

# Giovanni Cantatore

Trieste, January 19th 2024

## **EDUCATION**

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1986 “Laurea” Degree in Physics – University of Pisa, Pisa, Italy

## **ACADEMIC POSITIONS**

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- Associate Professor - University of Trieste, Trieste, Italy – 2001-present
- Researcher (permanent position) – University of Trieste, Trieste, Italy – 1992-2000
- Post-doctoral fellow, University of Rochester, Rochester, NY, U.S.A, 1989-1991
- Fellow, Istituto di Biofisica del C.N.R, Pisa, Italy - 1988
- Teaching Assistant – Naval Academy, Livorno, Italy – 1986-1987

## **RESEARCH**

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2019 – present

MUOnE experiment proposal at CERN – precision measurement of the hadronic contribution to the muon gyromagnetic anomaly from muon-electron elastic scattering (funding from INFN and CERN)

2014 - present

“Muon G-2”, E989 at Fermilab – precision measurement of the gyromagnetic anomaly of the muon (funding from INFN)

CAST experiment at CERN – Search for solar chameleons with the KWISP optomechanical force sensor – (funding from INFN)

2010-2014

CAST experiment at CERN – Search for solar axions with a magnetic helioscope – search for excess photons in the visible range with the BaRBE setup (funding from INFN)

2000-2010

PVLAS Experiment at Laboratori Nazionali di Legnaro of INFN, Legnaro, Italy - measurement of the vacuum magnetic birefringence with an heterodyne optical ellipsometer equipped with a superconducting magnet and amplification of the optical path – search for axion production and detection in a magnetic field (funding from INFN).

1992-2000

SYRMEP/FRONTRAD Project at INFN Trieste- digital mammography with synchrotron radiation (collaboration: University and I.N.F.N. Trieste, Società Sincrotrone Trieste, Istituto di Radiologia dell'Università di Trieste)

PVLAS Experiment at Laboratori Nazionali di Legnaro of INFN, Legnaro, Italy - measurement of the vacuum magnetic birefringence with an heterodyne optical ellipsometer equipped with a superconducting magnet and amplification of the optical path (funding from INFN).

1989-1991

LAS/E840 experiment at the Brookhaven National Laboratory, NY, (U.S.A.) - experimental study of the vacuum anisotropy induced by a magnetic field and production and detection of axion-like light scalar/pseudoscalar particles (collaboration: University and I.N.F.N. Trieste, University of Rochester, B.N.L., Fermilab, principal investigators A.C. Melissinos and E. Zavattini).

1985-1988

Biophysics of photo-reception - experimental study of phototaxis by unicellular organisms (experimental work at "Istituto di Biofisica del C.N.R"., Pisa, Italy).

## **TEACHING EXPERIENCE**

2021-2023 – “Napredna Elektrodinamika” course (Master degree in Physics) – University of Rijeka, Rijeka, Croatia

2020-present – Electrodynamics and laboratory courses – Physics Degree curricula – University of Trieste, Italy

2010-2020 – Physics courses– School of Engineering – University of Trieste, Italy

1998-2010 – Physics courses– School of Architecture – University of Trieste, Italy

1992-1998 – Physics courses– School of Engineering – University of Trieste, Italy

## **COORDINATION RESPONSIBILITIES AND OTHER POSITIONS**

- P.I. of the INFN Trieste group in “MUonE” – 2019-present
- Deputy spokesperson of the CAST experiment – 2015-present
- P.I. of the INFN Trieste group in “Muon G-2” – 2014-present
- CERN Scientific Associate – 2016
- Spokesperson of the KWISP experiment of INFN – 2008-present
- Spokesperson of the BaRBE experiment of INFN – 2008-2013
- Spokesperson the PVLAS experiment of the INFN – 2000-2007
- P.I. of the INFN Trieste group of the PVLAS experiment – 1999-2000
- Technical manager of the SYRMEP synchrotron radiation beam-line at Elettra, Trieste – 1996-1998

## CURRICULUM VITAE – Fulvia Arfelli

- Laurea in Fisica all'Università degli Studi di Trieste con 110/110 e lode (3/12/1990).
- Dottore di Ricerca in Fisica presso Università di Trieste (3/11/1995).
- Postdoctoral fellowship a Brookhaven National Laboratory (BNL, Upton, New York), National Synchrotron Light Source Department dal 4/1995 al 12/1995.
- Contratto di Collaborazione Coordinata e Continuativa alla Società Sincrotrone Trieste dal 1/1996 al 5/1998.
- Ricercatore Universitario, settore disciplinare B01B FISICA, per la Facoltà di Medicina e Chirurgia dell'Università di Trieste con afferenza al Dipartimento di Fisica dal 20/5/1998.
- Professore Associato dal 21/12/2012, SSD FIS/07 presso il Dipartimento di Fisica dell'Università di Trieste.
- Abilitazione a Professore Prima Fascia, settore concorsuale 02/B3 dal 27/12/2013 al 27/12/2022 (Abilitazione Scientifica Nazionale Tornata 2012).
- Abilitazione a Professore Prima Fascia, settore concorsuale 02/D1 dal 11/9/2019 al 11/09/2025 (Abilitazione Scientifica Nazionale 2018-2020).
- Titolare di Incarico di Ricerca alle attività dell'Istituto Nazionale di Fisica Nucleare (INFN) dal 1999.
- Membro del Collegio dei Docenti della Scuola di Dottorato in Fisica dell'Università di Trieste dal 2007.
- Brevetto internazionale *Contrast Enhanced X-ray Phase Imaging*. WO2004071535A1, EP1592456A1, US20060235296A1, JP2006517558A.
- Autore di 180 pubblicazioni su riviste scientifiche internazionali (indicizzate Scopus e/o WoS). Citazioni totali 4846 con h-index di 35 (fonte Scopus).

### Responsabilità scientifiche

- Responsabile Nazionale del progetto INFN (CSN5) "*Spectral PHAsE REtrieval X-ray imaging*" (SPHERE-X). Unità partecipanti: Sezione INFN di Trieste, Ferrara, Pisa in collaborazione con Elettra Sincrotrone Trieste (2023-2025).
- Responsabile locale per la Sezione di INFN Trieste del progetto INFN (CSN5) "*K-edge Imaging with Spectral Systems*" (KISS). Unità partecipanti: Sezione INFN di Pisa, Cagliari e Trieste in collaborazione con Elettra Sincrotrone Trieste (2019-2022).
- Responsabile Scientifico dell'Unità di Ricerca Università di Trieste nel progetto PRIN2022, prot. 20227N9LW7 (finanziamento MUR), "*Fully-digital 3D imager for gamma and hard-X rays*" dal 28/9/2023 al 27/9/2025. Partecipanti: Politecnico di Milano, INFN, Università di Udine, Università di Trieste, CNR-IOM
- Responsabile Scientifico dell'Unità di Ricerca Università di Trieste nel progetto PRIN2015, prot. 2015WMZ5C8 (finanziamento MUR), "*Rivelatori di raggi X in semiconduttori ad alto numero atomico per sorgenti di nuova generazione e imaging medicale*" dal 1/2/2017 al 1/2/2020. Partecipanti: Università di Udine, Università di Trieste, CNR-IOM (in collaborazione con Elettra-Sincrotrone Trieste).
- Responsabile Scientifico per Università di Trieste del EU project, V Programma Quadro (Contratto EU HPRI-CT-1999-50008) PHASY (*Phase Analyzer System for novel imaging modalities*) dal 1-03-2000 al 28-02-2005. Partners: Elettra Sincrotrone Trieste (Trieste), ESRF (Grenoble, France), DESY (Germany), SRS (Daresbury, UK), Università Trieste (Italy), University Siegen (Germany), University Bremen (Germany), Siemens AG, (Erlangen, Germany).
- Sostituto Responsabile (su decreto rettorale 1433/2011 del 17/11/2011) nella Convenzione Quadro tra Università di Trieste, l'Azienda Ospedaliero-Universitaria di Trieste e la Sincrotrone Trieste SCpA, per il progetto "*Mammografia con raggi X da sincrotrone: sperimentazione clinica*".

### **Partecipazioni a progetti e collaborazioni nazionali e internazionali**

- Dal 1996 Collaboratore Scientifico di Elettra-Sincrotrone Trieste, gruppo di ricerca SYRMEP (*SYnchrotron Radiation for MEDical Physics*) per sviluppo e applicazioni di tecniche di imaging innovative con radiazione di sincrotrone.
- Dal 1994 al 2006 partecipa ai progetti INFN, Gruppo V, Sezione di Trieste –SYRMEP (1994-1998), FRONTRAD (1999-2002), MATISSE (2003-2006) per lo sviluppo e lo studio di rivelatori a microstrip di silicio per applicazioni di radiologia diagnostica.
- Dal 2004 al 2016 e' parte ad una collaborazione scientifica con Universitaetklinikum di Freiburg (Germania), University of Saskatchewan (Saskatoon, Canada), Monash University (Melbourne, Australia), Australian Synchrotron (Melbourne, Australia) e Sincrotrone Trieste nel progetto "*Cell tracking in animal models of human diseases using computed tomography with synchrotron radiation*".
- Partecipa al progetto SYRMA – (*Synchrotron Radiation for Mammography*) per mammografia clinica con luce di sincrotrone in contrasto di fase, in collaborazione con INFN, Sincrotrone Trieste e Unità Clinico Operativa di Radiologia dell' Ospedale di Trieste (2006-2009).
- Partecipa al progetto PICASSO (*Phase Imaging for Clinical Application with Silicon detector and Synchrotron radiation*) dell'INFN, Gr.5, (2007-2010) in collaborazione con il Photon Science Detector group di Paul Scherrer Institut (PSI-Villigen, Switzerland).
- Partecipa ai progetti dell'INFN-gr.5 BEATS2 (*BEAm line from Thomson Source 2*) (2010-2012) e NTA-SL-THOMSON (2012-2016).
- Partecipa ai progetti INFN SYRMA-CT (*Synchrotron Radiation for MAMmography: Computed Tomography*) (2014-2016) e SYRMA-3D (2017-2018) dell'INFN-gruppo V, estensione del programma di mammografia ad Elettra alla tomografia mammaria in contrasto di fase con radiazione di sincrotrone. Collaborazione fra le sezioni INFN di Trieste, Pisa, Cagliari, Napoli, Ferrara, Bologna, Elettra Sincrotrone Trieste ScPA e l'Azienda Ospedaliero-Universitaria "Ospedali Riuniti" di Trieste.
- Collaboratore scientifico nel Project Deutsche Forschungsgemeinschaft (DFG) (2018-2022), Projektnummer 415839020 DFG: *Microbeam Irradiation, Radioprotection and Radioenhancement (Mikrostrahltherapie, Radioenhancers und Gewemetoleran)*, coordinato dall'University of Rostock.
- Partecipa, come responsabile locale, al progetto INFN KISS (2019-2022) su sistemi per imaging spettrale con radiazione di sincrotrone. Sezioni coinvolte: Pisa, Trieste, Cagliari.
- Partecipa, come responsabile nazionale, al progetto INFN SPHERE-X sullo sviluppo di un sistema integrato per imaging spettrale e contrasto di fase con radiazione di sincrotrone. Sezioni coinvolte: Trieste, Ferrara, Pisa.
- Partecipa al progetto INFN PEPI (Photon-counting Edge-illumination Phase-contrast Imaging (2021-2022). Sezione di Trieste, grant "Giovani Ricercatori".
- Partecipa al progetto INFN MEDIPIX4 (2021-2024) per implementazione di detector basati su Timepix4 ASIC. Sezioni coinvolte: Ferrara, Trieste, Pisa, Napoli e LNS
- Partecipa al progetto INFN VI-HI (2024-2026) su imaging avanzato per virtual histology tramite un sistema basato su gratings. Sezioni coinvolte: Torino, Milano, Trieste.

### **Attività didattica - Titolarità di Corsi presso l'Università degli Studi di Trieste**

- *Fisica Medica* per il Corso di Studio in Medicina e Chirurgia dal 1999.
- *Fisica Applicata* per il Corso di Studio in Odontoiatria e Protesi Dentaria dal 2015
- *Fisica* per il Corso di Studio in Chimica e Tecnologia Farmaceutiche dal 2013.
- *Fisica della Radiologia Diagnostica ed Interventistica con Raggi X* per il Master di II livello in Advanced Studies in Medical Physics, in collaborazione con ICTP dal 2013.
- *Laboratorio di Fisica Medica* per la Laurea Magistrale in Fisica dal 2019.

# Dr. Marco Incagli - Curriculum

May, 1st 2022

## Career

*High School:* Liceo Scientifico E.Fermi, Cecina - Final marks: 60/60

*University:* Corso di Laurea in Fisica, University of Pisa, Final marks 110/110, master thesis on CDF experiment at Fermilab (supervisor prof. Giorgio Bellettini);

*Guest Scientist:* oct 1988 - sep 1989 guest scientist at Fermilab for the construction and installation of CDSF experiment;

*PHD:* V ciclo (1989-1992), University of Pisa;

*High School teacher:* Mathematics and Physics High School teacher from September 1993 to September 1994 Liceo Socio-Pedagogico di Cecina (LI);

*INFN researcher:* June 1994 first classified in the national selection as Researcher at the Italian Institute of Nuclear Physics (INFN);

*First Reasearcher INFN:* October 2003 wins the national selection and becomes First Reasearcher at INFN;

*Full Professor:* 2014 and 2023 "Abilitazione Scientifica Nazionale" role of full professor in High Energy Experimental Physics;

*Teaching at University:* 1999-today teaches in several courses (Physics 1, Atmospheric Physics, Astroparticles, Particle Physics, etc). The detailed list is at the end of this document.

## Scientific Activity

EXPERIMENT E989 " $\mu$ ON  $g - 2$  (2017-TODAY)

- today Italian Reponsible of the E989 experiment;
- today chairman of the Publication Committee;
- 2020-2021 chairman of the Institutional Board;
- 2018-2022 "Detector OPS" (responsible of detectors operations)
- 2018-2021 Coordinator of the  $\omega_a - europa$  group. The team, formed by italian, english and german collaborators, produced one of the 4 measurements of the muon angular precession  $\omega_a$  which have been combined in the first publication of April 7, 2021;
- 2017-2021 responsible of the laser calibration system;

## AMS-02 EXPERIMENT(2003-2016)

- 2005-2016 responsible of the INFN-Pisa collaboration to the AMS-02 experiment;
- 2011-2017 coordinator of the online ECAL operations: monitoring tools, equalization and absolute calibration, data taking;
- 2013-2016 Physics Coordinator of the analysis on the determination of the Positron to Electron Fraction in Cosmic Rays, a tool to detect a possible Dark Matter contribution;
- 2011-2015 Physics Coordinator of the analysis of the total  $e^+ + e^-$  flux in Cosmic Rays;
- 2007-2011 responsible of the integration of the AMS-02 Electromagnetic Calorimeter, ECAL, with the USS (Unique Support Structure), the interface between AMS-02 and the Space Station;
- 2011 at Houston for the launch of the Shuttle Endeavour which carried AMS-02 to the Space Station. Responsible of the ECAL switch on procedure after installation;
- 2010-2011 at Cape Canaveral for the integration of AMS detector with the Space Shuttle Endeavour;
- 2003-2007 responsible of the construction of the ECAL electromagnetic calorimeter, of the associated electronics and of the High Voltage system performed by the collaboration of the groups of Pisa, Annecy and Beijing. Coordinator of several Test Beams.

## KLOE EXPERIMENT

- 2001-2005 responsible of the INFN-Pisa contribution;
- 2000-2003 member of the *Policy Board* and of the Executive Board;
- 1996-2000 co-responsible of event software reconstruction, in particular for what regards:
- reconstruction of photon shower apex, needed for the determination of the neutral vertex in  $k_L \rightarrow \pi^0 \pi^0$  decay;
  - vertex finding algorithm;
  - track-cluster association;
  - machine background filtering (FILFO module);
  - event classification.
- 1995-1998 responsible of the hardware construction of 24/64 modules of the "End-Cap" calorimeter.

## OTHER RESEARCH ACTIVITIES: MUONE, DUAL READOUT

- 2019-today participates to the writing of the Letter of intents (LOI) submitted to Cern in June 2020 for the MUONE experiment, a fixed target experiment to measure the hadronic contribution to muon  $g-2$  through scattering of muons on a Berillium target. Is responsible of the hardware construction of the tracker support system and its integration on the test beam;
- 2019-2020 european project AMUSE: 1.9 ME on european funds MSCA (Marie Sklodowska-Curie Actions) for "Innovative Training Networks", which includes 20 intitutions and universities;
- 2008-2009 participates to the Dual Readout Calorimetry (DREAM) project, coordinated by Richard Wigmans, proposing a new calorimeter for the readout of the electromagnetic contribution to the hadronic showers with the fiber technique used in the KLOE and AMS calorimeters. The first prototype has been test at Cern in Summer 2010;
- 1993-1994 high school teacher in Physics and Mathematics at the Liceo Socio-pedagogico E. Fermi, Cecina (LI).

## Selected workshops and conferences

- giu 1989 *CP violation and beauty factories and related issues in Physics (BLOIS89) Blois (Francia) "CP violation in p-pbar colliders" - Contributions to workshop on B-factories and related issues pag.158 (1989)*
- giu 1996 *ICCHEP 96 "Status report on the construction of the KLOE calorimeter" - Frascati Phys. Ser. vol.6 pag.237 (1996)*
- nov 1997 *Conference on Scintillating and Fibers Detectors (SCIFI97) Taipei (Taiwan) "The KLOE Fiber Electromagnetic Calorimeter" - AIP Conf.Proc. 450 (1998) 1, 437*
- giu 1999 *Kaon99 Chicago (USA) "CPT studies with KLOE" - Contributions to 1999 Chicago Conference on Kaon Physics (K 99) pag.263 (1999)*
- 3-7 dic 1999 *BCP3 Taipei (Taiwan) "Status report on KLOE/DAΦNE at Frascati National Laboratory (LNF)" - 3rd International Conference on B-Physics (BCONF99) pag.280 (1999)*
- lug 2003 *European Physical Society EPS2003 Aachen (Germania) "The Hadronic Cross Section Measurement at KLOE" - Eur.Phys.J.C33:s656-s658 (2004)*
- ott 2008 *IEEE Dresda Dresda (Germania) Time profile analysis of signals from the DREAM dual read-out calorimeter with the Domino Ring Sampler (DRS) - 2008 IEEE Nuclear Science Symposium Conference Record, pag,1673 (2008)*
- set 2009

Società Italiana di Fisica (SIF 2009) Bari (Italia) "ASTROPARTICLE PHYSICS WITH AMS02" - [www.sif.it/attivita/congresso/xcv](http://www.sif.it/attivita/congresso/xcv)

- apr 2010 VII Science with the New Generation of High Energy Gamma-ray Experiments (SCINEGHE 2009) Assisi (Italia) "Astroparticle Physics with AMS02" - AIP Conf. Proc. 1223(2010)1, 43
- set 2013 14th Conference on Astroparticle, Particle, Space Physics and Detectors for Physics Applications (ICATPP2013) Como (Italia) "First results from the AMS02 experiment on the International Space Station" - Contribution to ICATPP (2013) 52
- ott 2013 Physics in the LHC era Tbilisi (Georgia) " First results from the Alpha Magne4c Spectrometer (AMS) Experiment on the International Space Station" - [lhc2013.tsu.edu.ge](http://lhc2013.tsu.edu.ge)
- giu 2014 3rd International Conference on Technology and Instrumentation in Particle Physics (TIPP2014) Amsterdam (Olanda) "Performance of the AMS02 Electromagnetic Calorimeter in Space" - PoS TIPP 2014 (2014) 025
- mag 2014 New Frontiers in Theoretical Physics Cortona (Italy) "AMS02, Fermi and Planck space experiments: an experimentalist perspective" - [agenda.infn.it/event/7371](http://agenda.infn.it/event/7371)
- lug 2014 3rd International Conference on New Frontiers in Physics Creta (GR) " Results from the AMS02 experiment on the International Space Station" - [indico.cern.ch/event/277650](http://indico.cern.ch/event/277650)
- set 2014 Roma International Conference on Astroparticle Physics (RICAP2014) Noto (Italia) " Precision Cosmic Ray Physics in Space- born Experiments" - EPJ WEb Conf 121 (2016) 03001
- mar 2016 Les Rencontres de Physique de la Vallée d'Aoste La Thuile (Italia) "AMS02 results after 4 years of data taking on the International Space Station" - Nuovo Cim. C39 (2017) 4, 313
- lug 2016 XII interna:onal Workshop Dark Side of the Universe Bergen (Norvegia) "AMS02 results after 5 years of data taking on the International Space Station" - [indico.cern.ch/event/459881](http://indico.cern.ch/event/459881)
- mag 2018 Vulcano Workshop 2019 Vulcano (Italia) "The Muon g-2 experiment at Fermilab: Run 1 Status and Perspectives" - Frascati Phys. Ser. vol.66 pag.328 (2018)
- lug 2019 European Physical Society EPS2019 Gent (Belgio) "Measuring the muon precession frequency in the E989 Fermilab g-2 experiment" - EPS-HEP2019 pag.586 (2020)
- set 2019 Cosmology and Dark Matter with galaxies and clusters Matera (Italia) "DARK MATTER search with Space Born experiments" - [sites.google.com/inaf.it/astromatera2019](http://sites.google.com/inaf.it/astromatera2019)
- aug 2021 20th Lomonosov Conference on elementary particle physics (Moscow) " First results from the muon g-2 experiment at Fermilab" - published in Moscow Univ.Phys.Bull. 77 (2022) 2, 208-215

( May 2023) 21st Conference on Flavor Physics and CP Violation (FPCP 2023) "Updates and Perspectives on the Muon  $g-2$  Experiment" - Published in: PoS FPCP2023 043

## Contracts and Teaching duties

1988-1989 grant for studying abroad: 1 year at Fermilab;

2012-2013 MIT contract to work at CERN on AMS experiment;

2019-2022 Intensity Frontier Fellowship at Fermilab;

1995-1996 professor of "Fisica I" at "Ingegneria delle Telecomunicazioni" Università di Pisa

1996-1998 professor of "Radiation detectors in medicine" at "PHD school in Medical Physics", Università di Pisa

1995-1998 professor of "Elementary Particle Physics", Università di Pisa

2013-2016 professor of "Fisica I" at "Fisica", Università di Pisa

2020-today professor of "Atmospheric Physics" at "Environmental Science, Climatology", Università di Pisa

## Other roles and coordination activities

2018-today reviewer Phys. Lett. B;

2020-today editor Frontiers in Physics;

2017-today referee experiment GAPS, a balloon experiment flying from Antarctica;

2014-2019 referee experiment JEM-EUSO, proposed for the International Space Station;

2020-today italian responsible experiment "Muon  $g-2$ " at Fermilab;

2006-2016 local responsible experiment AMS-02, integrated at CERN and installed on the International Space Station.

2018-today Editor for the Elsevier Editorial System (EES), Phys. Lett. B journal

2017-today Internal Referee of the "Muon  $g-2$ " experiment E989 at Fermilab. When working in the KLOE experiment, the candidate lead the analysis on the hadronic cross section ( $e^+e^- \rightarrow \pi^+\pi^-$ ), which is a key input to the theoretical determination of the muon

anomaly. This competence is now being used in the INFN involvement within the “Muon  $g - 2$ ” project.

- 2014-today Referee within INFN Astroparticle Committee (so-called “Group 2”) of JEM-EUSO and GAPS experiments.
- 2016-today Responsible of Seminar Organization at INFN Pisa for a total of 78 seminars organized in 2.5 years.
- 2012-2014 Visiting scientist at MIT (Boston), then stable at Cern to coordinate the AMS-02 data taking activity and the first positron fraction analysis.
- 2009-today Coordinator of the INFN-ASI contract for INFN Pisa, which has funded the AMS-02 mission.
- 2008 Scientific responsible in Pisa (“RESPONSABILE SCIENTIFICO DELL’UNITA’ DI RICERCA”) of the italian reasearch program *Usage of SiPM for astroparticle experiments in space*: PRIN 20084KC82C\_003. PRIN = *Programmi di Ricerca Scientifica di Rilevante Interesse Nazionale* (Scientific Research Program of Relevant National Interest).
- 2005-today Responsible of the AMS-02 group in Pisa.
- 2004-2006 Member of a INFN working group on future experiments at the High Intensity Frontier (HIF). In particular, is a co-organizer of two national HIF meetings in May 2004 and May 2005 and writes the chapter dedicated to lepton flavor physics of the final report, together with doc. Marco Grassi (MEG experiment at PSI - CH).
- 2003 Chairman of the international *Workshop on hadronic cross section at los energies*, focused on understanding the role of the hadronic contribution to the muon  $g - 2$  anomaly.