

Curriculum Vitae

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Personal information.

- *Date and place of birth:* Barcelona, Spain, 15/02/1980.
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Education.

- *07/07/2006:* PhD in Theoretical Physics, University of Barcelona (Spain).
Supervisors: Prof. J. I. Latorre and Prof. S. Forte.
- *2004:* MSc in Physics, University of Barcelona (Spain).
- *2002:* BSc in Physics, University of Barcelona (Spain).

Current position. Associate Professor, Department of Physics and Astronomy, Vrije Universiteit Amsterdam; and Staff Member, Theory group, Nikhef, The Netherlands.

Previous positions.

- *2014-2018:* Associate Professor, Department of Physics and Astronomy, Vrije Universiteit Amsterdam.
- *2014-2016:* STFC Rutherford Fellow (Junior Faculty), University of Oxford, United Kingdom.
- *2011-2014:* Marie Skłodowska-Curie Fellow, Theory Department, CERN, Switzerland.
- *2008-2011:* Postdoctoral researcher, INFN and Milano University, Milano, Italy.
- *2006-2008:* Postdoctoral researcher, LPTHE, Université Paris VI, Paris, France.

A career in a nutshell.

- (Co-)authored 95 peer-reviewed papers on a wide variety of topics, from the structure of the proton and Higgs pair production with jet substructure to calculations of neutrino fluxes at IceCube.
- Secured more than €3M in grant funding as PI, including an ERC Starting Grant, which has been supporting 4 PhD students, 6 postdocs, and a large number of undergraduate students and temporary guests.
- Regularly invited at international conferences and workshops to give review talks.
- Nominated “Physics Coordinator” of the NNPDF Collaboration.
- Leadership in the particle physics theory community recognized by election as Affiliate Scientist both within the CMS (2011-2014) and ATLAS (2014-now) collaborations of the LHC.
- Awarded a Visiting Professorship at the University of Oxford, elected Fellow of Young Academy of Europe.

Supervision of graduate students and postdocs.

- Supervisor (completed and ongoing) of 5 PhD thesis: E. R. Nocera (Milano 2014), L. Rottoli (Oxford 2018), F. Giuli (Oxford 2018), E. Slade (Oxford 2019), R. A. Khalek (Amsterdam 2021).
- Supervisor of 6 postdoctoral researchers: N. P. Hartland (Oxford and Amsterdam 14-18), V. Bertone (Oxford and Amsterdam 15-18), M. Bonvini (Oxford 14-16), E. Nocera (Oxford 15-17), J. Ethier (Amsterdam 18-21), R. Gauld (Amsterdam 18-21).
- Supervisor of 7 BSc thesis, 5 MSc thesis, and 4 summer projects in Milano, CERN, Oxford, and Amsterdam.

Organization of scientific meetings and conferences (selection).

- *from 2018:* “*Dutch National Seminar of Theoretical High Energy Physics*” (Nikhef), organiser.
- *06/2017:* “*Big data tools for physics and astronomy*” conference (Amsterdam), organiser.
- *04/2017:* “*Deep Inelastic Scattering 2017*” workshop (Birmingham), organiser.
- *03/2017:* “*Parton Distributions and Lattice Calculations in the LHC Era*” workshop (Oxford), organiser.
- *08/2016:* “*Parton Distributions*” session, QCD@LHC2016 Conference (Zurich), convener.
- *07/2015:* *European Physical Society Conference on High Energy Physics 2015*, convener of QCD session.
- *02/2015:* “*Parton Distributions for the LHC*” workshop, Benasque Center for Science, organiser.
- *09/2014:* “*Topical workshop on $t\bar{t}$ distributions*” (Cannes), organiser.

- 11/2014: “*Implications of LHCb measurements and future prospects*” workshop (CERN), convener.
- 2012-2014: *CMS PDF Forum* (CERN), convener and organiser of kick-off workshop.
- 09/2010: “*Taller de Altas Energias*” (Barcelona), the Spanish national HEP PhD school, organiser.

Institutional responsibilities

- 2017-2019: *Management committee member*, COST action “*ParticleFace*”.
- 2017-now: *Outreach committee member*, Department of Physics and Astronomy, VU Amsterdam.
- 2017-now: *Physics Coordinator* of the [NNPDF Collaboration](#)
- 2016-now: *Coordinator* of Visiting Professorships of Amsterdam’s Institute of Physics and Astronomy.
- 2016-now: *Member*, Joint Activities Committee, Amsterdam’s Institute of Physics and Astronomy.
- 2014-2016: *Coordinator*, graduate admissions of Ph. D. candidates in the Particle Theory group, Oxford.
- 2014-2016: *Examiner for undergraduate admissions*, Balliol College, Oxford.

Teaching activities.

- 2017-now: “*Quantum Field Theory*”, joint UvA/VU MSc Physics and Astronomy.
- 2017-now: “*Introduction to Elementary Particles*”, BSc Applied Physics, Delft University of Technology.
- 2017: “*Topical Lectures on Symmetries*”, graduate course for Nikhef Ph. D. students.
- 2016-now: “*From Quantum to Molecules*”, BSc Medical Natural Sciences, VU Amsterdam.
- 2014-2016: *Lecturer at Balliol College*, University of Oxford. Courses taught: Electromagnetism, Thermal Physics, Atomic and Laser Physics, Subatomic Physics, Special Relativity.
- 2014-2016: “*The Standard Model*”, MSc in Mathematical and Theoretical Physics, University of Oxford.
- 2010-2011: “*Computational Methods in Physics*”, BSc in Physics, Milano University.
- 2004-2006: Teaching Assistant of “*Calculus*” and “*Advanced Quantum Mechanics*”, University of Barcelona.

In 2017 I obtained my University Teaching Qualification (*Basiskwalificatie Onderwijs*), official certification of didactic competence for university professors in the Netherlands.

Membership of scientific societies.

- Member of the [Young Academy of Europe](#) (YAE), elected in 2017.
- Member of the Dutch Research School of Theoretical Physics (DRSTP).
- Member of the Dutch Physical Society (*Nederlandse Natuurkundige Vereniging*).

Refereeing activities. I am referee for the following *national science funding agencies*: German Research Foundation (DFG), Israel Science Foundation, Agencia Nacional de Evaluación y Prospectiva (ANEP, Spain), Centro Nacional de Física de Partículas, Astropartículas y Nuclear (CPAN, Spain), Netherlands Organisation for Scientific Research (NWO), and the Romanian National Science Foundation.

I am referee for the following *scientific journals*: Physics Letters B, Journal of High Energy Physics, Nuclear Physics, European Journal of Physics, International Journal of Modern Physics A, Journal of Physics G.

Writing of popular science books.

- 2017: “*La vida íntima de las partículas*” (“*The inner life of particles*”), popular science book released in Spanish, Italian, and Portuguese, Editorial Materia.

Outreach activities (selection).

- 2017: “*Deciphering the secret code of Nature: from the Higgs particle to gravity waves*”, outreach lecture to high-school students at the *International School of Den Haag*, November 2017 ([slides](#)).
- 2017: “*Eureka: the adventure of scientific discovery*”, interview for the *London Encounter 2017* exhibit.
- 2015: “*Particle Physics, CERN and the Large Hadron Collider*”, presentation at the *Science Fair* of *St. Aloysius* school, Oxford ([slides](#)).
- 2015: “*The Standard Model and the Large Hadron Collider in the Higgs Boson Era*”, Oxford Saturday Mornings of Theoretical Physics, Oxford ([video recording](#)).
- 2014: “*Beyond the Boson: Higgs discovery and the next steps for particle physics*”, Physics Department Newsletter, University of Oxford ([.pdf](#)).

Media appearances (selection).

- “*After 40 years of studying the strong nuclear force, a revelation*”, *The Guardian*, December 2017.

- “*There’s still a lot we don’t know about the proton*”, interview for *Science News*, April 2017.
- “*What goes inside a proton?*”, *The Guardian*, February 2015.
- “*Proton Spin Mystery Gains a New Clue*”, interview for *Scientific American*, July 2014.

Research achievements highlights.

- Formulated and led the neural network (NNPDF) approach to parton distributions (main outcome of my PhD thesis) as well as its extension to polarised PDFs and to fragmentation functions.
- Demonstrated that LHC data provides unique constraints on the proton structure, from top quark to charm production, and quantified how the latter allows for precision predictions in ultra-high energy astrophysics.
- Provided evidence for BFKL dynamics in HERA data culminating 30 years of searches.
- Showed that Higgs self-couplings can be probed in the $b\bar{b}b\bar{b}$ final state at the LHC, thought to be impossible.
- Successfully applied machine learning tools to a variety of problems in high-energy physics.
- Developed the PDF reduction techniques used in the official PDF4LHC recommendations for LHC Run II.
- Author of widely-used high-energy physics software tools such as APFEL, HOPPET, and aMCfast.

Selected publications in leading international peer-reviewed journals. In my field, authors are always listed in alphabetical order. Number of citations and other bibliometric indicators have been obtained from the [InspireHep](#) database as of May 24, 2019. I indicate the publications more directly related to the proposal.

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| (1) R. D. Ball, V. Bertone, M. Bonvini, S. Marzani, J. Rojo , and L. Rottoli,
“ <i>Parton distributions with small-x resummation: evidence for BFKL dynamics in HERA data</i> ”,
Eur. Phys. J. C in press (2018), arXiv:1710.05935 . | # cit.

44 |
| (2) J. Gao, L. Harland-Lang, and J. Rojo ,
“ <i>The Structure of the Proton in the LHC Precision Era</i> ”,
Physics Reports in press (2018), arXiv:1709.04922 . | 59 |
| (3) R. D. Ball, V. Bertone, S. Carrazza, L. D. Debbio, S. Forte, A. Guffanti, N. P. Hartland, Z. Kassabov, J. Latorre, E. Nocera, J. Rojo , L. Rottoli, E. Slade, and M. Ubiali,
“ <i>Parton distributions from high-precision collider data</i> ”,
Eur. Phys. J. C 77 (2017) no.10, 663 , arXiv:1706.00428 . | 265 |
| (4) V. Bertone, S. Carrazza, N. P. Hartland, E. R. Nocera and J. Rojo ,
“ <i>A determination of fragmentation functions of pions, kaons and protons with faithful uncertainties</i> ”,
Eur. Phys. J. C 77, no. 8, 516 (2017), arXiv:1706.07049 . | 37 |
| (5) R. Gauld and J. Rojo ,
“ <i>Precision determination of the small-x gluon from charm production at LHCb</i> ”,
Phys. Rev. Lett. 118, 072001 (2017), arXiv:1610.09373 . | 49 |
| (6) R. D. Ball, V. Bertone, S. Carrazza, C. S. Deans, L. Del Debbio, S. Forte, A. Guffanti, N. P. Hartland, J. I. Latorre, J. Rojo , and M. Ubiali,
“ <i>Parton distributions for the LHC Run II</i> ”, <i>JHEP</i> 1504 , 040 (2015), arXiv:1410.8849 . | 1538 |
| (7) E. R. Nocera, R. D. Ball, S. Forte, G. Ridolfi, and J. Rojo ,
“ <i>A first unbiased global determination of polarized PDFs and their uncertainties</i> ”,
Nucl. Phys. B 867 (2013) 244, arXiv:1406.5539 . | 174 |
| (8) V. Bertone, S. Carrazza and J. Rojo , “ <i>APFEL: A PDF Evolution Library with QED corrections</i> ”,
Comp. Phys. Comm. 185 (2014) 1647, arXiv:1310.1394 . | 137 |
| (9) R. D. Ball, V. Bertone, S. Carrazza, C. S. Deans, L. Del Debbio, S. Forte, A. Guffanti, N. P. Hartland, J. I. Latorre, J. Rojo , and M. Ubiali,
“ <i>Parton Distributions with LHC data</i> ”, Nucl. Phys. B 867 (2013) 244, arXiv:1207.1303 . | 1290 |
| (10) R. D. Ball, V. Bertone, F. Cerutti, L. Del Debbio, S. Forte, A. Guffanti, J. I. Latorre, J. Rojo and M. Ubiali, “ <i>Impact of Heavy Quark Masses on Parton Distributions and LHC Phenomenology</i> ”,
Nucl. Phys. B 849 (2011) 296, arXiv:1101.1300 . | 492 |

My 93 peer-reviewed publications, published in the highest-impact journals of my field, accumulate **12092 citations** and average **130 cit/paper**, with an h -index of $h = 47$. They include 5 renowned papers (over 500 citations), seven famous papers (over 250 citations) and 19 very well-known ones (over 100 citations). An

Grants and funding as PI.

Grant	Amount	Funding source	Year of award
<i>Marie-Sklodowska Curie Intra-European Fellowship</i>	€ 180k	European Commission	2010
<i>Rutherford Fellowship</i>	£541k (\simeq €690k)	Science and Technology Facilities Council (UK)	2013
<i>Starting Grant</i>	€ 1330k	European Research Council	2013
<i>Ramon y Cajal Fellowship</i> (declined)	€ 359k	Ministry of Economy (Spain)	2013
<i>Rutherford Grant</i>	£233k (\simeq €298k)	Science and Technology Facilities Council (UK)	2015
<i>Physics Projectruimte</i>	€ 420k	Netherlands Organization for Scientific Research (NWO)	2017
<i>Total funding</i>	€3.277M		

updated publication list and citation metrics can be found at <http://tinyurl.com/JRpub> and <http://tinyurl.com/JRcite> respectively.

Invited talks at international conferences (selection).

- “*Bridging collider physics and neutrino telescopes with charm production*”, Physics@Veldhoven2018 *Focus Session*, Veldhoven, the Netherlands, January 2108 ([slides](#)).
- “*Parton Distributions in the high-precision LHC era*”, Zurich Phenomenology Workshop 2018 (ZPW18): Flavours, Light, Heavy, and Dark, Zurich, January 2018 ([slides](#)).
- “*Precision QCD Processes at the LHC*”, ICFA seminar on Future Perspectives in High Energy Physics, Ottawa, Canada, November 2017 ([slides](#)).
- “*Neural networks and machine learning in high energy physics*”, Trends in Theory 2017, Dutch Research School of Theoretical Physics, Delfsen, The Netherlands, May 2017 ([slides](#)).
- “*Recent progress in proton and nuclear PDFs*”, Large Hadron Collider Physics Conference 2017 (LHCP2017), Shanghai, China, May 2017 ([slides](#)).
- “*Neural network fits of parton distributions*”, 4th workshop on the QCD structure of the nucleon (QCD-N’2016), Bilbao, July 2016 ([slides](#)).
- “*The structure of the proton and precision LHC phenomenology*”, Center for Theoretical Physics, MIT, Boston, November 2016 ([slides](#)).
- “*Parton Distributions at the LHC: lesson from Run I and preparation for Run II*”, ATLAS Standard Model Workshop, Annecy, February 2015 ([slides](#)).

Awards, prizes, and distinctions.

- 2017: Elected member of the [Young Academy of Europe](#).
- 2016-2019: Awarded a *Visiting Professorship*, Department of Physics, University of Oxford.
- 2014-now: Elected *Short Term Affiliate* within the ATLAS Collaboration.
- 2011-2014: Elected *Affiliate Scientist* within the CMS Collaboration, convener of CMS PDF fit forum.
- 2002: *Undergraduate Award* of the Physics Faculty (best grades of cohort), University of Barcelona.

Scientific software development.

- NNPDF Parton Distributions, available via [LHAPDF](#) and the NNPDF website, nnpdf.mi.infn.it.
- APFEL-GUI, online graphical user interface for PDFs, luminosities, and cross-sections, apfel.mi.infn.it.
- aMCfast: automation of fast NLO calculations for PDF fits, amcfast.hepforge.org.
- APFEL: PDF DGLAP evolution and DIS structure functions up to NNLO, apfel.hepforge.org.
- HOPPET: a Higher Order Perturbative Parton Evolution Toolkit, hoppet.hepforge.org
- PromptNuFlux, calculation of the prompt atmospheric neutrino flux, promptnuflux.hepforge.org.

Involvement in future HEP planning.

- Convener of the PDF section (Standard Model WG) of the *HL/HE-LHC* Physics Yellow Report.
- Author of [Standard Model](#) (PDF section convener) and [Higgs](#) chapters of *Future Circular Collider* Report.
- Member of the *Snowmass Community HEP Planning* WG, author of [QCD](#) and [electroweak](#) physics reports.
- Member of the *TLEP/FCC-ee* WG, author of first overview of [physics potential](#) of this future e^+e^- collider.
- Member of the *Large Hadron Electron Collider* (LHeC) WG and author of its [Conceptual Design Report](#).