**Curriculum sintetico prof. Alessandro Cianchi**

Alessandro Cianchi, professore Associato in Fisica Applicata presso il dipartimento di Fisica dell'Università di Roma Tor Vergata.

Tiene, da 10 anni, il corso di Acceleratori di Particelle - Particle Accelerators for Science and Interdisciplinary Applications presso lo stesso dipartimento e ha da 8 anni l'affidamento dei corsi di Fisica Generale I e Fisica Generale II per il corso di laurea online in ingegneria gestionale presso il dipartimento di Ingegneria dell'impresa nello stesso ateneo.

Precedentemente, per 7 anni, ha tenuto le esercitazioni di elettronica del corso di Laboratorio 3 per la laurea triennale in fisica.

Ha insegnato nelle scuole del Cern, CAS Accelerator School, negli anni 2009, 2011, 2015, 2017, 2018, trattando argomenti riguardanti la diagnostica dei fasci di particelle.

È esperto di diagnostica dei fasci di particelle.

È stato responsabile nazionale per l'INFN, di cui è associato con incarico di ricerca da più di 20 anni, degli esperimenti ODRI e ODRI2D, è responsabile locale per la sezione di Roma Tor Vergata dell'esperimento SL_COMB2FEL.

È stato responsabile del Working Package 15 Diagnostics nel progetto europeo EuPRAXIA. È attualmente responsabile del Working Package 8, Diagnostics, nel progetto europeo CompactLight.

È responsabile del Working Group 13 Beam Diagnostics nel Progetto EuPRAXIA@SPARC_LAB.

È stato responsabile scientifico del progetto Responsabile scientifico progetto regionale TECNOMUSE (TECNOlogia MUOnica per la SicurEzza nei porti).

Ha avuto 12 inviti per talk a conferenza.

È stato chair del comitato di programma della conferenza 2019 Isola d'Elba 4th European Advanced Accelerator Concepts.

E' stato membro del comitato di programma delle seguenti conferenze: 2016 Barcelona IBIC16 (international Beam Instrumentation Workshop) , 2016 Havana Physics and Applications of High Brightness Beams, 2014 Trieste 6th microbunching instability workshop, 2013 Isola d'Elba 1st European Advanced Accelerator Concept workshop.

È autore in collaborazione di 115 articoli, con h-index pari a 29 e citazioni pari a 4811 (fonte Scopus)

Il sottoscritto, consapevole che, ai sensi ai sensi degli articoli 46 e 47 del D.P.R. 445 del 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 vigenti in materia, dichiara sotto la propria responsabilità la veridicità delle seguenti informazioni contenute nel curriculum vitae.

Roma, 25/05/2021 Firma

# Curriculum Scientifico di Barbara Liberti

**Luogo e data di nascita:**

**Indirizzo e-mail:** Barbara.Liberti@roma2.infn.it

**Formazione e carriera professionale**

- Diploma di Laurea in Fisica conseguito il 30 Maggio 1996, presso l'Università degli Studi di Roma "La Sapienza", con votazione 110/110, Titolo della tesi: "Studio di un prototipo di rivelatore optoelettronico basato su un dispositivo Electron Bombarded CCD e relativa acquisizione."
- Titolo di Dottore di Ricerca in Fisica conseguito il 21 Febbraio 2000, presso l'Università degli studi di Roma "Tor Vergata", Titolo della tesi: "RPCs as ATLAS Trigger detectors at LHC."
- Assegno di ricerca aggiuntivo di durata semestrale per la collaborazione ad attività di ricerca da svolgersi presso il Dipartimento di Fisica dell' Università degli Studi di Roma "Tor Vergata", relativo al programma di ricerca: "La Camera ad Elettrodi Piani Resistivi(RPC): un nuovo rivelatore a gas per la fisica dei muoni ad LHC." (settori disciplinari B01A-B04X, tutore Prof. Rinaldo Santonico). L'assegno semestrale vinto nel Maggio del 2000, in una selezione pubblica per titoli integrata da un colloquio, è stato rinnovato per la massima durata consentita fino a Giugno del 2001.
- Assegno di ricerca aggiuntivo di durata semestrale per la collaborazione ad attività di ricerca da svolgersi presso il Dipartimento di Fisica dell' Università degli Studi di Roma "Tor Vergata", relativo al programma di ricerca: "Progetto, realizzazione e test di circuiti elettronici di Front-End per rivelatori veloci di ionizzazione da impiegare nella fisica di particelle." (settori disciplinari B01A-B04X, tutore Prof. Rinaldo Santonico). L'assegno semestrale vinto nel Gennaio del 2002, in una selezione pubblica per titoli integrata da un colloquio, è stato rinnovato per la massima durata consentita fino a Dicembre del 2002.
- Contratto di collaborazione didattica per il corso di Fisica Sperimentale, per il Corso di Laurea Breve in "Scienze dei Media e della Comunicazione", presso Dipartimento di Matematica della Facoltà di Scienze Matematiche, Fisiche e Naturali dell'Università di Roma "Tor Vergata". La collaborazione iniziata nell'anno accademico 2002-2003, si è ripetuta nell'anno accademico 2003-2004.
- Assegno di ricerca di durata biennale per la collaborazione ad attività di ricerca da svolgersi presso il Dipartimento di Fisica dell' Università degli Studi di Roma

“Tor Vergata”, relativo al programma di ricerca: “Sviluppo di strumentazione elettronica per rivelatori di particelle ad alta risoluzione temporale.” (settori disciplinari FIS/01 e FIS/04, tutore Prof. Rinaldo Santonico). L’assegno è stato vinto nell’Ottobre del 2003, in una selezione pubblica per titoli integrata da un colloquio.

- Contratti di lavoro con profilo professionale di ricercatore, ai sensi dell’art.23 legge 70/75, presso la Sezione ”Tor Vergata” dell’INFN, dal Dicembre 2005 al Maggio del 2011.
- Contratto di collaborazione coordinata e continuativa per lo svolgimento di attività di tutoraggio sul corso di Fisica Generale SSD FIS/01 per l’a.a. 2008/2009 della Facoltà di Ingegneria dell’Università di Roma “La Sapienza” .
- Contratto di lavoro a tempo indeterminato con profilo professionale di ricercatore dal Giugno del 2011, presso la Sezione di Trieste dell’INFN. Nel Novembre del 2015 ottiene il trasferimento presso la sezione INFN di ”Tor Vergata” dove attualmente presta servizio.

**Ruoli istituzionali e responsabilità**

| | |
|---|---|
| dal 2011 | Attività di tutoraggio per numerose tesi di laurea (n. 10) e di dottorato (n. 3), presso il Dipartimento di Fisica dell’Università di Roma ”Tor Vergata” |
| dal 2014 | Autrice di referaggi per la rivista internazionale JINST Journal of Instrumentation |
| 2017 - 2019 | Membro della commissione per Assegni di Ricerca della sezione di Roma INFN ”Tor Vergata” |
| dal 2019 | Membro del comitato utenti per la BTF (Beam Test Facility) dei LNF dell’INFN |
| 2020 | Chair della conferenza internazionale ”XV Workshop on Resistive Plate Chambers and Related Detectors RPC2020”, e successivamente membro del comitato scientifico internazionale della stessa conferenza |
| 2020 | Editor dei Proceedings della Conferenza, 15th Workshop on Resistive Plate Chambers and Related Detectors (RPC2020), pubblicato su JINST 15 (2020) 10 |
| dal 2020 | Membro esperto per il gruppo di lavoro WP1 ”Gaseous Detectors” dell’”ECFA Detector R&D Roadmap” |
| dal 2021 | Membro della prima commissione scientifica nazionale CSN1 dell’INFN, come coordinatore della sezione di Roma INFN ”Tor Vergata” |

**Attività di ricerca**

1989 - 1996 Svolge il suo lavoro di tesi nell'ambito dell'esperimento ACTAR, Gruppo V INFN, su rivelatori di particelle traccianti ad alta risoluzione spaziale, costituiti da capillari di vetro riempiti di liquido scintillante, letti da una catena optoelettronica composta da un dispositivo ad accoppiamento di carica, CCD o EBCCD (Electron Bombarded CCD), preceduto da una catena di intensificatori di immagine. L'esperimento dal 1995 fa parte di un progetto di ricerca e sviluppo (progetto RD46) approvato dal CERN.

1997 - 2008 Come dottoranda e poi assegnista partecipa alla ottimizzazione, al test delle prestazioni, alla costruzione ed al commissioning dei rivelatori RPC (Resistive Plate Chamber), per il rivelatore a muoni del Barrel dell'esperimento ATLAS ad LHC (CERN). Si è occupata dell'ottimizzazione della miscela di gas, della costruzione e dei test dei primi prototipi a larga superficie, dell' elettronica di Front-End dei rivelatori RPC, curando il progetto e la realizzazione di un sistema di test per le schede dell'intera produzione dell'esperimento ATLAS e dell'esperimento ARGO. Ha partecipato ai test dedicati all'assemblaggio con i rivelatori MDT, al fine di formare le stazioni moduli elementari del sistema di Trigger di ATLAS, presso i Laboratori Nazionali di Frascati e poi presso il sito sperimentale BB5 del CERN. Ha curato lo sviluppo di una stazione di test con raggi cosmici, presso i laboratori dell'INFN della Sezione Roma-Tor Vergata, per il controllo funzionale e la verifica delle prestazioni degli RPC "BOL" di ATLAS, che sono i moduli di massima dimensione nel Barrel Trigger (circa 2,5 x 5,0 $m^2$). Il sistema è caratterizzato da un altissimo numero di canali di lettura (circa 4400). Ha condotto come responsabile il test sulle prime 150 unità RPC BOL. Come ricercatore a tempo determinato partecipa al commissioning dell'esperimento ATLAS, contribuendo a tutte le fasi della presa dati con raggi cosmici sull'apparato.

2009 - 2011 Si è dedicata allo studio sistematico di prototipi RPC di piccole dimensioni con diversi spessori del volume sensibile, equipaggiati con una elettronica innovativa. Il test è inserito in un progetto più ampio per aumentare le prestazioni del rivelatore ad elevate rate di conteggio ($> 1$ kHz/$cm^2$), mantenendo inalterate le proprietà di risoluzione temporale ed efficienza.

6/2011 - 9/2011 Come ricercatrice presso i laboratori dell'INFN di Trieste, collabora con il gruppo che progetta, sviluppa e testa un rivelatore a microstrip di silicio, ad alta resistività e doppio strato. Il detector era candidato a costituire il layer 0 del tracciatore di vertice al silicio dell'esperimento SuperB (SVT).

10/2011 - 2013 Presso i laboratori dell'INFN della sezione Tor Vergata nell'ambito dell' esperimento ATLAS conduce la costruzione ed il test in laboratorio di diversi prototipi di RPC da candidare per l'upgrade del trigger dell'end-cap dell'esperimento ATLAS (progetto NSW ATLAS). I prototipi testati sono caratterizzati da gap di gas sottili (1 mm) e bigap (1 + 1 mm), da elettrodi di read-out segmentati con strip di lettura sottili (2 mm di passo) e baricentro di carica veloce ottenuto tramite un circuito appositamente sviluppato (maximum selector). Tutti i prototipi sono equipaggiati con una innovativa elettronica di Front-End che aumenta la sensitività e diminuisce il rapporto segnale rumore permettendo di lavorare a campi e dunque a cariche per conteggio più basse di un ordine di grandezza, aumentando la rate capability a parità di invecchiamento. I detector testati alle beamtest facilities di H8 ed X5 al CERN hanno mostrato le prestazioni aspettate in risoluzione spaziale (130 $\mu$m) e temporale ($< 0.5$ ns) e per rate capability (fino a 10 kHz/cm$^2$).

Studia le prestazioni ed il data quality degli RPC di ATLAS, con dati ad alta statistica estratti dal secondo livello di trigger di ATLAS (calibration stream) presso diversi centri Tier2. L'obiettivo è la produzione di figure significative per il data quality per identificazione automatica di problematiche connesse alle performance del detector.

2013 - 2018 Nell'ambito di un R&D dell'INFN "ATLAS/CMS RPC per Fase 2", ha condotto studi sulle prestazioni degli RPC con nuove miscele di gas. La miscela "Standard" (TFE/IsoBut/SF6=96.5/3/0.5) presenta il problema di avere un elevato Global Warming Power (GWP) di $\sim$ 1500. Il limite internazionale imposto GWP $\leq$ 150 rende quindi necessario trovare un gas che sostituisca a parità di prestazioni la miscela standard. La definizione di nuove miscele necessita non solo un approfondito studio sulle prestazioni del detector e dei parametri caratteristici della miscela, ma anche un accurato studio sull'invecchiamento e sulle prestazioni ad alta rate. Uno dei candidati studiati e' il Tetrafluoropropilene, HFO1234-ze, con un GWP=6. Il gas studiato ha dato fino ad ora risultati interessanti e promettenti.

2019 - 2021 Continua lo studio di miscele gassose ecocompatibili, iniziando una collaborazione internazionale RPC-ECOGas@Gif++, per il test di invecchiamento del rivelatore e le prestazioni ad alta rate. Il piano di lavoro di questa collaborazione viene approvato in un working package del progetto europeo di finanziamento AIDAInnova (Advanced Infrastructures for Detectors and Accellerators). Continua lo studio di prototipi innovativi, sia nello spessore dell'elettrodo del detector (¡1mm) che per i materiali degli elettrodi (GaAs, vetri fenolici), per il raggiungimento di rate di conteggio (>10 kHz/cm$^2$).

È autrice ATLAS dall'inizio dell'esoerimento ed ha più di 60 pubblicazioni sulla fisica e sullo sviluppo del rivelatori.

# ANDREA MOSTACCI
## Curriculum Vitae

Place **Rome**
Date **22 May 2018**

**Part I – General Information**

| | |
|---|---|
| Full Name | **Andrea Mostacci** |
| Place and date of Birth | |
| Passport Number | |
| Citizenship | Italian |
| Permanent Address | |
| Mobile Phone Number | |
| E-mail | Andrea.Mostacci@uniroma1.it |
| Spoken Languages | Italian (mother tongue), English, French (basic knowledge) |

**Part II – Education**

| Type | Year | Institution | Notes (Degree, Experience …) |
|---|---|---|---|
| University graduation | 1997 | Sapienza University of Rome | **Electronic Engineering** degree with a dissertation on “Coupling impedance of pumping holes for LHC beam pipe” - **110/110 cum laude** |
| Post-graduate studies | 1997 | European Scientific Institute, Archamps (France) | Joint Universities Accelerator School, Course on **Particle Accelerator Physics** |
| Post-graduate studies | 1999 | CERN Accelerator School, Bénodet (France) | Course on **General Accelerator Physics**, Intermediate Level |
| PhD | 2001 | Sapienza University of Rome | Applied Electromagnetism and Electro-Physical Science, XIII cycle. Thesis on “**Beam wall interaction in the LHC liner**” |
| Licensure | 1997 | Sapienza University of Rome | Licensure for the profession of engineer |
| Licensure | 2013 | MIUR Ministry of Education, University and Research | National Academic Qualification as Associate Professor 2012 in Area 02-A1 **Experimental Physics of Fundamental Interactions** |
| Licensure | 2013 | MIUR Ministry of Education, University and Research | National Academic Qualification as Associate Professor 2012 in Area 02-B3 **Applied Physics** |

**Part III – Appointments**

IIIA – Academic Appointments

| Start | End | Institution | Position |
|---|---|---|---|
| 1/2018 | Today | Sapienza University of Rome | **Associate Professor** at the Department of Basic and Applied Science for Engineering (SBAI) |
| 11/2006 | 12/2017 | Sapienza University of Rome | **Assistant Professor** at the Department of Basic and Applied Science for Engineering (SBAI), former Energetics Department |
| 04/2006 | 10/2006 | Sapienza University of Rome | **Researcher** on Accelerator Physics (Co.Co.Co.) at the Department of Basic and Applied Science for Engineering (SBAI), former Energetics Department |
| 04/2002 | 03/2006 | Sapienza University of Rome | **Researcher** on Experimental techniques for accelerators and particle physics (Assegno di Ricerca) at the Department of Basic and Applied Science for Engineering (SBAI), former Energetics Department |
| 04/2008 | 06/2008 | Sapienza University of Rome | Member of the "Research and cultural activity'' working group of the Faculty of Engineering |
| 09/2015 | 09/2015 | Sapienza University of Rome | **Member of the selection board** for the PhD in Accelerator Physics |
| | | Sapienza University of Rome | **Supervisor** of theses in Electronic Engineering, Nuclear Engineering and **assistant supervisor of PhD thesis** in Applied Electromagnetism and Accelerator Physics |
| | | Sapienza University of Rome | **Member of several boards for selection** of research and post-doc grants at the SBAI Department |
| | | | |
| 2011 | Today | Sapienza University of Rome | Member of the Professor Board of **Electronic Engineering** |
| 2012 | Today | Sapienza University of Rome | Member of the Professor Board of **Electrical Engineering** |
| 2016 | Today | Sapienza University of Rome | **Member of Professor Board of the PhD** in Sciences and Technologies for Complex Systems |
| 2004 | 2009 | Sapienza University of Rome | Member of the Professor Board of **Aerospace Engineering** |

IIIB – Research Appointments

Coordination of national and international researcher teams

| Start | End | Institution | Position |
|---|---|---|---|
| 11/2015 | Today | Sapienza, University of Rome | **Coordination of Work Package on “Accelerator prototyping and experiments at Test facilities”** (WP12) of the project “Compact European Plasma Accelerator with superior beam quality” (EUPRAXIA); Horizon 2020 grant agreement No 653782 |
| 01/2015 | Today | INFN-Laboratori Nazionali di Frascati (LNF)<br><br>Sapienza, University of Rome | **Coordination of diagnostics group** for the linear accelerator of the Compton Gamma Source being built in the Extreme Light Infrastructure for Nuclear Physics (ELI-NP), Magruele (Romania) |
| 05/2002 | Today | SBAI Department-Sapienza | **Coordination** of the activity in the **Accelerator Laboratory** (former Accelerator and Detector Lab. of the Energetic Dep.) |
| 2012 | 2014 | SBAI Department-Sapienza | **Coordination of the Work Package "Accelerators: Novel compact particle sources"** (WP6) of the project “Cluster of Research Infrastructures for Synergies in Physics” (CRISP) in the framework of FP7-INFRASTRUCTURES-2011-1 |
| 2006 | 2013 | INFN-Laboratori Nazionali di Frascati (LNF) | **Coordination of the data analysis** of all the experiments executed on the SPARC photo injector at the LNF-INFN |

Research activity in qualified international institutions

| Start | End | Institution | Position |
|---|---|---|---|
| 04/2014 | 07/2014 | CERN-Geneva (CH) | **Visiting Scientist** (2 weeks) |
| 07/2013 | 07/2013 | CERN- Geneva (CH) | **Visiting Scientist** (1 month) |
| 08/2002 | 08/2002 | CERN- Geneva (CH) | **Visiting Scientist** (1 month) |
| 05/2001 | 04/2002 | CERN- Geneva (CH) | **Research Fellowship** |

Research activity in qualified national institutions

| Start | End | Institution | Position |
|---|---|---|---|
| 2012 | Today | INFN-Roma 1 Section | **Research appointment** renewed yearly on particle accelerators activities |
| 2008 | 2011 | INFN-Laboratori Nazionali di Frascati (LNF) | **Research appointment** renewed yearly on particle accelerators activities |
| 1998 | 2007 | INFN-Laboratori Nazionali di Frascati (LNF) | **Association appointment** renewed yearly on particle accelerators activities |
| | | INFN-Laboratori Nazionali di Frascati (LNF) | **Member of various selection boards** for research and technologist in Accelerator Science |

Integration in the Accelerator Physics international community

| Start | End | Institution | Position |
|---|---|---|---|
| 05/2014 | Today | Sapienza, University of Rome | **Governing board of EuroGammaS**, the European Consortium for the delivery of a High Intensity Gamma Beam System to the Extreme Light Infrastructure for Nuclear Physics (ELI-NP) |
| 2008 | Today | American Physical Society | **Referee** of Physical Review - Accelerators and Beams (former PRST-AB) |
| 2006 | Today | Elsevier | **Referee** of Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment |

IIIC – Other Appointments

| Start | End | Institution | Position |
|---|---|---|---|
| 06/1999 | 05/2001 | CERN- Geneva (CH) | **Doctoral Student** |
| 12/1997 | 07/1998 | CERN- Geneva (CH) | **Technical Student** |

**Part IV – Teaching experience**

IV A – Teaching experience at Sapienza University of Rome

| Year | Faculty | Lecture/Course |
|---|---|---|
| **From 2015-16 to Today** | Electrical Engineering (Bachelor degree) | **Physics II** (9 CFU, about 80 students) |
| | Electronic Engineering (Master degree) | Multidisciplinary Electronic Laboratory (**RF measurement module**, 3 CFU, 40 students) |
| **2014-15** | Electrical Engineering (Bachelor degree) | **Physics II** (9 CFU, about 80 students) |
| | Electronic Engineering (Master degree) | Multidisciplinary Electronic Laboratory (**RF measurement module**, 3 CFU, 30 students) |
| **2013-14** | Electrical Engineering (Bachelor degree) | **Physics II** (9 CFU, about 40 students) |
| | Electronic Engineering (Master degree) | **High Frequency measurement laboratory** (6 CFU, module of the course High Frequency system, 5 students) |
| **2012-13** | Electrical Engineering (Bachelor degree) | **Physics II** (9 CFU, about 40 students) |
| | Electronic Engineering (Master degree) | **High Frequency measurement laboratory** (6 CFU, module of the course High Frequency system, 5 students) |
| **2011-12** | Electronic Engineering (Master degree) | **High Frequency measurement laboratory** (6 CFU, module of the course High Frequency system, 5 students) |
| **2009-10** | Mechanical Engineering (Bachelor degree) | **Laboratory of Experimental Physics** (3 CFU, about 30 students) |
| **2008-09** | Aerospace Engineering (Bachelor degree) | **Laboratory of Experimental Physics** (4 CFU, about 90 students) |
| **2007-08** | Aerospace Engineering (Bachelor degree) | **Laboratory of Experimental Physics** (4 CFU, about 90 students) |
| | Clinical Engineering (Bachelor degree) | **Physics I** (5 CFU, about 80 students) |
| | Science for Engineering (Master Degree) | **Modern Physics Laboratory** (4 CFU, about 10 students) |
| **2006-07** | Aerospace Engineering (Bachelor degree) | **Laboratory of Experimental Physics** (4 CFU, about 90 students) |
| | Science for Engineering (Master Degree) | **Modern Physics Laboratory** (4 CFU, about 10 students) |
| **2005-06** | Aerospace Engineering (Bachelor degree) | **Laboratory of Experimental Physics** (60 hours, about 90 students) |

| | | |
|---|---|---|
| **2004-05** | Aerospace Engineering (Bachelor degree) | **Laboratory of Experimental Physics** (60 hours, about 90 students) |
| **2003-04** | Environmental Engineering (Bachelor degree), Rieti site | **Physics II** (6 CFU, about 20 students) |
| **2002-03** | Transportation Engineering (Bachelor degree), Civitavecchia site | **Physics II** (6 CFU, about 10 students) |
| | Transportation Engineering (Bachelor degree), Civitavecchia site | **Physics I** (6 CFU, about 10 students) |

IV B – International University level teaching experience

| Year | Place | Lecture/Course |
|---|---|---|
| 2017-2019 | ESI course, Joint University Accelerator School, Archamps (France) | **Introduction to RF** |
| 2014 | Accelerator Laboratory, SBAI Department, Sapienza University | **RF measurements**, 1 week intensive course for CERN researchers |

**Part V - Society memberships, Awards and Honours**

| Year | Title |
|---|---|
| From 2013 | **Member of SIF** (Italian Physical Society) and EPS (European Physical Society) |
| September 2014 | **Notice for oral communication** at Annual Meeting of the Italian Physical Society: "**Comb beam for particle driven plasma based accelerators**". |
| May 2001<br>April 2002 | Awarded of **Fellowship** by CERN, Geneva – CH |
| June 1999<br>April 2001 | Awarded of **Doctoral Student grant** by CERN, Geneva – CH |
| December 1997<br>July1998 | Awarded of **Technical Student grant** by CERN, Geneva – CH |
| January 1997 | **Winner** (6th classified over 30 positions available) in the competition organized by the INFN for grants for undergraduates, for starting the research activity at the INFN – LNF. |
| June 2001 | **APS/IEEE Student Travel Award** to join the Particle Accelerator Conference 2001, Chicago (USA). |
| June 2000 | **Financial Support for Young Scientists** to join the European Particle Accelerator Conference 2000, Vienna. |
| March 2009 | **Student Fellowship** to join the Particle Accelerator Conference 1999, New York (USA). |

**Invited Talks**

| Date | Conference | Title |
|---|---|---|
| 11/2004 | **Care-HHH Workshop** “Beam Dynamics in Future Hadron Colliders and Rapidly Cycling High-Intensity Synchrotrons”, CERN, Geneva (Switzerland) | RF coupling impedance measurements versus simulations |
| 06/2011 | **China-Italy Bilateral Workshop** “New Advanced Coherent Light Sources’’, Beejing (China) | SPARC/SPARX activity at LNF |
| 09/2011 | **International Particle Accelerator Conference** (IPAC 2011), San Sebastian (Spain) | Advanced Beam Manipulation Techniques at SPARC FEL Facility |
| 10/2013 | **International Seminar** “Advanced Accelerator and Radiation Physics”, Adyge State University, Maykop (Russia) | Frontiers in modern accelerator physics |
| 04/2014 | **ICFA Workshop** on “Electromagnetic wake fields and impedances in particle accelerators’’ Erice, Italy | History and development of bench measurement techniques for impedance evaluation |
| 11/2014 | 1st Particle Accelerator Components Metrology and Alignment to the Nanometre scale (**PACMAN**) Workshop, CERN, Geneve (Switzerland) | Stretched wire measurements and impedance matching |
| 04/2015 | **Advances in X-ray Free-Electron Lasers Instrumentation**, SPIE Optics Optoelectronics, Prague (Czech Republic) | Operational experience on the generation and control of high brightness electron bunch trains at SPARC-LAB |
| 11/2015 | **EuCARD-2 XBEAM-XRING-XLINAC** Workshop “Beam Dynamics meets Diagnostics” | Measurements of small impedances |
| 03/2016 | **ICFA Workshop** “Physics and Applications of High Brightness Beams”, Havana, Cuba | ELI: New frontiers of particle acceleration and radiation sources |
| 08/2017 | **IBIC 17** “International Beam Instrumentation Conference”, Grand Rapids, USA | Overview of the Diagnostics of the ELI-NP Gamma Beam System: Challenges for the Electron-Photon Interaction Point Diagnostics |
| 09/2017 | **ICFA Workshop** on “Impedances and Beam Instabilities in Particle Accelerators”, Benevento, Italy | Challenges and Pitfalls for impedance measurements in the lab |

**Paper awards**

The series of Virtual Journals in the physical science are designed by American Institute of Physics and the American Physical Society to highlight papers considered relevant to Nanoscience and Nanotechnology, Ultrafast Science, Biophysics, Quantum Information and Superconductivity.
A publication of A. Mostacci has been selected for Virtual Journal of Ultrafast Science:

> M. Ferrario, **A. Mostacci**, et al., “**Direct measurement of the double emittance minimum in the beam dynamics of the SPARC high-brightness photoinjector**”, selected for Virtual Journal of Ultrafast Science, **January 2008** Vol. 7, Issue 1 - High Field Physics.

**Part VI - Funding Information**

VI A – Grants as **Principal Investigator**

| Year | Title | Program | Grant Value |
|---|---|---|---|
| 2018 | Fondo per il finanziamento delle attività base di ricerca | ANVUR-FABR | 3k€ |
| 2018 | Beam energy measurement in advanced linear particle accelerators for electrons | **Sapienza Research Projects** (Medium Size) | About 13k€ |
| 2017 | Advanced beam position monitors for the Compton Gamma Source of the Extreme Light Infrastructure | **Sapienza Research Projects** (Medium Size) | About 38k€ |
| 2014-16 | Plasma based acceleration at SPARC-LAB | **National Scientific Committee V** of INFN (research unit responsible) | About 40k€ |
| 2013-16 | European FEL Design Study (EuroFEL project) | **National Scientific Committee V** of INFN (research unit responsible) | About 300k€ |
| 2012-15 | Generation of high brightness electron beams from plasma-based accelerators | **FIRB**-Futuro in Ricerca 2012 (research unit responsible) RBFR12NK5K_002 | About 180k€ |

VI B – Grants as **Investigator**

| Year | Title | Program |
|---|---|---|
| 11/2015 | **EUPRAXIA** – Compact European Plasma Accelerator with superior beam quality | **Horizon 2020** |
| 2013 | Optimization of a plasma-based short pulse laser amplifier | **Sapienza** Research Projects |
| 2012-14 | Cluster of Research Infrastructures for Synergies in Physics (**CRISP** project) | **FP7**-INFRASTRUCTURES |
| 2012 | ELI-NP | MIUR-FOE-INFN |
| 2012 | EUROFEL | MIUR-FOE-INFN |
| 2012 | ELI-NP | MIUR-FOE |
| 2010 | Charged particle beams from laser-plasma sources for medical applications | **Sapienza** Research Projects |
| 2008 | Innovative nanomaterials and nanostructures for photo-emission and field emission based devices | **FIRB** – Futuro in Ricerca - MIUR |
| 2006 | SPARX (phase II) | **FIRB** - MIUR |
| 2004 | SPARX (phase I) | **FIRB** - MIUR |
| 2002 | SPARC | **FISR** - MIUR |
| Since 2001 | Projects related to particle accelerator | **Sapienza** Research Projects |
| Since 2001 | Projects related to particle accelerator | **National Scientific Committee V** of INFN |
| Since 2001 | Projects related to particle accelerator | **New Techniques of Acceleration** NTA-INFN |

## Part VII – Research Activities

| Keywords | Brief Description |
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| Circular accelerators, Coupling impedance, | The electromagnetic interaction between the beam in a particle accelerator and its surrounding (beam pipe) in a circular accelerator is studied with the coupling impedance. Such interaction can lead to energy losses (longitudinal impedance) or transverse instability (transverse impedance). Applying Electromagnetic theory, A. Mostacci studied several potential impedance source relevant for modern particle accelerators. |
| LHC liner | The beam pipe foreseen for the Large Hadron Collider (LHC) is rather unconventional. To shield the magnets cold bore from the synchrotron radiation emitted by 7 TeV protons, a beam screen (the so called "liner") has been introduced practically along all the machine. The design of the liner is a compromise among the beam stability issues, the vacuum requirements, the heat load on the cold bore, the electron cloud effects and the realization constraints.<br><br>Three main potential sources of beam energy losses in the actual LHC liner are important, namely the interaction with the pumping holes, the (saw tooth) surface corrugation and the effect of an azimuthally inhomogeneous metallic beam pipe. |
| LHC liner<br>Pumping holes | The pumping slots in the beam screen couple the inside of the beam pipe with the external coaxial region, leading to RF power flow with possibly power dissipation on the cold bore. Interference effects between the slots have been studied in details [J75, J76] and analytical estimates for the power dissipated in the cold bore as a function of the slot dimensions (hole width and wall thickness) has been given [J74]. For the actual slots dimensions, the losses were still within the safe limits. Such studies are being revisited in the context the the Future Circular Collider (FCC) studies where the availability of analytical formulae can simplify the design phase. |
| LHC liner<br>Surface roughness | The artificial roughness (saw tooth corrugation) of the surface foreseen in the final design of the LHC beam pipe allows the propagation of surface waves synchronous with the beam and thus potentially dangerous for its stability. Using a field matching technique and assuming a periodically rough surface, the frequency of such waves is found to be very high (out of the relevant bunch spectrum): it scales with the inverse of the square root of the depth of the corrugation, that is in the range of microns. The potential dangers have been investigated for the nominal LHC bunch intensity [J72, J73]. |
| LHC liner<br>azimuthally inhomogeneous metallic beam pipe | Based on the Green's function approach, the field excited by a beam traveling in a pipe whose resistivity varies with the azimuth (but is constant in the z-axis direction) can be found (semi)analytically for an ultra-relativistic beam by using some approximated boundary conditions (for conductors) [J67]. |

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| Impedance studies | Even at relatively low frequencies (in the MHz range) it was found that the image currents do not avoid the low conductivity region (as you would expect in the limit of static solutions), thus implying potentially high power losses due to the longitudinal weldings in the LHC beam screen. Infact, the inner part of the beam screen is covered with a layer of copper (very good conductor) but the weldings have approximately the resistivity of stainless steel (bad conductor) which gives a big contribution to the losses.<br><br>Numerical studies using the conventional electromagnetic CAD code confirmed such a conclusion. A prototype has been designed and built to experimentally verify the azimuthal distribution of the image currents, through very accurate Q-factor measurements in a coaxial resonator. The measured data confirmed the theoretical predictions.<br><br>The theoretical environment built to study the LHC liner impedance issues has been subsequently applied to similar problem to give estimations of the impedance contribution in more complicated devices [J42, J52, J61, J65] in order to explain unexpected phenomena (e.g. heat load) suffered by the beam, particularly relevant in cryogenic machines. |
| RF devices, bead pull measurement, | In the "Accelerators" laboratory at the SBAI department, A. Mostacci designed, built and maintained a test bench to measure electromagnetic field inside closed RF structures (so called "bead-pull" method). Several devices installed in SPARC, the high brightness LINear Accelerator (linac) of Laboratori Nazionali di Frascati (LNF), have been tested in the laboratory [J68, J69]. Those measurements were calibrated to measure not only the field shape, but also the accelerating efficiency of the structure. Typical RF devices measured are deflector [J64, S20], electron gun and accelerating sections [J62] in the 3 to 12 GHz frequency range. The tuning procedure for 6GHz accelerating structures [J39] built at LNF have been defined and applied for the first time in the previously discussed test bench [J33].<br><br>The laboratory is equipped also with codes for electromagnetic CAD used both for designing novel devices [J56, J66] and for validating measurements on prototypes. A. Mostacci studied also on the bead-pull measurement theory for non-conventional RF structures. |
| Coupling impedance, bench measurements, coaxial wire method | Bench measurements nowadays represent an important tool to estimate the coupling impedance of any particle accelerator device. The well-known technique based on the coaxial wire method allows to excite in the device under test a field like the one generated by an ultra-relativistic point charge.<br><br>The field of a relativistic point charge in the free space (or in a perfectly conducting beam pipe) is a Transverse Electric Magnetic (TEM) wave, namely it has only components transverse to the propagation direction. The amplitude scales inversely with the distance from the propagation axis and phase velocity is equal to the speed of light. The fundamental mode of a coaxial wave guide is a TEM wave as well, with the same amplitude |

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| | dependence and the same propagation constant. Therefore, the excitation due to a relativistic beam in a given Device Under Test (DUT) can be "simulated" by exciting a TEM field by means of a conductor placed along the axis of the structure.<br><br>With the coaxial wire method, A. Mostacci measured the coupling impedance of many particle accelerator devices of interest of CERN machines such as LHC and its injectors [J71]. A. Mostacci also performed beam experiments at CERN to compare bench measurement with direct beam measurement on the same devices. The coaxial line approach has also been used to bench measured the effect of coating in the secondary emission yield, relevant for LHC electron cloud issues [J70].<br><br>More recently the new generation of LHC collimators has been bench measured in order to estimate the coupling impedance and look for possible trapped modes in the moving jaws [J3]. |
| SPARC, machine measurements<br><br><br><br><br><br><br><br><br><br><br><br><br><br>Physics of high brightness beam<br><br><br><br><br><br><br><br><br><br><br><br><br><br><br>Free Electron Laser | Since 2006, A. Mostacci joined SPARC commissioning and operation. SPARC is a high brightness linear accelerator initially conceived to drive proof-of-principle experiments in the generation of radiation with Free Electron Laser (FEL). Nowadays the SPARC accelerator has been upgraded to SPARC_LAB [J37, S06] with the installation of multi TW class lasers, allowing world-class, ground breaking experiments in accelerator and plasma physics as well as interdisciplinary research [J31].<br><br>Following the time line of the SPARC_LAB upgrades, the activity can be roughly divided in research on physics of high brightness electron beams, on FEL innovative schemes, on the generation of THz radiation, on novel plasma-based particle acceleration techniques and on Compton effect based radiation sources.<br><br>Concerning the physics of high brightness electron beam, SPARC measured for the first time the emittance oscillation of beams generated by RF photocathodes [J60, S18], assessing the working point used world-wide in all the FELs based on RF guns. Such result has been possible due to a carefully conducted experiments [J55, S16] and data analysis [J57, S17]. In order to longitudinally compress the electron beam (to increase the bunch current), SPARC introduced and demonstrated the low energy compression (namely "velocity bunching") properly tuning low energy focusing solenoids [J49, J54, S15], for the first time used there. Such velocity bunched beam exhibit non-negligible energy spread that must be considered in beam measurements [J47, S12] or exploited in to produce radiation [J53, S14] with non-conventional FEL configurations. SPARC high brightness beams are also used to propose and demonstrate novel concepts in beam diagnostics [J18, J20] or medical applications [J26] in electron based radiotherapy.<br><br>SPARC contributed to develop and test innovative ideas on Free Electron Laser schemes which have been afterword applied in bigger FEL facilities; such results have possible also to extensive benchmarking of code against experiments [J51] and innovative diagnostics [J23]. For instance, SPARC |

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| | introduced the undulator tapering to compensate energy spread [J45, S10, J53, S14] or demonstrated the generation of a super radiant pulse in the long radiator of a single stage cascaded FEL, by seeding the modulator with an external laser. Seeded FELs can operate either in the amplifier "direct seeding" scheme [J24, J48, S13], or in the high gain harmonic generation configuration [J44, S09], where the seed in a first undulator (modulator) is used to induce an energy-density modulation in the electron beam longitudinal phase space. This bunched beam then emits a higher order harmonics in a following undulator (radiator). This scheme can be repeated in a multiple stage cascade of modulators and radiators, extending the operation wavelength toward a range where seed sources are not available [J36, S05]. The versatility of the SPARC linac allowed also to send a train of bunches in the FEL undulator, resulting in a two colour FEL radiation [J32, S03], time modulated FEL radiation [J34, S04] and seeded two colours radiation [J21, S02]. Also, this scheme was pioneered at SPARC and it is now used in several other laboratories for pump-probe FEL experiments. |
| THz radiation | The generation of THz radiation at SPARC relies on the usage of sub-ps high brightness electron bunches when a broadband radiation is needed [J41], while longitudinally modulated electron beams allow for tunable narrow-band radiation [J22]. The generation is quite efficient since the velocity bunching imposes a longitudinal phase space distortion, leading to asymmetric current profiles with sharp rising charge distribution at the bunch head; therefore, high frequency (THz) radiation can be emitted if the bunch goes across a radiator (coherent transition radiation) [J17]. The resulting THz radiation is more intense than other sources and it has been used for advanced material studies [J16, S01]. |
| Laser-plasma accelerators, CRISP project, FIRB project, Eupraxia project | Plasma-based accelerators represent the new frontier for the acceleration of high quality, i.e. high brightness, electron beams because of their capability to sustain extremely large accelerating gradients. In conventional Radio-Frequency (RF) linear accelerators, accelerating gradients are currently limited to ~100 MV/m, mainly due to breakdown occurring on the metallic walls of the devices. Ionized plasmas, however, can sustain electron plasma waves with electric fields three orders of magnitude higher than those achievable with actual RF technologies. Moreover, the accelerating field strength is tunable by adjusting the plasma density.<br><br>Even though the principle of plasma-based acceleration has been proven by several groups, the so accelerated beams still suffer from large angular divergence, large energy spread [J40, S08], poor reproducibility, which prevent their use as an alternative to conventional RF accelerators which typically provide stable and high quality electron beams.<br><br>A possible solution is to use innovative transport lines based on conventional technology, such quadrupole or solenoid based transport lines arranged in a clever way [J4, J46, S11]. Another approach towards plasma-accelerated high-brightness electron beams relies on the use of the plasma only as the active media, injecting electrons into a pre-formed |

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| | plasma channel. A first scheme consists in injecting a witness electron bunch in a plasma where the plasma wave is excited by a high-power laser pulse, i.e. external injection in a Laser Wake Field Accelerator (LWFA) [J10, J27, J11]. The second scheme relies on the induction of coherent plasma oscillations with multiple electron bunches, that is a resonant Plasma Wake Field Accelerator (PWFA). Such idea relies on using a comb beam, i.e. a train of equidistant bunches, to increase the accelerating gradient.<br><br>A scheme to produce comb-like beams was conceived at Laboratori Nazionali di Frascati and successfully tested at SPARC for the first time [J13, J25]. The additional benefit of resonant PWFA relies on the use of lower charge bunches in the train with respect to traditional PWFA, with the advantage of a better control of acceleration and transport [J6].<br><br>The proof of principle experiments of resonant wake field acceleration triggered improvements in the plasma generation schemes [J28], in active plasma lens for symmetric beam focusing [J2], in the SPARC synchronisation [J15], in standard bunch measurement [J8, J35] as well as in non-intercepting beam diagnostics [J29]; also, the betatron radiation emitted by electron moving in the plamsa channel can be used [J19]. Efforts are ongoing also in measurement the plasma channel properties with spectroscopic [J5, J9] and opto-acoustic [J14] methods.<br><br>Moreover, to support the plasma source commissioning, simplified (but accurate) models are necessary to properly choose the machine working point. Those models, before being used, must be assessed against accurate Particle In Cell simulation [J30]. |
| Compton Sources<br>ELI-NP | High brightness linacs are used also in Gamma ray source based on Compton back scattering between electron and counter-propagating laser pulses. A possible design has been proposed in [J38, S07] investigating the bam dynamics as well as the issues due to the necessity of multi-bunch operation to increase the luminosity. A single bunch, proof of principle experiment has been done at SPARC_LAB [J12].<br><br>The Gamma Beam Source according to [J38, S07] is being built in Romania under the ELI-NP project supported by EU. One of the most relevant issues is the need of multi-bunch, high charge beams affecting the design and the operation of accelerating structures [J1] and diagnostics [J7]. |
| Medical applications<br>Hadroterapy, post-acceleration, | Hadroterapy protons are typically produced with Radio Frequency quadrupoles and then delivered to the patient with circular accelerators (even if recently hospital proton linacs are under construction). Few tens of MeV protons can also be produced with high energy laser pulse hitting a target; such scheme has interesting feature in terms of beam properties, versatility and compactness. In order to improve the beam properties up to medical requirements [J43, J50] proposed a post acceleration scheme based on modified hospital proton linac cavities. |

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| Montecarlo, FLUKA | A. Mostacci has been involved in the design of particle detectors for biomedicine, joining the research on Treatment Planning Systems (TPS) for tumour hadroterapy with carbon ions [J59] using Monte Carlo techniques (FLUKA code, [J58]); he was involved in the FLUKA collaboration on the optics module in order to calibrate the simulations against measurements on Compton chamber for Single Photon Emission Computed Tomography [J63, S19]. |

**Part VIII – Summary of Scientific Achievements**

The scientific activity quality parameters computed on the whole scientific production are:

| Product Type | Number | Data Base | Start | End |
|---|---|---|---|---|
| **Papers** (Journals and conferences) | 193 | SCOPUS | 1997 | 2017 |

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|---|---|
| Total Citations | **1272** (SCOPUS) |
| Hirsch (H) index | **19** (SCOPUS) |

**Invited Review Papers**

The **International Committee for Future Accelerators (ICFA)** is the reference international panel in accelerator physics and it is chaired by Yong Ho Chin, (KEK, Japan). The ICFA Beam Dynamics Newsletter of December 2016 collects 26 articles on the "Collective Effects in Particle Accelerators", edited by E. Métral (CERN, Switzerland); among them, **A. Mostacci wrote the review contribution on "Beam-Coupling Impedance and Wake Field – Bench Measurements".**

## List of peer reviewed papers on international Journals (total number 81)

[J1]. L. Sabato, **A. Mostacci**, et al., *Effects of Correlations Between Particle Longitudinal Positions and Vertical Plane on Bunch Length Measurement: a case study on GBS Electron LINAC at ELI-NP*, accepted for publications in Meas. Sci. Technol. (**2017**).

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**Part IX– Selected Publications (citations according to SCOPUS on 13/12/2017)**

| | | IF | Citations |
|---|---|---|---|
| **S01** | Giorgianni, F., Chiadroni, E., Rovere, A., Cestelli-Guidi, M., Perucchi, A., Bellaveglia, M., Castellano, M., Di Giovenale, D., Di Pirro, G., Ferrario, M., Pompili, R., Vaccarezza, C., Villa, F., Cianchi, A**.**, **Mostacci, A.**, Petrarca, M., Brahlek, M., Koirala, N., Oh, S., Lupi, S.,<br><br>**Strong nonlinear terahertz response induced by Dirac surface states in Bi2Se3 topological insulator**,<br>Nature Communications (**2016**),<br>DOI: 10.1038/ncomms11421 | **11.3** | **10** |
| **S02** | Petrillo, V., Anania, M.P., Artioli, M., Bacci, A., Bellaveglia, M., Chiadroni, E., Cianchi, A., Ciocci, F., Dattoli, G., Di Giovenale, D., Di Pirro, G., Ferrario, M., Gatti, G., Giannessi, L., **Mostacci, A.**, Musumeci, P., Petralia, A., Pompili, R., Quattromini, M., Rau, J.V., Ronsivalle, C., Rossi, A.R., Sabia, E., Vaccarezza, C., Villa, F.,<br><br>**Observation of time-domain modulation of free-electron-laser pulses by multipeaked electron-energy spectrum**<br>Physical Review Letters (**2013**),<br>DOI: 10.1103/PhysRevLett.111.114802 | **7.65** | **47** |
| **S03** | Ferrario, M., Alesini, D., Bacci, A., Bellaveglia, M., Boni, R., Boscolo, M., Castellano, M., Chiadroni, E., Cianchi, A., Cultrera, L., Di Pirro, G., Ficcadenti, L., Filippetto, D., Fusco, V., Gallo, A., Gatti, G., Giannessi, L., Labat, M., Marchetti, B., Marrelli, C., Migliorati, M., **Mostacci, A.**, Pace, E., Palumbo, L., Quattromini, M., Ronsivalle, C., Rossi, A.R., Rosenzweig, J., Serafini, L., Serluca, M., Spataro, B., Vaccarezza, C., Vicario, C.,<br><br>**Experimental demonstration of emittance compensation with velocity bunching**<br>Physical Review Letters (**2010**),<br>DOI: 10.1103/PhysRevLett.104.054801 | **7,65** | **100** |
| **S04** | Ferrario, M., Alesini, D., Bacci, A., Bellaveglia, M., Boni, R., Boscolo, M., Castellano, M., Catani, L., Chiadroni, E., Cialdi, S., Cianchi, A., Clozza, A., Cultrera, L., Di Pirro, G., Drago, A., Esposito, A., Ficcadenti, L., Filippetto, D., Fusco, V., Gallo, A., Gatti, G., Ghigo, A., Giannessi, L., Ligi, C., Mattioli, M., Migliorati, M., **Mostacci, A.**, Musumeci, P., Pace, E., Palumbo, L., Pellegrino, L., Petrarca, M., Quattromini, M., Ricci, R., Ronsivalle, C., Rosenzweig, J., Rossi, A.R., Sanelli, C., Serafini, L., Serio, M., Sgamma, F., Spataro, B., Tazzioli, F., Tomassini, S., Vaccarezza, C., Vescovi, M., Vicario, C.,<br><br>**Direct measurement of the double mittance minimum in the beam dynamics of the sparc high-brightness photoinjector**<br>Physical Review Letters (**2007**),<br>DOI: 10.1103/PhysRevLett.99.234801 | **7.65** | **52** |