

# CURRICULUM VITAE

VALERIO VERZI

INFN - Sezione di Roma "Tor Vergata"

Via della Ricerca Scientifica 1, 00133 Roma - Italia

Settembre 2023

## Informazioni personali

Conoscenze lingue: italiano, inglese parlato e scritto.

## Esperienze professionali e studi

- 2020-oggi** Ricercatore INFN di II livello professionale presso la Sezione INFN di Roma "Tor Vergata"
- 2001-2019** Ricercatore INFN di III livello professionale presso la Sezione INFN di Roma "Tor Vergata"
- 1997-2000** Dottorato di ricerca in Fisica presso l'Università degli Studi di Milano  
Titolo della tesi: *Study of the anomalous couplings  $ZZZ$ ,  $ZZ\gamma$  and  $Z\gamma\gamma$  at LEP II with the DELPHI detector*  
Milano, 20 Dicembre 2000, relatore dott.ssa C. Matteuzzi
- 1991-1997** Corso di laurea in Fisica presso l'Università degli Studi di Roma "Tor Vergata"  
Titolo della tesi di laurea: *Misura della massa del bosone  $W$*   
Roma, 8 Marzo 1997, relatore prof. G. Matthiae, votazione: 110/110
- 1991** Fine degli studi superiori. Diploma di maturità scientifica presso il Liceo Cristo Re di Roma - votazione: 60/60

## Attività di ricerca

- 2001-oggi** **Osservatorio Pierre Auger**  
Studio dei raggi cosmici di altissima energia. Progettazione, costruzione, commissioning e presa dati del Fluorescence Detector (FD). Test ed installazione dei fotomoltiplicatori dei telescopi a fluorescenza. Sviluppo degli algoritmi di ricostruzione dell'asse e del profilo longitudinale degli sciami rivelati con il FD. Calibrazione relativa ed assoluta dei telescopi, caratterizzazione dell'atmosfera in termini dell'yield di fluorescenza e del suo contenuto in aerosols e determinazione della così detta energia invisibile associata alle particelle che non depositano tutta la loro energia nell'atmosfera. Determinazione delle incertezze sistematiche sulla misura calorimetrica dell'energia dello sciame effettuata con il FD. Calibrazione in energia del segnale misurato a terra dal Surface Detector (SD) tramite l'analisi degli eventi ibridi rivelati simultaneamente dal SD e dal FD. Misura della composizione in massa dei raggi cosmici tramite la misura della profondità atmosferica alla quale lo sciame raggiunge il suo massimo sviluppo. Misura dello spettro in energia dei raggi cosmici. Determinazione delle *features* dello spettro nel range di energia  $10^{16}$  –  $10^{20}$  eV e prima osservazione del punto di *steepening* a  $10^{19}$  eV. Confronto delle

misure di spettro in energia con quelle effettuate dall'esperimento Telescope Array (TA). Combinazione dei data set Auger e TA al fine di studiare le sorgenti di raggi cosmici con la piena copertura della sfera celeste.

- 2015-oggi** **Esperimento CTA (Cherenkov Telescope Array)**  
Contributo alla realizzazione di un sistema di sincronizzazione in tempo dei telescopi tramite collegamenti Ethernet basata sulla tecnologia White Rabbit.
- 2010-2015** **Esperimento AMY (Air Microwave Yield)**  
Studio della fattibilità di una nuova tecnica di rivelazione degli sciami atmosferici basata sulla rivelazione della radiazione denominata *Microwave Bremsstrahlung Radiation* (MBR) alle frequenze di qualche GHz. Determinazione dei limiti sull'intensità del processo MBR utilizzando il fascio di elettroni della Beam Test Facility dei Laboratori Nazionali di Frascati. Progettazione e costruzione dell'apparato sperimentale incluso quello di una camera anecoica di Faraday di dimensioni 4m x 2m x 2m
- 2003-2013** **Esperimento AIRFLY (AIR Fluorescence Yield)**  
Misurare e caratterizzazione del processo di emissione della luce di fluorescenza che avviene durante lo sviluppo di sciami atmosferici. Progettazione e costruzione dell'apparato sperimentale. Misure effettuate in un ampio intervallo di energia degli elettroni utilizzando i fasci della Beam Test Facility dei Laboratori Nazionali di Frascati, dell'Advanced Wakefield Accelerator, Van de Graaf ed Advanced Photon Source dell'Argonne National Laboratory di Chicago (USA). Misura di precisione del valore assoluto dell'*yield* di fluorescenza utilizzando un fascio di protoni al Fermilab di Chicago tramite una tecnica innovativa in cui la calibrazione del rivelatore è ottenuta misurando il ben noto processo di emissione di radiazione Cherenkov.
- 1996-2013** **Esperimento DELPHI (Detector with Lepton, Photon and Hadron Identification)**  
Studio sulle reazioni di produzione di una coppia di bosoni di gauge WW, ZZ e Z $\gamma$  utilizzando il fascio della seconda fase di LEP al CERN ( $\sqrt{s} = 160-208$  GeV). Misura della massa e larghezza del W. Misura della sezione d'urto di produzione ZZ e Z $\gamma$ . Limiti sugli accoppiamenti anomali tra tre bosoni di gauge neutri, ZZZ, ZZ $\gamma$  e Z $\gamma\gamma$  utilizzando tutti i canali di decadimento ed utilizzando il formalismo in cui i bosoni sono prodotti *off-shell*. Combinazione dei limiti sugli accoppiamenti anomali tra bosoni di gauge neutri ottenuti dai quattro esperimenti LEP.
- 1998-2002** **Esperimento TOTEM (TOTAL Elastic and diffractive cross section Measurement)**  
Sviluppo di un sistema di trigger basato su rivelatori RPC (Resistive Plate Chamber) e test su fascio al CERN.

### Pubblicazioni e presentazione a conferenze

Sono coautore di più di 400 lavori a stampa e pubblicazioni di cui circa 300 sono pubblicazioni *peer review* (fonte *inSPIRE*: *h-index* 88; fonte Scopus: *h-index* 61). Sono stato relatore di più di 30 presentazioni a conferenze e workshop. Di seguito si elencano le pubblicazioni più rilevanti:

- *Features of the energy spectrum of cosmic rays above  $2.5 \times 10^{18}$  eV using the Pierre Auger Observatory*  
The Pierre Auger Collaboration, Phys. Rev. Lett. 125 (2020) 121106 (Editor's Suggestion)
- *Measurement of the cosmic ray energy spectrum above  $2.5 \times 10^{18}$  eV using the Pierre Auger Observatory*  
The Pierre Auger Collaboration, Phys. Rev. D 102 (2020) 062005 (Editor's Suggestion)

- *Data-driven estimation of the invisible energy of cosmic ray showers with the Pierre Auger Observatory*  
The Pierre Auger Collaboration, Phys. Rev. D 100 (2019) 082003
- *Observation of a Large-scale Anisotropy in the Arrival Directions of Cosmic Rays above  $8 \times 10^{18}$  eV*  
The Pierre Auger Collaboration, Science 357 (2017) no.6537, 1266
- *Measurement of Energy Spectrum of Ultra-High Energy Cosmic Rays*  
V. Verzi, D. Ivanov and Y. Tsunesada, PTEP (2017) no.12 12A103
- *The Pierre Auger Cosmic Ray Observatory*  
The Pierre Auger Collaboration, Nucl. Instrum. Methods A 798 (2015), 172
- *Depth of maximum of air-shower profiles at the Pierre Auger Observatory. I. Measurements at energies above  $10^{17.8}$  eV*  
The Pierre Auger Collaboration, Phys. Rev. D 90 (2014), 122005
- *Precise measurement of the absolute fluorescence yield of the 337 nm band in atmospheric gases*  
The AIRFLY Collaboration, Astropart. Phys. 42 (2013), 90
- *Observation of the suppression of the flux of cosmic rays above  $4 \times 10^{19}$  eV*  
The Pierre Auger Collaboration, Phys. Rev. Lett. 101 (2008), 06110
- *Measurement of the pressure dependence of the fluorescence emission induced by electrons*  
The AIRFLY Collaboration, Astropart. Phys. 28 (2007), 41
- *Study of Triple-Gauge-Boson Couplings  $ZZZ$ ,  $ZZ\gamma$  and  $Z\gamma\gamma$  at LEP*  
DELPHI Collaboration, Eur. Phys. J. C51 (2007), 525-542
- *Measurement of the  $W$  pair cross-section and of the  $W$  mass in  $e^+e^-$  interactions at 172 GeV*  
DELPHI Collaboration, Eur. Phys. J. C2 (1998), 581-595

Ruoli e incarichi di responsabilità in ambito delle Commissioni Scientifiche Nazionali (CSN) dell'INFN ed in ambito europeo

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|------------------|---|
| <b>2020-oggi</b> | Responsabile Nazionale dell'esperimento Auger (CSN II).   |
| <b>2013-oggi</b> | Responsabile dell'esperimento Auger nella sezione INFN di Roma "Tor Vergata" (CSN II).  |
| <b>2013-2016</b> | Responsabile fondi EPLANET per la Sezione INFN di Roma "Tor Vergata".<br><i>European Particle physics Latin American NETWORK</i> , Call FP7-PEOPLE-2009-IRSES.  |
| <b>2011-2015</b> | Rappresentante Italia del progetto AugerNext (CSN II) <i>Innovative Research Studies for the Next Generation Ground Based Ultra High Energy Cosmic Ray Experiment</i> .<br>2 <sup>o</sup> ASPERA Call (Settimo programma EU ERA-NET) "Future High Energy Cosmic Ray and Neutrino Mass. Exp. " |
| <b>2010-2013</b> | Responsabile nazionale dell'esperimento AMY (CSN V).  |
| <b>2010-2013</b> | Responsabile dell'esperimento AMY nella sezione INFN di Roma "Tor Vergata" (CSN V).   |

Ruoli e incarichi di responsabilità nell'ambito di esperimenti

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|------------------|---|
| <b>2020-oggi</b> | Auger <i>Country Representative</i> per l'Italia                          |
| <b>2015-oggi</b> | Leader del task di analisi <i>Energy Spectrum</i> dell'esperimento Auger. |

- 2014-oggi** Rappresentante Auger nel *Auger-Telescope Array Working Group* per il confronto delle misure di spettro in energia.
- 2013-oggi** Membro del *Collaboration Board* della Collaborazione Auger.
- 2013-oggi** Leader del sub-task *Camera* nell'ambito del task *Fluorescence Detector* dell'esperimento Auger.
- 2007-2014** Leader del task di analisi *Hybrid Reconstruction* dell'esperimento Auger.
- 2003-2007** Leader del task di analisi *FD Shower Reconstruction* dell'esperimento Auger.
- 2000-2001** Rappresentante DELPHI nel *LEP Working Group* per la combinazione dei limiti posti dagli esperimenti LEP sugli accoppiamenti anomali tra bosoni di gauge neutri.

#### Collaborazioni con università e attività di comunicazione della scienza

Ho effettuato attività didattica presso l'Università degli studi di Roma "Tor Vergata" facendo lezioni di fisica delle Particelle Elementari per il corso di laurea in Fisica, di fisica II (elettromagnetismo) per il corso di laurea in Chimica e lezioni per il dottorato di ricerca in Fisica su i raggi cosmici di altissima energia e sulle interazioni protone-protone a basso momento trasferito.

Sono coautore di 20 *reference letters* per l'applicazione a posizioni di post-doc e ricercatore e membro di 6 commissioni per conseguimento del dottorato di ricerca in Fisica presso enti stranieri.


Sono stato il relatore di presentazioni ad eventi svolti nell'area romana dedicati alla comunicazione, valorizzazione e trasferimento della conoscenza e partecipato alle attività di *outreach* organizzate dalla Collaborazione Auger.

Roma, li 24 Settembre 2023

# Curriculum Vitae

## PERSONAL INFORMATION

### Giulia Maria de Divitiis

 Dipartimento di Fisica, Università degli Studi di Roma "Tor Vergata",  
Via della Ricerca Scientifica 1, 00133 Roma - Italy



## EDUCATION AND TRAINING

08 Jan 2014 - 08 Jan 2023

### Habilitation as Associate Professor in Theoretical Physics

(sc 02/A2, ssd FIS/02) MIUR, Italian Ministry of Education, Universities and Research

1991-1994

### Ph.D in Physics

Dept of Physics, University of Rome "Tor Vergata", Italy

Thesis Title: "La determinazione della costante di accoppiamento forte nella formulazione della Cromo Dinamica Quantistica su reticolo: il collegamento con le definizioni utilizzate nelle predizioni sperimentali"

Supervisor: Prof. Roberto Petronzio

29 Nov 1990

### Master degree in Physics

Dept of Physics, University of Rome La Sapienza, Italy

Grade: 110/110 cum laude

Thesis Title: "Calibrazione del calorimetro elettromagnetico dell'esperimento L3 attraverso l'analisi di muoni cosmici"

Supervisors: Prof. Bruno Borgia and Dr. Marcella Diemoz

## PROFESSIONAL EXPERIENCE

02 Nov 2022 - Present

### Associate Professor

Associate Professor at Dept of Physics, University of Rome "Tor Vergata", Italy

settore concorsuale 02/A2: Fisica Teorica delle Interazioni Fondamentali

settore scientifico disciplinare FIS/02: Fisica teorica, modelli e metodi matematici

02 Nov 1998 - 01 Nov 2022

### Researcher

Researcher at Dept of Physics, University of Rome "Tor Vergata", Italy

RTI Ricercatore a Tempo Indeterminato

settore concorsuale 02/A2: Fisica Teorica delle Interazioni Fondamentali

settore scientifico disciplinare FIS/02: Fisica teorica, modelli e metodi matematici

Feb 1999 - May 1999

### Visiting Researcher

DESY laboratory, Hamburg, Germany

Aug 1997 - Jul 1998

### Post Doctoral Fellow

Department of Physics and Astronomy, Southampton, U.K.

Jun 1995 - May 1997 **Technical Assistant**

Fixed-term contract at INFN "Tor Vergata"/Roma2 Unit, Rome, Italy  
Tecnologo INFN a tempo determinato

**CAREER BREAKS**

09 Jun 2004 - 23 Mar 2005

22 Jun 2001 - 28 Feb 2002

**TEACHING EXPERIENCE**

All courses have been held at the Dept of Physics, University of Rome "Tor Vergata", Italy

- 2022-present** Elementi di QCD non perturbativa - Lecturer (Docente titolare del corso)  
level: Graduate (laurea magistrale)
- 2019-2022** Meccanica Quantistica - Lecturer (Docente titolare del corso)  
level: Undergraduate (laurea triennale)
- 2011-present** (excluding aa. 2012-2013) Quantum Mechanics - Lecturer (Docente titolare del corso)  
level: Graduate (laurea magistrale)
- 2009-2010** Fenomenologia delle Particelle Elementari (prof. R. Frezzotti) - Teaching Assistant  
level: Graduate and Postgraduate (laurea magistrale e dottorato)
- 2004-2006** Meccanica Quantistica 2 (prof. E. Pace) - Teaching Assistant  
level: Graduate (laurea magistrale)
- 2001-2005** Fisica Teorica 1 e 2 (prof. R. Petronzio) - Teaching Assistant  
level: Graduate (laurea magistrale)
- 1999-2019** (excluding aa. 2001-2002, 2004-2005) Meccanica Quantistica/Istituzioni di Fisica Teorica  
(prof. M. Bianchi, L. Biferale, R. Petronzio, A. Sagnotti) - Teaching Assistant  
level: Undergraduate (laurea triennale)

**SUPERVISORY EXPERIENCE**

- 2012-present** Supervisor of 20 Bachelor students, 3 Master students, 1 PhD student  
Co-Supervisor of 1 INFN Postdoctoral Fellow  
Organizer of several ALPHA Collaboration meetings

**ADMINISTRATIVE EXPERIENCE**

- 2017-present** INFN National Research Network ENP  
Title: Exploring New Physics  
Coordinator of the Rome "Tor Vergata" Unit
- 2014-2019** INFN National Research Network LQCD123  
Title: A first principle approach to phenomenology with Lattice QCD  
Coordinator of the Rome "Tor Vergata" Unit
- 2014-2017** INFN National Research Network QNP  
Title: Fundamental Interactions, Electroweak Symmetry Breaking, Fermion Masses and the Quest for New Physics  
Coordinator of the Rome "Tor Vergata" Unit

2011-2014 "INFN National Research Network RM123  
 Title: Phenomenology of the Standard Model and beyond with Lattice QCD  
 Coordinator of the Rome "Tor Vergata" Unit

2009-2015 Responsible for workplace safety of the APE (Array Processor Experiment) Laboratory,  
 Dept of Physics, University of Rome "Tor Vergata", Italy  
 (Dirigente per la sicurezza del Laboratorio APE)

#### MEMBERSHIPS

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- INFN, National Institute of Nuclear Physics, Italy (Fellowship, incarico di ricerca scientifica)
- CAST, Centre for Applications of Calculus to Science and Technology, Dept of Physics,  
 University of Rome "Tor Vergata", Italy

#### REASERCH NETWORKS

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- 2018-2019 Mission Sustainability - "Tor Vergata" University  
 Title: PLNUGAMMA, Electromagnetic corrections to leptonic decay rates of pseudoscalar mesons  
 PI: prof. N. Tantalo
- 2015-2016 Uncovering Excellence - "Tor Vergata" University  
 Title: LIBETOV, Leading Isospin Breaking effects from Lattice QCD+QED: pushing numerical computations to the physical pion point  
 PI: prof. R. Frezzotti
- 2013-2015 Progetto Premiale INFN  
 Title: SUMA (SUper MAAssive computing project)  
 Coordinator: prof. R. Tripiccion
- 2010-2013 MIUR National Research Network (PRIN 2009)  
 Title: Fisica adronica e test di precisione del Modello Standard dalla QCD su reticolo  
 Coordinator: prof. G.C. Rossi
- 2006-2009 MIUR National Research Network (PRIN 2006)  
 Title: Struttura non-perturbativa della Cromo-Dinamica Quantistica  
 Coordinator: prof. L. Maiani
- 2004-2006 MIUR National Research Network (PRIN 2004)  
 Title: Interazioni fondamentali: teoria e fenomenologia  
 Coordinator: prof. R. Barbieri
- 2001-2004 MIUR National Research Network (PRIN 2001)  
 Title: Teoria e fenomenologia delle particelle elementari  
 Coordinator: prof. R. Petronzio
- 1999-2001 MIUR National Research Network (PRIN 1999)  
 Title: Fenomenologia della fisica degli acceleratori; teoria dei campi su reticolo; teoria dei campi delle stringhe  
 Coordinator: prof. R. Petronzio

#### HIGH PERFORMANCE COMPUTING

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In the recent years I have accessed the following computer resources:

- QCD+QED Simulations with C\* Boundary Conditions, A. Patella (8.5 Mhours, cluster EAGLE, Poland)
- $\chi$ iSF Renormalization, I. Campos (~ 5.0 Mhours/year, cluster ALTAMIRA, Spain)
- QC DLAT INFN initiative, L. Giusti (~ 5.0 Mhours/year, clusters at CINECA, Italy)

CONFERENCES ORGANIZATION  
AND ATTENDANCE

- Organization Member of the LOC of LATTICE 2010,  
The XXVIII International Symposium on Lattice Field Theory, Jun 2010, Villasimius, Italy
- Attendance since 2016 – The 38th International Symposium on Lattice Field Theory LATTICE2021 26-30 July, 2021  
Zoom/Gather@Massachusetts Institute of Technology
- 35th annual International Symposium on Lattice Field Theory LATTICE2017 18-24 June 2017  
Granada, Spain
  - 34th annual International Symposium on Lattice Field Theory LATTICE2016 24-30 July 2016  
University of Southampton, UK

## PERSONAL SKILLS

- Mother tongue Italian
- Other languages English (B2 level)
- Computer skills
- Programming Languages: C, C++, FORTRAN
  - FORM symbolic manipulation system
  - Run HPC codes on supercomputers
  - Bash Scripting, Perl, Linux
  - Gnuplot
  - $\LaTeX$ , Microsoft Office programmes
  - Some experience with HTML

## REASERCH INTERESTS

- Theoretical Elementary Particle Physics, Quantum Field Theory
- Lattice Gauge Theories, Lattice QCD, numerical simulations
- Data analysis methods and models
- Flavour Physics, Heavy mesons and baryons
- Isospin Breaking effects from Lattice QCD+QED
- Non-perturbative renormalisation, Non-perturbative improvement

## REASERCH ACTIVITY

My research activity is mainly focused on the study of QCD through numerical simulations on the lattice. In particular, in collaboration with the Tor Vergata lattice theory group, I have given significant contributions to:

- Non-perturbative computation of the running coupling constant of strong interactions: the evolution of the coupling constant of  $SU(2)$  gauge theory in the quenched approximation has been computed as a function of energy, with a recursive finite size technique.
- Determination of coefficients that enter the improvement programme of the QCD Wilson action and operators, in order to eliminate the dominant lattice artifacts: I proposed the method to measure some coefficients required in the definition of renormalised mass. The first results were obtained in quenched QCD. The method has subsequently been generalized by us and other collaborations and is nowadays the standard technique for quark mass improvement.
- Non-perturbative study of heavy-flavour physics: a recursive finite size method has been developed to keep the cutoff above the mass of the quark  $b$ , enabling reliable lattice computations with relativistic  $b$ -quarks for the first time. I obtained important results for the calculation of the form factors and decay rates of heavy mesons as a function of the momentum transfer.
- New techniques have been developed in lattice computations, such as "flavor twisted" boundary conditions for fermionic variables on finite volume which allow the shift of discretized spatial momenta by a continuous offset.
- Study of isospin breaking corrections to hadronic processes: these address effects due to the mass difference between the up and down quarks and effects due to electromagnetic interactions, computed with a method based on a combined expansion of the path integral in powers of the mass splitting and the electromagnetic coupling.



**Recent activity** In the last 4 years I have coordinated a collaboration with colleagues in Rome “Tor Vergata”, Rome “La Sapienza”, Münster (Germany), Santander (Spain) and CERN (Switzerland) in order to apply some of the above findings to the more realistic QCD theory with 3 dynamical flavours. We obtained results for renormalisation constants and improved coefficients [1, 2].

My on-going long-term project regards lattice determinations of the SM kaon-mixing matrix elements [3]. The combination of such theoretical computations with the experimental measurements of the indirect CP-violation parameter  $\epsilon_K$ , allows to constrain the CP-violating phase in the SM. Overconstraining this phase through multiple processes would provide unambiguous evidence of possible BSM physics. While the SM matrix element  $B_K$  has been the subject of many studies, achieving 1-2%-level accuracy, the results for the ones relevant to BSM physics are relatively few, less precise (> 5%), and with tension between results from different collaborations. We aim to improve the situation by determining the origin of the observed discrepancies (see FLAG Review 2021, arXiv:2111.09849). On the side of the renormalisation, for example, we are using a newly developed scheme, the chiral Schrödinger Functional ( $\chi$ SF), which presents many advantages, such as discretisation effects quadratic in the lattice spacing and less noisy four quark operator correlation functions. It also represents a method which avoids perturbation theory at hadronic energy scales and allows for non-perturbative renormalisation group running up to electroweak scales. Our results of renormalisation constants of pseudoscalar and tensor bilinears are a by-product of the initial stage of the project [1, 5, 4].

## PUBLICATIONS AND BIBLIOMETRICS

24 peer-reviewed publications and 13 conference proceedings

**Google Scholar** Citations of all papers: 1682

h-index= 18

i10-index = 20 (n. publications with more than 10 citations)

[https://scholar.google.com/citations?hl=en&user=Zg\\_4wRMAAAAJ&view\\_op=list\\_works&sortBy=pubdate](https://scholar.google.com/citations?hl=en&user=Zg_4wRMAAAAJ&view_op=list_works&sortBy=pubdate)

## PEER-REVIEWED PUBLICATIONS

- [1] Isabel Campos Plasencia, Mattia Dalla Brida, Giulia Maria de Divitiis, Andrew Lytle, Mauro Papinutto, Ludovica Pirelli, and Anastassios Vladikas. “Nonperturbative running of the quark mass for  $N_f=3$  QCD from the chirally rotated Schrödinger functional”. In: *Phys. Rev. D* 105.5 (2022), p. 054506. arXiv: 2112.10606 [hep-lat].
- [2] Giulia Maria de Divitiis, Patrick Fritsch, Jochen Heitger, Carl Christian Köster, Simon Kuberski, and Anastassios Vladikas. “Non-perturbative determination of improvement coefficients  $b_m$  and  $b_A - b_P$  and normalisation factor  $Z_m Z_P / Z_A$  with  $N_f = 3$  Wilson fermions”. In: *Eur. Phys. J. C* 79.9 (2019), p. 797. arXiv: 1906.03445 [hep-lat].
- [6] G. M. de Divitiis, R. Frezzotti, V. Lubicz, G. Martinelli, R. Petronzio, G. C. Rossi, F. Sanfilippo, S. Simula, and N. Tantalo. “Leading isospin breaking effects on the lattice”. In: *Phys. Rev. D* 87.11 (2013), p. 114505. arXiv: 1303.4896 [hep-lat].
- [7] G. M. de Divitiis, R. Petronzio, and N. Tantalo. “On the extraction of zero momentum form factors on the lattice”. In: *Phys. Lett. B* 718 (2012), pp. 589–596. arXiv: 1208.5914 [hep-lat].
- [8] G. M. de Divitiis et al. “Isospin breaking effects due to the up-down mass difference in Lattice QCD”. In: *JHEP* 04 (2012), p. 124. arXiv: 1110.6294 [hep-lat].
- [9] G. M. de Divitiis, R. Petronzio, and N. Tantalo. “Distance preconditioning for lattice Dirac operators”. In: *Phys. Lett. B* 692 (2010), pp. 157–160. arXiv: 1006.4028 [hep-lat].
- [10] G. M. de Divitiis, R. Petronzio, and N. Tantalo. “Quenched lattice calculation of the vector channel  $B \rightarrow D^* l \nu$  decay rate”. In: *Nucl. Phys. B* 807 (2009), pp. 373–395. arXiv: 0807.2944 [hep-lat].

- [11] G. M. de Divitiis, E. Molinaro, R. Petronzio, and N. Tantalo. “Quenched lattice calculation of the  $B \rightarrow D$   $\ell$   $\nu$  decay rate”. In: *Phys. Lett. B* 655 (2007), pp. 45–49. arXiv: 0707.0582 [hep-lat].
- [12] G. M. de Divitiis, R. Petronzio, and N. Tantalo. “Quenched lattice calculation of semileptonic heavy-light meson form factors”. In: *JHEP* 10 (2007), p. 062. arXiv: 0707.0587 [hep-lat].
- [13] G. M. de Divitiis, R. Petronzio, and N. Tantalo. “On the discretization of physical momenta in lattice QCD”. In: *Phys. Lett. B* 595 (2004), pp. 408–413. arXiv: hep-lat/0405002.
- [14] G. M. de Divitiis, M. Guagnelli, F. Palombi, R. Petronzio, and N. Tantalo. “Heavy light decay constants in the continuum limit of quenched lattice QCD”. In: *Nucl. Phys. B* 672 (2003), pp. 372–386. arXiv: hep-lat/0307005.
- [15] Giulia Maria de Divitiis, Marco Guagnelli, Roberto Petronzio, Nazario Tantalo, and Filippo Palombi. “Heavy quark masses in the continuum limit of quenched lattice QCD”. In: *Nucl. Phys. B* 675 (2003), pp. 309–332. arXiv: hep-lat/0305018.
- [16] G. M. de Divitiis, L. Del Debbio, Massimo Di Pierro, J. M. Flynn, Christopher Michael, and J. Peisa. “Towards a lattice determination of the  $B^* B$   $\pi$  coupling”. In: *JHEP* 10 (1998), p. 010. arXiv: hep-lat/9807032.
- [17] G. M. de Divitiis and R. Petronzio. “Nonperturbative renormalization constants on the lattice from flavor nonsinglet Ward identities”. In: *Phys. Lett. B* 419 (1998), pp. 311–316. arXiv: hep-lat/9710071.
- [18] G. M. de Divitiis, R. Petronzio, and L. Silvestrini. “Flavor changing top decays in supersymmetric extensions of the standard model”. In: *Nucl. Phys. B* 504 (1997), pp. 45–60. arXiv: hep-ph/9704244.
- [19] G. M. de Divitiis, R. Frezzotti, M. Masetti, and R. Petronzio. “QCD at finite temperature and partially negative flavor numbers”. In: *Phys. Lett. B* 387 (1996), pp. 829–834. arXiv: hep-lat/9607067.
- [20] G. M. de Divitiis, R. Frezzotti, M. Masetti, and R. Petronzio. “Dynamical flavor dependence of static heavy meson decay constants on the lattice”. In: *Phys. Lett. B* 382 (1996), pp. 398–402. arXiv: hep-lat/9605002.
- [21] G. M. de Divitiis, R. Frezzotti, M. Masetti, and R. Petronzio. “Pseudofermion observables for static heavy meson decay constants on the lattice”. In: *Phys. Lett. B* 382 (1996), pp. 393–397. arXiv: hep-lat/9603020.
- [22] G. M. de Divitiis, R. Frezzotti, M. Guagnelli, M. Masetti, and R. Petronzio. “Light meson decay constants beyond the quenched approximation”. In: *Phys. Lett. B* 367 (1996), pp. 279–282. arXiv: hep-lat/9510048.
- [23] G. M. de Divitiis, R. Frezzotti, M. Guagnelli, M. Masetti, and R. Petronzio. “The Bermions: An Approach to lattice QCD dynamical fermions from negative flavor numbers”. In: *Nucl. Phys. B* 455 (1995), pp. 274–286. arXiv: hep-lat/9507020.
- [24] G. M. de Divitiis, R. Frezzotti, M. Guagnelli, M. Masetti, and R. Petronzio. “Smearred propagators for lattice hadron spectroscopy”. In: *Phys. Lett. B* 353 (1995), pp. 274–278. arXiv: hep-lat/9502011.
- [25] Giulia de Divitiis, Roberto Frezzotti, Marco Guagnelli, Martin Luscher, Roberto Petronzio, Rainer Sommer, Peter Weisz, and Ulli Wolff. “Universality and the approach to the continuum limit in lattice gauge theory”. In: *Nucl. Phys. B* 437 (1995), pp. 447–470. arXiv: hep-lat/9411017.
- [26] G. M. de Divitiis, R. Frezzotti, M. Guagnelli, and R. Petronzio. “Nonperturbative determination of the running coupling constant in quenched  $SU(2)$ ”. In: *Nucl. Phys. B* 433 (1995), pp. 390–402. arXiv: hep-lat/9407028.
- [27] G. M. de Divitiis, R. Frezzotti, M. Guagnelli, and R. Petronzio. “A Definition of the running coupling constant in a twisted  $SU(2)$  lattice gauge theory”. In: *Nucl. Phys. B* 422 (1994), pp. 382–396. arXiv: hep-lat/9312085.

## **Personal information**

- Nationality: Italian

## **Professional information**

I am author and co-author of more than 280 scientific articles and my Hirsch index is 82 (WOS). During my scientific activity, I visited the following research institutes:

- Laboratori Nazionali di Frascati (Frascati, Italy);
- CERN (Geneva, Switzerland);
- California Institute of Technology (Pasadena, USA);
- Leiden University (Leiden, Holland);
- Adelaide University (Adelaide, Australia).

My research activity can be summarized as follows:

**Gravitational wave detectors:** activity on resonant cryogenic detectors EXPLORER (CERN), NAUTILUS (INFN Frascati National Laboratories) and MiniGrail (Leiden, Holland) and on the interferometric detector Virgo (EGO, Cascina). Responsible for R&D activities on the development of read-out superconducting electronics, adaptive optical systems, quantum optics, thermal noise, calibration, detector characterization and data filtering algorithms.

**Astro-particle Physics:** study of the interaction of cosmic rays with GW resonant detectors. The activity concerned events recorded by NAUTILUS (EXPLORER) in coincidence with a system of streamer tubes (plastic scintillators) and the RAP experiment (Acoustic Detection of Particles, at LNF), to verify the thermo-acoustic model of the interaction between charged particles and mechanical oscillators at room and cryogenic temperatures.

## **Positions**

- 2019 –** Senior Research Scientist (Primo Ricercatore) at Istituto Nazionale di Fisica Nucleare (INFN), Rome Tor Vergata.
- 2013 – 2019** Research Scientist at Istituto Nazionale di Fisica Nucleare (INFN), Rome Tor Vergata.
- 2008 – 2013** Technologist at Istituto Nazionale di Fisica Nucleare (INFN), Rome Tor Vergata.
- 2005 – 2008** Post.Doc. at Istituto Nazionale di Fisica Nucleare (INFN), Rome Tor Vergata.
- 2003 – 2005** Post.Doc. at University of Rome Tor Vergata.

## **Current Assignments**

- 2023 –** Technical Scientific Expert for the evaluation of the PNRR Projects.
- 2023 –** member of the Virgo Executive Committee.
- 2022 –** Technical Manager of the ET-O Project Office.
- 2022 –** member of the ET Executive Board.
- 2022 –** TCS Subsystem Manager within the Advanced Virgo+ Project.

- 2021 –** Co-chair of the Wavefront Sensing and Control Workpackage in the Einstein Telescope Instrument Science Board.
- 2019 –** Co-chair of the LIGO-Virgo-KAGRA Joint Run Planning Committee.
- 2013 –** member of the review panel for the research projects submitted to the Italian Ministry of University and Research (MIUR).

### **Past Assignments**

- 2020 – 2023** Co-chair of the LIGO-Virgo-KAGRA Operations Division.
- 2019 – 2023** Virgo Run Coordinator.
- 2014 – 2023** responsible for the Tor Vergata INFN Section of the LSPE experiment, funded by the INFN Commission II.
- O2 – O3** Virgo Site Advocate and co-chair of the LIGO-Virgo-KAGRA Rapid Response Team.
- 2017 – 2023** member of the Virgo Steering Committee.
- 2017 – 2019** Virgo Commissioning Coordinator.
- 2017 – 2019** member of the LIGO-Virgo-KAGRA Joint Run Planning Committee.
- 2008 – 2012** Co-PI of the R&D activity for the development of the AdV TCS (Grant n. EGO-DIR-95-2008).
- 2007 – 2012** TCS Subsystem Manager within the Virgo+ Project.
- 2014 – 2016** responsible for the Tor Vergata INFN Section of the AdCOAT experiment, funded by the INFN Commission V.

### **Teaching activities**

- 2016 –** *Gravitational Physics*, lecturer, MSc in Astronomy, Astrophysics and Space Science, University of Rome Tor Vergata.
- 2013 –** *Mechanics and Thermodynamics*, co-lecturer, BSc in Physics, University of Rome Tor Vergata.
- 2015 – 2017** *Physics Laboratory 3*, co-lecturer, BSc in Physics, University of Rome Tor Vergata.

### **Students supervision**

MSc:


Ph.D.:

## **Post-doc supervision**

# CURRICULUM VITAE

## DATI PERSONALI

Alessandro Cianchi

 Università di Roma Tor Vergata  
Via della Ricerca Scientifica, 1  
00133 Roma – Italia



## POSIZIONE ATTUALE

### **Professore Associato FIS/07**

Dipartimento di Fisica

Università di Roma Tor Vergata

Abilitazione in FIS/01 per professore di prima fascia fino al  
25/05/2032

## CONTRATTI PRECEDENTI

**Ricercatore tempo indeterminato (RTI)** dal 17/04/2008 al  
14/04/2021 Dipartimento di Fisica – Università di Roma Tor Vergata

**Ricercatore tempo determinato INFN** dal 01/01/2005 al  
16/04/2008 sezione di Roma Tor Vergata

**Assegnista di Ricerca** dal 20/12/2002 al 20/12/2004 presso  
Dipartimento di Fisica Università di Roma Tor Vergata

**Guest Scientific Researcher** dal 19/06/1997 al 17/12/1997 presso  
Fermi National Accelerator Laboratory, Batavia, Illinois, USA

## TITOLO DI STUDIO

### **Dottorato di ricerca in Fisica (2002)**

Università di Roma Tor Vergata

Titolo della tesi: “Radiazione di diffrazione e suo utilizzo come  
sistema di diagnostica non intercettante per fasci intensi di  
particelle”

Relatori: Prof. Sergio Tazzari, Dott. Michele Castellano

### **Laurea in Fisica (1997)**

Università degli studi di Roma La Sapienza

Titolo della tesi: “Misure di stabilità lungo il macroimpulso del fascio  
di TTF (Tesla Test Facility) realizzate con la radiazione di transizione  
in banda ottica “

Relatori: Prof. Carlo Bernardini, Dott. Michele Castellano

## PUBLICATIONS ON JOURNALS WITH PEER REVIEW

Papers: 128  
Citation 5567  
h-index 33

Fonte Scopus

## RESPONSABILITÀ SCIENTIFICHE

2022-ora Responsabile WP2 del progetto EuAPS (PNRR), per una sorgente X compatta, il budget di tale WP è di circa 9.5 Meuro.

2021-2022 Responsabile del Working Package 8 Diagnostics nel Progetto europeo CompactLight, per la creazione di una sorgente di radiazione compatta.

2022-ora Responsabile della diagnostica di elettroni e fotoni nel WP8 del progetto Europeo EuPRAXIA-Preparatory phase (progetto ESFRI)

2020-ora Responsabile della diagnostica di elettroni nel progetto EuPRAXIA@SPARC\_LAB presso INFN-LNF, uno dei due pilastri del progetto europeo EuPRAXIA per la realizzazione di una sorgente Free Electron Laser (FEL) con uno stadio di accelerazione al plasma.

2019-ora Coordinatore locale per la sezione INFN di Roma Tor Vergata dell'esperimento SL\_COMB2FEL, che ha recentemente pubblicato i suoi risultati in Nature, ovvero la produzione di radiazione FEL tramite un fascio di particelle accelerato da un plasma.

2016-2019 Responsabile del gruppo diagnostica nel Work Package 15 nel progetto "Compact European Plasma Accelerator with superior beam quality" (EUPRAXIA) - Horizon 2020 per la realizzazione del Conceptual Design Report di una sorgente di radiazione compatta spinta da un acceleratore al plasma

2017-2019 Responsabile scientifico del Progetto Regionale TECNOMUSE per l'uso dello scattering muonico come strumento di diagnostica per i container dei porti. Topic: TECNOlogia MUonica per la SicurEzza nei porti. Intervento realizzato avvalendosi del finanziamento del POR FESR -Avviso Pubblico "Mobilità sostenibile e Intelligente" Contributo finanziato: €766.825,39

2013-2018 Coordinatore locale per la sezione INFN di Roma Tor Vergata dell'esperimento SL\_COMB che aveva l'obiettivo di accelerare un fascio di elettroni con uno stadio a plasma.

2013-2015 Principal investigator esperimento ODRI2D, collaborazione INFN-DESY per l'uso della radiazione di diffrazione come diagnostica non intercettante per un fascio di elettroni di alta brillantezza atto a pilotare un FEL.

2012-2014 Coordinamento del Gruppo diagnostica per il progetto Europeo Compton Gamma Source in costruzione a Extreme Light Infrastructure for Nuclear Physics (ELI-NP), Magruele (Romania)

2010-2012 Principal investigator esperimento ODRI, collaborazione INFN-DESY per l'uso della radiazione di diffrazione come diagnostica non intercettante per un fascio di elettroni di alta brillantezza atto a pilotare un FEL.

## DIDATTICA

2011-ora

Corso di Particle Accelerators for Physics and Interdisciplinary Applications per corso di studi in Fisica, Università di Roma Tor Vergata 6CFU

2013-ora

Corso di Fisica Generale I per corso di studi in Ingegneria Gestionale, Università di Roma Tor Vergata 12 CFU

2014- ora

Corso di Fisica Generale II per corso di studi in Ingegneria Gestionale Università di Roma Tor Vergata 9 CFU

2008-2010

Corso di Introduzione all'informatica per Meteorologia e Fisica dell'atmosfera, Università di Roma Tor Vergata 6CFU

2008-2015

Esercitazioni di laboratorio per il corso di Laboratorio 3, corso di laurea in Fisica, Università di Roma Tor Vergata

2018

Lezioni alla Cern Accelerator School (Beam Instrumentation) – Helsinki (Finlandia)

2018

Membro del board della scuola Cern Accelerator School (Beam Instrumentation) – Helsinki (Finlandia)

2017

Lezioni alla Cern Accelerator School (Advanced Level) Londra (UK)

2015

Lezioni alla Cern Accelerator School (Intensity Limitations in Particle beams), Ginevra, Svizzera

2015

Lezioni alla Cern Accelerator School (Advanced Level), Varsavia, Polonia

2011

Lezioni alla Cern Accelerator School (Advanced Level), Chios, Grecia

2009

Lezioni alla Cern Accelerator School (Advanced Level), Darmstadt (Germania)

Relatore di numerose tesi triennali, magistrali e di dottorato.



## PRESENTAZIONI A CONFERENZA

### Su invito:

- 2022 6th International Conference Frontiers in Diagnostic Technologies (Frascati)
- 2018 29th Linac Accelerator Conference Beijing (Cina)
- 2018 Topical Workshop on Emittance Measurements Barcellona (Spagna)
- 2017 American Physical Society annual meeting Milwaukee (USA)
- 2016 Physics and Applications of High Brightness Beams Havana (Cuba)
- 2015 SPIE Optics Optoelectronics: Advances in X-ray Free-Electron Laser Instrumentation Praga (Repubblica Ceca)
- 2015 2nd European Advanced Accelerator Workshop Isola d'Elba (Italia)
- 2014 100° congresso SIF Pisa (Italia)
- 2013 Physics and applications of high brightness beams San Juan (Portorico)
- 2013 3rd International Conference Frontiers in Diagnostic Technologies (Frascati) Frascati (Italia)
- 2013 99° congresso SIF Trieste (Italia)
- 2009 The Physics and Applications of High Brightness Electron Beams Maui, Hawaii (USA)
- 2007 8th DIPAC- Diagnostic and instrumentation for Particle accelerator conference Venezia (Italia)

### Contributed talks

- 2012 Free Electron Laser Conference Nara (Giappone)
- 2012 2nd International Conference Frontiers in Diagnostic Technologies (Frascati) Frascati (Italia)
- 2011 International Symposium on Radiation From Relativistic Electrons in Periodic Structures (RREPS) London (UK)
- 2003 International Conference Plasma 2003 Varsavia (Polonia)

## COMITATI DI PROGRAMMA EDITOR DEI PROCEEDINGS

- 2023 Physics and Applications of High Brightness Beams – San Sebastian (Spagna) – Editor dei proceedings
- 2022 International Beam Instrumentation Conference – comitato di programma - Cracovia (Polonia)
- 2019 Chair of Scientific Program Committee 4th European Advanced Accelerator Concepts, Elba (Italia), 2019 conferenza su invito, circa 300 partecipanti, con talk di apertura del premio Nobel della Fisica 2008 Gerard Mourou

- 2019 Editor dei Proceedings per IOP della 4th European Advanced Accelerator Concepts, Elba (Italia), 2019
- 2019 Editor dei Proceedings per la rivista Instruments della conferenza Physics and Applications of Brightness Beams, Creta (2019)
- 2016 IBIC (international Beam Instrumentation Workshop) Barcellona (Spagna), membro Program Committee, circa 300 partecipanti
- 2016 Physics and Applications of High Brightness Beams Havana (Cuba), membro program committee
- 2016 Guest Editor dei Proceedings della conferenza Physics and Applications of High Brightness Beams, Cuba (2016) per Elsevier
- 2014 membro comitato programma 6th microbunching instability workshop Trieste (Italia), 100 partecipanti
- 2013 membro comitato programma 1st European Advanced Accelerator Concept workshop, Isola d'Elba (Italia) 200 partecipanti

## **INTERESSI DI RICERCA**

La mia carriera parte con l'elettromagnetismo e la radiazione di transizione in banda ottica usata come diagnostica per fasci di alta brillantezza di elettroni adatti per produrre radiazione tramite FEL (Free Electron Laser).

La parte di diagnostica di questi fasci di particelle rimane sempre la mia specializzazione maggiore, come si evince dai molti incarichi di responsabilità che ho coperto in questo campo.

A questo però si è affiancato lo studio di sorgenti di radiazioni compatte, THz e raggi X, realizzate con fasci di alta brillantezza e acceleratori compatti, compresi gli acceleratori al plasma di ultima generazione per usi applicativi.

Proprio in questo filone va visto il recente progetto EuAPS (EuPRAXIA Advanced Photon Source) che ha vinto il bando PNRR per le infrastrutture di ricerca (è giunto primo), di cui coordino il WP più cospicuo, dedicato alla realizzazione di una sorgente X compatta basata sull'accelerazione a plasma, per usi applicativi.

## **ALTRO**

2022-ora

Membro Senato Accademico Università di Roma Tor Vergata

2017-ora

Membro collegio di dottorato in Fisica presso Università di Roma Tor Vergata

2018-ora Membro Editorial Board rivista Instruments

Referee:

Physical Review Applied, Physical Review Letters, Journal of Instrumentation, Plasma Physics and Controlled Fusion, Journal of the Optical Society of America B, Physical Review - Accelerators and Beams (former PRST-AB), Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment

**Dichiarazione sostitutiva di certificazioni/dell'atto di notorietà  
(Artt. 46 e 47 del D.P.R. 28 dicembre 2000, n. 445)**

a conoscenza di quanto prescritto dall'art. 76 del D.P.R. 28 dicembre 2000 n. 445, sulla responsabilità penale cui può andare incontro in caso di falsità in atti e di dichiarazioni mendaci, nonché di quanto prescritto dall'art. 75 del D.P.R. 28 dicembre 2000 n. 445, sulla decadenza dai benefici eventualmente conseguenti al provvedimento emanato sulla base di dichiarazioni non veritiere, ai sensi e per gli effetti del citato D.P.R. n. 445/2000 e sotto la propria personale responsabilità:

**D I C H I A R A**

che tutte le informazioni contenute nel proprio curriculum vitae sono veritiere.

Autorizzo il trattamento dei miei dati personali presenti nel CV ai sensi dell'art. 13 d. lgs. 30 giugno 2003 n. 196 - "Codice in materia di protezione dei dati personali" e dell'art. 13 GDPR 679/16 - "Regolamento europeo sulla protezione dei dati personali".

Letto, confermato e sottoscritto.

Roma, lì 08/05/2023

Il dichiarante

## CURRICULUM VITAE

### General Information

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Full Name	Ilaria Nardecchia
Place of Birth	
Date of Birth	
Citizenship	
E-mail	

### Positions

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2/11/2022- Present	Permanent Staff Researcher, INFN Roma Tor Vergata
1/04/2021 1/11/2022	PostDoc researcher, INFN Roma Tor Vergata
01/11/2018 31/10/2020	PostDoc researcher, University of Rome Tor Vergata.
15/03/2018 14/08/2018	Visiting Scientist, Gran Sasso Science Institute.
15/03/2016 15/03/2018	PostDoc researcher, University of Rome Tor Vergata.

## Education

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- 2012-2015    **Ph.D. Degree in Astronomy, Astrophysics and Space Science (cum laude)**  
Sapienza University of Rome and University of Rome Tor Vergata (joint supervision),  
Thesis title: *Control of optical aberration in advanced interferometric gravitational wave detectors.*  
Advisor: Prof. Viviana Fafone
- 2009-2012    **Master Degree in Astronomy and Astrophysics,**  
Sapienza University of Rome, 110/110,  
Thesis title: *Thermal noise in the monolithic suspension of Advanced Virgo.*  
Advisor: Dr. Paola Puppo
- 2006-2009    **Bachelor Degree in Physics and Astrophysics,**  
Sapienza University of Rome, 105/110,  
Thesis title: *Cosmological origin of the temporal asymmetry and of irreversibility.*  
Advisor: Prof. Sergio Caprara

## Research activities

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During my research activity I have been involved in the development of adaptive optical systems for the improvement of the performance of the interferometric gravitational-wave detectors and in the study of their future upgrades.

- 2012-2015    My PhD thesis was carried on at the INFN laboratory of the Virgo Group at University of Rome Tor Vergata. The group is responsible for the development and commissioning of one of the major subsystems of Advanced Virgo: the Thermal Compensation System (TCS), the **adaptive optical system** implemented to compensate the optical aberrations in the mirrors of gravitational-wave detectors. It is composed by actuators (ring heater and CO<sub>2</sub> lasers) and high-precision wavefront sensors (Hartmann wavefront sensors). The work of the thesis, entitled "*Control of optical*

*aberrations in advanced interferometric gravitational wave detectors*”, has been developed in close cooperation with Prof. P. Veitch, head of the LIGO group at the University of Adelaide (Australia), and with Dr. A. Brooks of the LIGO group at Caltech (USA), in charge of the Thermal Compensation System in Advanced LIGO. The work was focused on the realization of the first experimental setup designed for the characterization of wavefront sensors and actuators used to measure and compensate the optical distortions in gravitational-wave detectors. This test bench experiment allowed to sense the optical aberrations with the same sensitivity required in Advanced Virgo. During my PhD program, I acquired expertise on different tools for finite element analysis simulations (Ansys), optical simulations (Zemax), data acquisition systems (LabView) and data analysis (Matlab). In recognition to my work, my thesis has been awarded with the Honorable mention at GWIC Thesis Prize.

2016-2018

After the end of my PhD thesis, I spent medium-long time periods at the site of the Virgo experiment, the European Gravitational Observatory (EGO) having the chance to work in an international framework.

I participated to the installation of the thermal compensation system, and its integration in the interferometer. In particular, I was **responsible**

**for the characterization and validation of the optical aberration sensing system in Advanced Virgo.**

I was also involved in the commissioning of the full interferometer in preparation to the second observational run (O2).

In the meanwhile, I started to collaborate with the Virgo group at the Laboratoire APC (Paris – France) for the design and the realization of an adaptive optical actuator to tune the radius of curvature of the filter cavity mirrors of the Japanese experiment hosted in the former TAMA facility at NAOJ.

After the end of O2 (August 2017), all the ground-based interferometers started a new upgrade phase in view of the third observing run (O3, started in April 2019). During the time break between O2 and O3, my research activity focused on the study of the interferometer performance with optical simulations in presence of aberrations in order to optimize the thermal compensation strategy.

I participated to the interferometer commissioning phase preceding O3, with **the**

**role of responsible of the commissioning of the Advanced Virgo TCS** and as member of the optical characterization team.

2018-2020

I was part of the team responsible of securing the stable data taking during O3 and, in parallel, I continued my research and development activity on the thermal compensation system in view of O4 planned to start in mid 2022.

In recognition to my outstanding contribution to O3, **I was appointed member of the GWTC-2 catalog paper writing team (the paper summarizing all the transient GW signals observed during the first half of O3), and panelist for the webinar presenting the paper to the broader scientific community.**

During this same period, I was appointed **responsible of the design and the realization of an actuator to tune the radius of curvature of the mirrors composing the optical cavity used to implement the frequency-dependent squeezing technique in Advanced Virgo.**

I also started being involved in longer term R&D activities on adaptive optics, aiming at the fifth observing run (around 2025) and third generation interferometric detectors (circa 2035). In this framework, I am coordinating the activity (in collaboration with the University of Adelaide, Australia) for the development of the new Hartmann wavefront sensors based on CMOS technology. Furthermore, the high circulating power in the third-generation of gravitational wave interferometers, will make thermal effects more relevant than in Advanced Virgo or LIGO requiring a strong effort in the development of new and more advanced technologies for the compensation of thermal effects. In this framework, **I was in charge for the development of the new Hartmann wavefront sensors** based on CMOS technology.

2020-

Besides carrying on the project for the new CMOS-based Hartmann wavefront sensors, my present activity includes:

- serving as responsible for the TCS commissioning for the Advanced Virgo fourth observing run (O4);
- R&D for the actuator to mitigate the anomalous power absorptions in Advanced Virgo core optics, which is a critical issue to reach the interferometer sensitivity



planned for O4.

I am author and co-author of more than 190 peer-reviewed papers: my H-index is 72 (Scopus)\*.

\* Scopus updated at September 19<sup>th</sup>, 2023

## Teaching experience

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2018	Tutor for the <b>Gravitational Wave course</b> , University of Rome Tor Vergata, Prof. Viviana Fafone.
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## Supervising experience

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10/2022-05/2023	Co-advisor, [redacted], Master student, University of Rome Tor Vergata, Title: [redacted]
12/2019-07/2023	Tutor, [redacted], PhD student, University of Rome Tor Vergata, Title: [redacted]
12/2019-03/2023	Tutor, [redacted], PhD student, University of Pisa, Title: [redacted]
05/2022-01/2023	Co-advisor, [redacted], Master student, University of Rome Tor Vergata, Title: [redacted]
10/2020-05/2021	Co-advisor, [redacted], Master student, University of Rome Tor Vergata, Title: [redacted]
10/2019-05/2020	Co-advisor, Claudia Taranto, Master student, University of Rome Tor Vergata,

	Title: ‘ ”.
11/2016-06/2019	Tutor, , PhD student, Sissa GSSI, Title: ‘ ”.
10/2018-06/2019	Co-advisor, , Master student, University of Rome Tor Vergata, Title: ” ’.
10/2016-05/2017	Co-advisor, , Master student, University of Rome Tor Vergata, Title: ”

## Society memberships, Awards and Honors

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2017	<b>Einstein Medal 2017</b> , with the LIGO and Virgo collaborations, for the first detection of gravitational waves. Awarded by the <i>Albert Einstein Society</i> .
2016	<b>Special Breakthrough Prize in fundamental physics</b> , for the first detection of gravitational waves from the merging of two black holes. Awarded by the Breakthrough Prize Board to the authors of the GW150914 discovery paper.
2016	<b>Gruber Cosmology Prize</b> , for the first detection of gravitational waves. Awarded by the <i>Gruber Foundation at the Yale University</i> to the authors of the GW150914 discovery paper.
2016	<b>Scientific Merit Prize</b> , awarded by the University of Rome Tor Vergata for the contribution to the discovery of the Gravitational Waves.

2015 | GWIC Thesis Prize-honorable mention.

## Outreach activities

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2018 | Speaker for the Physics Department of the University of Rome Tor Vergata during the 'Salone dello Studente'.

2017 | Speaker at Maker Faire Rome.

2016 | Speaker for the event: 'Festa di Primavera' organized by the University of Rome Tor Vergata.

2016 | Speaker for the Pint of Science event: 'Un lunedì da leoni: l'alba della nuova astronomia gravitazionale'.

2016 | Outreach in Rome High Schools.

## Miscellaneous

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### Computer skills

O.S. | Mac Os, Linux, Windows

Editing | Latex, Microsoft Office

Programming | C

Computing | Mathworks Matlab, Wolfram Mathematica, Kaleidagraph, Origin, LabView

Simulation S.W. | Ansys (FEA simulation tool), Zemax Optics Studio, OSCAR (Matlab tool)

### Languages

Italian | Mother tongue

English | Fluent

## Conferences and seminars

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- GWADW (Gravitational Wave Advanced Detector Workshop), 2023 May 22<sup>nd</sup>-27<sup>th</sup>, Isola d'Elba (Italy);
  - Talk: *A Bildungsroman of the TCS in Advanced Virgo*;
- Amaldi 14, 2021, July 19<sup>th</sup> -23<sup>rd</sup>, Australia:
  - Talk: *Optical aberration control for Advanced Virgo fourth observing run (O4)*;
- Invited talk about the Status of Advanced Virgo + during the 7<sup>th</sup> KAGRA International Workshop (KIW), 18<sup>th</sup>-20<sup>th</sup> December 2020 in National Central University, Taoyuan City, Taiwan;
- Speaker presenting O3a observing run catalogue paper on the dedicated Webinar (5<sup>th</sup> November 2020);
- GRASS Conference, 2019 October 16<sup>th</sup> -17<sup>th</sup>, Padova (Italy):
  - Talk: *Dynamical thermal compensation techniques for the Advanced Virgo*;
- 105<sup>th</sup> Congress of the Società Italiana di Fisica (SIF), 2019 September 24<sup>th</sup> -29<sup>th</sup>, L'Aquila (Italy):
- Amaldi 13, 2019 7<sup>th</sup>-12<sup>th</sup> July, Valencia (Spain):
  - Talk: *Development of a DC adaptive actuator for optical aberration correction in future gravitational wave detectors*.
  - Poster: *Characterization of an acousto-optic deflector for the correction of asymmetric wavefront distortions through high-speed CO2 beam scanning*.
- 10<sup>th</sup> ET Symposium, 2019 11<sup>st</sup>-12<sup>nd</sup> April, Orosei (Italy):
  - Poster: *Correction of optical aberration: lessons from 2nd generation towards future detectors*.
  - Talk *Engagement of the Thermal Compensation System in Advanced Virgo for O3 observing run*;
- 104<sup>th</sup> Congress of the Società Italiana di Fisica (SIF), 2018 September 18<sup>th</sup>, Arcavata di Rende (Italy):
  - Talk: *"Commissioning of the Advanced Virgo Thermal compensation system in gravitational wave interferometric detectors"*;
- GRASS 18, 2018 March 1<sup>st</sup>-2<sup>nd</sup>, Padova (Italy):

- Talk: *Adaptive optics methods in GW interferometric detectors, a perspective*
- 101<sup>st</sup> Congress of the Società Italiana di Fisica (SIF), 2015 September 21<sup>th</sup> -26<sup>th</sup>, Roma (Italy):
  - Talk: *“Control of the optical aberrations in gravitational-wave interferometric detectors”*;
- Workshop Adaptive Optics National Laboratory in Italy (ADONI) on the Adaptive Optics for the Astronomy, 2018 May 17<sup>th</sup>, Orvieto (Italy):
  - Talk: *Adaptive optics systems to tackle aberrations in Advanced Gravitational wave interferometric detectors.*
- Workshop Adaptive Optics National Laboratory in Italy (ADONI) on the Adaptive Optics for the Astronomy, 2016 April 14<sup>th</sup>, Florence (Italy):
  - Talk: *Coping with optical aberrations in gravitational wave interferometric detectors.*
- GWADW (Gravitational Wave Advanced Detector Workshop), 2013 May 19<sup>th</sup>-25<sup>th</sup>, Isola d’Elba (Italy);
- Amaldi 10 Conference on Gravitational Waves, 2013 July 7<sup>th</sup> -13<sup>th</sup>, Warsaw (PL):
  - Poster: *Thermal compensation system for non symmetric optical distortions in future gravitational wave detectors*
  - Poster: *Characterization of the Lasy-50 Co2 laser to be used in the Advanced Virgo TCS*

## Collaboration meetings

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- Presentations at Virgo collaboration meetings at the European Gravitational Observatory, Cascina (Italy);
- LVC (LIGO-Virgo Collaboration) meeting, 2019 March 19<sup>th</sup>, Lake Geneva (US):
  - Talk *Advanced Virgo TCS engagement*;
- LVC meeting, 2018 September 4<sup>th</sup>-7<sup>th</sup>, Maastricht (Holland):
  - Talk: *“Adv Thermal Compensation System status”*;
- LVC meeting, 2017 August 28<sup>th</sup> -September 1<sup>st</sup>, CERN – Genève (Switzerland):
  - Poster *Thermal Compensation in Advanced Virgo*;
  - Talk: *“Adaptive optical system for advanced gravitational waves interferometric detectors”*;

- Organization and Participation at the meeting “*Thermal noise: open problems*”, 2015 April 16<sup>th</sup> -17<sup>th</sup>, Roma Tor Vergata, Roma & GSSI, L’Aquila (Italy);
- LVC meeting, 2014 March 17<sup>th</sup> -21<sup>st</sup>, Nice (France):
  - Poster: “*Roma Tor Vergata test facility for the characterization of the Advanced Virgo TCS*”;
- Workshop on the electromagnetic follow-up for the gravitational waves, 2013 December 5<sup>th</sup>, Observatory of Monte Mario, Roma (Italy):
  - “*New perspectives in time domain astronomy: electromagnetic follow-up of gravitational wave candidates*”;
- LVC meeting, 2012 March 19<sup>th</sup>-23<sup>rd</sup>, Cambridge (USA):
  - Talk: “*Qs Measurements and Thermal Noise in Virgo+MS*”.

Rome, September 2023

# *Curriculum Vitae*

Gonzalo Rodríguez Fernández

## PERSONAL DETAILS

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*First Name:* Gonzalo  
*Family Name:* Rodríguez Fernández  
*Home address:*  
*Date of Birth:*  
*Place of Birth:*  
*Phone:*  
*E-mail:*

## PRESENT PROFESSIONAL STATUS

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**Professional status:** **Researcher**  
from: 01/07/2022  
**Institution:** Istituto Nazionale di Fisica Nucleare  
**Address:** Via della Ricerca Scientifica, 1  
00172, Rome, Italia  
**Phone:**  
**E-mail:**

## RESEARCH AREAS

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- Analysis of Earth Observation Imagery (multispectral, hyperspectral and SAR) for application in Land and critical infrastructure Monitoring, Precision Farming and Forest Monitoring.
- Astroparticle Physics: Cosmic Rays, High Energy Gamma-rays, High-Energy Neutrinos, Detection of Extensive Air Showers, Indirect Dark Matter detection.
- High-Energy Particle Physics: High-Energy Hadronic Interactions, Neutrino Interactions.
- Low-Energy Particle Physics: Strangeness Physics, Kaon Interaction, Hypernuclei

Field of study (UNESCO codes): 2290

## WORK EXPERIENCE

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- June 2018 to June 2019*      *Data Scientist at OMICA S.R.L.*  
Monitoring agriculture using satellite data.  
Via A. Spinetti, 10 - 00176 Roma - Italy
- April 2012 to June 2019:*      *Researcher at INFN(Istituto Nazionale di Fisica Nucleare)*  
Working with Dr. Aldo Morselli, Valerio Verzi & Paolo Privitera.  
*Sezione INFN di Tor Vergata, Roma, Italia*
- Jan. 2012 – March 2012:*      *Fellowship at Centre for Particle, Astroparticle and Nuclear Physics.*  
Working with Prof. Enrique Zas's group.  
University of Santiago de Compostela, Spain.
- Set. 2011 to Dec. 2011:*      *Fellowship at INFN(Istituto Nazionale di Fisica Nucleare).*  
Working with Dr. Catalina Curceanu's group.  
Laboratorio Nazionale di Frascati, Roma, Italia.
- Set. 2009 – Set. 2011:*      *Postdoctoral researcher at CPAN(Centre for Particle, Astroparticle and Nuclear Physics).*  
Working with Prof. Enrique Zas's group.  
University of Santiago de Compostela, Spain.
- Nov. 2006 – Jul. 2009:*      *Postdoctoral researcher.*  
Working with Prof. Giorgio Matthiae's group.  
*Sezione INFN di Tor Vergata, Roma, Italia*

## EDUCATION & TRAINING

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- Mar. 23, 2007:*      *Ph. D. in Physics: University of Santiago de Compostela, Spain*  
Advisor: Prof. Enrique Zas and Dr. Ángeles López.  
Dissertation: "Horizontal Air Showers At The Pierre Auger Observatory".
- Jun. 22, 2004:*      *Master of advanced studies in Physics*  
Advisor: Dr. Carlos Merino  
Dissertation: "Simulation and calibration of the Cherenkov detectors in the Pierre Auger Observatory".4
- May 23, 2002:*      *Laurea in Physics: University of Santiago de Compostela, Spain*  
Advisor: Dr. Carlos Merino  
Dissertation: "Jets observables en la ecuación BFKL".
- Mar. 16, 2001:*      *Bachelor Degree in Physics*  
University of Santiago de Compostela, Spain



## **RESPONSIBILITIES WITHIN THE OMICA S.R.L**

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Development of automated processing chains with application of Machine Learning Models to:

- Monitor land and critical infrastructure stability
- Monitor agriculture fields & Geoparks using Sentinel 1 & 2, MODIS & Landsat8 data.
- Modelling and forecasting solar panels output power.

## **RESEARCH & LAB ACTIVITIES FOR THE Istituto Nazionale di Fisica Nucleare**

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- I have designed and participated in the construction of a dark camera and the acquisition system to test and calibrate the photomultipliers used in the Pierre Auger observatory.
- I have designed and participated in the construction of a dark camera and the acquisition system to test and characterize the Silicon detectors to be used in the CTA observatory.
- I have created a test facility to check the timing synchronization based on the White Rabbit system. I have supervised the purchases and the implementation of the different components of the white rabbit network: routers, network cards, optical fibers, etc. This facility will be used for the CTA but also for other future experiment
- I have designed and participated in the commissioning of the anechoic RF Chamber necessary for the AMY experiment, I have supervised the purchases and the implementation of the acquisition system of the RF laboratory. Broadband oscilloscopes, spectrum analyzers and signal generators between 100 MHz and 30 GHz.
- I have participated in the calibration and characterisation of the RF antennas for the AMY experiment.
- Optimization of the Silicon tracker detector geometry to be use on a satellite experiment.
- Dark Matter studies from MeV to TeV energy range.
- Trigger studies of the Large and Small telescopes using montecarlo simulation simtelarray.
- Responsible for migration of standalone reconstruction program for reconstruction of inclined showers to the Official Software package.
- Maintenance of the GEANT4 module in the Offline package.

## OUTREACH & ORGANISATIONAL SKILLS ACTIVITIES

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- 7<sup>th</sup> Roma International Conference on AstroParticle Physics, Roma (Italy), 4-7 Sep 2018
- 6<sup>th</sup> Roma International Conference on AstroParticle Physics, Roma (Italy), 21-24 June 2016
- Blog author: <https://statandcode.wordpress.com/>
- Webmaster: <https://asieriitalia.wordpress.com>
- Interview at V television:  
[http://www.vtelevision.es/informativos/meteo/2012/03/08/0031\\_62\\_129591.htm?utm\\_source=buscador&utm\\_medium=buscador](http://www.vtelevision.es/informativos/meteo/2012/03/08/0031_62_129591.htm?utm_source=buscador&utm_medium=buscador) *¿Podría haber auroras boreales en Galicia?* (03/08/2012)
- Interview at V television:  
[http://www.vtelevision.es/informativos/meteo/2012/04/03/0031\\_62\\_134152.htm?utm\\_source=buscador&utm\\_medium=buscador](http://www.vtelevision.es/informativos/meteo/2012/04/03/0031_62_134152.htm?utm_source=buscador&utm_medium=buscador) *¿Ha sufrido un chispazo últimamente?* (03/04/2012)
- Organizer of the research project “Searching the most energetic particles in the Universe” aimed at high-school students, and funded by the Ministerio de Educación and Fundación Española de Ciencia y Tecnología (Spain), Univ. Santiago de Compostela, 3-30 July 2011.
- Teacher in “Hands on Particle Physics: International Masterclass for High School Students 2011”, Santiago de Compostela (Spain), 21 March 2011.
- Organizer in the exhibition “Discovering the misteries of the Universe with Particle Physics”, Department of Particle Physics, Univ. Santiago de Compostela, 17-27 January 2011.
- Interview at Torvergata.TV: <http://www.torvergata.tv/tv/diretta.asp?clipID=198>, *Osservatorio di raggi cosmici Pierre Auger, Italia (September 2008)*
- Teacher in “Hands on Particle Physics: International Masterclass for High School Students 2005”, Santiago de Compostela (Spain), 29 March 2005.

## COMPUTING SKILLS

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<i>Operating systems:</i>	MS-DOS, Windows, GNU/Linux, Mac OS.
<i>Analysis Physics software:</i>	ROOT, PAW, IBM-SPSS, Mathematica, R
<i>Monte Carlo Simulation software:</i>	Geant4, AIRES, CORSIKA, simtelarray.
<i>Programming languages:</i>	C/C++, Java, JavaScript, HTML/CSS, JQuery, MySQL, Fortran, Python, php, Lua, and shell scripts.
<i>Word Processing:</i>	LaTeX, MS Office, OpenOffice.
<i>Open Hardware:</i>	Arduino, Raspberry Pi, White Rabbit system.
<i>Mobile App dev:</i>	Eclipse IDE for Java Developers, Corona SDK.
<i>Dev. Framworks:</i>	RStudio, Eclipse, jupyter, emacs.

Application for Android (Educational)

MyPendulum: <https://play.google.com/store/apps/details?id=eu.science.eu.appendulo&hl=it>

Muon Flux: <https://play.google.com/store/apps/details?id=it.android.muonflux&hl=it>

## LANGUAGES SKILLS

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Galician (native)

Spanish (native)

English (fluent)

Italian (fluent)

## REFERENCES

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- Enrique Zas Arregui, Professor (Head of the Astroparticle Physics Group)  
Department of Particle Physics, University of Santiago de Compostela  
Campus Vida s/n, 15782 Santiago de Compostela, Spain  
E-mail:  
Tel: , Fax:
- Jaime Àlvarez Muñiz, Associate Professor (Head of the Neutrino Team in the Pierre Auger Observatory)  
Department of Particle Physics, University of Santiago de Compostela  
Campus Vida s/n, 15782 Santiago de Compostela, Spain  
E-mail:  
Tel: , Fax:
- Valerio Verzi, Professor (Head of the Astroparticle Physics Group)  
Department of Particle Physics, Università degli studi di Roma Tor Vergata  
Via della Ricerca Scientifica 1, 00133 Roma, Italy  
E-mail:  
Tel: +
- Aldo Morselli, Professor (Head of the CTA Group at Roma II)  
Department of Particle Physics, Università degli studi di Roma Tor Vergata  
Via della Ricerca Scientifica 1, 00133 Roma, Italy  
E-mail:  
Tel: