

ANDREA VACCHI

CURRENT ROLE
*Professore ordinario, Ricercatore*

PERSONAL INFORMATION

🖂: andrea.vacchi@uniud.it

EDUCATION

1976

**Degree in Physics**

University of Bologna, Italy

**Present**

2022 -2023

Teaching assignment "Complements of General Physics" University of Udine

Department of Mathematics, Computer Science and Physics

PREVIOUS POSITIONS AND FELLOWSHIPS

2017 – 2022

Extr. **Prof. Experimental Physics** Dep. Math. Inform. Phys.

Udine University

2014 – 2019

**Visiting Scientist** - Advanced Meson Science Laboratory - **RIKEN Nishina Center** for Accelerator-Based Science, **Wako, Saitama, Japan**

1997 – 2017

**Director of Research**,

Istituto Nazionale di Fisica Nucleare (INFN), Trieste Division

1990 – 1997

**Senior Researcher** - **INFN**

**Trieste Division**, Italy

1990 – 1991

**Visiting Professor** - Physics Department

**Rockefeller University NY USA**

1987 – 1990

**Assistant Professor**, Physics Dep.

Rockefeller University NY USA working at CERN

1986 – 1987

**Senior Researcher** , Physics Dep.

Rockefeller University NY USA working at CERN

1983 – 1985

 **Senior Fellow**,

Exp. Physics Division  - **CERN**

1982 – 1983

**Research Associate**, Physics Dep.

Rockefeller University NY USA working at CERN

1977 – 1982

**Research Scientist**, ETH-PSI

Swiss Federal Institute of Technology ETH Swiss.

**INSTITUTIONAL RESPONSIBILITIES**

2008 –2021

**Bruno Kessler Foundation FBK** Trento (I),Coordinator of Scientific Technical Advisory

Board for the Material-Micro-system Centre CMM

2011 2018

Board of financing agencies, Neutrino factory experiment MICE

Rutherford laboratory, UK

2012 – 2016

**Board of Directors** of the International School for Advanced Studies (SISSA ), Trieste

2012 – 2016

**Chair National Technology Transfer Board** of the **INFN**

2012 – 2016

**President of FIT**, the International Trieste Foundation for the future of sciences

2010 – 2011

**Board of directors** of the GARR, Italian Academic-Research telecommunication Network

2010 – 2011

**INFN/MIUR Delegate** in the European Project **ELI  - Extreme Light Infrastructure**

2009 – 2011

**Executive Board Member of INFN**

2007 – 2011

**Scientific Board Chair & Editorial Director** of the INFN review **ASIMMETRIE**

2003 – 2008

**Director** of the INFN Trieste division

2000 – 2003

**Chair of the INFN National Scientific Board,** **CSN 5 for R&D.**

RESPONSIBILITIES IN COORDINATION OF RESEARCH AND PROJECTS

since 2015

**Responsible of the XAFS** Silicon Drift Detectors (SDD) development within **SESAME**

(Synchrotron-light for Experimental Science and Applications in the Middle East - Jordan)

since 2010

**Principal investigator** of **FAMU** experiment (muonic hydrogen precision spectroscopy)

2004 - 2010

**Principal investigator** of QCL-MUH Quantum Cascade Lasers QCL - MUonic – Hydrogen

since 2012

**Responsible of the SDD Detectors development** within the Collaboration EUROFEL

2010 - 2013

**Italian Principal investigator** of the GAMMA400 space satellite experiment

since 2009

Proponent and **Member** of LOFT experiment (X-ray astrophysics, today eXTP)

2008 - 2020

**Principal investigator** of XDXL-REDSOX developing SDD for X-ray astrophysics & ALS

1994 - 2011

**Coordinator** for the development of SDD for the tracking system of CERN LHC ALICE

1994 -1998

**Project manager** of the satellite Wizard-NINA, first successful INFN CR satellite (1997)

1993 - 2011

Proponent and **scientific committee** **member of the** Cosmic Ray satellite **PAMELA**

1982 - 1993

CERN UA6 experiment SppS collider TRD detector development

1977 - 1982

ETHZ PSI **muonic atoms**, Bragg crystal spectrometer

TEACHING ACTIVITIES

2014 - 2022

**Professor** of Experimental Physics at University of Udine: II and III level Physics courses.

1978 - 1982

Teaching Assistant - Physics course Engineering Department, **ETH Zurich Switzerland**.

*Throughout the years I have given lectures and courses at various levels, most recently:*

*2016, 2017 and 2021*

*physics lectures  - Scuola Superiore of Udine University.*

RESEARCH PERFORMANCE (Source: SCOPUS)

Co-author of >400 citable papers, >200 articles are from the last 10 years, 20 having more than 200 and 2 more than 1500 citations; H-index = 55.

RECENT SELECTED PUBLICATIONS

Cirrincione D.;Antonelli M.;Vacchi A. et.al. A new collimated multichannel modular detection system based on Silicon Drift Detectors Nuclear Instruments and Methods in Physics Research, Section A: Volume 1049, April 2023, Article number 168118; DOI: 10.1016/j.nima.2023.168118

M. Stoilov, A. Adamczak, D. Bakalov, P. Danev, E. Mocchiutti, C. Pizzolotto, ... and A. Vacchi (2023)

Experimental determination of the energy dependence of the rate of the muon transfer reaction from muonic hydrogen to oxygen for collision energies up to 0.1 eV

M. Stoilov e.al. The FAMU collaboration

Physical Review A (Vol. 107, No. 3):

DOI: 10.1103/PhysRevA.107.032823

Silicon Drift Detectors,

Vacchi, A. (2023). Silicon Drift Detectors. Handbook of X-ray and Gamma-ray Astrophysics pp 1–53

In: Bambi, C., Santangelo, A. (eds) Handbook of X-ray and Gamma-ray Astrophysics. Springer, Singapore. https://doi.org/10.1007/978-981-16-4544-0\_18-1

Dilillo, G., Zampa, N., Campana, R., Fuschino, F., Pauletta, G., Rashevskaya, I., ... & Vacchi, A. (2022). Space applications of GAGG: Ce scintillators: a study of afterglow emission by proton irradiation. Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms, 513, 33-43.

Marcelli, N., Boezio, M., Lenni, A., Menn, W., Munini, R., Aslam, O. P. M., ... & Zampa, N. (2022). Helium fluxes measured by the PAMELA experiment from the minimum to the maximum solar activity for solar cycle 24. The Astrophysical Journal Letters, 925(2), L24.

Carlomagno, I., Antonelli, M., Aquilanti, G., Bellutti, P., Bertuccio, G., Borghi, G., ... & Meneghini, C. (2021). Trace-element XAFS sensitivity: a stress test for a new XRF multi-detector. Journal of Synchrotron Radiation, 28(6).

Bruno, A., et al. "East-West Proton Flux Anisotropy Observed with the PAMELA Mission." The Astrophysical Journal 919.2 (2021): 114.

Bruno, A., et al. "Solar-cycle Variations of South Atlantic Anomaly Proton Intensities Measured with the PAMELA Mission." The Astrophysical Journal Letters 917.2 (2021): L21.

Pizzolotto, C., Sbrizzi, A., Adamczak, A., Bakalov, D., Baldazzi, G., Baruzzo, M., ... & Vacchi, A. (2021). Measurement of the muon transfer rate from muonic hydrogen to oxygen in the range 70-336 K. Physics Letters A, 403, 127401.

Stoychev, L. I., Cabrera, H., Suárez-Vargas, J. J., Baruzzo, M., Gadedjisso-Tossou, K. S., Nikolov, I. P., ... & Vacchi, A. (2020). DFG-based mid-IR tunable source with 0.5 mJ energy and a 30 pm linewidth. Optics Letters, 45(19), 5526-5529.

Mocchiutti, E., Adamczak, A., Bakalov, D., Baldazzi, G., Benocci, R., Bertoni, R., ... & Vacchi, A. (2020). First measurement of the temperature dependence of muon transfer rate from muonic hydrogen atoms to oxygen. Physics Letters A, 384(26), 126667.

Gadedjisso-Tossou, K. S., Stoychev, L. I., Mohou, M. A., Cabrera, H., Niemela, J., Danailov, M. B., & Vacchi, A. (2020, September). Cavity ring-down spectroscopy for molecular trace gas detection using a pulsed DFB QCL emitting at 6.8 µm. In Photonics (Vol. 7, No. 3, p. 74). MDPI.

Pizzolotto, C., Adamczak, A., Bakalov, D., Baldazzi, G., Baruzzo, M., Benocci, R., ... & Vacchi, A. (2020). The FAMU experiment: muonic hydrogen high precision spectroscopy studies.

The European Physical Journal A, 56(7), 1-15.

Marcelli, N., et al. "Time dependence of the flux of helium nuclei in cosmic rays measured by the PAMELA experiment between 2006 July and 2009 December." The Astrophysical Journal 893.2 (2020): 145.

Sammartini, M., Gandola, M., Mele, F., Bertuccio, G., Ambrosino, F., Bellutti, P., ... & Vacchi, A. (2020).

Pixel drift detector (PixDD)–SIRIO: An X-ray spectroscopic system with high energy resolution at room temperature. Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment, 953, 163114.

Clemenza, Massimiliano, et al. "Muonic atom X-ray spectroscopy for non-destructive analysis of archeological samples." Journal of Radioanalytical and Nuclear Chemistry 322.3 (2019): 1357-1363.

Stoychev, L. I., Cabrera, H., Gadedjisso-Tossou, K. S., Vasiliev, N., Zaporozhchenko, Y., Nikolov, I. P., ... & Vacchi, A. (2019). 24 mJ Cr+ 4: forsterite four-stage master-oscillator power-amplifier laser system for high resolution mid-infrared spectroscopy. Review of Scientific Instruments, 90(9), 093002.

Clemenza, M., et al. "CHNET-TANDEM experiment: Use of negative muons at RIKEN-RAL Port4 for elemental characterization of “Nuragic votive ship” samples." Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment 936 (2019): 27-28.

Fuschino, Fabio, et al. "HERMES: An ultra-wide band X and gamma-ray transient monitor on board a nano-satellite constellation." Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment 936 (2019): 199-203.

Cirrincione, D., Ahangarianabhari, M., Ambrosino, F., Bajnati, I., Bellutti, P., Bertuccio, G., ... & Vacchi, A. (2019). High precision mapping of single-pixel silicon drift detector for applications in astrophysics and advanced light source. Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment, 936, 239-241.

Kourousias, G., et al. "XRF topography information: Simulations and data from a novel silicon drift detector system." Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment 936 (2019): 80-81.

Rachevski, A., Ahangarianabhari, M., Aquilanti, G., Bellutti, P., Bertuccio, G., Borghi, G., ... & Vacchi, A. (2019). The XAFS fluorescence detector system based on 64 silicon drift detectors for the SESAME synchrotron light source. Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment, 936, 719-721.

Bonesini, M., et al. "The upgraded beam monitor system of the famu experiment at riken–ral."

Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment 936 (2019): 592-594.

Stoychev, L. I., Cabrera, H., Gadedjisso-Tossou, K. S., Nikolov, I. P., Sigalotti, P., Demidovich, A. A., ... & Vacchi, A. (2019). Pulse amplification in a Cr4+: forsterite single longitudinal mode (SLM) multi-pass amplifier.

Laser Physics, 29(6), 065801.

Zhang, ShuangNan, et al. "The enhanced X-ray Timing and Polarimetry mission—eXTP."

SCIENCE CHINA Physics, Mechanics & Astronomy 62.2 (2019): 1-25.

Bozzo, Enrico, et al. "Observatory science with eXTP."

SCIENCE CHINA Physics, Mechanics & Astronomy 62.2 (2019): 1-42.

Vacchi, A. "Measuring the muonic H ground state hyperfine splitting with FAMU."

Il nuovo cimento C42.2-3 (2019):1-4.

Adamczak, A., Baccolo, G., Banfi, S., Bakalov, D., Baldazzi, G., Benocci, R., ... & Vacchi, A. (2018). The FAMU experiment at RIKEN-RAL to study the muon transfer rate from hydrogen to other gases.

Journal of Instrumentation, 13(12), P12033.

Most cited publications

 An anomalous positron abundance in cosmic rays with energies 1.5-100 GeV

PAMELA Collaboration Oscar Adriani et al.). Oct 2008. 20 pp.

Published in Nature 458 (2009) 607-609

 A new measurement of the antiproton-to-proton flux ratio up to 100 GeV in the cosmic radiation

O. Adriani et al.. Oct 2008. 11 pp.

Published in Phys.Rev.Lett. 102 (2009)

PAMELA results on the cosmic-ray antiproton flux from 60 MeV to 180 GeV in kinetic energy

PAMELA Collaboration O. Adriani et al.. Jul 2010. 11 pp.

Published in Phys.Rev.Lett. 105 (2010)

PAMELA Measurements of Cosmic-ray Proton and Helium Spectra

PAMELA Collaboration (O. Adriani et al.. Mar 2011. 13 pp.

Published in Science 332 (2011) 69-72

 The cosmic-ray electron flux measured by the PAMELA experiment between 1 and 625 GeV

PAMELA Collaboration O. Adriani et al.. Mar 2011. 11 pp.

Published in Phys.Rev.Lett. 106 (2011)

 The ALICE experiment at the CERN LHC ALICE Collaboration (K. Aamodt (Oslo U.) et al.). 2008. 259 pp. Published in JINST 3 (2008)

 Elliptic flow of charged particles in Pb-Pb collisions at 2.76 TeV

ALICE Collaboration K Aamodt et al.. Nov 2010. 10 pp.

Published in Phys.Rev.Lett. 105 (2010)

 Suppression of Charged Particle Production at Large Transverse Momentum in Central Pb-Pb Collisions at √sNN=2.76 TeV ALICE Collaboration (K. Aamodt et al.). Dec 2010. 10 pp.

Published in Phys.Lett. B696 (2011) 30-39

 Centrality dependence of the charged-particle multiplicity density at mid-rapidity in Pb-Pb collisions at

s√sNN =2.76 TeV ALICE Collaboration (Kenneth Aamodt et al.). Dec 2010. 14 pp.

Published in Phys.Rev.Lett. 106 (2011)

Main research management activities at the Italian National level

- **Coordinator of Scientific Technical Advisory Board for the CMM Centre of FBK** (2008 –2021)

**- Chair National Technology Transfer Board** of the INFN (2011-2016);

**- Executive Board of** (**INFN) (2009-11);**

**- Board of directors** of the GARR, Italian Academic-Research telecommunication Network (2009-11); - - **Chair of the Scientific Board & Editorial Director** of the INFN review **ASIMMETRIE (2007-11), - - Chair of the National Scientific Board** for financing R&D activities of (**INFN) (2000-2003).**

While locally, in the Trieste region, he was member of the **Board of Directors** of the International School for Advanced Studies (SISSA ) **(2012-2016), President of FIT**, the International Trieste Foundation for the future of sciences (2012-2016); **Director** of the Trieste division of the National Institute for Nuclear Research (**INFN) (**2003 – 08).

Meetings, Memberships and Talks

**ORGANISATION OF SCIENTIFIC MEETINGS (selection)**

XIX International Conference on Science, Arts and Culture
THE PROTON RADIUS- *Veli Lošinj, Croazia, 15 - 20 settembre 2019*

9-11/05/16 **Co-chair**, 2nd Meeting on Silicon Drift Detectors for Low Energy X-Ray Application, Palazzo Natta, COMO (I) 30 participants.

13-17/05/15 **Organizer** Workshop on Off-the-Beaten-Track Dark Matter and Astrophysical Probes of Fundamental Physics. ICTP Trieste, Italy

25-27/08/14 **Director & organizer** - GEOTHERMAL ENERGY: Status and Future in the Peri-Adriatic Area Veli Lošinj, Croatia, 60 participants.

22-26/06/14 **Organizing Committee** - International Workshop on Radiation Imaging Detectors iWoRID Trieste - Italy; 230 participants.

1-4/05/13 **Co-chair & organizer**: Workshop Science with GAMMA400, ICTP . 50 participants;

12-23/11/12 Organizer - Workshop on Recent Developments in Astro-nuclear and Astro-particle Physics ICTP; 60 participants.

18-24/9/16. **LOC** "Cosmic Ray Origin - beyond the standard models" San Vito di Cadore Italy

10-14/10/2016 ICPPA 2016  **International Advisory Committee Member** the Second International Conference on Particle Physics and Astrophysics Moscow, Russia

**COMMISSIONS OF TRUST / MEMBERSHIPS OF SCIENTIFIC SOCIETIES**

Since 2022 Distinguished Fellow **Bruno Kessler Foundation FBK** Trento (I),

2011&13 **Reviewer** - Accelerator and Detector R&D Program of the Scientific User Facilities Division, Office of Sciences, DOE; USA.

2010-13 **Member** OECD Experts Group on International Distributed Research Infrastructures (IDRIS)

2005 – 2006 **Member GSI FAIR** cost-review CORE-E at FAIR accelerator at GSI in Darmstadt (BRD).

**Member of** : **SIF** *Società Italiana di Fisica*;

**WAAS** *World Academy of Sciences and Arts* (USA);

**TALKS**

**Present status of the experiment to measure the ground state HFS of muonic hydrogen**

Workshop "Proton structure in and out of muonic hydrogen — the ground-state hyperfine splitting”

PSI 14-15 October 2022

" **The FAMU experiment aiming to measure the ground stat hyperfine splitting of muonic hydrogen**" invited presentation

The 25th International Conference of Spectral Line Shapes Caserta from June 19th to 24th, 2022.

"**Advanced customized high resolution X-ray detection systems**" 14th international conference on Synchrotron radiation instrumentation 28/3-1/04 2022 Hamburg Germany

- **Antimateria; la teoria gli esperimenti le applicazioni** Festival delle scuole di eccellenza universitarie 2022 - on line

- High Precision X-ray Measurements 2018 LNF 17-19/10/2018

"Development and performance of large area Silicon-drift detectors SDD and their potentials for

x-ray astrophysics and synchrotron light sources"

**"Towards the measurement of the hyperfine transition in muonic hydrogen"**

**- Nucleon Spin Structure at Low Q:**  **A Hyperfine View**

[ECT\* - European Centre for Theoretical Studies in Nuclear Physics](https://www.eventbrite.co.uk/o/ect-european-centre-for-theoretical-studies-in-nuclear-physics-and-related-areas-3796336629)

July 2-6, 2018 [Trento, Italy](https://www.eventbrite.co.uk/d/italy--trento/events/)

**"The FAMU experiment: Spectroscopy of the 1S HFS transition in muonic hydrogen
Determination of the Zemach radius of the proton"**

European Nuclear Physics Conference Bologna 2-9 September 2018

**"Development and performance of large area Silicon-drift detectors SDD and their potentials for low energy x-ray detection in synchrotron light sources & astrophysics"**

High Precision X-ray Measurements 2018 LNF 17-19/10/2018

09/2017 “ **The proton charge radius and Precision spectroscopy in Muonic Hydrogen**” Invited talk Italian Physical Society 103rd National Congress Section 1 Nuclear and Subnuclear Physics Trento

10/2017 "**Development and Performance of Advanced Room Temperature Solid State Drift Detectors and Electronics in Synchrotron Radiation, X-ray Astronomy and Astrophysics"** Invited talk 24th International Workshop on Room Temperature Semiconductor Detectors Atlanta Georgia USA

26/06/16 “**Development and performance of Si-drift-based detectors and their potential capability for x-ray astrophysics**,” invited: SPIE Astronomical Telescopes and Instrumentation, Edinburgh, UK

19/06/16 "**Muonic hydrogen ground state hydrogen Hyperfine splitting - towards the high precision measurement**" 2nd ECT\* Workshop on the Proton Radius Puzzle Trento Italy

22/05/16 " **Towards the high precision measurement of the hyperfine splitting of muonic hydrogen in the ground state**" PSAS‘2016: International Conference on  Precision Physics of Simple Atomic Systems [Hebrew University of Jerusalem](http://www.huji.ac.il/), Jerusalem, Israel

09/01/15 "**Measurement of the muon transfer rate from proton to heavier nuclei at epithermal energies**", 11th Program Advisory Committee Meeting RIKEN Nishina Center Japan

*I authorize the processing of my personal data pursuant to art. 13 Legislative Decree 196 of 30 June 2003 – “Personal data protection code” and art. 13 GDPR 679/16 – “European regulation on the protection of personal data”*

*14/04/2023*