D. Giusti *et al.* ,  
*First lattice calculation of the QED corrections to leptonic decay rates*  
Phys. Rev. Lett. **120** (2018) no.7, 072001, [arXiv:1711.06537 [hep-lat]].
- V. Lubicz *et al.* [ETM Collaboration],  
*Scalar and vector form factors of  $D \rightarrow \pi(K)\ell\nu$  decays with  $N_f = 2 + 1 + 1$  twisted fermions*  
Phys. Rev. D **96** (2017) no.5, 054514, [arXiv:1706.03017 [hep-lat]].
- D. Giusti, V. Lubicz, C. Tarantino, G. Martinelli, S. Sanfilippo, S. Simula and N. Tantalo  
*Leading isospin-breaking corrections to pion, kaon and charmed-meson masses with Twisted-Mass fermions*  
Phys. Rev. D **95** (2017) no.11, 114504, [arXiv:1704.06561 [hep-lat]].
- A. Bussone *et al.* [ETM Collaboration]  
*Mass of the  $b$  quark and  $B$ -meson decay constants from  $N_f=2+1+1$  twisted-mass lattice QCD*  
Phys. Rev. D **93** (2016) no.11, 114505, [arXiv:1603.04306 [hep-lat]].
- N. Carrasco, P. Lami, V. Lubicz, L. Riggio, S. Simula and C. Tarantino [European Twisted Mass Collaboration]  
 *$K \rightarrow \pi$  semileptonic form factors with  $N_f = 2 + 1 + 1$  twisted mass fermions*  
Phys. Rev. D **93** (2016) no.11, 114512, [arXiv:1602.04113 [hep-lat]].
- N. Carrasco *et al.* [European Twisted Mass Collaboration]  
 *$\Delta S=2$  and  $\Delta C=2$  bag parameters in the standard model and beyond from  $N_f=2+1+1$  twisted-mass lattice QCD*  
Phys. Rev. D **92** (2015) 3, 034516, [arXiv:1505.06639 [hep-lat]].
- N. Carrasco *et al.*  
*QED Corrections to Hadronic Processes in Lattice QCD*  
Phys. Rev. D **91** (2015) 7, 074506, [arXiv:1502.00257 [hep-lat]].
- N. Carrasco *et al.* [European Twisted Mass Collaboration]  
*Leptonic decay constants  $f_K$ ,  $f_D$ , and  $f_{D_s}$  with  $N_f = 2 + 1 + 1$  twisted-mass lattice QCD*  
Phys. Rev. D **91** (2015) 5, 054507, [arXiv:1411.7908 [hep-lat]].
- N. Carrasco *et al.* [European Twisted Mass Collaboration]  
 *$D$ - $D$ bar Mixing in the Standard Model and Beyond from  $N_f=2$  Twisted Mass QCD*  
Phys. Rev. D **90** (2014) 1, 014502, [arXiv:1403.7302 [hep-lat]].
- N. Carrasco *et al.* [European Twisted Mass Collaboration]  
*Up, down, strange and charm quark masses with  $N_f = 2+1+1$  tmLattice QCD*  
Nucl. Phys. B **887** (2014) 19 [arXiv:1403.4504 [hep-lat]].

- A. J. Bevan *et al.* [UTfit Collaboration]  
*The UTfit collaboration average of D meson mixing data: Winter 2014*  
 JHEP **1403** (2014) 123, [arXiv:1402.1664 [hep-ph]].
- N. Carrasco *et al.* [European Twisted Mass Collaboration]  
*B-physics from  $N_f = 2$  tmQCD: the Standard Model and beyond*  
 JHEP **1403** (2014) 016, [arXiv:1308.1851 [hep-lat]].
- V. Bertone *et al.* [European Twisted Mass Collaboration]  
*Kaon Mixing Beyond the SM from  $N_f = 2$  tmQCD and model independent constraints from the UTA*  
 JHEP **1303** (2013) 089, [arXiv:1207.1287 [hep-lat]].
- A. J. Bevan *et al.* [UTfit Collaboration]  
*The UTfit Collaboration Average of D meson mixing data: Spring 2012*  
 JHEP **1210** (2012) 068, [arXiv:1206.6245 [hep-ph]].
- D. Becirevic *et al.*  
*D-meson decay constants and a check of factorization in non-leptonic B-decays*  
 JHEP **1202** (2012) 042, [arXiv:1201.4039 [hep-lat]].
- G. M. de Divitiis *et al.*  
*Isospin breaking effects due to the up-down mass difference in Lattice QCD*  
 JHEP **1204** (2012) 124, [arXiv:1110.6294 [hep-lat]].
- P. Dimopoulos *et al.* [European Twisted Mass Collaboration]  
*Lattice QCD determination of  $m_b$ ,  $f_B$  and  $f_{B_s}$  with twisted mass Wilson fermions*  
 JHEP **1201** (2012) 046, [arXiv:1107.1441 [hep-lat]].
- B. Blossier *et al.* [European Twisted Mass Collaboration]  
*Average up/down, strange and charm quark masses with  $N_f = 2$  twisted mass lattice QCD*  
 Phys. Rev. D **82** (2010) 114513, [arXiv:1010.3659 [hep-lat]].
- B. Blossier *et al.* [European Twisted Mass Collaboration]  
*A proposal for B-physics on current lattices*  
 JHEP **1004** (2010) 049, [arXiv:0909.3187 [hep-lat]].
- M. Bona *et al.* [UTfit Collaboration]  
*An Improved Standard Model Prediction of  $BR(B \rightarrow \tau\nu)$  and Its Implications for New Physics*  
 Phys. Lett. B **687** (2010) 61, [arXiv:0908.3470 [hep-ph]].
- M. Blanke, A. J. Buras, B. Duling, S. Recksiegel and C. Tarantino  
*FCNC Processes in the Littlest Higgs Model with T-Parity: a 2009 Look*  
 Acta Phys. Polon. B **41** (2010) 657, [arXiv:0906.5454 [hep-ph]].
- V. Lubicz, F. Mescia, S. Simula and C. Tarantino [European Twisted Mass Collaboration]  
 *$K \rightarrow \pi$  Semileptonic Form Factors from Two-Flavor Lattice QCD*  
 Phys. Rev. D **80**, 111502(R) (2009), [arXiv:0906.4728 [hep-lat]].
- B. Blossier *et al.* [European Twisted Mass Collaboration]  
*Pseudoscalar decay constants of kaon and D-mesons from  $N_f = 2$  twisted mass Lattice QCD*  
 JHEP **0907** (2009) 043, [arXiv:0904.0954 [hep-lat]].

- M. Blanke, A. J. Buras, S. Recksiegel and C. Tarantino  
*The Littlest Higgs Model with T-Parity Facing CP-Violation in  $B_s - \bar{B}_s$  Mixing*  
 arXiv:0805.4393 [hep-ph].
- G. Buchalla *et al.*  
*B, D and K decays*  
 Eur. Phys. J. C **57** (2008) 309 [arXiv:0801.1833 [hep-ph]].
- M. Raidal *et al.*  
*Flavor physics of leptons and dipole moments*  
 Eur. Phys. J. C **57** (2008) 13 [arXiv:0801.1826 [hep-ph]].
- B. Blossier *et al.* [European Twisted Mass Collaboration]  
*Light quark masses and pseudoscalar decay constants from  $N_f = 2$  Lattice QCD with twisted mass fermions*  
 JHEP **0804** (2008) 020, [arXiv:0709.4574 [hep-lat]].
- M. Blanke, A. J. Buras, S. Recksiegel, C. Tarantino and S. Uhlig  
*Correlations between epsilon'/epsilon and Rare K Decays in the Littlest Higgs Model with T-Parity*  
 JHEP **0706** (2007) 082, [arXiv:0704.3329 [hep-ph]].
- M. Blanke, A. J. Buras, S. Recksiegel, C. Tarantino and S. Uhlig  
*Littlest Higgs model with T-parity confronting the new data on  $D0$  anti- $D0$  mixing*  
 Phys. Lett. B **657** (2007) 81, [arXiv:hep-ph/0703254].
- M. Blanke, A. J. Buras, B. Duling, A. Poschenrieder and C. Tarantino  
*Charged lepton flavor violation and  $(g-2)(\mu)$  in the littlest Higgs model with T-parity: A clear distinction from supersymmetry*  
 JHEP **0705** (2007) 013, [arXiv:hep-ph/0702136].
- M. Blanke, A. J. Buras, A. Poschenrieder, S. Recksiegel, C. Tarantino, S. Uhlig and A. Weiler  
*Rare and CP-violating K and B decays in the littlest Higgs model with T-parity*  
 JHEP **0701** (2007) 066, [arXiv:hep-ph/0610298].
- M. Blanke, A. J. Buras, A. Poschenrieder, S. Recksiegel, C. Tarantino, S. Uhlig and A. Weiler  
*Another look at the flavor structure of the littlest Higgs model with T-parity*  
 Phys. Lett. B **646** (2007) 253, [arXiv:hep-ph/0609284].
- D. Becirevic, P. Boucaud, V. Lubicz, G. Martinelli, F. Mescia, S. Simula and C. Tarantino  
*Exploring twisted mass lattice QCD with the clover term*  
 Phys. Rev. D **74** (2006) 034501, [arXiv:hep-lat/0605006].
- M. Blanke, A. J. Buras, D. Guadagnoli and C. Tarantino  
*Minimal flavor violation waiting for precise measurements of  $\Delta M_s$ ,  $|V_{ub}|$ ,  $\gamma$  and  $B_{s,d}^0 \rightarrow \mu^+ \mu^-$*   
 JHEP **0610** (2006) 003, [arXiv:hep-ph/0604057].
- D. Becirevic, B. Blossier, Ph. Boucaud, V. Gimenez, V. Lubicz, F. Mescia, S. Simula and C. Tarantino  
*Non-perturbatively renormalised light quark masses from a lattice simulation with  $N_f = 2$*   
 Nucl. Phys. B **734** (2006) 138, [arXiv:hep-lat/0510014].
- D. Becirevic, G. Isidori, V. Lubicz, G. Martinelli, F. Mescia, S. Simula and C. Tarantino  
*The  $K \rightarrow \pi$  vector form-factor at zero momentum transfer on the lattice*  
 Nucl. Phys. B **705** (2005) 339, [arXiv:hep-lat/0403217].



- M. Ciuchini, E. Franco, V. Lubicz, F. Mescia and C. Tarantino  
*Lifetime differences and CP violation parameters of neutral B-mesons at the next-to-leading order in QCD*  
JHEP **0308** (2003) 031, [arXiv:hep-ph/0308029].
- D. Becirevic, V. Lubicz, F. Mescia and C. Tarantino [SPQcdR Collaboration]  
*Coupling of the light vector meson to the vector and to the tensor current*  
JHEP **0305** (2003) 007, [arXiv:hep-lat/0301020].
- D. Becirevic, V. Lubicz and C. Tarantino [SPQcdR Collaboration]  
*Continuum determination of light quark masses from quenched lattice QCD*  
Phys. Lett. B **558** (2003) 69, [arXiv:hep-lat/0208003].
- E. Franco, V. Lubicz, F. Mescia and C. Tarantino  
*Lifetime ratios of beauty hadrons at the next-to-leading order in QCD*  
Nucl. Phys. B **633** (2002) 212, [arXiv:hep-ph/0203089].

## INFORMAZIONI PERSONALI

Fabbri Andrea

ESPERIENZA  
PROFESSIONALE

27/12/2018–alla data attuale

Istituto Nazionale di Fisica Nucleare, Roma (Italia)  
Tecnologo

01/02/2011–31/01/2014

Università degli Studi Roma Tre - Dipartimento di Fisica, Roma (Italia)  
Assegnista di Ricerca progetto DIAMED

01/02/2016–31/01/2018

Istituto Nazionale di Fisica Nucleare, Roma (Italia)  
Assegnista di Ricerca - Progetto EOS

01/02/2015–31/01/2016

Università degli Studi La Sapienza, Roma (Italia)  
Assegnista di Ricerca - Progetto Europeo MindView

01/06/2010–31/12/2018

Partita IVA - Attività degli Studi di Ingegneria, Roma (Italia)

## ISTRUZIONE E FORMAZIONE

01/11/2006–10/04/2010

**Dottorato di Ricerca**

Università degli Studi Roma Tre - Dipartimento di Ingegneria Elettronica, Roma (Italia)

01/10/2004–05/10/2006

**Laurea Magistrale in Ingegneria Elettronica**

Università degli Studi Roma Tre - Dipartimento di Ingegneria Elettronica, Roma (Italia)

01/10/2001–20/12/2004

**Laurea Triennale in Ingegneria Elettronica**

Università degli Studi Roma Tre - Dipartimento di Ingegneria Elettronica

## COMPETENZE PERSONALI

Lingua madre italiano

Lingue straniere

inglese

COMPRESIONE		PARLATO		PRODUZIONE SCRITTA
Ascolto	Lettura	Interazione	Produzione orale	
C1	C1	B2	B2	B2

Livelli: A1 e A2: Utente base - B1 e B2: Utente autonomo - C1 e C2: Utente avanzato  
Quadro Comune Europeo di Riferimento delle Lingue

## Competenze digitali

AUTOVALUTAZIONE				
Elaborazione delle informazioni	Comunicazione	Creazione di Contenuti	Sicurezza	Risoluzione di problemi
Utente avanzato	Utente avanzato	Utente avanzato	Utente avanzato	Utente avanzato

Competenze digitali - Scheda per l'autovalutazione

Il sottoscritto, consapevole che – ai sensi dell'art. 76 del D.P.R. 445/2000 – le dichiarazioni mendaci, la falsità negli atti e l'uso di atti falsi sono puniti ai sensi del codice penale e delle leggi speciali, dichiara che le informazioni rispondono a verità. Il sottoscritto dichiara di aver preso visione dell'informativa sul trattamento dei dati personali pubblicata all'indirizzo <http://host.uniroma3.it/uffici/urp/page.php?page=Privacy>

16/2/2022

agli atti]

# Giuseppe Salamanna

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Department of Mathematics and Physics  
Roma Tre University  
via della vasca navale, 84  
00149 Rome  
Italy

## Education

- Jan 2007                      Ph.D. in Physics at Università degli Studi di Roma *La Sapienza*, Rome, Italy. Thesis title: “*First observation of  $B_s$  mixing at the CDF II experiment with a newly developed Opposite Side  $b$  flavour tagger using Kaons*”, (Prof. C. Dionisi and Dr. M. Rescigno)
- Sep 2003                      B.S. and M.S. (“Laurea in Fisica”) at Università degli Studi di Roma *La Sapienza*, Rome, Italy. Thesis title: “*Study of the resolution of the Time-Of-Flight detector for the Fermilab CDF experiment*”, (Prof. C. Dionisi and Dr. S. Giagu, marks: 110/110)

## Employment history

- Apr 2017 - present              Associate Professor at Roma Tre University (Italy), based in Rome
- Apr 2014 - Mar 2017              Lecturer at Roma Tre University (Italy), based in Rome
- Apr 2011 - Mar 2014              Research Associate at Queen Mary, University of London (UK), based in London
- Mar 2008 - Feb 2011              Post-doctoral staff at NIKHEF (The Netherlands), based at CERN, Geneva, Switzerland
- Jan 2007 - Feb 2008              Research Associate at the University of Washington (USA), based at CERN, Geneva, Switzerland

## Scientific responsibilities and roles

Jul 2020 - present	L3 for liquid argon FE electronics, LEGEND-1000 project
Jul 2019 - present	Principal Investigator LEGEND group at Roma Tre
Oct 2018 - Jul 2019	Member of the internal JUNO committees for the final review of the Top Tracker mechanics and the preliminary review of the Top Tracker electronics;
Mar 2017 - Jul 2019	Simulation coordinator for the Small PMT group of the JUNO experiment;
Aug 2016 - Jul 2019	Member of the internal JUNO committee for the review of the software readiness;
Aug 2016 - Jul 2019	L3 (coordinator) of JUNO experiment physics validation and MC sample production, validating the output of the simulation and reconstruction and coordinating the production of large simulations for detector, calibration and physics studies;
Mar 2016 - Dec 2019	physics and software coordinator of the Italian collaboration in the JUNO experiment;
Apr 2016 - Sep 2016	representative of the ATLAS Level-1 Muon barrel trigger at the Trigger Menu coordination group;
Dec 2013 - Aug 2015	Editor in charge of the publication and convener of the analysis team for the search for the associated production of Higgs bosons and top quarks in a specific final state (with many electrons and muons);
Jul 2011 - Sep 2012	Convener of the ATLAS Top quark Reconstruction working group. The group's work consists of studying the performance and calibrations of all the building blocks of analysis (lepton ID, jets, Missing Energy, b-jet ID) in the context of top quark decays. The group's goals are: optimization all the object selections, assessment of the effect of efficiency and energy scaling <i>in-situ</i> on top events and provision of procedures to evaluate the systematic uncertainties. All ATLAS Top quark analysis (published and preliminary) follow the group's official recommendations and inputs. The group includes about 40 people from several different universities world-wide.
Jun 2013 - Oct 2013	Coordinator of the ATLAS $H \rightarrow WW$ sub-group on top quark background.
Jun 2012 - May 2013	Convener of the ATLAS Top UK national group which brings together all the British analysis teams involved in Top quark physics. The position also encompasses the vetting of material to be shown at national conferences in the UK
Oct 2011 - Jul 2013	Member of the Local Organizing Committee of the TOP2012 conference and Chief Editor of the conference proceedings (J. Phys. Conf. Ser. 452 (2013), <a href="http://iopscience.iop.org/1742-6596/452/1">http://iopscience.iop.org/1742-6596/452/1</a> )
Aug 2012 - Jun 2019	Internal reviewer for ATLAS conference proceedings
2009 - 2011	Coordinator of the Top quark Working Group sub-group optimizing the muon selections for all Top quark analysis, both at the trigger level and offline; the group includes about 10 people from different institutions.
Winter-Summer 2011	Main editor of notes on lepton selection, efficiency and scale factor determination used in the $t\bar{t}$ cross-section measurements for 2011 winter and summer conferences.
Winter 2011	Main editor of the note on the cross-section measurement using kinematic fit and b-tagging (for 2011 winter conferences).

### Academic responsibilities and roles

Jul 2022 - Oct 2022	Member of the Selection Committee for an RTDa in physics at Università di Milano Bicocca.
Jul 2022 - present	Member of Collegio di Dottorato at Roma Tre
Mar 2022 - present	Member of the Teaching Committee for physics (Commissione Didattica di Fisica) at the Department of Mathematics and Physics at Roma Tre
Sep 2019 - Feb 2022	Erasmus+ Coordinator for physics at Roma Tre.
Jul 2018	Member of the Selection Committee for the PhD in accelerator physics at Università degli Studi di Roma <i>La Sapienza</i> .
Nov 2014 - present	Member of the Student-Staff joint committee (Commissione Paritetica) of the Department of Mathematics and Physics at Roma Tre
Sep 2016 - Jan 2019	Member of the Teaching Committee for physics (Commissione Didattica di Fisica) at the Department of Mathematics and Physics at Roma Tre

### Refereeing

Sep 2019 - Present	Referee, EPJ C journal.
Mar 2012	Invited referee of the "Electroweak model and constraints on new physics" section of the Particle Data Group "Review of Particle Physics" for 2012 (Phys. Rev. D86, 010001 (2012)).

### Awards and fellowships

2013	Winner of the Italian "Rita Levi Montalcini" fellowship awarded to outstanding junior faculty working abroad to take on an academic position in Italy, endowed with a personal 3-year start-up research budget. The committee selected 24 candidates from all fields of science.
2003 – 2006	Scholarship accompanying my PhD courses, assigned by the Department of Physics, Università degli Studi di Roma <i>La Sapienza</i> .

### Student Supervision

2022-present, Roma Tre	supervision several bachelor theses on LEGEND
2020-present, Roma Tre	N. Burlac (Ph.D. student): LAr veto and first analysis of $0\nu 2\beta$ with LEGEND-200
2019-2021, Roma Tre	D. Liberati (Master student): study of muon-induced backgrounds in liquid argon for an on-line veto system for the LEGEND-200 experiment.
2018-2021, Roma Tre	L. Martinelli (Ph.D. student): measurement of the top quark mass in the di-lepton final state with leptonic only variable. Uses LHC Run 2 data with the ATLAS detector.
2018, Roma Tre	D. Tulli (Bachelor student): validation of MET in ATLAS.
2018, Roma Tre	L. Masturzo (Bachelor student): b-tagging in ATLAS with pTrel.
2018, Roma Tre	A. Rettaroli (Master student): characterization of superconducting resonant RF cavities for axion search with the QUAX experiment.
2017-2020, Roma Tre	V. Vecchio (Ph.D. student): measurement of the $R_b$ ratio in top quark decays in the de-lepton final state. Uses LHC Run 2 data with the ATLAS detector.
2017-Mar 2018, Roma Tre	A. Marazzi (Bachelor student): efficiency of the Level-1 muon trigger of the ATLAS experiment.
2016, Roma Tre	V. Vecchio (Master student): development of strategies to discriminate signal from prompt lepton backgrounds using kinematical information in the search for the associated production of top quarks and Higgs bosons in the multi-lepton final state. Uses LHC Run 2 data with the ATLAS detector.
2015-start 2017, Roma Tre	M. Sessa (Ph.D. student): search for the associated production of top quarks and Higgs bosons in the multi-lepton final state using LHC Run 2 data with the ATLAS detector.
2011-2014, QMUL	R. Sandbach (Ph.D. student): search for the Standard Model Higgs Boson in $H \rightarrow WW(\ell\nu q\bar{q})$ decays in the gluon fusion production mode in the low mass region, using soft muons from the $c$ quark decays. Calibration of Soft Muon Tagger mistag rate.
	G. Snidero (Ph.D. student): measurement of $t\bar{t}$ cross-section in semi-leptonic channel and of the associated production of a W boson and a charm quark using a Soft Muon Tagger.
2008-11, Nikhef	N. Ruckstuhl (Ph.D. student): measurement of muon momentum scale and resolution using LHC collision and cosmic ray events.
	A. Doxiadis (Ph.D. student): estimation of the secondary lepton background for the first measurement of $t\bar{t}$ cross-section in (di-)leptonic channels.
	E.J. Schioppa (CERN Summer Student): timing calibration of the Level-1 Muon trigger with cosmic ray events.
2007, UW	D. Ventura (Ph.D. student): detection of long-lived particles in Hidden Valley models.
2006, Roma 1	M. Nardecchia (Fermilab Summer Student): $b$ -flavour tagging using $\Lambda$ baryons.

## Teaching

2020-present	Fisica e didattica della fisica, degree in Primary school education, Roma Tre University
2015-present	Course of particle physics phenomenology for the Master degree in Physics, Roma Tre University
2016-2020	Course on current problems in neutrino physics for the PhD in Physics, Roma Tre University
2015-present	Lab course of sub-nuclear physics for the Bachelor degree in Physics, Roma Tre University
2014-16	Course of sub-nuclear, Roma Tre University
2004	Teaching assistant (Classical mechanics, thermodynamics and electromagnetism), Undergraduate courses, University of Rome, La Sapienza

## Outreach

2021	Neutrinos for “Professione ricercatore” with high school students
2014-2019	Notte Europea dei Ricercatori, Roma Tre: “Particles treasure hunt” (2014), seminar on neutrinos (2015), 7 minutes on Dark Matter (“Pillole di scienza”, 2016), 7 minutes on anti-matter (“Pillole di scienza”, 2018) and “I tarocchi della scienza” (2018, 2019)
Mar 2018	“Occhi su saturno” at Roma Tre, neutrino seminar
Apr 2017	“STEM Careers in science” at Laboratori Nazionali di Frascati
May 2016, Feb 2017-2018-2019	Seminar on neutrinos with Dr. D. Meloni (Roma Tre) for high school students and teachers
2014-15	International Masterclass, Roma Tre.
2013	UK STFC stand on LHC at the Big Bang Fair, London.
2013	International master classes, help in organization at QMUL, London.

## Invited talks at international conferences



- Sep 2022 “The LEGEND experiment”, IPA2022 conference, Vienna, Austria (invited for 2020, cancelled due to COVID)
- Aug 2019 “Top quark measurements with the ATLAS detector”, 19th Lomonosov conference on elementary particle physics, Moscow, Russia
- Jun 2018 “Solar neutrinos with the JUNO experiment”, 5th International Solar Neutrino Conference, Dresden, Germany
- Aug 2017 “Status and physics potential of JUNO”, 18th Lomonosov conference on elementary particle physics, Moscow, Russia
- Jan 2016 “Top quark production measurements using the ATLAS detector at the LHC”, 6th International Workshop on High Energy Physics in the LHC Era, Valparaiso, Chile
- Dec 2014 “Search for the Higgs boson in the ttH production mode using the ATLAS detector”, Kruger 2014 conference on discovery physics at the LHC, Kruger National Park, South Africa
- Jul 2012 “Measurement of the Top quark mass” , 36th International Conference on High Energy Physics (ICHEP 2012), Melbourne, Australia. Conference Proceedings: <http://pos.sissa.it/cgi-bin/reader/conf.cgi?confid=174>
- Sep 2010 “ATLAS Electroweak results” , The XIX International Workshop on High Energy Physics and Quantum Field Theory, Golitsyno, Moscow, Russia. Conference proceedings: <http://pos.sissa.it/cgi-bin/reader/conf.cgi?confid=104>
- Oct 2009 “Results from the ATLAS Barrel Level-1 Muon Trigger timing studies using combined trigger and offline tracking” 2009 IEEE Nuclear Science Symposium and Medical Imaging Conference (IEEE NSS MIC 09), Orlando, FL, USA
- Jul 2006 “Measurement of  $B_s$  oscillations at CDF” 7th International Conference on Hyperons, Charm And Beauty Hadrons (BEACH06), Lancaster, UK. Conference Proceedings published by Nuclear Physics B (proceedings Supplements)
- Apr 2006 “Measurement of  $B_s$  oscillation frequency at CDF” Incontri di Fisica delle Alte Energie, Pavia, Italy

### **Additional talks, seminars and posters**

- Apr 2021 “The LEGEND experiment”, invited seminar at the EPAP, King’s College London, UK
- Nov 2017 “Status and physics potential of the JUNO experiment”, invited seminar at the DPNC, Faculté de Physique, Université de Geneve, Switzerland
- Mar 2017 “Double Calorimetry System of JUNO experiment” (with Dr. S. Dusini, INFN Padova, Italy), poster at Neutrino Telescopes 2017, Venezia, Italy
- Aug 2016 “Solar, supernova, atmospheric and geo neutrino studies using JUNO detector”, poster at ICHEP 2016, Chicago, USA
- Aug 2016 “Double Calorimetry System of JUNO experiment” (Main author: Dr. S. Dusini, INFN Padova, Italy), poster at ICHEP 2016, Chicago, USA
- May 2015 “Search for the associated production of Higgs bosons and top quarks at  $\sqrt{s}=7-8$  TeV with the ATLAS detector at LHC” invited seminar at Cavendish Laboratory, University of Cambridge, Cambridge, United Kingdom
- Jun 2013 “Top quark physics at LHC: from precision measurements to gateway for new physics” University of Melbourne, Melbourne, Australia
- Oct 2011 “Experimental status of Top quark physics at LHC” NExT Institute workshop, Queen Mary University of London, London, United Kingdom
- Feb 2010 “Measurement of the Top quark pair production at ATLAS with the first data from LHC” CPPM Laboratory Seminar, Centre de Physique de Particules de Marseille, Marseille, France
- Jan 2009 “Early Top physics with ATLAS at the LHC”, Physics@FOM Veldhoven 2009
- Feb 2006 “ $B_s$  and sensitivity to new physics at CDF”, Third workshop on  $b$  physics, Parma, Italy,
- Jul 2005 “Techniques for  $B_s$  Mixing at CDF”, poster at the Hadron Collider Physics Symposium 2005, Les Diablerets, Switzerland
- Apr 2005 “Opposite side B-flavour tagging using combined TOF and dE/dx particle identification technique”, American Physics Society April Meeting 2005, Tampa, FL, USA
- Feb 2006 “ $b$  flavour tagging with Kaons for B physics at CDF”, RTN “The third generation as a probe for new physics” meeting, Karlsruhe, Germany

## Research Activities

### LEGEND (2019-current)

#### Electronics and bkg veto in liquid argon

Optimization of HV and amplifier card for SiPM read-out in the liquid argon veto. Commissioning of the liquid argon instrumentation for LEGEND-200. Design and implementation of neutron moderators and detectors against cosmogenic backgrounds in view of LEGEND-1000. Design and responsibility of project for liquid argon instrumentation electronics for LEGEND-1000.

#### Reflectivity measurements in VUV

Measurements of reflectivity of germanium detector with the actual surface polishing and shapes in LEGEND-200 and of copper and silicon support elements; down to wavelengths of  $\approx 125$  nm, where LAr photons are emitted. Use of synchrotron radiation and deuterium lamps and design of experimental setup for measurements in vacuum.

#### Optical response of LAr and tuning of simulation

Design and implementation of cryogenic set-up for measurements of the optical response of pure (“class 6”) LAr for LEGEND-200 and for future noble liquid scintillator R&D.

### JUNO (2016-2019)

#### Detector design optimization

I am working on optimizing the relative positioning of the 3” to the 20” PMTs of JUNO, to maximize the optical photon collection, which has an impact on the stochastic term of the energy resolution. This involves studying the optical interaction of photons with the surfaces of the photocathodes and protective masks of the PMTs.

#### Physics simulation production and validation

I coordinate the group ( 10 people internationally) producing the simulated samples and validating their physical content at each stage (from detector response to digitization to PMT waveform reconstruction to energy and position measurement). The samples are used in various detector optimization and JUNO physics potential studies and are currently also envisaged as input to develop the energy calibration procedure.

#### Solar neutrinos

I am working together with other people from INFN in Italy to develop a strategy to use the JUNO potential to measure the relative abundances of chemical elements in the solar neutrino flux. I am particularly interested in minimizing the intrinsic radioactivity and cosmogenic backgrounds to lower the energy threshold of such measurements, in order to be sensitive to pp and pep channels; and to constrain the impact of new physics on the matter effects in the neutrino oscillations within the sun ( $< 5$  MeV). The current status is documented in my proceedings for the ICHEP16 poster (Salamanna *et al*, arXiv:1610.09508).

#### Statistical analysis

I am the proponent, with Dr. L. Stanco of INFN Padova, of a new estimator to improve the mass hierarchy determination with reactor neutrino data. (Salamanna *et al*, arXiv:1707.07651v2).

## ATLAS (2007-current)

### SM Higgs boson searches

- Search for  $t\bar{t}H$  decays with 3 leptons in the final state (particularly selection optimization and estimate of background from secondary leptons). Developed a method to estimate the non-prompt and fake lepton background *in-situ*. Worked with T. Baroncelli, M. Sessa and V. Vecchio to discriminate  $t\bar{t}H$  from  $t\bar{t}V$  using kinematic information (fit full final state) and multi-variate techniques. Work is part of the analysis that reached evidence for  $t\bar{t}H$  production mode in Oct 2017.
- 2013: work on top quark background reduction in the  $H \rightarrow WW(\ell\nu\ell\nu)+1$  jet channel. Crucial issue presently limiting the ATLAS sensitivity in the WW channel. Optimization of b-tagging (incl. soft muon) and development of kinematic variables: my work is now the main input to a multi-variate technique which will be used for the 2013 publication on  $H \rightarrow WW$ . ATLAS publication in preparation. Internal note: <https://cds.cern.ch/record/1624408>.
- 2013: With R. Sandbach I have conducted a feasibility study to increase the sensitivity of ATLAS searches to the SM Higgs Boson in the  $H \rightarrow WW(\ell\nu q\bar{q})$  decay channel in the low mass region. We have studied how to suppress the large backgrounds at low mass using soft muons.

### Top quark and W boson physics

Currently I am working with my Ph.D. student, V. Vecchio, to design and perform a measurement of the branching ratio of top quark into bottom quark, looking for sizeable deviations from unity, as predicted in the CKM matrix. This involves a careful definition of the strategy, including b-tagging calibrations. In the past (until 2013) have been involved in several aspects of the ATLAS Top quark physics programme, fundamental part of the experimental probing of the validity of the Standard Model and privileged gateway to New Physics. Where available, links to internal publications are provided to prove my direct engagement. The summary of my contributions includes:

- work on the preparation of the common software, the study and optimization of lepton selections for all ATLAS Top quark measurements (Internal notes: <https://cds.cern.ch/record/1226764>, <https://cds.cern.ch/record/1177146>, <https://cds.cern.ch/record/1180281>, <https://cds.cern.ch/record/1278460>, <https://cds.cern.ch/record/1328033>, <https://cds.cern.ch/record/1312944>, <https://cds.cern.ch/record/1447086>, <https://cds.cern.ch/record/1472525>, <https://cds.cern.ch/record/1509562>);
- primary author of two measurements of the  $t\bar{t}$  production cross-section in the lepton + jets channel, with the full 2010 and 2011 datasets, using likelihood fitting techniques based on Monte-Carlo templates. ATLAS publication: Phys. Lett. B 711, 244 (2012), Eur. Phys. J. C 71, 1577 (2011). ATLAS conference note: <https://atlas.web.cern.ch/Atlas/GROUPS/PHYSICS/CONFNOTES/ATLAS-CONF-2011-035/>;
- primary author of the measurement of the  $t\bar{t}$  production cross-section in the lepton + jets channel with the full 2011 dataset (2012,  $5 fb^{-1}$ ), using a sample of semileptonic  $b$ -decays (window on new physics in sample orthogonal to standard ATLAS analysis). ATLAS conference note: <https://atlas.web.cern.ch/Atlas/GROUPS/PHYSICS/CONFNOTES/ATLAS-CONF-2012-131/>

- contribution to measurement of  $W + c$  production from the correlation of the charges of the  $W$  lepton and a soft muon from  $c$  quark decays: such measurement probes the  $s$  quark content in protons and studies one of the most relevant backgrounds for Top quark and BSM physics. ATLAS publication in preparation;

### Soft Muon Tagger

2011-2012: calibration of the Soft Muon b-Tagging algorithm, using an inclusive QCD multi-jet sample. The tagger is applied to several measurements of Standard Model processes and in Higgs boson searches to suppress top quark decays. The algorithm and its performance are documented in a refereed paper on the performance of  $b$ -jet identification in ATLAS, 2016 JINST 11 P04008.

### Study of detection of long-lived particles expected in New Physics scenarios

Particles travelling a long path length (up to some meters) before decaying are expected in many different New Physics scenarios and need dedicated trigger signatures. During my time at the Univ. of Washington I have developed and proposed specific trigger paths, using calorimetry and muon information, to detect long lived particles from Hidden Valley models.

### Study and measurement of Muon momentum resolution

- I have been the coordinator and a primary author of the measurement of the muon momentum scale and resolution as a function of muon kinematics and track quality. The techniques and tools are currently in use for all ATLAS analysis with muons in the final state. ATLAS publication: Eur. Phys. J. C 70, 875 (2010).  
ATLAS conference note: <https://atlas.web.cern.ch/Atlas/GROUPS/PHYSICS/CONFNOTES/ATLAS-CONF-2011-046/>.
- first ATLAS measurement of momentum scale and resolution, using the momentum imbalance between the MS and ID measurements on single muons. Measurement presented at the ICHEP 2010 conference

### Level-1 Muon trigger time alignment

2015-17: I am working again on the calibration and performance of the Level-1 Muon trigger in the barrel, using the methods described below and correlating hardware defects with trigger inefficiencies for fast diagnostics. 2010-11: I have developed and performed a technique to synchronize the Level-1 Muon trigger elements by comparing their time response to an external time reference, with reconstructed offline muon tracks. Work vital for all analysis using muons, to maximize the event efficiency and perform an unbiased event building. The procedure has been used by ATLAS to achieve full synchronization during the trigger commissioning with collision and cosmic ray events. ATLAS publication: Eur. Phys. J. C 72, 1849 (2012).

### CDF (2002-2006)

#### First observation of $B_s$ oscillations and measurement of their frequency $\Delta M_s$

The observation of the oscillations of  $B_s$  mesons and their frequency measurement is one of the major highlights of the Tevatron physics program, given its constraint on New Physics in the flavour sector. CDF has performed this measurement in 2006 and I am one of the authors. The two publications for the evidence and then observation of the phenomenon are, respectively: Phys.Rev.Lett. 97 (2006) 062003, Phys.Rev.Lett. 97 (2006) 242003

I have directly been responsible of the following parts:

- the development, for the first time at a hadron collider, of an Opposite Side Kaon tagger, increasing the statistical sensitivity to oscillations (CDF Internal note CDF8179);
- the combination of flavour taggers into Neural Network, providing the necessary sensitivity for  $B_s^0$  mixing measurement (CDF Internal Note CDF8314);
- the completion of an independent measurement of  $\Delta M_s$  using a Fourier Transform approach, alternative to the Amplitude method, used as a cross-check of the *mainstream* result.

My work on flavour tagging has also contributed to other time-dependent measurements, notably Phys. Rev. Lett. 100, 161802 (2008)

### **Study of time resolution of the Time-of-Flight detector**

The TOF detector is a crucial tool for particle identification in CDF, and in particular it is used in all time-dependent  $b$  physics measurements for flavour tagging. Its time resolution is the most important parameter in terms of Particle Id. I have been in charge of studying the contributions to the resolution from tracking and electronics. CDF Internal notes: CDF6810, CDF7488, CDF8169.

# CURRICULUM VITAE

## DATI PERSONALI

Nome e Cognome: **Antonio Budano**  
Email:

## FORMAZIONE

**2003** il 29/04/2003 Laurea in Fisica presso l'Università degli Studi Roma Tre. Titolo della tesi: "Studio ed ottimizzazione del sistema ottico di proiezione per un impianto di microlitografia nell'estremo ultravioletto".

## RUOLI E RESPONSABILITÀ TECNICO SCIENTIFICHE

**2006-2013** Responsabile operativo del DAQ e del trasferimento dati nell'esperimento **ARGO-YBJ**  
**Dal 2008** Responsabile operativo e di coordinamento del CED e del sito **GRID** della sezione di **Roma 3**  
**Dal 2010** Responsabile tecnico del **Tier 3** di **Roma 3** nell'ambito dell'esperimento **Atlas**.  
**2010 - 2011** Software Manager della **VO Eumed**  
**2010-2012** Responsabile del sistema di acquisizione dati del test stand dell'apparato **Inner Tracker** dell'esperimento **KLOE-2**.  
**2010-2012** Responsabile del sistema di acquisizione dati del test stand del prototipo del calorimetro dell'esperimento **SUPERB**.  
**Dal 2012** Referente locale della **Commissione Nazionale del Trasferimento Tecnologico**  
**Dal 2012** Responsabile operativo del portale **Science Gateway** del progetto **CHAIN-REDS**:  
**2014-2017** Responsabile del **Task 2.6** per il progetto premiale **EOS-MIUR**: Progettazione front-end e caratterizzazione dinamica di circuiti integrati analogici  
**Dal 2014** Responsabile del servizio di **Calcolo e Reti** e membro della **Commissione nazionale Calcolo e Reti**  
**Dal 2018** Responsabile del laboratorio di **Realtà Virtuale** della sezione di **Roma Tre**  
**2018-2019** Incarico presso il **MIUR** per il coordinamento al livello nazionale verso iniziative **EOSC**  
**Dal 2020** Referente locale della **Commissione Nazionale di Terza missione**

## ESPERIENZA PROFESSIONALE

Nel 2003 - 2004 ho svolto l'obbligo di leva presso il Centro di Calcolo del Dipartimento di Fisica dell'Università degli Studi Roma Tre, nel quale ho avuto la possibilità di gestire ed amministrare, in collaborazione con altri colleghi, una rete di medie dimensioni di circa 400 nodi suddivisi in diverse Virtual Lan ed alcuni server (Mail, Web, stampa, DNS, etc.).

In seguito nel 2005 ho usufruito di una borsa di studio presso il **CASPUR** (Consorzio interuniversitario per le Applicazioni di Supercalcolo Per Università e Ricerca). Il mio compito è stato quello di sviluppare un software Open Source per analisi statistiche, scritto in linguaggio Java. Il progetto (denominato **OpenIDAMS**) è stato sviluppato in collaborazione con l'**UNESCO** e con l'**ECI** (Escuela Colombiana de Ingeniería).

Nel 2006 ho partecipato allo sviluppo del sistema di acquisizione dati (**DAQ**) dell'esperimento **Argo-YBJ**, sviluppando un'applicazione grafica (**Argo Run Control**), in linguaggio Java, per il controllo e la gestione del sistema di acquisizione dati dell'esperimento. Nel 2007 ho inoltre partecipato all'upgrade del **DAQ** dell'esperimento, in particolare mi sono occupato dell'installazione e della configurazione del sistema di

archiviazione dei dati. Nell'ambito del progetto EUChinaGRID ho inoltre sviluppato il sistema di trasferimento dati dell'esperimento.

Nel 2008 ho partecipato alla realizzazione di un nuovo centro di elaborazione dati (CED) per il calcolo scientifico avanzato su network, di cui tutt'ora sono il responsabile.

Nel periodo 2008 –2010 ho avuto un assegno di ricerca tecnologica titolo “Sviluppo di sistemi di acquisizione dati ad alta velocità per la sperimentazione a DAFNE-2”. Mi sono occupato principalmente dell'aggiornamento hardware e software del sistema di acquisizione dati (DAQ) e del sistema di controllo (Slow Control) dell'apparato dell'esperimento KLOE-2. Ho, inoltre, collaborato allo sviluppo del sistema di acquisizione dati dell'Inner Tracker dell'esperimento KLOE-2.

Da novembre del 2010 sono il responsabile tecnico del Tier 3 di Roma 3 nell'ambito dell'esperimento Atlas. Tale incarico riguarda principalmente l'installazione, la configurazione e la manutenzione dei servizi GRID utilizzati dall'esperimento ATLAS, in particolare della gestione di: code di calcolo per la produzione MonteCarlo e dell'analisi dati; servizi di storage dedicati; server dedicato alle releases del software dell'esperimento (CVMFS).

Nel 2011 ho collaborato alla costruzione di un prototipo del calorimetro per l'esperimento SUPER-B curando in particolare la parte di acquisizione dati e alla progettazione del sistema di trigger.

Nel 2011 ho poi collaborato al progetto EUMEDGRID-Support e mi sono occupato principalmente dell'installazione delle applicazioni ad alto grado di parallelizzazione sfruttando le librerie MPI over Infiniband e le schede GPU.

Dal 2012 al 2018 ho collaborato a diversi progetti europei tra cui CHAIN e CHAIN-REDS ed agINFRA.

Dal 2014 sono membro dell'esperimento Belle-II dove mi occupo della gestione dei servizi GRID utilizzati dall'esperimento sul cluster di calcolo di Roma 3.

Dal 2014 sono stato nominato Responsabile del Servizio di Calcolo e Reti della Sezione di Roma 3, in particolare sono responsabile di tutti i servizi della sezione (Mail server, server Web, autenticazione e autorizzazione, ..) e di tutta l'infrastruttura di rete (firewall, gateway, router,...). La maggior parte dei servizi sono stati recentemente migrati verso un'infrastruttura virtuale basata su VMware vSphere, tale infrastruttura prevede un sistema di storage condiviso collegato in Fiber Channel ad un serie di servers che si occupano di eseguire le macchine virtuali.

Nel 2015 ho ideato e realizzato, in collaborazione con i colleghi della sezione di Roma Tor Vergata e dei Laboratori Nazionali di Frascati, grazie anche al supporto del GARR un'infrastruttura Cloud basata sul software Openstack. L'infrastruttura denominata RMLab è tutt'ora in produzione e il modello di gestione e realizzazione è stato preso di esempio per la costituzione della Cloud nazionale INFN denominata INFN Cloud (INFN-Cloud).

Nel 2018 è stato costituito, presso la sezione di Roma Tre, un laboratorio da me coordinato, dedicato allo sviluppo di applicazioni di “realtà virtuale”. Il laboratorio è dotato di apparecchiature e spazi dedicati per l'esecuzione di applicazioni tramite diversi sistemi di Virtual Reality (VR): Oculus e HTC Vive. La collaborazione dell'esperimento Belle II ha prodotto un software in VR che permette la visualizzazione di particelle e le loro interazioni nell'apparato sperimentale. Attraverso questo software ho svolto le diverse attività di divulgazione scientifica a livello locale e nazionale.



# Curriculum Vitae della dott.ssa Michela Biglietti

## Formazione Accademica

La dott.ssa Michela Biglietti si occupa di ricerche nel campo della fisica sperimentale delle particelle elementari

Laurea in Fisica con voto 110/110 e Lode, con discussione di tesi dal titolo: "Misura della sezione d'urto del processo  $e+e \rightarrow Z\gamma\gamma$  e Studio degli Accoppiamenti Anomali Quartici dei Bosoni di Gauge", conseguita presso l'Università Federico II di Napoli nel 2001.

Dottorato di Ricerca conseguito il 15 gennaio 2005 presso l'Università Federico II di Napoli, con discussione della tesi dal titolo: "Muon Object Oriented Reconstruction for the Atlas Experiment at LHC".

## Posizioni contrattuali post-dottorato

2004 - 2005 : post-doc fellowship presso 'Michigan University'

2005 - 2007 : Assegno di ricerca di 2 anni presso la Sezione di Napoli dell'Istituto Nazionale di Fisica Nucleare (INFN)

2007 - 2008 : Assegno di ricerca presso l'Universita' di Napoli Federico II

2009 - 2011 : Assegno di ricerca di 2 anni presso l'Universita' "La Sapienza" di Roma

2007-2008 : progetto PON - S.Co.Pe (Sistema Cooperativo Distribuito ad Alte Prestazioni per Elaborazioni Scientifiche Multidisciplinari) presso l'Universita' di Napoli Federico II, contribuendo alla realizzazione dell'infrastruttura di calcolo "Grid" nel Sud Italia

Vincitrice di due borse INFN di "fellowship" per svolgere attivita' di ricerca presso il CERN a partire da Maggio 2008 per un periodo di sei mesi e a partire da Gennaio 2010 per un periodo di sei mesi.

2009 : 'idoneita' a seguito del concorso pubblico nazionale (BANDO INFN N. 13153/2009) per il titolo di personale ricercatore di III livello professionale presso l'Istituto Nazionale di Fisica Nucleare

2011 : vincitrice di un posto di ricercatore a tempo indeterminato presso l'INFN a seguito di un concorso nazionale.

## Attività scientifica

Nell'ambito dell'attività di ricerca fondamentale in fisica delle particelle, si è occupata, nel corso degli anni, di vari aspetti caratterizzanti gli esperimenti di fisica delle alte energie: studio delle prestazioni di rivelatori per muoni, realizzazione e studio di trigger veloci per la rivelazione di muoni, progetto e realizzazione del software di simulazione e ricostruzione degli eventi di collisione, analisi dei dati, studio della fisica delle interazioni elettrodeboli e fisica del sapore, ricerca del bosone di Higgs e dei segnali di fisica oltre il Modello Standard.

Dal 2001 lavora nella collaborazione ATLAS al LHC, nella quale e' attualmente impegnata, dove, ad oggi, si e' personalmente occupata di:

- sviluppo del software per la ricostruzione ed identificazione dei muoni
- trigger dei muoni: calibrazione temporale del primo livello di trigger dei muoni, sviluppo del software per la ricostruzione online dei muoni al terzo livello di trigger, studio globale delle prestazioni del trigger muonico
- studio della fisica di produzione di risonanze leggere ( $J/\psi$  e  $Upsilon$ ), di barioni pesanti e misure di polarizzazione, ricerca di segnali di Supersimmetria, ricerca del bosone di Higgs con lo studio del canale di decadimento in due bosoni elettrodeboli carichi  $W+W^-$ .
- studio delle prestazioni dei rivelatori "Micromegas" per muoni in vista dell'upgrade di LHC ad alte luminosita' (super-LHC)
- sviluppo e test di strumenti per il calcolo computazionale su GRID
- gestione e sviluppo del software per il Data Quality dei rivelatori per muoni MDT e Micromegas
- dal 2018 e' membro dell' Editorial Board per l'analisi  $H \rightarrow ZZ \rightarrow 4l$

Sviluppo di rivelatori a gas Micro Pattern per tomografie con raggi cosmici e dello sviluppo di Micromegas con lettura a "pad" resistive per le esigenze di tracciamento in ambiente ad alto rate in vista dell'Upgrade di Fase II di LHC.

Durante il 2014 e 2015 e' stata referente locale della sezione Roma 3 per la Commissione Nazionale Formazione INFN

Partecipa regolarmente all'organizzazione e realizzazione del programma "Masterclass" CERN per studenti di scuole superiori presso l'Universita' di Roma Tre e sez. INFN Roma 3

Ha dato comunicazioni scientifica a 20 conferenze nazionali e internazionali.

E' autrice di numerose pubblicazioni scientifiche su riviste internazionali, di seguito si riportano alcune pubblicazioni recenti:

1. "Study of  $(W/Z)H$  production and Higgs boson couplings using  $H \rightarrow WW^*$  decays with the ATLAS detector", G. Aad et al. [ATLAS Collaboration]. arXiv:1506.06641 [hep-ex], DOI:10.1007/JHEP08(2015)137, JHEP 1508, 137 (2015)
2. "Observation of  $H \rightarrow b\bar{b}$  decays and  $VH$  production with the ATLAS detector" M. Aaboud et al. [ATLAS Collaboration]. arXiv:1808.08238 [hep-ex], DOI:10.1016/j.physletb.2018.09.013, Phys. Lett. B 786, 59 (2018)
3. "Observation of Higgs boson production in association with a top quark pair at the LHC with the ATLAS detector", M. Aaboud et al. [ATLAS Collaboration]., arXiv:1806.00425 [hep-ex], DOI:10.1016/j.physletb.2018.07.035, Phys. Lett. B 784, 173 (2018)
4. "Measurement of fiducial differential cross sections of gluon-fusion production of Higgs bosons decaying to  $WW$  with the ATLAS detector at  $\sqrt{s}=8$  TeV", G. Aad et al. [ATLAS Collaboration]. arXiv:1604.02997 [hep-ex] DOI:10.1007/JHEP08(2016)104, JHEP 1608, 104 (2016)
5. "Measurement of the Higgs boson mass in the  $H \rightarrow ZZ^* \rightarrow 4l$  and  $H \rightarrow \gamma\gamma$  channels with  $\sqrt{s} = 13$  TeV pp collisions using the ATLAS detector" M. Aaboud et al. [ATLAS Collaboration]/, arXiv:1806.00242 [hep-ex] DOI:10.1016/j.physletb.2018.07.050, Phys. Lett. B 784, 345 (2018)

6. "Measurements of the Higgs boson production and decay rates and coupling strengths using pp collision data at  $\sqrt{s} = 7$  and 8 TeV in the ATLAS experiment" G. Aad et al. [ATLAS Collaboration], arXiv:1507.04548 [hep-ex], DOI:10.1140/epjc/s10052-015-3769-y, Eur. Phys. J. C 76, no. 1, 6 (2016)
7. "Measurements of Higgs boson production and couplings in the four-lepton channel in pp collisions at center-of-mass energies of 7 and 8 TeV with the ATLAS detector", G. Aad et al. [ATLAS Collaboration]. arXiv:1408.5191 [hep-ex], DOI:10.1103/PhysRevD.91.012006, Phys. Rev. D 91, no. 1, 012006 (2015)
8. "Evidence for the Higgs-boson Yukawa coupling to tau leptons with the ATLAS detector" G. Aad et al. [ATLAS Collaboration]. arXiv:1501.04943 [hep-ex], DOI:10.1007/JHEP04(2015)117, JHEP 1504, 117 (2015)
9. "Performance of the ATLAS Trigger System in 2015" M. Aaboud et al. [ATLAS Collaboration]. arXiv:1611.09661 [hep-ex] DOI:10.1140/epjc/s10052-017-4852-3, Eur. Phys. J. C 77, no. 5, 317 (2017)
10. "Observation and measurement of Higgs boson decays to  $WW^*$  with the ATLAS detector" G. Aad et al. [ATLAS Collaboration]. arXiv:1412.2641 [hep-ex], DOI:10.1103/PhysRevD.92.012006, Phys. Rev. D 92, no. 1, 012006 (2015)
11. "Measurement of the production cross section for a Higgs boson in association with a vector boson in the  $H \rightarrow WW^* \rightarrow \ell\nu\ell\nu$  channel in pp collisions at TeV with the ATLAS detector", Aaboud M, Biglietti M, et al, ATLAS Collaboration, Physics Letters B, Volume 789, (2019)
12. "A search for the dimuon decay of the Standard Model Higgs boson with the ATLAS detector", ATLAS Collaboration, arXiv:2007.07830 (2020)

# Roberto Di Nardo

## Curriculum Vitae

### Carriera professionale

- Lug 2022 – Presente Professore Associato SSD FIS/01 presso l'Università degli Studi Roma Tre  
dal 2022 Associazione scientifica INFN con incarico di ricerca
- Lug 2019 – Lug 2022 Ricercatore a tempo determinato (art. 24 c. 3 lett. b legge 240/10) presso l'Università degli Studi Roma Tre
- Mar 2018 – Giu 2019 Postdoctoral Research Associate, University of Massachusetts Amherst (USA) presso il CERN di Ginevra
- Feb 2016 – Feb 2018 Research Fellow al CERN di Ginevra
- Ago 2015 – Feb 2016 Ricercatore a tempo determinato (Art.36) ai Laboratori Nazionali di Frascati dell' Istituto Nazionale di Fisica Nucleare (INFN)
- Set 2013 – Lug 2015 Assegnista di Ricerca presso i Laboratori Nazionali di Frascati dell' INFN
- Gen 2013 – Dic 2013 CERN Associate (simil-fellow INFN)
- Set 2011 – Ago 2013 Assegnista di Ricerca presso i Laboratori Nazionali di Frascati dell' INFN
- Lug 2010 – Giu 2011 CERN Associate (simil-fellow INFN)

### Ruoli di Responsabilità e incarichi di coordinamento

- dal 2022 Membro del Publication Committee dell'esperimento ATLAS
- dal 2022 Rappresentante del Personale Ricercatore e Tecnologo per la Sezione INFN di Roma Tre.
- 2021 Contact editor della nota pubblica di ATLAS "Combined measurements of Higgs boson production and decay using up to  $139 \text{ fb}^{-1}$  of proton-proton collision data at  $\sqrt{s} = 13 \text{ TeV}$  collected with the ATLAS experiment", **ATLAS-CONF-2021-053**
- dal 2020 Convener del gruppo *LHC Higgs Cross Section working Group 1*
- dal 2019 Membro della commissione paritetica docenti-studenti, Dipartimento di Matematica e Fisica, Università degli Studi Roma Tre
- 2019–2020 Contact editor dell'articolo "Measurements of the Higgs boson inclusive and differential fiducial cross sections in the  $4\ell$  decay channel at  $\sqrt{s} = 13 \text{ TeV}$ ", **Eur. Phys. J. C 80 (2020) 941**
- 2019 – 2021 Membro del comitato di revisione interno alla collaborazione ATLAS dell'articolo "Measurements of differential cross-sections in four-lepton events in 13 TeV proton-proton collisions with the ATLAS detector", **JHEP 07 (2021) 005**
- 2017–2019 Convener del gruppo *HComb* nell'esperimento ATLAS.
- 2017 Organizzatore del workshop "**Higgs Combination & Properties (HComb) Workshop**", 14 Giugno 2017, CERN
- 2017 Contact editor dell'articolo "Measurement of the Higgs boson coupling properties in the  $H \rightarrow ZZ^* \rightarrow 4\ell$  decay channel at  $\sqrt{s} = 13 \text{ TeV}$  with the ATLAS detector", **JHEP 1803 (2018) 095**

- 2017 – 2018 Membro del comitato di revisione interno alla collaborazione ATLAS dell'articolo "Search for supersymmetry in events with four or more leptons in  $\sqrt{s} = 13$  pp collisions with ATLAS", **Phys. Rev. D 98, 032009 (2018)**
- 2016 – 2018 Convener del gruppo *LHC Higgs Cross Section Off-shell working Group*
- 2016–2018 Responsabile delle analisi per la misura degli accoppiamenti del bosone di Higgs nel canale  $H \rightarrow ZZ^* \rightarrow 4l$
- 2015–2016 Convener del gruppo  $H \rightarrow ZZ$  nell'esperimento ATLAS.
- 2016 Organizzatore del workshop "**ATLAS Higgs-ZZ Workshop 2016**", 26-29 Aprile 2016, Monaco, Germania
- 2016 Contact editor della nota pubblica di ATLAS "Study of the Higgs boson properties and search for high-mass scalar resonances in the  $H \rightarrow ZZ^* \rightarrow 4l$  decay channel at  $\sqrt{s} = 13$  TeV with the ATLAS detector", **ATLAS-CONF-2016-079**
- 2014 Contact editor dell'articolo "Measurements of Higgs boson production and couplings in the four-lepton channel in pp collisions at center-of-mass energies of 7 and 8 TeV with the ATLAS detector", **Phys. Rev. D 91, 012006**
- 2014 Contact editor dell'articolo "Measurement of the Higgs boson mass from the  $H \rightarrow \gamma\gamma$  and  $H \rightarrow ZZ^* \rightarrow 4l$  channels in pp collisions at center-of-mass energies of 7 and 8 TeV with the ATLAS detector", **Phys. Rev. D 90, 052004**
- 2013 Contact editor dell'articolo "Evidence for the spin-0 nature of the Higgs boson using ATLAS data", **Phys. Lett. B 726 (2013), pp. 120-144**
- 2012-2013 Responsabile delle analisi per gli studi di spin e parità del bosone di Higgs nel canale di decadimento  $H \rightarrow ZZ^* \rightarrow 4l$ .
- 2012 Contact editor della nota pubblica di ATLAS "Reconstruction and calibration of missing transverse energy and performance in Z and W events in ATLAS proton-proton Collisions at  $\sqrt{s}=7$  TeV" **ATLAS-CONF-2012-101**
- 2010 Contact editor della nota pubblica di ATLAS "Kinematic Distributions of  $K_s^0$  and  $\Lambda^0$  decays in collision data at  $\sqrt{s} = 7$  TeV", **ATLAS-CONF-2010-033**

## Istruzione e Formazione

- Mar 2011 **Ph.D. in Fisica**, *Università di Roma "Tor Vergata"*.
- Titolo "Minimum Bias measurements with the ATLAS experiment at LHC: strangeness production and  $\bar{\Lambda}$  to  $\Lambda$  particle ratio"
- Set 2007 **Laurea Specialistica in Fisica**, *Università di Roma "Tor Vergata"*, 110/110 cum laude.
- Titolo "L'esperimento ATLAS al collisore LHC del CERN: commissioning dei rivelatori RPC e studi di simulazione del bosone di Higgs nel canale  $H \rightarrow 4$  leptoni"
- Ott 2005 **Laurea Triennale in Fisica**, *Università di Roma "Tor Vergata"*, 110/110 cum laude.
- Titolo "Calibrazione ed analisi dati del monitor di carica dell'esperimento RAP presso la Beam Test Facility dei Laboratori Nazionali di Frascati"

## Premi e Conseguimenti

- 2019 Vincitore del concorso INFN per posizioni di ricercatore a tempo indeterminato III livello n.20012/2018
- 2016 Idoneità al concorso INFN per posizioni di ricercatore a tempo indeterminato III livello n.18221/2016
- 2014 Abilitazione Scientifica Nazionale per il settore concorsuale 02/A1 (Fisica Sperimentale delle Interazioni Fondamentali)- II Fascia

- 2013 High Energy and Particle Physics Prize conferito dall' European Physical Society (EPS) alle collaborazioni ATLAS e CMS del CERN, "per la scoperta del bosone di Higgs, come predetto dal meccanismo di Brout-Englert-Higgs"
- 2010 Premio "Orso Mario Corbino" conferito dalla Società Italiana di Fisica per giovani ricercatori meritevoli che hanno conseguito la laurea Specialistica dopo il Maggio 2007
- 2008 Premio "Sebastiano e Rita Raeli" dell' Università di Roma "Tor Vergata" per i migliori 300 laureati dell'anno accademico
- 2006 Vincitore di una sovvenzione INFN per neolaureati di primo livello

## Attività scientifica

La mia attività di ricerca scientifica si colloca nell'ambito della fisica sperimentale delle particelle elementari, ed è incentrata principalmente sullo studio delle collisioni protone-protone ad alta energia prodotte dal Large Hadron Collider (LHC) presso il CERN di Ginevra con l'esperimento ATLAS. Durante questi anni ho coordinato e svolto in prima persona diverse analisi legate alla ricerca, alla scoperta e allo studio delle proprietà del bosone di Higgs. Ho coordinato i gruppi di analisi  $HZZ$  e  $HComb$  in ATLAS. Ho contribuito ad attività legate al computing e all'upgrade dello spettrometro a muoni di ATLAS. Attualmente sono anche impegnato nell'attività di ricerca e sviluppo su Micro Pattern Gas Detectors (MPGDs) per applicazioni in condizioni di elevato flusso di particelle. Infine sono stato impegnato in uno studio di fattibilità della produzione di un fascio di muoni a bassa emittanza a partire da positroni su bersaglio fisso, valutandone il suo potenziale utilizzo per un collisore di muoni. Una sinossi delle attività alle quali ho dato un importante contributo personale è riportata di seguito:

- **Studio del bosone di Higgs nei canali  $H \rightarrow ZZ^* \rightarrow 4\ell$ ,  $H \rightarrow WW^* \rightarrow \ell\nu\ell\nu$  e in combinazione con altri canali:** misure di massa, rate di produzione, spin e parità, accoppiamenti off-shell e sezioni d'urto fiduciali differenziali a diverse energie del centro di massa nel canale  $H \rightarrow ZZ^* \rightarrow 4\ell$  e contributo alle rispettive combinazioni con altri canali di decadimento del bosone di Higgs. Studio della produzione associata del bosone di Higgs con  $W$  e  $Z$  nel canale  $H \rightarrow WW^* \rightarrow \ell\nu\ell\nu$ . Contact editor di diversi articoli e note pubbliche di ATLAS. Convenership dei gruppi ATLAS HZZ e HComb.
- **Ricerca di risonanze ad alta massa:** contributo alle analisi di ricerca di risonanze di alta massa, che potrebbero indicare l'esistenza di fisica oltre il Modello Standard, nei canali  $H \rightarrow ZZ$  e  $H \rightarrow \gamma\gamma$  a un energia del centro di massa di  $\sqrt{s} = 8$  TeV e  $\sqrt{s} = 13$  TeV.
- **Studio di fattibilità di un collisore di muoni a bassa emittanza:** sviluppo di simulazioni per lo studio di produzione di un fascio di muoni a bassa emittanza da interazioni  $e^+e^- \rightarrow \mu^+\mu^-$  con positroni su bersaglio fisso. Ottimizzazione (in rate ed emittanza) della scelta del bersaglio. Ideazione di un possibile schema di collisore di muoni Multi-TeV. Studi di fisica del bosone di Higgs in un collisore di muoni Multi-TeV.
- **Ricerca e scoperta del bosone di Higgs:** contributo rilevante nelle analisi che hanno condotto alla scoperta bosone di Higgs nei canali  $H \rightarrow ZZ \rightarrow 4\ell$  e  $H \rightarrow WW \rightarrow \ell\nu\ell\nu$
- **Upgrade dello spettrometro di muoni di ATLAS:** partecipazione alle fasi di costruzione di prototipi e studio di performance dei rivelatori Micromegas.
- **Attività legata al calcolo di LHC - PROOF-on-Demand (PoD) su grid:** sviluppo, test e studi di performance nell'utilizzo di PoD (Proof-On-Demand) per l'analisi dati su grid nei Tier2 Italiani di ATLAS.
- **Ricostruzione e calibrazione dell'energia trasversa mancante (MET) in ATLAS:** sviluppo di un metodo data-driven per la stima degli errori sistematici della MET. Sviluppo di metodi di riduzione dell'impatto del pileup nella ricostruzione della MET. Contact editor della nota sugli studi di performance con i dati a  $\sqrt{s} = 7$  TeV.

- **Misura della sezione d'urto di produzione  $W$  e  $Z$** : ottimizzazione dei tagli di selezione per la riduzione dei fondi. Studio dell' impatto del pileup nelle efficienze di ricostruzione. Studi di accettazione per le misure di sezioni d'urto differenziali di produzione di  $W$  e  $Z$ .
- **Studio della produzione di  $K_s^0$  e  $\Lambda$**  : analisi delle prime collisioni protone-protone ad LHC a  $\sqrt{s} = 900$  GeV e  $\sqrt{s} = 7$  TeV. Studio delle distribuzioni cinematiche del mesone  $K_s^0$  e del barione  $\Lambda^0$ . Misura del rapporto di produzione  $\bar{\Lambda}^0/\Lambda^0$ . Contact editor della nota pubblica di ATLAS relativa a queste misure e utilizzata per la corrispondente pubblicazione.
- **Studio di performance di ricostruzione di muoni in ATLAS**: studio delle performance di ricostruzione dei muoni ad alto impulso trasverso; studio degli effetti del fondo di caverna sulla ricostruzione dei muoni in ATLAS e impatto nel canale  $H \rightarrow ZZ \rightarrow 4\ell$ .
- **Commissioning dello spettrometro di muoni di ATLAS**: commissioning e studio di performance delle camere di trigger RPC con raggi cosmici.

## Seminari e Presentazioni a conferenze Internazionali e Nazionali

### Presentazioni:

- 1 "10 years of the Higgs boson at the LHC", SIF 108 Congresso Nazionale 2022, Milano, 12-16 Settembre 2022, su invito
- 2 "Small-pad resistive Micromegas for high-rate environment", ICHEP 2022, Bologna, 6-13 Luglio 2022
- 3 "Recent results from the ATLAS experiment", Miami 2021, 15-22 Dicembre 2021, online, su invito
- 4 "Probing the Higgs boson Couplings at the LHC: latest results", Università degli Studi Roma Tre, 2019, su invito
- 5 "Observation of the  $ttH$  production in ATLAS at  $\sqrt{s} = 13\text{TeV}$ ", 30th Rencontres de Blois - Particle Physics and Cosmology, 3-8 Giugno 2018, Blois, France
- 6 "Offshell couplings and Higgs width in ATLAS and CMS", Workshop on the physics of HL-LHC, and perspectives at HE-LHC, 30 October 2017, CERN
- 7 " $H \rightarrow \gamma\gamma$  and  $H \rightarrow ZZ^* \rightarrow 4\ell$  with  $36.1 \text{ fb}^{-1}$  at  $\sqrt{s} = 13\text{TeV}$ ", XIII workshop ATLAS Italia, 27-27 Ottobre, Pavia, Italy
- 8 "Recent Higgs Boson Results from the LHC", Vulcano Workshop 2016 - Frontier Objects in Astrophysics and Particle Physics, 22-28 May 2016 Vulcano Island, Sicily, Italy, su invito
- 9 "Higgs boson width measurements with different methods at LHC", LHCP2015, August 31 - September 5 2015, St. Petersburg, Russia
- 10 "Higgs boson measurements in RUN2 with the bosonic decay channels", X ATLAS Italia Workshop on Physics and Upgrades; 10-12 February 2015, Milano
- 11 "ATLAS Higgs off-shell and interferometry in Run 1 and wish list for Run 2", Higgs (N)NLO MC and Tools Workshop for LHC RUN-2; 17-19 December 2014, CERN
- 12 " $H \rightarrow ZZ \rightarrow 4\ell$ : results, precision and performances achieved with Run1 data",  $H \rightarrow ZZ$  ATLAS Workshop; 18-19 October 2014, CERN
- 13 "A caccia della particella da Nobel con il rivelatore ATLAS", INFN-Piano Triennale 2014-2016. Napoli, 17-18 October 2013
- 14 "Individual and Combined Measurements of the Spin and Parity Properties of the Higgs boson using the ATLAS Detector", 19th International Symposium on Particles, Strings and Cosmology (PASCOS 2013); 20-26 November 2013, Taipei
- 15 "Higgs combined results: mass, signal strengths, scalar couplings, spin and parity", VI Workshop Italiano sulla Fisica p-p a LHC; 8-10 Maggio 2013 Genova

- 16 "Search for the SM Higgs Boson in the  $H \rightarrow WW^{(*)} \rightarrow l\nu l\nu$  decay channel at the LHC", LNF Third Mini-workshop series: Higgs search at LHC - Laboratori Nazionali di Frascati, March 28th 2012"
- 17 "Charged particle distributions and correlations in proton-proton collisions measured with the ATLAS detector", 6th International Workshop on High-pT physics at the LHC; Utrecht, 4-7 April 2011
- 18 "Minimum bias and soft QCD ATLAS Results", LC10 - New Physics: complementarities between direct and indirect searches; INFN - Laboratori Nazionali di Frascati, Italy, 30 November - 3 December 2010
- 19 "Reconstruction of known particle decays in proton-proton collisions at energies of 7 TeV with the ATLAS detector", Società Italiana di Fisica, XCVI Congresso Nazionale; Bologna, 20 - 24 September, 2010
- 20 "Measurement of  $pp \rightarrow Z \rightarrow \mu\mu$  cross section at LHC with ATLAS experiment", The XIV LNF Spring School "Bruno Touschek" in Nuclear, Subnuclear and Astroparticle Physics, Young Researchers Workshop; 11-15 May 2009
- 21 "Measurement of  $Z \rightarrow \mu\mu$  cross section in LHC", XLIV Rencontres de Moriond Electroweak Session, La Thuile, March 7-14, 2009 Young Scientists Forum

### Lista delle pubblicazioni più rappresentative

- 1 G. Aad et al., "**Observation of a new particle in the search for the Standard Model Higgs boson with the ATLAS detector at the LHC**", Phys. Lett. B 716 (2012) 1-29
- 2 G. Aad et al., "**Evidence for the spin-0 nature of the Higgs boson using ATLAS data**", Phys. Lett. B 726 (2013), pp. 120-144
- 3 G. Aad et al., "**Measurement of the Higgs boson mass from the  $H \rightarrow \gamma\gamma$  and  $H \rightarrow ZZ^* \rightarrow 4l$  channels with the ATLAS detector at the LHC**", Phys. Rev. D. 90, 052004
- 4 G. Aad et al., "**Measurements of Higgs boson production and couplings in the four-lepton channel in pp collisions at center-of-mass energies of 7 and 8 TeV with the ATLAS detector**", Phys. Rev. D 91, 012006 (2015)
- 5 G. Aad et al., "**Measurements of the Higgs boson inclusive and differential fiducial cross sections in the  $4\ell$  decay channel at  $\sqrt{s} = 13$  TeV**", Eur. Phys. J. C 80 (2020) 941
- 6 The ATLAS Collaboration, "**A detailed map of Higgs boson interactions by the ATLAS experiment ten years after the discovery**", Nature 607 (2022) 7917, 52-59
- 7 M. Aaboud et al., "**Measurement of the Higgs boson coupling properties in the  $H \rightarrow ZZ \rightarrow 4l$  decay channel at  $\sqrt{s} = 13$  TeV with the ATLAS detector**", JHEP 03 (2018) 095
- 8 M. Aaboud et al., "**Observation of Higgs boson production in association with a top quark pair at the LHC with the ATLAS detector**", Phys. Lett. B 784 (2018) 173
- 9 G. Aad et al., "**Measurements of differential cross-sections in four-lepton events in 13 TeV proton-proton collisions with the ATLAS detector**", JHEP 07 (2021) 005
- 10 G. Aad et al., "**Muon reconstruction and identification efficiency in ATLAS using the full Run 2 pp collision data set at TeV**", Eur. Phys. J. C 81, 578 (2021)
- 11 M. Aaboud et al., "**Search for supersymmetry in events with four or more leptons in  $\sqrt{s} = 13$  pp collisions with ATLAS**", Phys. Rev. D 98, 032009
- 12 M. Aaboud et al., "**Measurement of inclusive and differential cross sections in the  $H \rightarrow ZZ^* \rightarrow 4\ell$  decay channel in pp collisions at  $\sqrt{s} = 13$  TeV with the ATLAS detector**", JHEP 1710 (2017) 132
- 13 M. Antonelli, M. Boscolo, R. Di Nardo, P. Raimondi, "**Novel proposal for a low emittance muon beam using positron beam on target**", Nucl.Instrum.Meth. A807 (2016) 101-107
- 14 G. Aad et al., "**Constraints on the off-shell Higgs boson signal strength in the high-mass  $ZZ$  and  $WW$  final states with the ATLAS detector**", Eur. Phys. J. C (2015) 75:335



- 15 M. Aaboud et al., “**Search for new phenomena in high-mass diphoton final states using  $37 \text{ fb}^{-1}$  of proton-proton collisions collected at  $\sqrt{s}=13 \text{ TeV}$  with the ATLAS detector**”, Phys. Lett. B 775 (2017) 105
- 16 M. Aaboud et al., “**Measurement of the ZZ Production Cross Section in pp Collisions at  $\sqrt{s}=13 \text{ TeV}$  with the ATLAS Detector**”, Phys. Rev. Lett. 116, 101801 (2016)
- 17 G. Aad et al., “**Measurements of the Higgs boson production and decay rates and coupling strengths using pp collision data at  $\sqrt{s} = 7$  and  $8 \text{ TeV}$  in the ATLAS experiment**”, Eur.Phys.J. C76 (2016) no.1, 6
- 18 G. Aad et al., “**Fiducial and differential cross sections of Higgs boson production measured in the four-lepton decay channel in pp collisions at  $\sqrt{s} = 8 \text{ TeV}$  with the ATLAS detector**”, Physics Letters B 738 (2014) 234-253
- 19 G. Aad et al., “**Search for the Higgs boson in the  $H \rightarrow WW^* \rightarrow l\nu l\nu$  decay channel in pp collisions at  $\sqrt{s} = 7 \text{ TeV}$  with the ATLAS detector**”, Phys. Rev. Lett. 108, 111802 (2012)
- 20 G. Aad et al., “ **$K_s^0$  and  $\Lambda$  production in pp interactions at  $\sqrt{s} = 0.9$  and  $7 \text{ TeV}$  measured with the ATLAS detector at the LHC**”, Phys.Rev. D85 (2012) 012001
- 21 G. Aad et al., “**Search for the Standard Model Higgs boson in the  $H \rightarrow WW^* \rightarrow l\nu l\nu$  decay mode with  $4.7 \text{ fb}^{-1}$  of ATLAS data at  $\sqrt{s} = 7 \text{ TeV}$** ”, Phys. Lett. B 716 (2012) 62-81
- 22 G. Aad et al., “**Measurement of the inclusive  $W^{+-}$  and  $Z/\gamma$  cross sections in the electron and muon decay channels in pp collisions at  $\sqrt{s} = 7 \text{ TeV}$  with the ATLAS detector**”, Phys. Rev. D85 (2012) 072004
- 23 G. Aad et al., “**Measurement of the  $W \rightarrow l\nu$  and  $Z \rightarrow ll$  production cross sections in proton-proton collisions at  $\sqrt{s} = 7 \text{ TeV}$  with the ATLAS detector**”, JHEP 1012 (2010) 060
- 24 D. de Florian et al., “**Handbook of LHC Higgs Cross Sections: 4. Deciphering the Nature of the Higgs Sector**”, CERN-2017-002-M, arXiv:1610.07922
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- 27 G. Aad et al., “**Expected Performance of the ATLAS Experiment Detector, Trigger and Physics**”, arXiv:0901.0512, CERN-OPEN-2008-020
- 28 F. Anulli et al., “**The Level-1 Trigger Muon Barrel System of the ATLAS experiment at CERN**”, JINST 4:P04010, 2009

Autore di più di 1000 pubblicazioni, principalmente con la collaborazione ATLAS. La lista completa è consultabile sul sito <http://inspirehep.net/author/profile/R.Di.Nardo.1>

Alla data del 19 Settembre 2022, Nel database *Web of Science* risultano i seguenti indicatori:

- o 1066 pubblicazioni
- o numero medio di citazioni per pubblicazione: 55.3
- o indice  $h$  : 108

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## Attività didattica

- a.a. 2021-2022 Esercitazioni per il corso di Fisica Generale I, Università degli Studi Roma Tre
- a.a. 2021-2022 Laboratorio di didattica della Fisica, Università degli Studi Roma Tre
- a.a. 2021-2022 Elementi di Fisica degli Acceleratori, Università degli Studi Roma Tre
- a.a. 2020-2021 Esercitazioni per il corso di Fisica Generale I, Università degli Studi Roma Tre
- a.a. 2020-2021 Laboratorio di didattica della Fisica, Università degli Studi Roma Tre
- a.a. 2019-2020 Esercitazioni per il corso di Fisica Generale II, Università degli Studi Roma Tre

- a.a. 2019-2020 Laboratorio di didattica della Fisica, Università degli Studi Roma Tre  
dal 2019 Membro di commissione delle sedute di laurea magistrale e triennale in fisica, Università degli Studi Roma Tre

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### Attività di terza missione

- 2019 e 2021 Partecipazione agli eventi organizzati per la “**Notte Europea dei ricercatori**”, Università degli Studi Roma Tre
- 2021 Organizzazione e partecipazione della “**Masterclass di Fisica delle Particelle Elementari**”, Università degli Studi Roma Tre
- 2020 Partecipazione agli eventi organizzati per “**Occhi sulla luna**”, Università degli Studi Roma Tre
- 2015 Membro staff per “**OpenLabs 2015 - in the Year of Light**”, LNF 23 Maggio 2015
- 2014 Membro staff per “**OPEN DAY 2014 - LNF is open!**”, LNF 17 Maggio 2014