Curriculum Vitæ

Grégory Soyez

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Birthdate:	September 16 1978	Nationality:	Belgian

Research in a nutshell: Collider phenomenology, QCD, jet physics, QCD at high-energy

My current research activities focus mainly on jet physics. With G.P. Salam and M. Cacciari, we have introduced three tools widely used at the LHC: the anti-k_t algorithm, FastJet (a package for jet finding), and a strategy for pileup subtraction. The largest fraction of my research today is focused on a first-principle approach to jet substructure and related topics.

More generally, I am interested by LHC phenomenology and QCD in particular. For example, I spend a fraction of my research on the study the high-energy limit of QCD with the group at the IPhT in CEA Saclay, an activity that I started as a PostDoc at the IPhT and at the Brookhaven National Laboratory. Very recently, I have started to study parton showers in the quark-gluon plasma.

My earlier research experience, during my PhD, focused on the proton structure functions and the interplay between perturbative QCD and Regge theory. I have also worked independently on the structure of the QCD vacuum, using light-cone quantisation.

Employment

02/2010 - now:	CNRS Associate Scientist at the IPhT (CEA Saclay)
10/2009 - 09/2010:	CERN fellow
10/2007 - 09/2009:	Research Associate at the Brookhaven National Laboratory
10/2004 - 09/2007:	Postdoc as a FNRS Research Fellow (Chargé de recherches)

With this fellowship, I have visited the following places:

- 10/2004 - 10/2006: SPhT, CEA Saclay, France.
- 11/2006 - 01/2007: LPTHE, University Paris VI/VII, France.
- 02/2007 - 03/2007: GGI program, Firenze, Italy.
- 03/2007 - 06/2007: BNL, New York, USA.

Education

- 2017-03: Habilitation thesis from the University Pierre et Marie Curie.
  Title: *Pileup mitigation at the LHC, a theorist view* [PDF]
- 2001-04: Ph.D. in Physics from the University of Liège. Highest honours on January 6, 2004.
  Title: *Deep Inelastic Scattering at small x: Perturbative QCD and S-matrix theory* [PDF]
- 2001-02: D.E.A. (5^{th} year degree) in Physics from the University of Liège. Highest honours.
  Title: *The DGLAP equation: analytical properties and numerical resolution* [PDF]
- 1999-00: License (4^{th} year degree) in Physics from the University of Liège. Highest honours.
  Title: *Light-cone quantisation, application to vacuum and zero modes*
- 1997-98: Candidature (2^{nd} year degree) in Physics from the University of Liège. Highest honours.
- 1997-98: 2^{nd} year degree in Mathematics from the University of Liège. Highest honours.

Selected most-representative publications: (both major achievements and recent interests)

- The 3 works that lay basis for the current jet-reconstruction framework at the LHC:
  1. M. Cacciari, G.P. Salam and G. Soyez, *The anti-k_t jet clustering algorithm*, JHEP 0804 (2008) 063 [arXiv:0802.1189], 4905 citations (as of Jan 3 2018).
  2. M. Cacciari, G.P. Salam and G. Soyez, *FastJet User Manual*, Eur. Phys. J. C 72 (2012) 1896 [arXiv:1111.6097], 2113 citations.
  3. M. Cacciari, G.P. Salam and G. Soyez, *The Catchment Area of Jets*, JHEP 0804 (2008) 005 [arXiv:0802.1188], 596 citations.
- The original work addressing the question of infrared-and-collinear safety for jet clustering:
  4. G.P. Salam and G. Soyez, *A Practical Seedless Infrared-Safe Cone jet algorithm*, JHEP 0705 (2007) 086, [arXiv:0704.0292], 436 citations.
- Recent work on jet substructure with perturbative-QCD analytic control:
  5. A. J. Larkoski, S. Marzani, G. Soyez and J. Thaler, *Soft Drop*, JHEP 1405 (2014) 146 [arXiv:1402.2657], 200 citations.
  6. G.P. Salam, L. Schunk and G. Soyez, *Dichroic subjettiness ratios to distinguish colour flows in boosted boson tagging*, JHEP 1703 (2017) 22, [arXiv:1612.03917], 8 citations.
- Recent work on pileup mitigation (area-median extensions and proposal for new methods):
  7. G. Soyez, G.P. Salam, J. Kim, S. Dutta and M. Cacciari, *Pileup subtraction for jet shapes*, Phys Rev. Lett. 110 (2013) 16, 162001 [arXiv:1211.2811], 71 citations.
  8. M. Cacciari, G.P. Salam and G. Soyez, *SoftKiller, a particle-level pileup removal method*, Eur.Phys.J. C75 (2015) 2, 59 [arXiv:1407.0408], 42 citations.
- Two representative examples of work done on the high-energy limit of QCD:
  9. E. Iancu, J.D. Madrigal, A.H. Mueller, G. Soyez, D.N. Triantafyllopoulos, *Resumming double logarithms in the QCD evolution of color dipoles*, Phys.Lett. B744 (2015) 293-302 [arXiv:1502.05642], 64 citations.
  10. G. Soyez, *Saturation QCD predictions with heavy quarks at HERA*, Phys. Lett. B 655 (2007) 32 [arXiv:0705.3672], 113 citations.

Major software projects:

- *FastJet*: an interface to fast jet-finding algorithms with tools for background subtraction using jet areas. Developed with M. Cacciari and G.P. Salam. See `http://www.fastjet.fr`
- *SISCone*: the Seedless and Infrared-Safe Cone algorithm, developed with G.P. Salam. See `http://projects.hepforge.org/siscone`

Distinctions and grants

- 12/2016: Thibaud Prize of the "Académie des Sciences, Belles Lettres et Arts" in Lyon (awarded every 2 years in nuclear and particle physics)
- 09/2016: Auditionned for the ERC Consolidator grant. Rated A but not funded.
- 10/2016-03/2021: Member of the ANR *DenseQCDAtLHC* (Projet Blanc; PI: E.Iancu)
- 10/2015-09/2019: PI of the ANR *OptimalJets* (Défi de tous les savoirs)
- 10/2011-03/2016: Member of the ANR *CGC@LHC* (Projet Blanc; PI: F.Gélis)
- 10/2010-09/2014: PI of the ANR *Jets4LHC* (Chaire d'Excellence)
- 07/1997: Roset Prize of the AMULg (Association of the Ulg Mathematicians), granted each year to a student in Mathematics
- 07/1996: Participation, with the Belgian team, to the 37th International Mathematical Olympiad. Bronze medal.

Supervision of students and postdocs

- 2018-2019: Supervision of Vincent Theeuwes' postdoc (German DAAD-Prime)
- 2017-2020: PhD advisor of Giovanni Stagnitto (with M. Cacciari)
- 2017-2020: PhD advisor of Paul Caucal (with E. Iancu)
- 2017-2019: Supervision of Davide Napoletano's postdoc (ANR OptimalJets)
- 2017: Master (2nd year) internship of Paul Caucal (with E. Iancu)
- 2017: Master (1st year) internship of Linnéa Gräns Samuelsson (with E. Iancu)
- 2014-2017: PhD advisor of Lais Sarem Schunk (graduated on September 21 2017)
- 2014: Master internship advisor of Lais Sarem Schunk
- 2011-2013: Supervision of Ji-Hun Kim's postdoc (ANR Jets4LHC)
- 2011: Master internship advisor of Stéphane Dartois (ENS Lyon)

Teaching experience

- 04/2017: External examiner for Heather McAslan (PhD)
- 2011-now: Exercises for the QCD lectures at the ENS (Master 2) (6 hours)
- 06/2016: Lectures on jet physics at the QCDMasterClass summer school (France, 6 hours)
- 06/2016: Member of Matthias Saimpert's PhD jury
- 12/2015: Lectures on Advanced QCD at the UCL (Louvain, Belgium, 10 hours)
- 10/2015: Lectures on jets physics the Prague University (6 hours)
- 2015: QCD lectures at the ENS (Master 2) (12 hours)
- 10/2014: Member of Martin Zeeman's PhD jury
- 09/2014: Lectures on jets physics at a Summer school in Natal (Brazil, 6 hours)
- 04/2014: Lectures on QCD and jet physics at a school in Trento (Italy, 6 hours)
- 09/2011: Discussion Leader at the *CERN European School of High-Energy Physics* (Romania, 2011, 11 hours)
- 09/2010 Lectures on Phenomenology of hardonic collisions at the BND Summer School (Oostende, Belgium, 6 hours)
- 12/2008: Lectures on Advanced QCD at the UCL (Louvain, Belgium, 10 hours)
- 2004: Physics laboratories for 1st year students in Computer Sciences (50 hours/year)
- 2003: Physics laboratories for 1st year students in Computer Sciences (50 hours/year)
- 2000-2001: Programming exercises for B.A. students in Chemistry (30 hours/year)

Institutional responsibilities

- 2018-now: Member of the IPhT Scientific Council ("conseil scientifique")
- 2016-now: Member of the IT Committee ("commission informatique") of the IPhT
- 2016-now: Coordinator of the jet working group of the GDR-QCD
- 09/2012-09/2016: Member of the Section 02 ("Particle physics: Theory and Models") of the French National Committee for Scientific Research (CoNRS)
- 2011, 2013: Jet contact for the Les-Houches Physics at TeV collider workshops

Organisation of meetings and seminars

- 2018: Main organiser (with Matteo Cacciari) of the Boost 2018 conference
- 2016: Main organiser (with Matteo Cacciari) of the PSR 2016 workshop
- 2015: Organisation committee for the conference "Poetic 6"
- 2015: Organisation committee for the conference "Blois 2015"
- 04/2014: Co-organisation of the workshop "QCD and forward physics at the LHC"
- 07/2013: Co-organisation of the "Workshop on jets in Heavy-Ion collisions", in Paris
- 10/2011-now: Co-organisation of the weekly Particle Physics and Cosmology seminars at the IPhT (CEA Saclay)
- 10/2008-09/2009: Organisation of the weekly Nuclear Theory Group seminars at Brookhaven National Laboratory

Seminars:

1. *New perspectives in QCD with jet substructure*, January 16 2018, Vienna University.
2. *Jets and their substructure: What? Why? How?*, May 04 2017, Sussex University.
3. *Jets at the LHC: from Run I to Run II and beyond*, May 27 2016, Manchester University.
4. *Jet substructure at the LHC*, April 27 2016, Université de Liège.
5. *Boosted jets and jet substructure*, December 2 2015, Université Catholique de Louvain.
6. *New challenges for jet physics at the LHC*, October 22 2015, Prague University.
7. *Towards a standard approach to jet reconstruction*, MIT LNS colloquium, May 20 2013, Cambridge, MA, USA.
8. *Pileup subtraction for jet shapes*, ATLAS substructure meeting, November 27 2012, CERN.
9. *Pileup subtraction for jets at the LHC*, September 27 2012, Orsay, France
10. *Modern jet finding*, February 29 2012, Santiago di compostela, Spain.
11. *The cookbook for jets in heavy-ion collisions*, November 26 2010, IPN, Orsay, France.
12. *What (optimal) definition for jets at the LHC*, April 30 2010, IFAE, Barcelona, Spain.
13. *Tagging boosted jets - Application to $t\bar{t}H$*, March 25 2010, CERN, Switzerland.
14. *Jet reconstruction in heavy-ion collisions*, March 12 2010, BNL, Upton NY, USA.
15. *Defining jets at the dawn of the LHC*, January 11 2010, EPFL Lausanne, Switzerland.
16. *Tagging boosted objects*, December 4 2009, CERN, Switzerland.
17. *Defining jets at the dawn of the LHC*, October 9 2009, CERN, Switzerland.
18. *Saturation in high-energy QCD*, May 27 2009, LPTHE, University Paris VI, Paris, France.
19. *Jets playing hide and seek*, May 12 2009, Los Alamos National Laboratory, NM, USA.
20. *Defining jets at the LHC*, March 24 2009, Baruch College, NY, USA.
21. *Recent progress in defining jets*, January 16 2009, LBNL, Berkeley, CA, USA.
22. *Saturation in high-energy QCD*, December 18 2008, UA, Antwerpen, Belgium.
23. *Recent progress in defining jets*, November 20 2008, Stony Brook, NY, USA.
24. *Recent progress in defining jets*, October 14 2008, ULg, Liège, Belgium.
25. *Optimizing jet finding in pp and AA collisions*, August 14 2008, BNL, Upton NY, USA.
26. *The FastJet jet package*, July 1 2008, Yale, USA.
27. *An overview of saturation in QCD*, February 21 2008, ULg, Liège, Belgium (blackboard lecture).
28. *New tools in jet physics: SISCone (a new cone algorithm) - jet areas (a new concept)*, February 18 2008, IIHE, ULB/VUB, Brussels, Belgium.
29. *New tools in jet physics: SISCone (a new cone algorithm) - jet areas (a new concept)*, February 14 2008, UCL, Louvain-la-Neuve, Belgium.
30. *Overview of saturation in QCD*, February 13 2008, ULB, Brussels, Belgium (blackboard lecture).
31. *New tools in jet physics: SISCone (a new cone algorithm) - jet areas (a new concept)*, February 12 2008, UMH, Mons, Belgium.
32. *New tools in jet physics: SISCone (a new cone algorithm) - jet areas (a new concept)*, October 31 2007, Fermilab, Batavia IL, USA.

33. *QCD saturation phenomenology: geometric scaling at HERA*, October 11 2007, BNL, NY, USA.
34. *SISCone: a Seedless Infrared-Safe Cone algorithm*, August 8 2007, ULg, Liège, Belgium.
35. *SISCone: a Seedless Infrared-Safe Cone algorithm*, June 12 2007, BNL, NY, USA.
36. *Saturation in High-energy QCD: scaling laws and phenomenological applications*, December 1 2006, VUB, Brussels, Belgium.
37. *Saturation in High-energy QCD: scaling laws and phenomenological applications*, November 30 2006, UCL, Louvain, Belgium.
38. *Saturation in High-energy QCD: scaling laws and phenomenological applications*, October 13 2006, CERN, Geneva, Switzerland.
39. *High-Energy QCD: saturation and fluctuation effects*, April 10 2006, KEK, Tsukuba, Japan.
40. *Saturation in High-energy QCD*, December 16 2005, ULg, Liège, Belgium.
41. *Geometric scaling in High-Energy QCD*, November 23 2005, SPhT, CEA Saclay, Paris, France.
42. *Saturation in High-energy QCD*, November 4 2005, ECT*, Trento, Italy.
43. *Saturation in High-energy QCD*, October 12 2005, UFRGS, Porto Alegre, Brasil.
44. *Geometric scaling in High-energy QCD: nonzero momentum transfer and fluctuation effects*, June 23 2005, LPT, Université de Paris Sud, Orsay, France.
45. *Geometric scaling in High-energy QCD*, April 20 2005, ULg, Liège, Belgium.
46. *New insight in global QCD fits using Regge theory*, March 31 2005, LPTHE, Paris, France.
47. *New insight in global QCD fits using Regge theory*, January 20 2005, Ecole Polytechnique, Palaiseau, France.
48. *Deep Inelastic Scattering at small x: Perturbative QCD and S-matrix theory*, May 28 2004, IIHE, ULB, Brussels, Belgium.
49. *The QCD factorisation theorem and DGLAP evolution*, 2003, ULg, Liège, Belgium.
50. *S-matrix theory: introduction and application to DIS*, 2001, ULg, Liège, Belgium.
51. *Light-cone quantisation: the vacuum problem*, 2000, ULg, Liège, Belgium.

Conference talks:

1. *New perspectives in QCD with jet substructure*, GDR-QCD annual meeting, December 4-6 2017.
2. *Theory Summary*, Boost 2017, July 17-21 2017.
3. *Towards a predictive high-energy evolution*, Partons and Nuclei (GDR-QCD), June 1-2 2017.
4. *Fast clustering of jets*, Progress in algorithms and numerical tools (GDR-QCD), May 15-16 2017.
5. *Dichroic subjettiness ratios*, PSR workshop, March 27-29 2017, Cambridge, UK.
6. *Quark vs. gluon jets*, FCC-ee meeting, Novembre 21-22 2016, CERN, Geneva, Switzerland.
7. *Towards better use of N-subjettiness*, Boost 2016, June 18-22 2016, Zurich, Switzerland.
8. *Boosted jets, from Run I to Run II*, SM@LHC, April 20-24 2015, Florence, Italy.
9. *Fishing for new physics decaying to boosted objects: the why and how of boosted jets*, GDR Terascale meeting, March 29-April 1 2015, Gif-sur-Yvette.
10. *Recent progress in QCD*, RPP 2015, January 15-17 2015, Paris.
11. *Theory Lessons from Run I*, ISMD 2014, September 22-26 2014, Bologna, Italy.
12. *Theory Lessons from Run I*, Boost Workshop, August 18-22 2014, London, UK.
13. *Jets: seeing quarks and gluons at the LHC*, LHCPhenoNet meeting, June 4-6 2014, Paris.
14. *SoftKiller*, Pileup Workshop, May 15-17 2014, CERN, Switzerland.
15. *Gaps and jet vetos*, QCD and forward physics at the LHC, April 14-18 2014, Trento, Italy.
16. *Jet tools for Higgs analyses*, Higgs Hunting 2013, July 25-27 2013, Orsay.
17. *Area-median pileup subtraction*, ESI program on Jets at the LHC, July 2013, Vienna, Austria
18. *Area-median background subtraction*, Jet in Heavy-ion collisions workshop, July 1-4 2012, Paris
19. *Summary talk*, Physics at TeV colliders, June 3-12 2013, Les Houches [with Keith Hamilton].
20. *Pileup subtraction for jets at the LHC*, Heavy Ion forum, November 15 2012, IPhT, Saclay
21. *Pile-up subtraction for jet p_t, masses and shapes*, BOOST 2012, July 23-27 2012, Valencia, Spain.

22. *FastJet tutorial*, BOOST 2012, July 23-27 2012, Valencia, Spain.
23. *Basic jet clustering at the LHC*, SM@LHC, April 10-13 2012, Copenhagen, Denmark.
24. Workshop on the diffraction at the LHC, November 28-30 2011, Krakow, Poland.
25. Workshop on the future of Alice, July 12-13 2011, CERN, Geneva, Switzerland.
26. Physics at TeV colliders, May 30-June 8 2011, Les-Houches.
27. Jet reconstruction and Spectroscopy at the LHC, April 18-19 2011, INFN, Pisa, Italy.
28. Winter Workshop on Recent QCD Advances at the LHC, February 13-18 2011, Les-Houches.
29. Mini workshop on ATLAS physics, November 29-30 2010, CPPM, Marseille.
30. Journées Jeunes Chercheurs, November 22-26 2010, Angers.
31. Hard Probes 2010, October 10-15 2010, Eilat, Israel.
32. HIC10, CERN Institute, August 16-Septembre 10 2010, CERN, Switzerland.
33. Hot Quarks 2010, June 21-25 2010, Lalonde-les-Maures.
34. 5^{e} rencontres IPhT/SPP, November 17 2009, CEA Saclay, Paris.
35. Workshop on low-x physics (Low-x 2009), September 9-12 2009, Ischia, Italy.
36. RHIC/AGS user's meeting, June 1-5 2009, Brookhaven National Laboratory, NY, USA.
37. LHC@BNL, March 16 2009, Brookhaven National Laboratory, NY, USA.
38. Winter Workshop on Nuclear Dynamics, February 1-8 2009, Big Sky, Montana, USA.
39. New trends in HERA physics, October 5-10 2008, Ringberg Castle, Tegernesee, Germany.
40. Initial conditions in heavy-ion collisions, September 1-19 2008, Goa, India.
41. HERA/LHC workshop, May 26-30 2008, CERN, Geneva, Switzerland.
42. Deep Inelastic Scattering 2008 (DIS 08), April 7-11 2008, UCL, London, UK.
43. Workshop on Electron-Ion Collider (EIC), December 7-8 2007, Stony Brook, USA.
44. Workshop on low-x physics (Low-x 2007), August 29 - September 1 2007, Helsinki, Finland.
45. HERA/LHC workshop, March 12-16 2007, DESY, Hamburg, Germany.
46. QCD at high energy, January 8-12 2007, ECT*, Trento, Italy.
47. GGI program on QCD at high energy and high density, February 5-March 9 2007, Firenze, Italy.
48. Workshop on low-x physics (Low-x 2006), June 28 - July 1 - 2006, Lisbon, Portugal.
49. Cracow School of Theoretical Physics, XLVI Course, May 27 - June 5 2006, Zakopane, Poland.
50. Deep Inelastic Scattering 2006 (DIS 06), April 20-24 2006, Tsukuba, Japan.
51. Rencontre de Physique des Particules (RPP 06), Mars 1-3 2006, Paris.
52. Brasilian particle and field meeting, October 4-7 2005, Sao Laurencio, Brasil. (1 hour talk as an invited speaker)
53. Workshop on low-x physics (Low-x 2005), June 29 - July 2 2005, Sinaia, Romania.
54. Conference on Elastic and Diffractive Scattering (EDS05), May 15-20 2005, Blois.
55. 40th Rencontres de Moriond on QCD and High Energy Hadronic Interactions, March 12-19 2005, La Thuile, Aosta Valley, Italy.
56. Workshop on low-x physics (Low-x 2004), September 14-17 2004, Prague, Czeck Republic.
57. Diffraction at the LHC 2004, March 31-April 2 2004, Rio de Janeiro, Brasil. (Introduction and regular talk given)
58. Workshop on low-x physics (Low-x 2003), June 3-6 2003, Nafplio, Greece.
59. Deep Inelastic Scattering 2003 (DIS 03), April 23-27 2003, St Petersbourg, Russia.
60. Meeting Heidelberg-Saclay-Rostock-Liège, December 19-21 2002, Ladenburg, Germany.
61. Workshop on low-x physics (Low-x 2002), September 16-19 2002, Antwerp, Belgium.