

Andrea Signori

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Profile

I am a *Marie Curie Global Fellow* at the University of Pavia (IT) and Jefferson Lab (VA, USA) and I work in the field of theoretical subatomic physics. My interests focus on quantum chromodynamics (QCD), the theory which describes the strong force and the emergence of composite particles, the hadrons, from the elementary degrees of freedom, quarks and gluons. I conduct theoretical and phenomenological investigations into the structure of hadrons and the hadronization mechanism, also studying their impact on high-energy physics experiments. I can rely on a growing network of collaborations within international groups. I have experience and attitude for teaching and tutoring and I am involved in outreach activities.

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Work experience

Sept. 2019 - University of Pavia

present *Marie Curie Global Fellow*

Theoretical and phenomenological investigations of hadronization and hadron structure, multi-dimensional imaging of hadrons, impact on high-energy physics.
Supervisors: prof. Alessandro Bacchetta, prof. Jianwei Qiu.

Location: Theory Center, Jefferson Lab (2019-2021), and Physics Department, University of Pavia (2021-2022)

Aug. 2018 - Argonne National Laboratory

Aug. 2019 *Postdoctoral researcher*

Member of the Physics Division. Investigations of quantum chromodynamics with perturbative and non-perturbative methods, in support of the scientific program of a future Electron-Ion Collider (EIC).

Supervisor: dr. Ian Cloet.

Location: Physics Division, Argonne National Laboratory

Nov. 2016 - Thomas Jefferson National Accelerator Facility - Jefferson Lab

Aug. 2018 *Postdoctoral researcher*

Member of the Theory Center, working on the scientific case of high-energy scattering experiments aimed at improving our understanding of hadron structure.

Main collaborators: prof. Alberto Accardi, prof. L. Gamberg (Penn State U.), prof. Jianwei Qiu (supervisor), prof. Ted Rogers.

Location: Theory Center, Jefferson Lab

Nov. 2012 - FOM - Foundation for Fundamental Research on Matter

Oct. 2016 *Junior scientist*

Ph.D. candidate in the FOM team led by prof. dr. P.J.G. Mulders.

Topic: Theoretical subatomic physics.

Research program focused on theory and phenomenology of transverse-momentum-dependent partonic distributions and their impact on high-energy scattering experiments.

Locations:

- Department of Physics and Astronomy, Vrije Universiteit Amsterdam (VU)
- Theory Group, Nikhef - National Institute for Subatomic Physics

Graduation date: Oct. 17th 2016.

Dissertation: Flavor and evolution effects in TMD phenomenology (ISBN: 978-94-6233-401-4).

Jul. 2012 - DESY - Deutsches Elektronen-Synchrotron

Sep. 2012 *Summer Intern*

Phenomenological investigation of quantum chromodynamics at the HERMES experiment, supervised by dr. Gunar Schnell and dr. Aram Movsisyan.

Topic: Transverse double spin asymmetry in inclusive hadron production at HERMES.

Report: see my list of publications or the DESY online archive.

Awards and grants

June 2019 Jefferson Science Associates, LLC
JSA postdoctoral prize

The JSA postdoctoral prize for distinguished postdocs is run by the Jefferson Lab Users Organization Board of Directors. The award is based, in part, on a record of accomplishment in physics, the originality and quality of the proposed research, its impact on the Jefferson Lab physics program, and the proposed use of the research grant.

Title: ***Unraveling hadronization***

Grant amount: \$10 000 (announcement here)

Feb. 2018 European Commission - Horizon 2020 program
Marie Skłodowska-Curie Global Fellowship

The Marie Skłodowska-Curie Actions (MSCA) are a set of major mobility research grants created by the European Commission to support excellent scientific research. The MSCA fellowships are among Europe's most competitive and prestigious awards. The fellowship program aims to foster the career development and further training of researchers at all career stages, promoting interdisciplinary research and international collaborations.

Title: ***SQuHadron - Strategies to tackle the quest for hadronization***

Beneficiary: University of Pavia (IT), 2021-2022. Partner institution: Jefferson Lab (VA, USA), 2019-2021.

Grant amount: euro 262 269 (announcement here, fact-sheet here)

Sept. 2015 ILCAC - International Light Cone Advisory Committee
Gary McCartor travel award

Prize assigned by ILCAC to allow young scientists to develop their expertise and contribute to forefront physics research. Travel awards are granted to present research topics at the annual light cone conferences.

Research stays and visits

- **Institut de Physique Nucléaire, Orsay (FR)**
Collaboration with Dr. J. P. Lansberg
Mar. 15-18, 2015 / Nov. 2-4, 2014
- **Penn State University - Berks, Reading, PA (USA)**
Collaboration with prof. L. Gamberg, prof. A. Prokudin, dr. D. Pitonyak
Nov. 2-9, 2017
- **Thomas Jefferson National Accelerator Facility - Newport News, VA (USA)**
Collaboration with the Theory Center
Regular visits in 2018-2019
- **University of Michigan - Ann Arbor, MI (USA)**
Collaboration with prof. C. Aidala and her research group
Apr. 9-11, 2019
- **University of Pavia and INFN, Pavia (IT)**
Collaboration with the local "Hadron structure and QCD" group
Dec. 13-21, 2018 / Apr. 24-28, 2017 / Jul. 20-24, 2015 / Dec. 17-20, 2013

Teaching experience

- June, 4th - 6th 2019** - Hampton University Graduate School, HUGS 2019 - Jefferson Lab, Newport News (USA)
Recitation sessions - TMD physics
 Tutoring and recitation sessions for the TMD physics lectures in the HUGS 2019 program at Jefferson Lab (for the homepage of the HUGS program [click here](#)).
School director: prof. A. Accardi.
- June, 7th - 8th 2018** - Hampton University Graduate School, HUGS 2018 - Jefferson Lab, Newport News (USA)
Recitation sessions - TMD physics
 Tutoring and recitation sessions for the TMD physics lectures in the HUGS 2018 program at Jefferson Lab (for the homepage of the HUGS program [click here](#)).
School director: prof. A. Accardi.
- June, 22nd - 28th 2017** - TMD Collaboration Summer School - Temple University, Philadelphia, PA (USA)
TMD phenomenology
 Co-lecturer for the phenomenology section of the summer school organized by the Topical Collaboration for the Coordinated Theoretical Approach to Transverse Momentum Dependent Hadron Structure in QCD (TMD collaboration).
Organizer: TMD collaboration.
- Feb. 2014 - Mar. 2014** - Vrije Universiteit Amsterdam, Department of Physics and Astronomy
Electrodynamics and theory of relativity
 Teaching assistant for the students in the B.Sc. program in Physics: tutoring activities and grading homework.
Teacher: Prof. dr. H.G. Raven (VU, Nikhef).
- Nov. 2013 - Jan. 2014** - Universiteit van Amsterdam (UvA), Institute of Physics
Quantum Field Theory
 Teaching assistant for the students in the M.Sc. program in Physics: tutoring activities and grading homework.
 The course was part of the joint M.Sc. program between VU and UvA.
Teacher: dr. A. Castro Anich (UvA).
- Feb. 2013 - Mar. 2013** - Vrije Universiteit Amsterdam, Department of Physics and Astronomy
Electrodynamics and theory of relativity
 Teaching assistant for the students in the B.Sc. program in Physics: lecturing, tutoring activities and grading homework.
Teacher: Prof. dr. H.G. Raven (VU, Nikhef).
- Nov. 2012 - Jan. 2013** - Vrije Universiteit Amsterdam, Department of Physics and Astronomy
Quantum Field Theory
 Teaching assistant for the students in the M.Sc. program in Physics: tutoring activities.
 The course was part of the joint M.Sc. program between VU and UvA.
Teacher: Prof. dr. P.J.G. Mulders (VU, Nikhef).

Mar. 2012 - University of Pavia, Faculty of Economics

Sep. 2012 *Methods and models for business management*

Teaching assistant for the students in the Master courses in the Faculty of Economics: lecturing and tutoring activities.

Focus on mathematical models relevant for business management.

Teacher: Prof. dr. F. Francavilla (University of Pavia).

Oct. 2011 - University of Pavia, Faculty of Economics

Feb. 2012 *Methods and models for economic choices*

Teaching assistant for the students in the Master courses in the Faculty of Economics: lecturing and tutoring activities.

Focus on mathematical models relevant for economic problems and strategy planning.

Teacher: Prof. dr. F. Francavilla (University of Pavia).

Mar. 2010 - University of Pavia, Department of Mathematics

Sep. 2010 *Electromagnetic phenomena*

Teaching assistant for the students in the B.Sc. program in Mathematics: lecturing and tutoring activities.

Teachers:

Prof. dr. G. Giuliani (University of Pavia)

Prof. dr. E. Vitali (University of Pavia).

Mentoring

I contributed to the mentoring of the following students:

- M. Grewal (B.Sc. UCLA) 2017-2018 - project: predictive power of transverse momentum distributions

Education

- 2012-2016 Ph.D. Theoretical Subatomic Physic**
 Department of Physics and Astronomy,
 Vrije Universiteit Amsterdam, the Netherlands
- Topics:*
 Theory and phenomenology of transverse-momentum-dependent partonic distributions and their impact in high-energy physics processes.
- Promotor and supervisor:** Prof. dr. P.J.G. Mulders (VU and Nikhef)
Copromotor: Dr. Marco Radici (INFN Pavia)
Final dissertation: Flavor and evolution effects in TMD phenomenology (ISBN: 978-94-6233-401-4).
Graduation date: Oct. 17th 2016.
*Declared equivalent (“**equipollente**”) to the Italian title of “dottore di ricerca” by the Italian Ministry for Education (MIUR) in 2018.*
- 2009-2012 M.Sc. Physical Sciences - Theoretical curriculum**
 Faculty of Mathematical, Physical and Natural Sciences
 University of Pavia, Pavia (Italy)
- Outline of the topics:*
 Quantum field theory, Fundamental interactions theory, elementary particles phenomenology, hadronic physics.
 Foundations of quantum mechanics.
 General relativity and astrophysics.
 Computational and statistical methods in simulations and data analysis.
 Mathematical methods in physics, Econophysics, Biomathematics.
- Scientific writing.**
Promoters: Prof. dr. A. Bacchetta, Dr. M. Radici (INFN and University of Pavia)
Final dissertation:
 Exploring the flavour dependence of unpolarized transverse-momentum-dependent distributions
- 2006-2009 B.Sc. Physics**
 Faculty of Mathematical, Physical and Natural Sciences
 University of Pavia, Pavia (Italy)
- Outline of the topics:*
 Mathematical analysis, algebra, geometry, probability and statistics.
 Theoretical and experimental aspects of general physics (classical mechanics, thermodynamics, electromagnetism, waves and optics) and chemistry .
 Modern physics (relativity and quantum mechanics, fundamentals of nuclear and subnuclear physics, structure of matter).
 IT Skills (Unix environment, C++ and HTML programming languages).
- Promotor:** Prof. dr. G. Zambotti (University of Pavia)
Final dissertation: Yang-Lee’s theory of phase transitions (statistical mechanics)
- 2001-2006 Scientific high-school diploma** (Diploma di maturità scientifica)
 Liceo Scientifico G. Aselli, Cremona (Italy)
- Outline of the topics:*
 Experimental branch in Physics and IT - PNI (Piano Nazionale di Informatica).
 Natural sciences, mathematics.
 Italian literature, Latin, Philosophy, History, History of Art.
 English language and literature.

See also *Annex A: attended schools and lecture series.*

Appointments and scientific services

Peer-review

I serve as a *referee* for the following scientific journals:

- The European Physical Journal - Particles and Fields (EPJ-C)
- Physical Review D (PRD)
- Physical Review Letters (PRL)

Conferences and workshops

Sept. 2017 INT 17-3: Spatial and Momentum Tomography of Hadrons and Nuclei
Convener for the workshop "Hadron imaging at Jefferson Lab and at a future EIC"

Jun. 2017 - Light Cone 2018 Conference
May 2018 *Member of the organizing committee*

Member of the organizing committee (OC) and convener (C) for the Light Cone 2018 Conference, which belongs to a series of meetings that started in 1991 and played an important role in promoting the research towards a rigorous description of hadrons and nuclei.

1. [OC/C] Light Cone 2018 - Jefferson Lab, May 14-18, 2018

Dec. 2015 - QCD Evolution workshops
present *Member of the organizing committee and convener*

Member of the organizing committee (OC) and convener (C) for the QCD Evolution workshops, a series of meetings aimed at deepening our understanding of hadron structure combining theoretical and experimental efforts.

3. [OC/C] QCD evolution workshop 2019 - Argonne National Laboratory, 13-17 May 2019
2. [OC/C] QCD evolution workshop 2017 - Jefferson Lab, May 22-26, 2017
1. [OC/C] QCD evolution workshop 2016 - Nikhef, May 30-June 03, 2016

Jun. 2014 - Resummation-Evolution-Factorization (REF) workshops
present *Member of the organizing/advisory committees*

Member of the organizing committee (OC) or advisory committee (AC) for a series of workshops on the connection between transverse-momentum-dependent distributions (TMDs) and unintegrated distributions (uPDFs) and on the role of Resummation, Evolution, Factorization (REF) in high-energy physics.

6. [AC] REF 2017 - Madrid, November 13-16, 2017
5. [AC] REF 2016 - Antwerp, November 7-10, 2016
4. [AC] REF 2015 - DESY-Hamburg, November 2-5, 2015
3. [OC] preREF 2015 - Amsterdam, June 1-3, 2015
2. [OC] REF 2014 - Antwerp, December 8-11, 2014
1. [OC] TMD/uPDF workshop - Antwerp, June 23-24, 2014

Other services

Aug. 2017 - Jefferson Lab - Theory Center
Aug. 2018 *Member of the organizing committee for the Theory Seminars 2017-2018*
 Selection of topics, speakers, local support.

Oct. 2014 - Quantum Diaries

Oct. 2016 *Blogger*

Periodic contributors for Quantum Diaries, blog of the Interactions Collaboration, a communication resource from the world's particle physics laboratories. Some articles were also posted by the Nikhef Blog.

Apr. 2014 - ProVU - PhDs and postdocs organization at VU

Jun. 2014 *Member of the organizing committee for the PhD Day 2014 at VU: "Science, connecting people"*

Event held on 25/06/2014 - established contacts with non-academic institutions, e.g. Shell, Roland Berger, Amsterdam University Press, Amsterdam Center for Entrepreneurship. For more information see the webpage of the event.

Nov. 2013 - Nikhef Theory Group

Oct. 2016 *Member of the organizing committee of the monthly "Factor Society" meetings*

A series of informal talks and discussions about factorization theorems in QCD, part of the educational activities within the Theory Group at Nikhef.

Nov. 2013 - Dutch Research School in Theoretical Physics (DRSTP) - Educational Board

Jan. 2014 *Assisting Prof. dr. J.W. van Holten and Prof. dr. S. Ando in organizing the THEP school 2014*

Selection of topics and speakers.

Nov. 2012 - Dutch Research School in Theoretical Physics (DRSTP)

Nov. 2015 *Member of the Ph.D. council - representative of Vrije Universiteit Amsterdam*

Active participation in the annual meetings of the PhD council, member of the organizing committees for the annual "PhD Day" and the bi-annual "Trends in Theory" meeting.

IT skills

- *Operating systems*: Unix environment, Mac OS, Windows
- *Programming languages*: C/C++, FORM, Fortran, HTML, Mathematica, Python
- *Simulation and statistical data analysis*: ROOT, CERN library, Gnu Scientific Library

Languages

- **Italian**: native speaker
- **English**: full working proficiency (C2 level EF SET certificate - May 2018)
- **Dutch**: first intermediate A2+ level

Courses and certificates

- EF SET certificate: C2 level (May 2018)
- VU-NT2 - Nederlands voor werk en studie. First intermediate level A2+ (May-July 2015)
- First Certificate in English - B level (June 2005)

Outreach

My interests focus mostly on **scientific writing**, for which I have taken specific classes at University of Pavia. I contributed to the following websites and magazines:

- *Stukhtra*: <http://www.stukhtra.it/>
- *Puntozero*: <http://puntozeroblog.com/>
- *Eureka*, science online issue of Corriere del Ticino, Swiss newspaper: <http://plus.cdt.ch/eureka>
- *Meridiana*, magazine of the Ticinese Astronomical Society

I have been a contributor for the Nikhef Blog and Quantum Diaries, the blog of the Interactions Collaboration, a communication resource from the world's particle physics laboratories.

Participation in the Nikhef Open Day - year 2013, 2014, 2015, 2016.

Outreach publications on academic journals

1. **Femtostrutture: e pluribus unum**

Alessandro Bacchetta (INFN and Pavia U.), AS (VU and Nikhef)

Contributions to the “Quaderni Borromaici”, Italian magazine of the Almo Collegio Borromeo in Pavia (Italy)

Other interests

- Supporting **Youth for Understanding**, association advancing intercultural understanding through educational exchanges for youth, families and communities (VA, USA, 2017-present)
- Volunteering for **Aaneen**, association supporting social integration in the Netherlands (Amsterdam, 2015-2016)
- Experiences with boy scouts and other educational activities involving adolescents (Cremona, Italy)
- Cycling, trekking, cooking, reading, photography

References

(listed in alphabetic order)

Name Alberto Accardi
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 Jefferson Lab
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Name Alessandro Bacchetta
Institution University of Pavia e INFN
Position Associate physics professor
Contact alessandro.bacchetta@unipv.it

Name Ian Cloët
Institution Argonne National Laboratory
Position Physicist
Contact icloet@anl.gov

Name Leonard Gamberg
Institution Penn State University
Position Professor of Theoretical Physics
Contact lpg10@psu.edu

Name Piet Mulders
Institution Vrije Universiteit and Nikhef
Position Physics professor
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Name Jianwei Qiu
Institution Jefferson Lab
Position Associate director for Theoretical
 and Computational Physics
 and Theory Center Director
Contact jqiu@jlab.org

Name Marco Radici
Institution INFN
Position Senior researcher and
 physics professor
Contact marco.radici@pv.infn.it

Annex A: attended schools and lecture series

14. **Summer School of the TMD collaboration**
June 22-28, 2017, Temple University, Philadelphia (USA)
13. **Software Carpentry Workshop**
May 17-19, 2017, Thomas Jefferson National Accelerator Facility (USA)
12. **FOM Foundation Business Orientation Week**
November 22-27, 2015, Nijenrode Business Universiteit, Breukelen (NL)
11. **NT2-VU Nederlands voor werk en studie**
May-July 2015, Vrije Universiteit Amsterdam, Amsterdam (NL)
10. **High-performance computing**
Jan. 2015, Universiteit van Amsterdam, Amsterdam (NL)
9. **Bound states in QED and QCD**
Mar./Apr. 2014, Paul Hoyer, Nikhef, Amsterdam (NL)
8. **DRSTP - Theoretical High-Energy Physics School 2014**
27/01-07/02/2014, Dutch Research School in Theoretical Physics (THEP), Doorn (NL)
7. **Taking charge of your PhD project**
Sept. 10, Oct. 01, 2013, FOM, Utrecht (NL)
6. **Dutch Welcome Course**
September 19-25, 2013, Babel Talen institute - FOM, Utrecht (NL)
5. **Soft and collinear gluons in perturbative QCD**
May/June 2013, Lorenzo Magnea, Nikhef, Amsterdam (NL)
4. **DRSTP - Theoretical High-Energy Physics School 2013**
11-22/02/2013, Dutch Research School in Theoretical Physics (THEP), Doorn (NL)
3. **Introduction to C++ and object-oriented programming**
Jan. 2013, Wouter Verkerke, Nikhef, Amsterdam (NL)
2. **Nikhef Topical Lectures** - Nikhef, Amsterdam (NL)
15-17/6/2015, Kinetic theory, hydrodynamics and AdS/CFT to model heavy-ion collisions
17-19/12/2014, Nuclear Physics
05-07/03/2014, CP violation
05-07/12/2012, Higgs physics
1. **Introduction to FORM**
Nov. 2012, Jos Vermaseren, Nikhef, Amsterdam (NL)